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Dragi čitaoci,

Pred vama je drugo Specijalno izdanje Časopisa "Sportske nauke i zdravlje". I u ovom broju zainteresovanost autora za objavljivanje radova u našem Časopisu je velika, što nas dodatno podstiče da napredujemo i dižemo Časopis "Sportske nauke i zdravlje" na stepenicu više.

U ovom broju imamo 16 radova, autora iz Bosne i Hercegovine, Srbije, Sjeverne Makedonije, Hrvatske, Crne Gore, Indije, Italije, Indonezije, Irana, Albanije, Alžira, Rusije, Malezije. Tematika radova je dosta raznovrsna i zanimljiva: anemija kod sportistkinja: studija presjeka timskih i individualnih sportova sa rizicima specifičnim za sportsku disciplinu, balansiranje tradicionalnog i inovativnog: pregledni članak o nedavnim promjenama pravila u kriketu, komparativna analiza varijabilnosti srčanog ritma kod trkača na kratke staze i ultramaratonaca, učinkovitost modela učenja na otvorenom koji sadrži lokalnu kulturu na razvoj grubih motoričkih vještina kod djece, praćenje otkucaja srca i oporavka kod mladih tenisera, ključni statistički parametri povezani s igrom koji predviđaju ocjenu indeksa uspješnosti za košarkaše U16, U18 i U20 na različitim igračkim pozicijama, nejednakosti u vrhunskom sportu temeljene na invaliditetu: perspektiva gluhih sportašica u Hrvatskoj, odnos između kvalitetnog fizičkog vaspitanja i komunikacije nastavnika, stavovi nastavnika o specifičnosti relacije razvojno primjerene prakse i sportski nadarenih učenika unutar individualnog kurikulumu, uticaj pliometrijskog treninga skoka na kutiju i skokova sa kutije na eksplozivnu snagu i jačinu mišića nogu u trajanju od šest sedmica, odnos između remetilackih faktora i uspjeha u jedrenju, povećanje korisničkog iskustva i izvrsnosti usluga u sportskim objektima putem integrisanih sistema upravljanja informacijama, strategije za razvoj lokalnog sportuskog turizma i postavljanje ciljeva održivog razvoja u provinciji Južni Sulawesi, razvoj sistema za učenje temeljenom na android aplikaciji za poboljšavanje sposobnosti udarca sa terena kod početnika u tenisu, uticaj finansijske podrške prvog pratitelja brenda na društvenim mrežama na kvalitetu odnosa brend-potrošač u iranskoj prvoj fudbalskoj ligi, fizička spremnost paraglajdera.

Uredništvo Časopisa kao i svaki put do sada želi da se zahvali svim autorima, ali i recenzentima koji svojim učešćem unaprijeđuju i poboljšavaju kvalitet samog Časopisa. Pozivamo vas i dalje da na našu adresu www.siz-au.com i dalje šaljete svoje radove, kako bi što više doprineli razvoju kako Časopisa, tako i nauke uopšteno.

UREDNIŠTVO ČASOPISA

Dear readers,

In front of you is the second special edition of the Journal "Sports Science and Health". In this issue as well, the interest of authors in publishing works in our Journal is great, which further encourages us to progress and raise the Journal of "Sports Science and Health" a step higher from issue to issue..

In this issue, we have 16 scientific papers by authors from Bosnia and Herzegovina, Serbia, North Macedonia, Croatia, Montenegro, India, Italy, Indonesia, Iran, Albania, Algeria, Russia, Malaysia. The topics of the papers are quite diverse and interesting: anemia in female athletes: a cross-sectional study of team and individual sports with risks specific to the sport discipline, balancing the traditional and the innovative: a review article on recent rule changes in cricket, a comparative analysis of heart rate variability in sprinters and ultramarathoners, the effectiveness of an outdoor learning model incorporating local culture on the development of gross motor skills in children, heart rate and recovery monitoring in young tennis players, key statistical parameters related to the game that predict the performance index score for U16, U18 and U20 basketball players in different playing positions, inequalities in top-level sport based on disability: the perspective of deaf female athletes in Croatia, the relationship between quality physical education and teacher communication, teachers' views on the specificity of the relationship between developmentally appropriate practice and gifted students within the individual curriculum, the impact of plyometric training of box jumps and box jumps on explosive power and leg muscle strength over a period of six weeks, the relationship between disruptive factors and success in sailing, increasing user experience and service excellence in sports facilities through integrated information management systems, strategies for the development of local sports tourism and setting sustainable development goals in the province of South Sulawesi, development of a learning system based on an android application to improve the ability to hit the court in tennis beginners, the impact of financial support of the first brand follower on social networks on the quality of the brand-consumer relationship in the Iranian football league, the physical fitness of the first paraglider.

The editorial board of the Journal, as always, would like to thank all the authors, as well as the reviewers, who, with their participation, improve and improve the quality of the Journal itself. We invite you to go to our address www.siz-au.com you send your papers, in order to contribute as much as possible to the development of both the Journal and science in general.

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ANEMIA IN FEMALE ATHLETES: A CROSS-SECTIONAL STUDY OF TEAM AND INDIVIDUAL SPORTS WITH DISCIPLINE-SPECIFIC RISKS

ANEMIJA KOD SPORTISTKINJA: STUDIJA PRESJEKA TIMSKIH I INDIVIDUALNIH SPORTOVA SA RIZICIMA SPECIFIČNIM ZA SPORTSKU DISCIPLINU

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Abstract: This study examined the prevalence of anemia among female athletes in team ball sports (volleyball, soccer, and basketball) and individual sports (karate, dance, and athletics) aged 11 to 35. The results showed no statistically significant difference in anemia prevalence between athletes in team sports (2.15%) and individual sports (1.73%). Older female athletes (19–35 years) demonstrated a significantly higher prevalence of anemia compared to younger athletes (11–18 years), regardless of the type of sport. Within the individual sports group, significant differences were observed, with track and field athletes showing a higher anemia prevalence (7.14%) compared to athletes in karate and dance. These findings suggest that the type of sport does not significantly influence anemia risk, but specific disciplines with high aerobic demands, such as athletics, carry a higher risk. The study highlights the need for targeted approaches to anemia prevention and monitoring based on the sport and physical demands of individual disciplines.

Key words: Anemia, female athletes, team sports, individual sports, prevalence

Sažetak: Ovo istraživanje je ispitivalo prevalenciju anemije među sportistkinjama u timskim sportovima sa loptom (odbojka, fudbal i košarka) i individualnim sportovima (karate, ples i atletika) u uzrastu od 11 do 35 godina. Rezultati su pokazali da nema statistički značajne razlike u prevalenciji anemije između sportistkinja iz timskih (2.15%) i individualnih sportova (1.73%). Starije sportistkinje (19–35 godina) pokazale su značajno višu prevalenciju anemije u poređenju sa mlađim sportistkinjama (11–18 godina), bez obzira na tip sporta. Unutar grupe individualnih sportova, primjećene su značajne razlike – atletičarke su imale višu stopu anemije (7.14%) u odnosu na sportistkinje u karateu i plesu. Ovi nalazi ukazuju na to da tip sporta ne utiče značajno na rizik od anemije, ali specifične discipline sa velikim aerobnim zahtjevima, poput atletike, nose veći rizik. Studija naglašava potrebu za specifičnim pristupom u prevenciji i praćenju anemije u zavisnosti od sporta i fizičkih zahteva pojedinih disciplina.

Ključne riječi: Anemija, sportistkinje, timski sportovi, individualni sportovi, prevalencija

INTRODUCTION

Anemia, particularly iron deficiency anemia, is a common issue among athletes, with female athletes being especially susceptible due to physiological demands and nutritional challenges (Beard & Tobin, 2000; Rowland, 2011). Research in recent decades has focused on the

UVOD

Anemija, posebno anemija uzrokovana nedostatkom gvožđa, je čest problem među sportistima, a sportistkinje su posebno podložne zbog fizioloških zahtjeva i nutritivnih izazova (Beard & Tobin, 2000; Rowland, 2011). Istraživanja u poslednjih nekoliko decenija su se fokusirala na

prevalence of anemia across various sports, with special interest in risks depending on the type of sport, including team and individual disciplines. Female athletes show higher rates of anemia compared to male athletes, mainly due to iron deficiency (Peeling et al., 2007). Several factors contribute to this increased risk, including menstrual blood loss, increased iron metabolism due to intensive training, and dietary challenges in maintaining adequate iron levels (DellaValle, 2013). Anemia can affect physical abilities, slow down recovery, and increase the risk of injuries (Ashenden et al., 1999; Dellavalle & Haas, 2012). Athletes in endurance sports, such as long-distance running and swimming, are particularly prone to anemia due to hemolysis resulting from repetitive trauma in runners and frequent exposure to oxidative stress, which affects red blood cell metabolism (Nieman et al., 2001; Fallon, 2008). Therefore, maintaining optimal iron levels is essential for performance in sports and the health of female athletes with high levels of physical exertion. The type of sport—particularly the distinction between team and individual sports—plays a role in the risk of anemia among female athletes. Individual endurance sports, such as long-distance running, triathlon, and cycling, have higher rates of iron deficiency anemia compared to team sports (Malczewska et al., 2000). The repetitive impacts and high aerobic demands of these sports increase the likelihood of hemolysis, iron loss through sweating, and gastrointestinal microbleeds, all of which contribute to the depletion of iron stores (Schumacher et al., 2002; Mettler & Zimmermann, 2010). Team sports, on the other hand, such as soccer and basketball, though physically demanding, show lower rates of anemia due to more varied physical demands and often shorter, intense work intervals (Rowland, 2011). However, studies indicate that female athletes in team sports are still at risk, especially if they have heavy menstrual cycles or a history of insufficient dietary iron intake (McClung et al., 2009). Female endurance athletes are among the most at risk for anemia. A systematic review by DellaValle & Haas (2012) found that iron deficiency affects approximately 30-50% of female endurance athletes, with a significant proportion reaching clinical anemia. The demands of these sports accelerate iron loss while also requiring optimal oxygen transport for demanding training and competitions. Although less affected than female endurance athletes, female athletes in team sports still show significant anemia prevalence, with rates varying according to competition level and training intensity (Ziegler et al., 2014). For instance, female soccer players can register high levels of iron breakdown and anemia risk due to physical con-

prevalenciju anemije u različitim sportovima, s posebnim interesovanjem za rizike u zavisnosti od tipa sporta, uključujući timske i individualne discipline. Sportistkinje bilježe veće stope anemije u poređenju sa sportistima, uglavnom zbog nedostatka gvožđa (Peeling i saradnici, 2007). Više faktora doprinosi ovom povećanom riziku, uključujući menstrualni gubitak krvi, povećan metabolizam gvožđa zbog intenzivnog treninga i prehrambene izazove u održavanju odgovarajućeg nivoa gvožđa (DellaValle, 2013). Anemija može uticati na fizičke sposobnosti, usporiti oporavak i povećati rizik od povreda (Ashenden i saradnici, 1999; Dellavalle & Haas, 2012). Sportisti u disciplinama koje zahtijevaju izdržljivost, kao što su trčanje na duge staze i plivanje, posebno su skloni anemiji zbog hemolize usljed ponavljajućih trauma kod trkača i čestog izlaganja oksidativnom stresu, što utiče na metabolizam eritrocita (Nieman i saradnici, 2001; Fallon, 2008). Stoga je održavanje optimalnog nivoa gvožđa ključno za izvedbu u sportu i zdravlje sportistkinja sa visokim nivoom fizičkog opterećenja. Tip sporta — posebno razlika između timskih i individualnih sportova — igra ulogu u riziku od anemije među sportistkinjama. Individualni sportovi koji zahtijevaju izdržljivost, kao što su trčanje na duge staze, triatlon i biciklizam, bilježe veće stope anemije zbog nedostatka gvožđa u poređenju sa timskim sportovima (Malczewska i saradnici, 2000). Repetitivni udarci i visoki aerobni zahtjevi ovih sportova povećavaju vjerovatnoću hemolize, gubitka gvožđa znojenjem i gastrointestinalnih mikrokrvarenja, što sve doprinosi iscrpljivanju rezervi gvožđa (Schumacher i saradnici, 2002; Mettler & Zimmermann, 2010). Timski sportovi, s druge strane, kao što su fudbal i košarka, iako su fizički zahtjevniji, bilježe niže stope anemije zbog raznovrsnijih fizičkih zahtjeva i često kraćih intenzivnih intervala rada (Rowland, 2011). Međutim, studije ukazuju na to da su sportistkinje u timskim sportovima i dalje u riziku, posebno ako imaju obilne menstrualne cikluse ili istoriju nedovoljnog unosa gvožđa putem ishrane (McClung i saradnici, 2009). Sportistkinje u sportovima izdržljivosti su među najugroženijima kada je u pitanju rizik od anemije. Sistematski pregled DellaValle i Haas (2012) pokazao je da nedostatak gvožđa pogađa otprilike 30-50% sportistkinja u sportovima izdržljivosti, pri čemu značajan procenat dolazi i do stanja kliničke anemije. Zahtjevi ovih sportova ubrzavaju gubitak gvožđa, dok istovremeno zahtijevaju optimalan transport kiseonika za zahtjevne treninge i trke. Iako su manje pogođene od sportistkinja u sportovima izdržljivosti, sportistkinje u timskim sportovima i dalje bilježe značajnu prevalenciju anemije, sa stopama koje variraju u zavisnosti od nivoa takmičenja i intenziteta treninga (Ziegler i saradnici, 2014). Kod

tact, sprinting, and combined aerobic-anaerobic activity, albeit to a lesser extent than in endurance sports (Hinton, 2014). Based on previous research and the need for further investigation on this issue, the aim of this study was defined. The goal was to determine whether there is an association between the prevalence of anemia in female athletes and the type of sport they practice (team ball sports and individual sports). Additionally, the aim was to determine whether there is a difference in anemia prevalence within these two groups of sports, between different sports disciplines.

METHODS

Study Design

This research employed a cross-sectional study design with data (blood hemoglobin levels) obtained from medical records of athletes tested at the Institute of Occupational and Sports Medicine of the Republic of Srpska (Bosnia and Herzegovina) in 2023.

Participants

The sample consisted of 949 female athletes aged 11-35, divided into two categories: team ball sports and individual sports. In the team sports sub-sample, there were 604 female athletes, while the individual sports sub-sample included 345 athletes. Among the 604 team sport athletes, 321 were volleyball players, 194 were football players, and 89 were basketball players. In the individual sports sub-sample, 131 were karate athletes, 172 were dancers, and 42 were athletes in track and field. The structure of the sample is presented in Table 1.

Variables

To detect anemia in female athletes, blood hemoglobin concentration (HGB) results from complete blood counts were analyzed. Blood sampling for analysis was performed by an accredited technician according to the standardized protocol of the Institute of Sports Medicine of the Republic of Srpska, and venous blood samples were tested on a fully automated hematology analyzer Sysmex XN-330. A hemoglobin concentration below 12 g/dL was the threshold for determining anemia (Lopez et al., 2016). Athletes with hemoglobin levels below 12 g/dL were diagnosed with anemia.

Statistical Analyses

Statistical analyses were performed using IBM SPSS Statistics Version 20. Based on empirical data, the percentages of anemia prevalence in all participant categories were calculated. The Chi-square test was used to compare categorical variables between female athletes in team and individual sports, as well as between athletes

fudbalerki se, na primjer, može registrovati visok stepen raspada gvožđa i rizik od anemije zbog fizičkog kontakta, sprinteva i kombinovanog aerobnog-anaerobnog rada, mada u manjoj mjeri nego u sportovima izdržljivosti (Hinton, 2014). Na osnovu dosadašnjih istraživanja i potrebom da se ova problematika dodatno istraži definisan je i cilj ovog istraživanja. Cilj je bio da se utvrdi da li postoji veza između prevalencije anemije kod sportistkinja i tipa sporta kojim se bave (timski sportovi sa loptom i individualni sportovi). Pored toga, cilj je bio da se utvrdi da li postoji razlika u prevalenciji anemije unutar ove dvije grupe sportova, a između različitih sportskih disciplina.

METODE

Dizajn studije

U ovom istraživanju je korištena studija presjeka sa podacima (hemoglobin u krvi) koji su uzeti iz medicinskih kartona sportista koji su testirani u Zavodu za medicinu sporta Republike Srpske (Bosna i Hercegovina) u toku 2023. godine.

Ispitanici

Uzorak ispitanika je činilo 949 sportistkinja uzrasta od 11-35 godina podijeljnih u dvije kategorije, timski sportovi sa loptom i individualni sportovi. U subuzorku timski sportovi sa loptom bilo je 604 sportistkinje, a u subuzorku individualni sportovi bilo je 345 sportistkinje. Od 604 sportistkinje iz timskih sportova sa loptom, 321 je bila iz odbojke, 194 iz fudbala i 89 iz košarke. Od 345 sportistkinje iz individualnih sportova, 131 je bila iz karatea, 172 iz plesa i 42 iz atletike. Struktura uzorka ispitanika je prikazana u Tabeli 1.

Varijable

Da bi se detektovalo stanje anemije kod sportistkinja uzeti su rezultati koncentracije hemoglobina u krvi (HGB) iz kompletne krvne slike. Uzorkovanje krvi za analizu obavljeno je od strane akreditovanog tehničara prema standardizovanom protokolu Zavoda za medicinu sporta Republike Srpske, a uzorci venske krvi su testirani na potpuno automatizovanom hematološkom analizatoru Sysmex XN-330. Koncentracija hemoglobina ispod 12 g/dl je bila granična za određivanje stanja anemije (Lopez i saradnici, 2016). Sportistkinjama sa nižim vrijednostima hemoglobina od 12 g/dl je dijagnostikovana anemija.

Statističke analize

Statističke analize su izvedene korištenjem statističkog paketa IBM SPSS Statistics Version 20. Na osnovu empirijskih podataka izračunati su procenti zastupljenosti anemije kod svih kategorija ispitanika. Hi-kvadrat test je korišten radi poređenja kategoričkih varijabli između

from different sports within these two categories. Statistical significance of differences was tested at the 0.05 level.

RESULTS

Table 1 shows the structure of the sample, which includes 949 female athletes. The participants were divided according to the type of sport: in the category of team ball sports (volleyball, football, and basketball), a total of 604 athletes participated, while in the category of individual sports (karate, dance, and athletics), 345 athletes participated.

Table 1. Structure of the sample of participants

Ball Sports / Timski sportovi	Volleyball / Odbojka	Soccer / Fudbal	Basketball / Košarka	Total / Ukupno
	321	194	89	604
Individual Sports / Individualni sportovi	Karate / Karate	Dance / Ples	Track and Field / Atletika	Total / Ukupno
	131	172	42	345

Table 2 presents data on the prevalence of anemia among female athletes from team and individual sports. Results show that 2.15% of athletes from team sports and 1.73% from individual sports exhibited the presence of anemia. Although there is a small difference in the percentages of anemic athletes between these two groups, statistical analysis ($\chi^2=0.191$, $df=1$, $p=0.662$) did not show a statistically significant difference, suggesting that the type of sport (team or individual) does not have a significant impact on the prevalence of anemia among participants.

Table 2. Differences in anemia prevalence between female athletes from team ball sports and individual sports

	Anemia / Anemija		
	Yes / Da	No / Ne	Total / Ukupno
Ball Sports / Sportske igre sa loptom	13 2.15 %	591 97.85 %	604
Individual Sports / Individualni sportovi	6 1.73 %	339 98.27 %	345
Total / Ukupno	19 2.00 %	930 98.00 %	949

$$\chi^2=0.191, df=1, p=0.662$$

Table 3 presents data on the prevalence of anemia among female athletes from different age categories, grouped by type of sport. The results reveal notable differences between younger athletes (11–18 years) and older athletes (19–35 years) in both sport categories. Among athletes participating in team ball sports, the

sportistkinja iz timskih i individualnih sportova, kao i između sportistkinja iz različitih sportova unutar ove dvije kategorije. Statistička značajnost razlika je testirana na nivou od 0.05.

REZULTATI

Tabela 1 prikazuje strukturu uzorka koji uključuje 949 sportistkinja. Ispitanice su bile podjeljene prema tipu sporta: u kategoriji timskih sportova sa loptom (odbojka, fudbal i košarka) učestvovalo je ukupno 604 sportistkinje, dok je u kategoriji individualnih sportova (karate, ples i atletika) učestvovalo 345 sportistkinja.

Tabela 1. Struktura uzorka ispitanika

Tabela 2 predstavlja podatke o prevalenciji anemije među sportistkinjama iz timskih i individualnih sportova. Rezultati pokazuju da je 2.15% sportistkinja iz timskih sportova i 1.73% iz individualnih sportova pokazalo prisustvo anemije. Iako postoji mala razlika u procentima anemičnih sportistkinja između ove dve grupe, statistička analiza ($\chi^2=0.191$, $df=1$, $p=0.662$) nije pokazala statistički značajnu razliku, što sugerise da tip sporta (timski ili individualni) nema značajan uticaj na prevalenciju anemije među ispitanicama.

Tabela 2. Razlike u prevalenciji anemije između sportistkinja iz sportskih igara i individualnih sportova

$$\chi^2=0.191, df=1, p=0.662$$

U Tabeli 3 su prikazani podaci o prevalenciji anemije među sportistkinjama različitih starosnih kategorija, grupisanim prema tipu sporta. Rezultati pokazuju izražene razlike između mlađih (11–18 godina) i starijih sportistkinja (19–35 godina) u obje posmatrane kategorije sportova. Kod sportistkinja koje se bave timskim spor-

prevalence of anemia was 1.20% in the 11–18 age group, whereas it increased significantly to 8.40% in the 19–35 age group. A similar pattern was observed among athletes in individual sports, with a prevalence of 0.70% in the younger group and 7.10% in the older group. Statistical analysis confirmed that these differences were significant ($\chi^2=30.147$, $df=3$, $p<0.001$), indicating that age is an important factor influencing the prevalence of anemia among female athletes, regardless of the type of sport they practice.

Table 3. Differences in anemia prevalence among female athletes in team and individual sports grouped by age

	Anemia / Anemija		
	Yes / Da	No / Ne	Total / Ukupno
Ball Sports (11-18 years) / Sportske igre sa loptom (11-18 god)	6 1.20%	503 98.80%	509
Ball Sports (19-35 years) / Sportske igre sa loptom (19-35 god)	8 8.40%	87 91.60%	95
Individual Sports (11-18 years) / Individualni sportovi (11-18 god)	2 0.70%	301 99.30%	303
Individual Sports (19-35 years) / Individualni sportovi (19-35 god)	3 7.10%	39 92.90%	42
Total / Ukupno	19 2.00%	930 98.00%	949

$$\chi^2=30.147, df=3, p=0.000$$

Table 4 analyzes anemia prevalence among athletes in three different team sports: volleyball, soccer, and basketball. Anemia prevalence in volleyball was 1.56%, in soccer 2.58%, while it was highest in basketball at 3.37%. However, analysis of these data ($\chi^2=1.333$, $df=2$, $p=0.514$) did not show a statistically significant difference among female athletes from different team sports.

Table 4. Differences in anemia prevalence among female athletes from different team ball sports

	Anemia / Anemija		
	Yes / Da	No / Ne	Total / Ukupno
Volleyball / Odbojka	5 1.56 %	316 98.44 %	321
Soccer / Fudbal	5 2.58 %	189 97.42 %	194
Basketball / Košarka	3 3.37 %	86 96.63 %	89
Total / Ukupno	13 2.15 %	591 97.85 %	604

$$\chi^2=1.333, df=2, p=0.514$$

tovima sa loptom, prevalencija anemije u grupi od 11–18 godina iznosila je 1.20%, dok je u grupi od 19–35 godina zabilježena znatno viša stopa od 8.40%. Sličan obrazac je uočen i kod sportistkinja koje se bave individualnim sportovima, gdje je prevalencija anemije kod mladih iznosila 0.70%, a kod starijih 7.10%. Statistička analiza pokazala je da su ove razlike značajne ($\chi^2=30.147$, $df=3$, $p<0.001$), što ukazuje na to da starosna dob predstavlja važan faktor u prevalenciji anemije kod sportistkinja, neovisno o tipu sporta kojim se bave.

Tabela 3. Razlike u prevalenciji anemije između sportistkinja iz sportskih igara i individualnih sportova grupisanih prema uzrastu

$$\chi^2=30.147, df=3, p=0.000$$

Tabela 4 analizira prevalenciju anemije među sportistkinjama u tri različita timska sporta: odbojka, fudbal i košarka. Prevalencija anemije u odbojci iznosila je 1.56%, u fudbalu 2.58%, dok je u košarci bila najviša, 3.37%. Međutim, analiza ovih podataka ($\chi^2=1.333$, $df=2$, $p=0.514$) nije pokazala statistički značajnu razliku među sportistkinjama iz različitih timskih sportova. Ovi rezul-

Tabela 4. Razlike u prevalenciji anemije između sportistkinja iz različitih timskih sportova sa loptom

These results indicate that although there is variability in anemia prevalence among different team sports, it is not statistically significant.

Table 5 presents differences in anemia prevalence among female athletes in individual sports: karate, dance, and athletics. The lowest prevalence of anemia was recorded among athletes who engage in dance (0.58%), while the highest prevalence was recorded among track and field athletes (7.14%). Statistical analysis ($\chi^2=8.560$, $df=2$, $p=0.014$) showed a statistically significant difference in anemia prevalence among different individual sports, indicating that athletes in athletics have a significantly higher risk of anemia compared to athletes from other individual sports.

Table 5. Differences in anemia prevalence among female athletes from different individual sports

	Anemia / Anemija		
	Yes / Da	No / Ne	Total / Ukupno
Karate / Karate	2 1.53 %	129 98.47 %	131
Dance / Ples	1 0.58 %	171 99.42 %	172
Track and Field / Atletika	3 7.14 %	39 92.86 %	42
Total / Ukupno	6 1.74 %	339 98.26 %	345

$$\chi^2=8.560, df=2, p=0.014$$

DISCUSSION

The aim of this research was to examine the existence of a difference in anemia prevalence between female athletes involved in team ball sports and those engaged in individual sports, specifically dance, karate, and track and field events. Additionally, differences in anemia prevalence among sports within these two categories were explored. The results of this study showed no statistically significant difference in anemia prevalence between female athletes in team ball sports (2.15%) and individual sports (1.73%). These findings align with previous research, which also suggests that the type of sport (team or individual) may not significantly impact the risk of anemia. This is evident in studies showing similar prevalence rates across various types of sports (Beard & Tobin, 2000; DellaValle, 2013). The lack of statistically significant differences between these groups may be explained by the fact that female athletes in both types of sports experience similar physiological demands in terms

tati ukazuju na to da, iako postoji varijabilnost u prevalenciji anemije među različitim timskim sportovima, ona nije statistički značajna.

Tabela 5 prikazuje razlike u prevalenciji anemije među sportistkinjama u individualnim sportovima: karate, ples i atletika. Najniža prevalencija anemije zabilježena je kod sportistkinja koje se bave plesom (0.58%), dok je najviša zabilježena kod sportistkinja u atletici (7.14%). Statistička analiza ($\chi^2=8.560$, $df=2$, $p=0.014$) pokazala je statistički značajnu razliku u prevalenciji anemije između različitih individualnih sportova, što ukazuje da sportistkinje u atletici imaju značajno veći rizik od anemije u poređenju sa sportistkinjama iz drugih individualnih sportova.

Tabela 5. Razlike u prevalenciji anemije između sportistkinja iz različitih individualnih sportova

$$\chi^2=8.560, df=2, p=0.014$$

DISKUSIJA

Cilj ovog istraživanja bio je da se ispita postojanje razlike u prevalenciji anemije između sportistkinja koje se bave timskim sportovima sa loptom i onih koje se bave individualnim sportovima, konkretno plesom, karateom i trkačkim disciplinama u atletici. Takođe, istraženo je i postojanje razlika u prevalenciji anemije među sportovima unutar ove dvije kategorije. Rezultati ovog istraživanja pokazali su da ne postoji statistički značajna razlika u prevalenciji anemije između sportistkinja u timskim sportovima sa loptom (2.15%) i individualnim sportovima (1.73%). Ovi podaci su u skladu sa prethodnim istraživanjima koja takođe sugerišu da tip sporta (timski ili individualni) možda nema značajan uticaj na rizik od anemije, što je primjećeno u studijama koje pokazuju slične stope prevalencije u različitim tipovima sportova (Beard & Tobin, 2000; DellaValle, 2013). Nedostatak statistički značajnih razlika između ovih grupa može se objasniti činjenicom da sportistkinje u oba tipa sporta doživljavaju slične fiziološke zahtjeve u smislu

of training intensity and iron requirements. Studies indicate that, regardless of the sport type, intense physical activity can lead to an increased need for iron due to higher erythrocyte turnover and losses through sweating (Rowland, 2011; Peeling et al., 2007). Additionally, the menstrual cycle poses an added risk for iron deficiency among female athletes, especially in high-intensity sports (DellaValle & Haas, 2012). The age-specific results demonstrate that the prevalence of anemia among female athletes is significantly influenced by age, with older athletes (19–35 years) exhibiting substantially higher rates of anemia compared to their younger counterparts (11–18 years), regardless of whether they participate in team or individual sports. These findings align with previous studies suggesting that physiological and hormonal changes, as well as the cumulative effects of prolonged exposure to intense physical training and menstrual blood loss, may increase the risk of iron deficiency and anemia in adult female athletes (Thomas et al., 2016; DellaValle, 2013). In contrast, although iron requirements are elevated during adolescence due to growth, development, and the onset of menstruation, the lower anemia rates observed in younger athletes might reflect a shorter duration of exposure to risk factors or more effective physiological adaptation at a younger age. These findings emphasize the need for age-specific strategies in the prevention and monitoring of iron status, particularly during the transition from adolescence to adulthood in athletic populations. The second aspect of this research examined differences in anemia prevalence among female athletes within team ball sports and individual sports. Among team sports, no significant differences were found in anemia prevalence between athletes in volleyball, soccer, and basketball. This conclusion aligns with research indicating that athletes in team ball sports are exposed to similar physical demands, such as intensive training and periodic physical contact, which may have comparable effects on iron levels and anemia risk (Hinton, 2014; Nicotra et al., 2023). In contrast, within the group of individual sports, statistically significant differences in anemia prevalence were observed among different sports, with track and field athletes showing a substantially higher anemia prevalence (7.14%) compared to those in karate and dance. This finding is consistent with previous research, which indicates that athletes in endurance sports, such as track events, are at an increased risk of iron deficiency and anemia due to enhanced hemolysis from repeated trauma and other physiological stressors that accelerate erythrocyte breakdown (Schumacher et al., 2002; Fallon, 2008). Furthermore, dietary restrictions

intenziteta treninga i potrebe za gvoždem. Studije ukazuju da, bez obzira na vrstu sporta, intenzivan fizički napor može uzrokovati povećanu potrebu za gvoždem zbog veće potrošnje eritrocita i gubitaka kroz znojenje (Rowland, 2011; Peeling et al., 2007). Osim toga, menstrualni ciklus kod sportistkinja predstavlja dodatni rizik za manjak gvožđa, što je dodatno važno kada se radi o ženama u sportovima visokog intenziteta (DellaValle & Haas, 2012). Rezultati prema starosnim kategorijama pokazuju da starost sportistkinja ima značajan uticaj na prevalenciju anemije, pri čemu starije sportistkinje (19–35 godina) bilježe znatno više stope anemije u poređenju sa mlađima (11–18 godina), bez obzira na to da li se bave timskim ili individualnim sportovima. Ovi nalazi su u skladu sa dosadašnjim istraživanjima koja ukazuju da kod odraslih sportistkinja hormonske promjene, duži periodi izlaganja fizičkom stresu, kao i kumulativni efekti intenzivnih treninga i menstrualnih gubitaka, mogu povećati rizik od deficita gvožđa i anemije (Thomas et al., 2016; DellaValle, 2013). Nasuprot tome, kod mlađih sportistkinja, iako su potrebe za gvoždem povećane usljed rasta i razvoja, učestalost anemije ostaje niska, što može ukazivati na bolju adaptaciju organizma u ranom uzrastu ili na kraće trajanje izloženosti faktorima rizika. Ovi rezultati naglašavaju potrebu za starosno specifičnim strategijama prevencije i praćenja statusa gvožđa kod sportistkinja, posebno u periodu prelaska iz adolescencije u odraslo doba. Drugi aspekt istraživanja je ispitivao razlike u prevalenciji anemije među sportistkinjama unutar timskih sportova sa loptom, kao i među individualnim sportovima. U okviru timskih sportova, nije utvrđena značajna razlika u prevalenciji anemije između sportistkinja koje se bave odbojkom, fudbalom i košarkom. Ovaj zaključak je u skladu sa istraživanjima koja pokazuju da su sportistkinje u timskim sportovima sa loptom izložene sličnim fizičkim zahtevima, kao što su intenzivni treninzi i periodični fizički kontakt, što može imati slične efekte na nivoe gvožđa i rizik od anemije (Hinton, 2014; Nicotra i saradnici, 2023). Nasuprot tome, unutar grupe individualnih sportova, primjećene su statistički značajne razlike u prevalenciji anemije između različitih sportova, pri čemu su sportistkinje u atletici imale znatno veću prevalenciju anemije (7.14%) u poređenju sa sportistkinjama u karateu i plesu. Ovaj rezultat je u skladu sa dosadašnjim istraživanjima čiji nalazi ukazuju na to da sportistkinje u sportovima izdržljivosti, poput trkačkih disciplina, imaju povećane rizike od nedostatka gvožđa i anemije usljed pojačane hemolize zbog ponavljajućih trauma i drugih fizioloških stresora koji povećavaju raspad eritrocita (Schumacher et al., 2002; Fallon, 2008). Osim toga, kod sportistkinja u atletici često su prisutna ograničenje u ishrani, što dodatno može povećati rizik od anemije zbog nedo-

are often present among track athletes, which may further increase the risk of anemia due to inadequate iron intake (McClung et al., 2009). These results emphasize the specific needs of female athletes in particular disciplines concerning iron intake and balance. Endurance athletes require special attention to nutritional needs, as the high training intensity and increased erythrocyte turnover elevate iron requirements. Research on anemia among female athletes largely confirms the conclusions of this study. Studies have shown that female athletes in high-intensity and endurance sports, such as athletics, are more prone to anemia compared to those in lower-intensity sports, such as dance or team sports with shorter aerobic periods (Malczewska et al., 2000; Ziegler et al., 2014). These data support the theoretical premise that specific physical demands, such as prolonged activities and frequent impact on surfaces, are factors contributing to a higher anemia risk in sports like athletics.

One limitation of this study pertains to the sample size within specific sports, which may affect the statistical power of the results and the ability to generalize. Additionally, factors such as diet, supplement intake, or menstrual cycle were not considered, which could further impact anemia prevalence. Future research should include these variables to provide a more comprehensive picture of the impact of different factors on anemia risk among female athletes across various disciplines. Another limitation of this study concerns the wide age range of participants, from 11 to 35 years. This broad age range may influence the results, as physiological and hormonal factors affecting iron levels and anemia prevalence vary significantly between adolescents and adult women. During adolescence, iron needs increase due to growth and development, as well as the onset of menstrual cycles, while in adult women, additional factors, such as training intensity and sports experience, may have a different impact on anemia risk.

Future research should consider a narrower age range or analyze results by age category to gain a more precise understanding of the impact of age on anemia prevalence in different sports. Additionally, future studies could include factors such as diet, iron supplementation, menstrual cycle, and the specific demands of individual sports to better understand the interaction between these variables and anemia risk across different age groups.

CONCLUSION

The analysis of the results showed that, while the type of sport (team vs. individual) was not significantly associated with anemia prevalence, a significant differ-

statka unosa gvožđa (McClung et al., 2009). Ovi rezultati naglašavaju specifične potrebe sportistkinja u pojedinim disciplinama kada je u pitanju unos i balans gvožđa. Sportistkinje u sportovima izdržljivosti zahtijevaju posebnu pažnju u pogledu nutritivnih potreba, jer visoki intenzitet treninga i veća potrošnja eritrocita povećavaju potrebu za gvoždem. Istraživanja u oblasti anemije kod sportistkinja u velikoj mjeri potvrđuju zaključke ovog istraživanja. Studije su pokazale da su sportistkinje u sportovima visokog intenziteta i izdržljivosti, poput atletike, sklonije anemiji u odnosu na sportistkinje u sportovima nižeg intenziteta, kao što su ples ili timski sportovi sa kraćim periodima aerobnog rada (Malczewska et al., 2000; Ziegler et al., 2014). Ovi podaci podržavaju teorijsku postavku da su specifični fizički zahtjevi, kao što su dugotrajne aktivnosti i česti udarci od podlogu, faktori koji doprinose većem riziku od anemije u sportovima kao što je atletika.

Jedno od ograničenja ovog istraživanja odnosi se na veličinu uzorka u pojedinim sportovima, što može uticati na statističku snagu rezultata i mogućnost generalizacije. Takođe, nisu uzeti u obzir faktori kao što su ishrana, uzimanje suplemenata ili menstrualni ciklus, koji bi mogli dodatno uticati na prevalenciju anemije. Buduća istraživanja bi trebalo da uključe ove varijable kako bi se dobila sveobuhvatnija slika uticaja različitih faktora na rizik od anemije među sportistkinjama u različitim disciplinama. Jedno od ograničenja ovog istraživanja odnosi se na širok raspon starosti ispitanica, od 11 do 35 godina. Ovaj veliki raspon godina može uticati na rezultate, jer fiziološki i hormonalni faktori koji utiču na nivo gvožđa i prevalenciju anemije variraju značajno između adolescenata i odraslih žena. Tokom adolescencije, potrebe za gvoždem su povećane zbog rasta i razvoja, kao i zbog početka menstrualnih ciklusa, dok kod odraslih žena dodatni faktori, poput intenziteta treninga i iskustva u sportu, mogu imati drugačiji uticaj na rizik od anemije.

Buduća istraživanja trebalo bi da uzmu u obzir uži raspon starosnih grupa ili da analiziraju rezultate po starosnim kategorijama kako bi se dobio precizniji uvid u uticaj starosti na prevalenciju anemije u različitim sportovima. Pored toga, buduća istraživanja bi mogla da obuhvate dodatne faktore kao što su ishrana, suplementacija gvoždem, menstrualni ciklus i specifične zahtjeve pojedinačnih sportova, kako bi se bolje razumjela interakcija između ovih varijabli i rizika od anemije u različitim uzrasnim grupama.

ZAKLJUČAK

Analiza rezultata pokazala je da, dok tip sporta (timski naspram individualnog) nije značajno povezan sa prevalencijom anemije, postoji značajna razlika unutar pojedinih in-

ence exists within certain individual sports, with track and field athletes exhibiting a higher rate of anemia. The results revealed a significantly higher prevalence of anemia among female athletes aged 19 to 35 compared to their younger counterparts, highlighting the importance of monitoring iron status in older age groups. These findings underscore the need for tailored approaches in monitoring and preventing anemia based on the sport practiced by female athletes, especially in high-intensity sports like athletics.

dividualnih sportova, gde su sportistkinje u atletici pokazale višu stopu anemije. Rezultati su pokazali da je prevalencija anemije značajno viša kod sportistkinja uzrasta od 19 do 35 godina u poređenju sa mlađim sportistkinjama, što ukazuje na važnost praćenja statusa gvožđa u starijim starosnim kategorijama. Ovi rezultati naglašavaju potrebu za specifičnim pristupima u praćenju i prevenciji anemije u zavisnosti od sporta kojim se sportistkinje bave, naročito u sportovima visokog intenziteta poput atletike.

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BALANCING TRADITION AND INNOVATION: A REVIEW ARTICLE ON RECENT RULE CHANGES IN CRICKET

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Abstract: Cricket, often referred to as a “gentleman’s game”, has a rich history and many traditions intricately woven into its fabric. Recent rule changes introduced by the International Cricket Council (ICC) have taken center stage, sparking discussion, debate and the occasional controversy. These changes, which came into force on 1 October 2022, symbolize cricket’s ability to adapt to modern standards while addressing issues related to fairness, safety and pace of play. The primary objective of this study is to determine the effects of recent rule changes in cricket; and to determine how these rule changes affected player behavior, the balance between batsman and bowler, and the overall dynamics of the game. The study aims to provide a comprehensive understanding of the implications of these rule changes, with particular attention to their role in preserving both traditional and modern elements of the sport. The study methods followed a five-stage methodological framework to identify the research question, identify the literature, select the study, draft the data, outline the data and report the data. Eight different changes made by the ICC are covered, covering areas such as batters’ return after catch, ball maintenance, incoming batters’ readiness, striker’s rights, fielding conduct, non-striker’s run-out, bowler action and penalties for slowing play rates. The results show the multi-faceted impact of these rule changes, affecting wicket-to-wicket transitions, strategies and the overall dynamics of the game. The study offers a number of recommendations to ensure a smooth transition to the new rules, focusing on education, consistency, technological integration, player development, research collaboration, fan participation and adjustment periods. These measures are aimed at promoting the coexistence of cricket’s traditions and evolution, preserving its intrinsic values while remaining relevant to modern norms. Cricket’s ongoing dialogue about rule changes reflects the sport’s adaptability as it strives to maintain its competitive spirit and provide a fair and safe environment for players and fans. As the game continues to evolve, these discussions will play a key role in shaping its future, striking a balance between adhering to tradition and embracing change.

Keywords: Cricket Rules, International Cricket Council (ICC), Rule Changes, Historical Context, Recommendations.

INTRODUCTION

Cricket, often known as the “gentleman’s game,” boasts a deep-rooted history and a multitude of customs. Governed by a comprehensive set of rules, this sport regulates player conduct, maintains the game’s equilibrium between bat and ball, and embodies the spirit of fair competition. Recent rule changes introduced by the International Cricket Council (ICC) have taken center stage, sparking discussions, debates, and occasional controversies. These changes, which came into effect on October 1, 2022, symbolize cricket’s adaptability to contemporary standards while addressing issues related to fairness, safety, and the pace of the game. At its core, this sport is governed by an extensive set of regulations and guidelines that dictate player behavior, determine the flow of the game, and strike a balance between the roles of batsman and bowler (ICC, 2021). The strict adherence to these rules is considered pivotal in upholding the integrity of the game and ensuring a level playing field. Consequently, any modifications to these established rules are subject to meticulous examination, fueling widespread interest among cricket enthusiasts on a global scale (Sterns, 2016; Singh & Adhikari, 2015).

Historical Development of Cricket Rules

Cricket’s roots extend back to the 16th century, and throughout its existence, the game has undergone a multi-

tude of rule transformations. The Marylebone Cricket Club (MCC), established in 1787, has played a pivotal role in the standardization of cricket laws, which have formed the bedrock of modern cricket (Sanjaykumar, S et al., 2024). The MCC's "Laws of Cricket," most recently revised in 2017, have been indispensable in preserving the sport's core identity and guiding its progression. One of the most prominent transitions in cricket occurred with the emergence of limited-overs formats, including One Day Internationals (ODIs) and Twenty20 (T20) cricket (ICC, 2021). These formats introduced regulations tailored to shorter match durations, power play phases, and fielding restrictions. These changes were introduced to make cricket more captivating to a broader audience and have substantially contributed to cricket's burgeoning global popularity (Adie et al., 2022; Arif et al., 2018).

Recent implications

In recent times, the International Cricket Council (ICC), the preeminent global governing body for the sport, has introduced a series of substantial changes to cricket's rules. These rule adjustments have become a focal point of debates, discussions, and on occasion, controversies, as they endeavor to address diverse aspects of the game, ranging from on-field strategies to the comportment of players. The ICC's rule-altering process has been methodical, involving a comprehensive review and ratification by the Chief Executives' Committee (CEC) and various cricket committees led by distinguished figures, such as Sourav Ganguly, an illustrious former Indian cricket captain. These changes, which took effect on October 1, 2022, mirror not only the ever-evolving nature of the game but also the continuous pursuit of equity, entertainment, and safety within the realm of cricket (ICC, 2021; ICC, 2022; News18, 2022).

Rationale

These regulations dictate player conduct, shape the game's flow, and maintain the balance between batsmen and bowlers. The strict adherence to these established rules is fundamental in upholding the integrity of the sport. Any alterations to these rules require careful scrutiny and have piqued the interest of cricket enthusiasts worldwide. Recent rule changes introduced by the International Cricket Council (ICC) have sparked discussions, debates, and, at times, controversies, as they aim to address various facets of the game, from on-field strategies to player behavior. These changes, which came into effect on October 1, 2022, signify the evolving nature of cricket and its ongoing commitment to equity, entertainment, and safety.

The primary objective of this study is to determine the effects of recent rule changes in cricket; and to determine how these rule changes affected player behavior, the balance between batsman and bowler, and the overall dynamics of the game. The study aims to provide a comprehensive understanding of the implications of these rule changes, with particular attention to their role in preserving both traditional and modern elements of the sport.

METHODS

The study followed a five-stage methodological framework to identify the research question, identify the literature, select the study, draft the data, outline the data and report the data

Research Question

The research aims to investigate the recent rule changes introduced by the International Cricket Council (ICC) and their implications for the game of cricket. Specifically, it seeks to understand the impacts of these rule changes on player behavior, fairness, the balance between batting and bowling, and the overall dynamics of the game (ICC, 2021).

Identify the Literature

To understand the context and significance of these rule changes, a review of pertinent literature was conducted. This review covered historical developments of cricket rules, the rationale behind rule alterations, past controversies and ongoing debates in the cricketing world, and the overall importance of adapting rules to the evolving sporting landscape (Borooah, 2016; News18, 2022).

Select the Study

The study focuses on the analysis of recent rule changes introduced by the ICC. These changes were recommended by the Sourav Ganguly-led Men's Cricket Committee after discussing the MCC's updated 3rd Edition of the

2017 Code of the Laws of Cricket. The study places a particular emphasis on the changes that came into effect on October 1, 2022 (ICC, 2022).

Draft the Data

The data was collected by thoroughly examining the ICC documents, official sources, and news articles related to the rule changes in cricket. Each rule change was analyzed in detail, considering its context, expected impact, possible challenges, and suggested measures to address these challenges (ICC, 2021).

Outline the Data

The data is outlined in a structured format for each of the eight rule changes introduced by the ICC. This format includes:

1. A brief description of the rule change.
2. An analysis of the impact of the rule change on the game.
3. Considerations for the variation of the rule across different formats.
4. Identification of potential challenges and concerns arising from the rule change.
5. Proposed strategies for addressing these challenges and ensuring effective implementation of the new rules.

Report the Data

The findings from the data analysis are reported in a comprehensive manner, highlighting the significance of these rule changes. The report emphasizes the evolving nature of cricket and how the recent modifications align the game with contemporary standards and emerging challenges. The report also reflects the cricketing community's diverse responses to these changes, underlining the need for a balance between adapting to new norms while preserving the fundamental spirit of the game.

Study Characteristics

This research is characterized by the following key features:

1. *Time Frame:* The study primarily focuses on recent rule changes in cricket introduced by the International Cricket Council (ICC), specifically those that came into effect on October 1, 2022. It examines how these changes have influenced various aspects of the game (ICC, 2021).
2. *Multifaceted Analysis:* The research involves a multifaceted analysis of eight distinct rule changes. Each rule change is scrutinized based on its potential impact, format variations, challenges, and suggested measures to address these challenges. This comprehensive approach provides a detailed understanding of the evolving cricket landscape.
3. *Evidence-Based Analysis:* The research relied on a rigorous data collection process, encompassing official ICC sources, credible news articles, and documented information about the rule changes (ESPN Cricinfo, 2022). The findings and recommendations are based on evidence and substantiated by various sources.
4. *Proposed Strategies:* As a practical component, the research suggests strategies to address potential challenges posed by these rule changes. These recommendations are based on the analysis and aim to facilitate effective implementation of the new rules.

RESULT

Analysis of Recent Rule Changes

The International Cricket Council (ICC) has announced several changes to its Playing Conditions after the Chief Executives' Committee (CEC) ratified recommendations from the Sourav Ganguly-led Men's Cricket Committee, which discussed MCC's updated 3rd Edition of the 2017 Code of the Laws of Cricket and shared its conclusions with Women's Cricket Committee, who endorsed the recommendations to CEC. The main changes and key finding (**Table 1**) to the Playing Conditions that come into effect on 1 October 2022 are:

1. *Batters returning when caught:* When a batter is out Caught, the new batter will come in at the end the striker was, regardless of whether the batters crossed prior to the catch being taken. Previously, in cricket,

the striker and non-striker would seize the opportunity to swap ends while the ball was airborne. If they successfully switched ends before the striker was caught out, the incoming batter would find themselves at the non-striker's end. However, the recent rule change eliminates this possibility. The incoming batsman, after a caught dismissal, is now designated to take the strike, regardless of any prior exchange of ends. The exception to this rule is when the dismissal happens on the final ball of an over (ICC, 2021; Singh, S & Adhikari, A., 2015).

2. *Use of saliva to polish the ball:* This prohibition has been in place for over two years in international cricket as a Covid-related temporary measure and it is considered appropriate for the ban to be made permanent. Polishing the cricket ball is a critical element for bowlers, but it's imperative to note that the use of saliva for this purpose is no longer allowed. Players are permitted to utilize their sweat to shine the ball, while saliva is strictly prohibited. This rule change also eliminates the possibility of players resorting to mints or gum to thicken their saliva for ball maintenance (ICC, 2021; Geo.tv, 2022).
3. *Incoming batter ready to face the ball:* An incoming batter will now be required to be ready to take strike within two minutes in Tests and ODIs, while the current threshold of ninety seconds in T20Is remains unchanged (ICC, 2022; Bhalla et al., 2019).
4. *Striker's right to play the ball:* This is restricted so as to require some part of their bat or person to remain within the pitch. Should they venture beyond that, the umpire will call and signal Dead ball. Any ball which would force the batter to leave the pitch will also be called No ball (ICC, 2021; Rehman & Shah, 2017).
5. *Unfair movement by the fielding side:* Any unfair and deliberate movement while the bowler is running in to bowl could now result in the umpire awarding five penalty runs to the batting side, in addition to a call of Dead ball. Once the field has been arranged, fielders are required to maintain their positions without making any changes once the bowler begins their run-up. Altering one's fielding position at that stage is not only disruptive to the batsman but is also considered unfair. There have been occasions when batsmen were caught off guard by sudden changes in the field. In the past, umpires used to signal a dead ball in such situations. However, under the new rule, the batting side will be awarded 5 penalty runs for such infractions (ESPN, 2022; Geo.tv, 2022; Hill, Orchard, & Kountouris, 2019).
6. *Running out of the non-striker:* The Playing Conditions follow the Laws in moving this method of effecting a Run out from the 'Unfair Play' section to the 'Run out' section. The incident that unfolded during IPL 2019, when Ashwin 'Mankaded' Jos Buttler, remains a memorable and controversial moment. It raised debates about the act not aligning with the spirit of the game. To put an end to the discussions, the MCC (Marylebone Cricket Club) has officially classified it as a 'run out' and will no longer be considered unfair. In 1948, former India captain Vinoo Mankad executed a similar run-out of Australian wicketkeeper-batsman Bill Brown at the non-striker's end. The Australian media coined the term 'Mankading,' which has since become a part of cricket terminology (ICC, 2021; Borooah, 2016).
7. *Bowler throwing towards striker's end before delivery:* Previously, a bowler who saw the batter advancing down the wicket before entering their delivery stride, could throw the ball to attempt to Run out the striker. This practice will now be called a Dead ball (ICC, 2021; NDTV Sports, 2022; Ramos et al. 2016)
8. *Consequences of Slow Over Rate:* The in-match penalty introduced in T20Is in January 2022, (whereby the failure of a fielding team to bowl their overs by the scheduled cessation time leads to an additional fielder having to be brought inside the fielding circle for the remaining overs of the innings), will now also be adopted in ODI matches after the completion of the ICC Men's Cricket World Cup Super League in 2023 (ICC, 2022; Jamil et al., 2023).

Table 1. Analysis of Recent ICC Rule Changes and Their Impacts on Cricket

Rule Change	Impact	Format Variation	Challenge	Addressing Challenges
1.Batters returning when caught	Influence running between wickets. Affects partnerships and run-scoring strategies	Impact expected in all formats and ensuring fairness and clarity in dismissals	Risk of confusion and disputes. Misinterpretation in high-stakes situations	Educate players, umpires, and teams. Consistent enforcement and clear communication
2.Use of saliva to polish the ball	Commitment to player safety and hygiene. Potential impact on ball swing and seam movement	Applies uniformly across formats. Emphasis on player well-being	Concerns about the balance between bat and ball	Adapt to alternative ball maintenance methods. Focus on player health
3.Incoming batter ready to face the ball	Expedite the pace of the game. Influences field placements and strategies	More pronounced impact in Tests and ODIs	Pressure on teams for swift transitions. Potential impact on the game's strategic element	Emphasize efficient readiness procedures. Designated roles for swift preparation
4.Striker's right to play the ball	Introduces a new dimension to the game. Requires cautious batter and exploitable by bowlers	Consistency and fairness across formats	Alters traditional dynamics. Challenging for batters	Train umpires for consistent enforcement. Players adapt to stay within the pitch
5.Unfair movement by the fielding side	Adds fairness to the game. Discourages unsportsmanlike tactics	Consistent change across formats. Promotes ethical play	Open to interpretation of "unfair and deliberate movement"	Well-defined guidelines for recognizing unfair movement. Effective communication between umpires and captains
6.Running out of the non-striker	Aligns Playing Conditions with Laws of Cricket. Provides clarity and reduces ambiguity	Mainly affects procedural aspects in all formats	Requires players and umpires to adapt to a new process	Comprehensive training and education for players and umpires. Vigilance of match officials
7.Bowler throwing towards striker's end	Prevents bowlers from attempting run-outs before the delivery stride. Reduces disputes and controversies	Applies uniformly across all formats. Ensures uniformity and rule adherence	Limits bowlers' options for dismissing non-strikers	Bowlers focus on delivering a legal ball instead. Explore alternative dismissal strategies
8.Consequences of Slow Over Rate	Encourages punctuality in completing overs. Requires efficient over-rate management	Initially introduced in T20Is and extended to ODIs	Challenges in managing bowling resources efficiently	Enhance over-rate management strategies. Plan overs effectively and designate bowlers for specific phases

DISCUSSION

Recent changes to the rules of cricket by the International Cricket Council (ICC), as detailed in this study, illustrate the continuous evolution of the sport to meet modern standards and address emerging issues (ICC, 2021). Past rule changes have typically sought to address issues related to player safety, fairness, and the pace of the game. The recent changes reflect a continued emphasis on these aspects, with player safety, especially due to the saliva ban, being a prominent consideration. The game has evolved to accommodate various formats, and rule changes have evolved accordingly to maintain its relevance (ICC, 2021; Kumar et al. 2019). Recent changes in cricket rules have sparked a range of responses from the cricketing community. These rule modifications have garnered strong support, particularly in the case of the permanent saliva ban, which is seen as a vital step for health and safety. It reflects a responsible and prudent approach, particularly given the concerns regarding disease transmission in light of the COVID-19 pandemic (ICC, 2021). Nevertheless, rule changes that impact the game's balance, such as the stricter leg-

before-wicket (LBW) criteria and restrictions on bowlers' actions before delivery, have prompted varying opinions (Stern, 2016). Some individuals perceive these alterations as necessary to enhance competition and equilibrium in the game, while others express reservations about potential disruptions to conventional strategies and the added pressure on batters. Additional amendments relating to various aspects of the game, including the return of batters when caught, the readiness of incoming batters, the striker's rights, actions deemed unfair on the field, non-strikers' running out, and penalties for slow over rates, have also stirred nuanced discussions within the cricketing community (Hill et al., 2019). This ongoing discourse highlights the dynamic nature of cricket, as it adapts to meet contemporary standards and address the concerns of those who value its traditions and competitive spirit. Ultimately, these rule changes seek to harmonize cricket with changing global norms while preserving the essence of the sport. The methodology used in this study involved a comprehensive analysis of ICC documents, official sources and news articles to gather information on recent rule changes. Analysis of these changes reveals their consequences and potential problems, as well as proposed measures to solve them. Changes to the rules of cricket reflect the sport's ability to evolve while maintaining its core values (Ali & Khusro 2019). The purpose of these modifications is to provide a level, fun and safe cricketing experience for players and fans. As cricket continues to adapt, continued dialogue within the cricket community will play a key role in shaping the future of the game. The key challenge going forward will be to ensure that players, umpires and teams adapt effectively to these rule changes while maintaining the spirit of cricket even as the sport continues to transform (Bhattacharjee et al., 2015). The study also confirms the data regarding the influence of rules on the development of not only cricket, but also other sports games.

Proposed Strategies

1. *Educational Initiatives:* To mitigate potential confusion and disputes regarding rule changes, it is recommended that cricket governing bodies, including the ICC, invest in comprehensive educational programs. These programs should target players, coaches, umpires, and fans, providing clear and concise explanations of the rule alterations and their practical implications. Well-informed stakeholders will contribute to smoother transitions and a more streamlined implementation of the changes.
2. *Consistency and Clarity:* Ensuring consistency in rule interpretation and clear communication is vital. Umpires play a central role in this, and they must be trained rigorously to enforce the rules consistently. Cricket authorities should develop comprehensive guidelines and reference materials to assist umpires in interpreting and implementing the rules correctly, reducing the scope for disputes.
3. *Technological Integration:* Embrace technology to aid in rule enforcement. The Decision Review System (DRS) has already demonstrated the benefits of using technology for decision-making. Further technological integration, such as using ball-tracking systems to confirm fair deliveries or fielding positions, can enhance the accuracy of rule enforcement.
4. *Player Development:* Cricketers must adapt to the evolving rules. This requires changes in training and preparation. Coaches and cricket academies should include rule changes in their training curricula. Players need to develop new strategies and techniques to excel under the modified rules. Specialized coaching in adapting to the rule changes can be beneficial.
5. *Research and Collaboration:* Encourage research on the impact of rule changes on the game. Collaborations between cricketing bodies, academic institutions, and experts can yield valuable insights. Research findings can inform future rule adjustments and contribute to the understanding of the game's dynamics.
6. *Fan Engagement:* Cricket's popularity depends on fan engagement. To keep the audience invested, cricket authorities should actively communicate the reasons behind rule changes and their expected impact. Engaging fans through social media, broadcasts, and fan forums can foster a deeper appreciation of the evolving game.
7. *Adaptation Period:* Allow a reasonable adaptation period for players and teams to get accustomed to the rule changes. In some cases, like the permanent ban on saliva use, players may need time to adjust to new ball-maintenance practices. Providing this transitional period can help avoid undue disruptions to the game.

These recommendations, when implemented, can ensure a smoother transition to the new rules, uphold the integrity and fairness of the game, and preserve its essential traditions while adapting to modern standards.

CONCLUSION

Rule changes have been shown to play a key role in maintaining a balance between batting and bowling, promoting competitive spirit and ensuring player safety. They also strive to solve problems related to the speed of the game. The rule changes have been met with widespread approval, especially the permanent ban on the use of saliva, which is considered a responsible response to global health problems. The impact of rule adjustments on game balance and game strategies has given rise to differing opinions within the cricket community. While some see these changes as necessary to increase competition and adaptability, others have expressed reservations about potential disruptions to traditional tactics and increased pressure on batsmen. These varied perspectives highlight the complex nature of rule modifications and the importance of striking a balance between compliance with existing regulations and preserving the fundamental essence of cricket. The historical development of the rules of cricket, which have evolved over the centuries, highlights the sport's ability to adapt to changing times. This study highlighted the importance of rule changes to ensure fairness, accuracy and clarity in decision making. However, the world of cricket is still no stranger to controversy and ongoing debate, with topics such as the Decision Review System (DRS) and field restrictions illustrating the controversial nature of these topics.

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Conflict of Interest

The authors declare that there is no conflict of interest

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COMPARATIVE ANALYSIS OF HEART RATE VARIABILITY IN SHORT-DISTANCE AND ULTRAMARATHON RUNNERS: IMPLICATIONS FOR TRAINING OPTIMIZATION

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Abstract: This study investigated heart rate variability (HRV) as a biomarker for assessing athletes' functional states and adaptation mechanisms to different training modalities. The objective was to develop a technology for monitoring and controlling the training process of runners using HRV indicators. Thirty participants were divided into two groups: Group 1 consisted of short-distance runners, and Group 2 included long-distance runners. HRV was assessed via electrocardiography using the "Varicard" system, while additional data were gathered through a Google Forms survey. Statistical analysis was conducted using SPSS software (version 13.0).

Results revealed minimal differences in heart rate between the two groups, with the resting heart rate being lower in long-distance runners. The low-frequency component (%LF) exhibited a more pronounced response to the orthostatic test in short-distance runners ($p < 0.05$). Regression analysis demonstrated that factors such as age, alcohol consumption, and smoking led to an increase in LF% and a decrease in parasympathetic activity.

HRV effectively reflects the adaptive capacity of runners and can be employed to monitor and control training processes. Non-training factors, including nutrition, health status, perceived load tolerance, age, and gender, also influence HRV and must be considered when preparing runners. These findings highlight the critical role of HRV in optimizing athletic performance and tailoring individualized training strategies for short- and long-distance runners.

Keywords: heart rate variability, athletes, short-distance runners, long-distance runners, adaptation to physical exercise.

INTRODUCTION

Track and field is one of the oldest sports, which was included in the Olympic Games of Ancient Greece (776 BC - 394 AD) and to this day, is included in the programs of the Olympic Games, World and European Championships. The International Association of Athletics Federations (IAAF) includes 214 national federations of six continental associations. Running remains the most popular and spectacular discipline of athletics, which is practiced by more than 600 million people in the world.

Under the influence of systematic athletic training, heart rate slows down due to enhanced parasympathetic modulation of cardiac automatism, accompanied by a tendency toward a reduction in arterial blood pressure. Regulatory changes in the autonomic nervous system explain this effect in the autonomic nervous system centers in trained runners at rest, which are linked to an increased parasympathetic tone. As a result, negative chronotropic and inotropic effects are observed, ultimately leading to a decreased heart rate (Aubert et al., 2003). Moreover, a correlation has been observed between the intensity of negative chronotropic influences and the nature of the training regimen (Gronwald et al., 2021). The development of endurance in long-distance runners is associated with an increased tone of the parasympathetic division of the autonomic nervous system (Rogers et al., 2021). In contrast, anaerobic training loads in sprinters do not suppress the sympathoadrenal system, as the predominant activation of the humoral pathway is maintained, along with unchanged catecholamine metabolism (Rogers & Gronwald, 2022; Schaffarczyk et al., 2022).

E.P. Ilyin (2004) emphasizes that theoretical understanding of human adaptive capacities significantly lags behind actual achievements. This is evidenced by advancements in sports and other fields of activity that were once deemed unattainable. One of the most extreme forms of physical activity is trail running, which involves off-road races covering distances of 100 km or more. A specialized discipline within trail running is skyrunning, which con-

sists of mountain races conducted at high altitudes or featuring significant elevation gain (Ovsyannikova et al., 2020). Another emerging and rapidly growing endurance discipline is the backyard ultra, a race format in which athletes must complete a 6,700-meter loop every hour, restarting at the top of each hour, until only one runner remains on the course (Marathonec, 2023). Additionally, traditional annual ultramarathon competitions are held on stadium tracks, featuring continuous running events lasting 6, 12, 24, 48, and even 72 hours. It is essential to highlight that such remarkable achievements in endurance sports necessitate a highly developed level of physiological system functionality to sustain performance over extreme durations.

Athletes strive for excellence, often pushing their bodies through intense training schedules (Durandt et al., 2006). This constant pressure without adequate rest can lead to a state of overtraining, which can take weeks or months to recover from, much longer than early overtraining (Cochrane, 2004; Kiss et al., 2015; Kenneally et al., 2018). When overtraining occurs, the autonomic nervous system responds to the constant stress placed on the body by activating the sympathetic-adrenal system. On the other hand, overtraining depletes the body's physiological resources, leading to a reduced capacity for recovery (Aubert et al., 2003; Cornforth et al., 2015).

Furthermore, one of the primary factors contributing to thanatogenesis in cases of sudden cardiac death among young athletes is the insufficiency of compensatory-adaptive mechanisms. The main cause of this phenomenon is the chronic overload of the cardiac muscle due to intensive training. Initially, short-term compensatory mechanisms are activated; however, these processes are highly energy-consuming. When sustained over prolonged periods, they disrupt metabolic processes in cardiomyocytes, ultimately compromising cardiac function.

This is where HRV monitoring becomes critical (Mal'tsev et al., 2010; Minnis, 2015; Sammito & Böckelmann, 2016; Korobeynikov et al., 2018; Kölling et al., 2019). By identifying early signs of HRV disruption, athletes and coaches can adjust training plans, incorporate more recovery strategies, and prevent the detrimental effects of overtraining (Hynynen et al., 2006; Cornforth et al., 2015; Augustine & Howard, 2018; Boullosa et al., 2020). All of this points to the importance of measuring HRV in improving the performance of exercise programs in athletes.

HRV can be affected by various non-training factors such as medication, co-morbidities, alcohol and cigarette use, sleep quality, etc., which need to be considered when planning the training process for runners (Lukaski, 2004; Brooks et al., 2005; Paul & Garg, 2012; Strüven et al., 2021; Lundstrom et al., 2023).

Problems of the study.

The study of the functional characteristics of athletes engaged in extreme forms of physical activity represents a large-scale biological experiment aimed at determining the true capabilities of the human body. The findings of such research can contribute to the comprehensive study of human physiological potential. A comparative analysis of heart rate variability in relation to other factors influencing the training process arises from the necessity of understanding cardiovascular adaptation to physical exertion of varying intensity. This is particularly relevant, as the cardiovascular system often serves as a limiting factor in determining the intensity and duration of physical workloads. The assessment of systemic functional levels and the identification of trends in their improvement with the enhancement of physiological capacity constitute a pressing challenge in contemporary physiology of muscular activity.

The purpose of the study is to conduct a comparative analysis of heart rate variability (HRV) indicators to identify the most significant parameters for assessing cardiovascular adaptation to physical exercise of varying duration. Additionally, the study aims to determine key factors contributing to the optimization of the training process among runners with different specializations.

Hypothesis:

- HRV indices are different in short distance runners and long-distance runners which need different training programs.
- Heart rate variability (HRV) indicators in runners are influenced by auxiliary factors such as sleep quality, smoking, supplementation, and other lifestyle variables, which are, in turn, dependent on the nature of training loads.
- Considering HRV characteristics in combination with additional influencing factors can serve as a foundation for developing advanced training optimization strategies for runners with different specializations.

MATERIALS AND METHODS

The study was conducted at the Laboratory of Human Abilities of the Moscow City University from November 2023 to January 2024. The study involved 30 people aged between 25 and 35 years, of whom equal proportions were male and female. They were divided into 2 groups depending on their level of physical activity and specific sports activities. Group 1 - short-distance runners (competitive distances up to 1 kilometers). Group 2 - long-distance runners (competitive distances over 42.2 kilometers, including ultramarathoners, competitive distances over 100 kilometers). The athletes were tested at the same time (10 a.m.) after breakfast before their first training session. All athletes had the same pre-competition preparation period.

The biomedical research has been conducted in accordance with the ethical principles of the Helsinki Declaration of the World Medical Association (WMA) of 1964 (as amended in 2008). The inclusion of athletes in the study group has been carried out based on a written signed and dated Informed Consent Form. The informed consent has been drawn up in accordance with the laws of the Russian Federation, the GCP rules and the principles of the Helsinki Declaration of the BMA (Food and Drug Administration, 1995).

To assess the body's adaptive capabilities, ECG recording was performed in accordance with the "International Standard" proposed by the North American Society of Electrophysiologists and the European Society of Cardiology in 1996. The study of heart rate variability in athletes was conducted using the "Varicard" computer system. HRV parameters have been measured in the state of relative rest and in response to a functional test for both groups. The time domain method is a low-error approach that examines factors such as standard deviation of the NN interval (SDNN), percentage of consecutive NN intervals, the difference between which exceeds 50 mc (pNN50), and the square root of the mean squared differences of successive NN interval (RMSSD). The frequency domain method is a rapid approach that considers three general peaks: VLF (<0.04 Hz), LF (0.04-0.15 Hz), and HF (0.15-0.4 Hz). In the non-linear method, the entropy score is calculated as a reliable measure. This study employed both time domain and frequency domain methods to assess the status of athletes.

Interpretation of the results of the study of heart rate variability (HRV) was carried out taking into account the activity of the heart rate regulation circuits (R.M. Baevsky, 1997). The sympathetic channel of regulation was assessed by such indicators as % LF, % VLF. The parasympathetic channel of regulation is characterized by RMSSD, % HF. The ratio of the activity of the autonomic nervous system departments can be assessed by SDNN, LF/HF. The degree of centralization in the control of the heart rhythm was determined by the HR, SI indicators. The total activity of neurohumoral influences on the heart rhythm was revealed by the TP indicator.

To assess the influence of auxiliary factors on HRV, a questionnaire was developed, which included several sections:

1. sports history;
2. signs of autonomic disorders (A. Veyn, 2000);
3. health;
4. pernicious habits;
5. nutrition and supplements.

The initial results of the pilot testing of individual methodologies were presented in the proceedings of the International Conference (A. Nalobina, O. Ivashchenko, 2017), and since then, these methodologies have been employed in more than 50 studies (according to data from the Russian Science Citation Index). Statistically significant direct correlations between the indicators of all methodologies, as well as their associations with other variables, attest to their convergent validity. Reliability was assessed using Cronbach's α coefficient, along with Raykov's ρ coefficient (Raykov, 1997), which is also known as McDonald's ω (McDonald, 1999) when derived from a factor model. The internal consistency indices ($\alpha = 0.72$, $\rho = 0.73$) indicated a satisfactory level of reliability for the questionnaire.

Statistical processing of research results.

An assessment of the nature of the data distribution using the Shapiro-Wilk and Kolmogorov-Smirnov criteria made it possible to consider the distribution of heart rate variability data as close to normal in all the samples under consideration and to apply parametric statistics methods (the arithmetic means of the samples were considered as indicators of position, and the standard deviation as an indicator of variation). To assess the differences in cardiac rhythm parameters in the selected groups, a one-dimensional multivariate analysis of variance (General Linear Mod-

el, Univariate) was used, followed by Tukey's post-hoc test. Differences were considered statistically significant at P-values <0.05.

Multiple linear regression was used to evaluate the questionnaire data to examine the relationship between the response results and each of the HRV indicators to understand the importance of each factor. In this statistical process, a code is assigned to each qualitative variable. SPSS (13.0) software was used for statistical calculations.

RESULTS

In the process of a typical stress response (and in our case, stress is physical activity), several hierarchical levels can be distinguished that support the optimal functional state of a person:

1. Higher nervous activity, which ensures the change of the dynamic behavioral stereotype.
2. The autonomic nervous system (the system of neurohumoral regulation), This system affects the involuntary functions of the body, such as heart rate, respiration, and digestion.
3. Morphological changes in organs and systems that determine physical performance and work capacity.

Despite the great difference in the training process, the results show that there is a small difference in the cardiac indices of short- and long-distance runners, and the only differentiating factor is the resting heart rate (table 1). One of the reasons for this fact is the long-term mechanisms of adaptation to physical activity, which have common features in athletes of different sports. On the other hand, the high spread of indicators (sigma) indicates the heterogeneity of the group and the presence of individual-typological features of the athletes' bodies.

Table 1. Comparison of heart rate variability in a state of relative rest in an experimental group depending on sports specialization

Indicator	Short distance (n=11)		Ultra marathon (n=11)		The validity of the differences (P)
	mean	sigma	mean	sigma	
HR (bpm)	68.45*	8.92	59.09*	8.26	0.0122
SDNN, mc	77.45	35.83	66.49	36.68	0.2533
RMSSD, mc	78.90	53.57	64.72	58.04	0.2882
TP, mc ²	8267.25	10292.42	4882.18	6616.20	0.1960
pNN50, %	37.52	20.87	29.85	24.88	0.2318
SI, a.u.	73.91	55.86	84.27	56.00	0.3415
HF, %	45.9	14.00	35.64	17.75	0.0835
LF, %	37.85	11.74	45.76	15.43	0.1059
VLF, %	16.24	7.83	18.65	5.85	0.2224
LF/HF, a.u.	0.98	0.55	1.95	1.72	0.0518
LF, mc ²	3149.68	4930.41	2062.76	3160.82	0.2819
HF, mc ²	3308.09	4218.37	1523.16	2007.31	0.1205
VLF, mc ²	1009.70	1409.71	794.25	1211.94	0.3589

Legend: HR - Heart Rate; SDNN - Standard Deviation of the NN interval; RMSSD - Root Mean Square of Successive Differences; TP- Total Power; pNN50 - Percentage of NN50; SI- Stress Index; HF - High-Frequency Power; LF - Low-Frequency Power; VLF - Very-Low-Frequency Power.

() - the validity of the differences at a p-value < 0.05.*

To better understand this fact, an analysis of the HRV indices in response to the orthostatic test was conducted (table 2,3).

Table 2. The reaction of heart rate variability indicators in response to a functional test in short-distance runners

Indicator	in a state of relative rest		Orthostasis		increase, %
	mean	sigma	mean	sigma	
HR (bpm)	68.45	8.92	83.72	14.35	22.30
SDNN, mc	77.45	35.83	374.18	894.96	383.12
RMSSD, mc	78.90	53.57	370.63	889.94	369.74
TP, mc ²	8267.25	10292.42	11357.72	23989.86	37.38
pNN50, %	37.52	20.87	14.35	16.29	-61.75
SI, a.u.	73.91	55.86	169.27	134.37	56.33
HF, %	45.90	14.00	21.37	15.36	-53.44
LF, %	37.85	11.74	54.90	15.50	45.04
VLF, %	16.24	7.83	23.72	16.78	46.05
LF/HF, a.u.	0.98	0.55	3.74	2.36	281.63
LF, mc ²	3149.68	4930.41	2900.89	3819.24	-7.89
HF, mc ²	3308.09	4218.37	1720.48	2750.54	-47.99
VLF, mc ²	1009.70	1409.71	4744.70	13439.80	369.91

Legend: HR - Heart Rate; SDNN - Standard Deviation of the NN interval; RMSSD - Root Mean Square of Successive Differences; TP- Total Power; pNN50 - Percentage of NN50; SI- Stress Index; HF - High-Frequency Power; LF - Low-Frequency Power; VLF - Very-Low-Frequency Power.

Table 3. The reaction of heart rate variability indicators in response to a functional test in ultramarathon runners

Indicator	in a state of relative rest		Orthostasis		increase, %
	mean	sigma	mean	sigma	mean
HR (bpm)	59.09	8.26	74.18	12.15	25.53
SDNN, mc	66.49	36.68	70.05	52.57	5.35
RMSSD, mc	64.72	58.04	63.28	64.64	-2.22
TP, mc ²	4882.18	6616.20	4568.43	4797.53	-6.42
pNN50, %	29.85	24.88	10.42	15.70	-65.09
SI, a.u.	84.27	56.00	167.45	125.33	98.70
HF, %	35.64	17.75	29.26	23.71	-17.90
LF, %	45.76	15.43	46.08	18.76	0.69
VLF, %	18.65	5.85	24.66	16.31	32.22
LF/HF, a.u.	1.95	1.72	3.58	3.88	83.58
LF, mc ²	2062.76	3160.82	1210.39	1267.95	-41.32
HF, mc ²	1523.16	2007.31	2003.15	3532.65	31.51
VLF, mc ²	794.25	1211.94	593.98	316.88	-25.21

Legend: HR - Heart Rate; SDNN - Standard Deviation of the NN interval; RMSSD - Root Mean Square of Successive Differences; TP- Total Power; pNN50 - Percentage of NN50; SI- Stress Index; HF - High-Frequency Power; LF - Low-Frequency Power; VLF - Very-Low-Frequency Power.

The transition from a resting state to an orthostatic position triggers an increase in heart rate due to the activation of the sympathetic nervous system. This system is responsible for the body's "fight-or-flight" response and prepares the body for physical activity or stressful situations.

In the context of athletes, maintaining proper heart function during posture changes is crucial for optimal performance. As expected, factors associated with sympathetic nervous system activity, such as heart rate, increase during this transition. This increase is necessary to meet the demands of increased blood flow and maintain blood pressure.

Conversely, factors related to parasympathetic nervous system activity, which is responsible for “rest and digest” functions, tend to decrease during the transition from rest to standing. This temporary shift in autonomic nervous system balance allows the body to prioritize immediate physiological needs associated with the change in posture.

It’s important to note that the extent of these changes may vary among athletes depending on individual factors such as fitness level.

At first glance, when examining the tables, there appears to be a significant difference in the change in numbers obtained between short-distance and long-distance runners. According to such indicators as RMSSD; TP; VLF%, HF, LF runners have different reactions to the standard test. There is also a different degree of expression of the reaction to the standard test in runners of different specializations, which is clearly visible from the following parameters: SDNN (382.12 and 5.35), %LF (45.04 and 0.69), LF/HF (281.63 and 83.58). Only in such indicators as HR, pNN50, SI the results are very close.

However, to determine the difference in the percentage change in activity of each HRV index with the transition from rest to orthostatic state, the p-value was measured. In this section, due to the great importance of the change in each factor, the percentage change was considered. P-values are mentioned for each index (table 4).

Table 4. The significance levels of intergroup differences in the percentage change in the activity of each heart rate variability (HRV) parameter during the transition from a resting state to an orthostatic position (as assessed using the Mann-Whitney criterion)

Indicator	HR	SDNN	RMSSD	TP	PNN50	SI	% HF	% LF	% VLF	LF/HF	LF	HF	VLF
P-values	0.33	0.13	0.13	0.26	0.43	0.13	0.065	0.042*	0.11	0.18	0.21	0.16	0.17

Legend: (*) - the validity of the differences at a p-value < 0.05.

The only factor that should be considered as a difference between ultramarathon runners and sprinters is %LF. LF power is dependent on the activity of the sympathetic and parasympathetic nervous systems. In the context of HRV analysis, the observation of a significant difference in LF with other parameters remaining relatively constant requires a closer look at the underlying mechanisms. This pattern suggests that the sympathetic nervous system (SNS) may be the primary driver of the observed physiological changes. The significant decrease in LF HRV combined with minimal changes in other parameters may reflect a predominant increase in PNS activity. In the context of comparing HRV data between ultramarathon runners and sprinters, the observed significant decrease in LF HRV (41%) among ultramarathon runners during the transition from rest to standing compared to a smaller decrease (7.89%) among sprinters. ultramarathon runners can cause damage to the heart and muscles, and ultramarathon runners experience more inflammation than sprinters. This inflammation can be caused by muscle damage as they work for long periods of time.

Thus, we selected the HRV indicators that characterize the most typical mechanisms characteristic of the process of long-term adaptation of runners: HR, PNN50, SI, LF. In regression analysis, R refers to the correlation coefficient between the dependent variable (Y) and the predicted variable (x). In this study the questions of questionnaire are considered as X and HRV indices as Y. Multiple linear regression was used to examine the relationship between questionnaire results and each of the HRV indices and understand how important each factor is.

%LF is a factor that is an indicator of the sympathetic nervous system. A change in %LF at relative rest has a reliable correlation with the following survey results (table 5).

Table 5. Correlation Data: %LF at Relative Rest and Survey Responses

Survey Response	Lower %LF at Relative Rest	Higher %LF at Relative Rest
Alcohol consumption		-0.62
Chronic disease		-0.18
Discoloration of fingers or toes		-0.032
Drinking sports drinks	0.19	
Feeling good after a hard workout	0.84	
Feeling of energy and strength		-0.26
Feeling of improved physical fitness	0.69	
Getting older		-0.28
More sweating	0.65	
More water consumption	0.367	
Typical symptoms of anxiety		-0.24

The provided results suggest that increasing age, alcohol consumption, and smoking lead to an increase in %LF and a decrease in parasympathetic activity. Conversely, consuming more vegetables and water is associated with a decrease in %LF, which is generally considered favorable. In general, LF increases when transitioning from the supine position to orthostatic position. A pronounced increase in LF% may indicate excessive sympathetic activation, which could be detrimental and gradual LF increase upon standing in healthy individuals indicates a normal cardiovascular response to gravity.

The stress index (SI) tends to increase with age, reflecting a decline in parasympathetic nervous system activity and an increased susceptibility to stress. A change in SI at relative rest has a reliable correlation with the following survey results (table 6).

Table 6. Correlation Data: Stress Index at Relative Rest and Survey Responses

Survey Response	Lower Stress Index at Relative Rest	Higher Stress Index at Relative Rest
Being in competition phase		0.61
Being in recovery phase	-0.65	
Chronic diseases		0.66
Discoloration of fingers or toes		0.51
Drinking coffee and tea	-0.162	
Excessive sweating		0.307
Getting older		0.02
Male gender		1.09
More alcohol consumption	-0.34	
More training frequency	-0.335	
More vegetable consumption	-0.78	
More water consumption	-0.15	
Tendency to facial redness		0.05
Typical symptoms of anxiety		0.469

Index (SI) should increase with a change in position from supine to standing. This increase indicates normal sympathetic nervous system activity in response to postural changes and excessive SI increase could signify excessive stress or cardiovascular issues.

No or a reduced SI increase might indicate sympathetic nervous system weakness or other health problems. Therefore, it cannot be definitively stated whether a higher or lower changes in SI is better therefor the results of questionnaire cannot properly define the effective factors because sometimes too much increase means that autonomic nervous system does not work well and sometimes increase means better function of sympathovagal system. The results we obtained in this study indicate that SI depends on the period of the training process. The pre-competition period is characterized by higher SI values, and the recovery period is characterized by the lowest ones.

PNN50 quantifies parasympathetic nervous system function. A change in PNN50 at relative rest has a reliable correlation with the following survey results (table -7).

Table 7. Correlation Data: PNN50 at Relative Rest and Survey Responses

Survey Response	Lower PNN50 at Relative Rest	Higher PNN50 at Relative Rest
Alcohol consumption		1.169
Coffee or tea		0.64
Discoloration of fingers and toes	-0.81	
Excessive sweating	-0.27	
Feeling of fitness increase	-0.1	
More training frequency		0.45
More typical symptoms of anxiety	-0.45	
Protein consumption before training	-1.33	
Protein food after exercise		0.82
Sport drink		0.41
Vegetable consumption		1.4
Water consumption		0.28
Well-being feeling after hard exercise		0.26

Notably in this part is the positive effect of alcohol consumption. It should be considered that alcohol consumption can have complex effect on PNN50.

Low to moderate amounts of alcohol may have different effects than high quantities. Type of alcohol is also important (beer, wine, spritis, etc.)

DISCUSSION

HRV indicators reflect the state of adaptive capabilities of the runners' body well, which can be used to assess functional indicators and manage the training process. The state of long-term adaptation to training loads is characterized by high activity rates of the parasympathetic division of the ANS (HF, PNN50) and high heart rate variability (SDNN, TP) and low stress index (SI) values.

These findings are consistent with our previous scientific research in this field (Dakuko et al., 2020; Kalsina & Nalobina, 2018; Nalobina, 2020). Other researchers have established that high values of indicators associated with parasympathetic activity, such as HF and pNN50, are correlated with better adaptation to physical exertion and more effective recovery in athletes. For instance, a study published in the *European Journal of Applied Physiology* demonstrated that training based on daily heart rate variability (HRV) measurements contributes to improved endurance and aerobic performance in professional runners. Furthermore, studies indicate that a decrease in HRV may be associated with increased sympathetic activity and insufficient recovery, potentially leading to overtraining conditions. For example, research published in *Sports Medicine - Open* found that reduced HRV is linked to higher training intensity and inadequate recovery in endurance athletes (Carrasco-Poyatos et al., 2022; Nuuttila et al., 2024).

At the same time, specific HRV indicators have been identified that can be used as specific markers considering the specifics of the sports discipline: short-distance runners or ultramarathon runners. For ultramarathon runners, the most significant indicator is HR, which was significantly ($p < 0.05$) lower than that of short-distance runners. And for short-distance runners, the most important is the response of the cardiovascular system to the orthostatic test, which

consists in an increase in %LF- frequency.

Non-training factors such as nutrition, health, subjective feelings of load tolerance, age, gender, etc., affect HRV values. This must be considered when training runners. We have received reliable information about which additional factors help athletes achieve high sports results, and which hinder this. The most important things in the diet of athletes are: sufficient amount of vegetables, sufficient amount of protein in food after training, proper drinking regime. From the health side, the absence of diseases, the absence of symptoms of cold fingers are important.

Of the subjective symptoms, the well-being after training, the feeling of increased physical strength and performance are important.

It may be useful for nutritionists and coaches of ultra runners to include high-protein foods in their training plans to help prevent heart problems. On the other hand, another important point is that strenuous training and long-distance running may be harmful to these people. The survey found that even when athletes feel strong and energetic, it is possible that their autonomic nervous system is not functioning properly. Having more anxiety symptoms does not necessarily mean that the autonomic nervous system is not functioning properly, but it does not rule out the possibility of problems in this system. It is possible that people's different physical reactions to anxiety are due to individual differences. In general, by consuming more water and vegetables, athletes can improve their overall health and well-being, which may help improve the function of their autonomic nervous system. Moreover, the effects of alcohol depend on various factors, as mentioned earlier, and it is impossible to predict its effects without having more accurate information about it. The exact effect of coffee or tea consumption on the nervous system remains unclear. Further research is needed. This study found that athletes who consumed a protein-rich meal after exercise tended to perform better, although more research is needed to confirm this. In addition, frequent training appears to have a very positive effect on the autonomic nervous system, and the model developed reported a positive effect on each factor. It is important to consider the athlete's age when prescribing a training program, as aging has a negative effect on cardiovascular factors. It may be better to focus on increasing the frequency of training rather than the duration of exercise to improve the health of the autonomic nervous system in these athletes.

CONCLUSION

Training process management based on HRV indices allows to objectively assess the adaptive capabilities of runners taking into account their sport specialization. Taking into account additional factors affecting the activity of different parts of the autonomic nervous system, such as nutrition, rest regime and age of the athlete, can help to optimize the training process for runners of different specializations. This study will be useful for both coaches and sports physicians.

Conflict of interest

The authors state no conflict of interest.

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EFFECTIVENESS OF THE OUTDOOR LEARNING MODEL CONTAINING LOCAL CULTURE ON CHILDREN'S GROSS MOTOR SKILLS

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Abstract: Outdoor learning is a model of learning conducted outside the classroom through direct utilization of the environment that provides authentic and concrete experiences for children. These experiences allow children to receive stimuli that can expand the learning environment and allow the development of various domains of child development. This study aims to examine the effectiveness of outdoor learning model with local culture on gross motor skills. The type of experimental research used in this study is quasi experimental research with the assumption that this study cannot fully control the variables that will affect the results of this study later. In this case, the sample was selected from a population that was not randomized because the subjects were already formed in class groups. The sample in this study were children aged 5-6 years with a total sample size of 42 children who were divided into two groups, namely the experimental group and the control group. Data collection instruments in the form of observation sheets. The data obtained were then analyzed statistically using an independent t-test on the SPSS.16 program to see the difference between the experimental group and the control group. The results showed that there was a difference between the experimental group using the outdoor learning model with local culture and the control group using the expository method with a value of $0.000 < 0.05$. This means that the outdoor learning model is effective in improving gross motor skills. Based on the findings, this study recommends teacher training in using outdoor learning model with local culture through new ways to improve gross motor development.

Keywords: children aged 5-6 years, gross motor skills, local culture, outdoor learning model.

INTRODUCTION

Early childhood is defined as the period from pregnancy to 6 years of age (Castaño et al., 2019). The early years period marks a critical time for children's growth and development (Vanderloo et al., 2015). As is the case, one of the main goals of early childhood education is to support the child's complete growth and development (Ozturk & Ozer, 2021). One aspect of child development that is important to optimize is the physical-motor aspect. Physical activity and motor skills have a cyclical or reciprocal relationship (Saraiva et al., 2013). Physical activity is very beneficial for the development of motor skills, especially when implemented in formal settings with opportunities for practice under guidance (Dapp et al., 2021). Physical activity and motor skills are important components of current and future health trajectories in children (Palmer et al., 2019).

Physical activity in early childhood can promote the development of motor skills (Stodden et al., 2008), (Susanto et al., 2024). Engaging in regular structured physical activity is a promising way to improve motor skills and support long-term motor development (Dapp et al., 2021), (Susanto et al., 2022). Motor skills play a fundamental role in the foundation of a lifelong active lifestyle that has not only been shown to contribute to physical health and physical development, but also substantially contribute to cognitive and social development (Lubans et al., 2010). The early development of children's motor skills depends on the interaction between environmental and biological factors. The quality and extent of movement experiences during childhood are initially strongly related to the child's chosen conditions (e.g. biological conditions at birth) and are further shaped by the variable nature of the environment and the balance of maturation processes (Saraiva et al., 2013). Motor skills in childhood are important determinants of physical activity and physical fitness later in life (Bardid et al., 2015). When a child's motor skills are impaired, this can affect school readiness, academic progress, social skills, play and independence (van der Walt et al., 2020).

Gross motor skills are very important for children's health and development (Veldman et al., 2020). This is because gross motor skills are the basis for humans to reach the optimal level needed to undergo normal development, maintain health, and achieve athletic excellence (Hussain & Cheong, 2022). Gross motor skills are the building blocks of movement consisting of locomotor skills, object manipulation, and stability. These abilities include jump-

ing, running, and kicking which are critical in the promotion and maintenance of a healthy developmental trajectory (Veldman et al., 2019). The proper development of gross motor skills in early childhood is considered an important factor for child development (Castaño et al., 2019). Motor skills that develop fully and evenly will have a significant impact on the subsequent learning of motor skills, namely in school and adulthood (Fu et al., 2022). Motor abilities also influence children's physical, social, and cognitive development (Iivonen & Sääkslahti, 2013). It is generally agreed that cognitive and language development depends on the emergence of motor abilities (Houwen et al., 2016).

The decline in children's motor skills is a global issue that is largely influenced by increasing sedentary behavior and decreasing physical activity (Bardid et al., 2015). Children with low motor skills are generally less physically active and have an increased risk of obesity and cardiorespiratory disease (Saraiva et al., 2013), as well as peer victimization (Øksendal et al., 2022). Obesity in children is a serious health problem. Overweight and obesity in children and adolescents are not only associated with poor performance in gross motor coordination activities but also with greater physical health risks (Barros et al., 2022). Apart from these problems, there is a common misconception that children naturally develop basic motor skills through a maturation process, when in reality children also need practice and instruction to learn and develop basic motor skills (Bardid et al., 2016; Escolano-Pérez et al., 2021; Honrubia-Montesinos et al., 2021; Su et al., 2022).

Delaying intervention regarding gross motor delays due to lack of instruction, experience, feedback, and opportunities creates a negative impact on children's academic performance, physical activity, and health-related fitness later in life (Liu et al., 2017). Researchers from various countries have reported lower-than-expected levels of development of children's motor skills (Bardid et al., 2015; Su et al., 2022). This reflects the critical situation regarding the low physical development of children in various countries which raises concerns.

Research in Norway showed the highest prevalence of developmental delays among children who were developing, namely gross motor skills at 6.1% at 12 months of age compared to communication, problem-solving, and fine motor skills. During the first year of life, delays most often occur in the gross motor area (Valla et al., 2015). In addition, a study conducted in China reported that 18.5% of children aged 1-35 months experienced gross motor delays (Wei et al., 2015). Three studies in Iran conducted on children in the age range of 4-60 months showed a prevalence of delays in gross motor development of 2.2% (Yaghini et al., 2015), at the ages of 20 and 22 months showed a prevalence of delays in gross motor development of 4.04% (Sajedi et al., 2014), at the age of 36-60 months showed a prevalence of delays of 3.1% (Ghazavi et al., 2013). Furthermore, research in Colombia on children aged 1-5 years around 15% of 240 children who had been assessed had a risk of 10.8% or gross motor skill development problems of 3.8% (Castaño et al., 2019). Research in Japan shows that around 6-13% of all children aged 5-13 years have poor motor coordination (Katagiri et al., 2021). In 2018, the World Health Organization (WHO) reported that child growth and development problems were increasing, the incidence rate in the United States ranged from 12-16%, Argentina 22%, Thailand 37.1%, and Indonesia between 13-18%. A ten-year longitudinal study observing children from 5/6 years old to 15/16 years old by Haugen & Johansen (2018), reported that children with poor motor skills would not be able to catch up with their peers and had motor difficulties. persist into young adolescence.

Therefore, there is a need for a good understanding of the determinants of developing effective strategies to promote physical activity throughout life (Aoyama et al., 2023). The development of gross motor skills requires the use of various learning models and psycho-pedagogical interventions to strengthen the basics of body position and balance related to posture and mobility (Calero-Morales et al., 2023). Motor development in early childhood will be more optimal if the environment in which children grow and develop supports them to move freely. One learning model that provides this environment is the outdoor learning model. The model provides a unique learning opportunity with many advantages for studying affective, psychomotor, and implicit knowledge. Outdoor play is also in line with the United Nations Convention on Children's Rights because it allows children to play, experience nature, and in the long-term help alleviate global sustainability problems (Yew et al. 2022).

Experiences through outdoor activities have been proven to benefit children's health and development in many ways (Martin et al., 2023), such as increasing physical activity which has several health effects, better cognitive and social competence (Sandseter et al., 2019). The outdoor learning model can be enriched in ways that are interesting to children, thereby creating fun alternative games. One way to transform this learning model is by integrating local cultural content into the environment around the child. This indirectly has a positive impact on children in getting to know and preserving the culture around them.

The characteristics of the outdoor learning model used are certainly different from the previous learning model which was limited to traditional games only. The difference in this model lies in the creative games in which there is a cooperative approach by integrating several local cultural elements that exist around the child such as Javanese traditional clothing (*surjan* and *kebaya*), art instruments (*ceng-ceng*, *gamelan*, and *gong*), traditional games in the form of *bakiak*, and the *Pandawa Lima* puppet characters and their characters as symbols to build children's interest and attraction in doing physical activities in a new and fun way through game design, so that it can have a positive impact on the overall development of the child.

METHOD

The type of research used in this study is quasi-experimental research with the assumption that this study cannot fully control the variables that will affect the results of this study later. In this case a sample is selected from a population that is not held randomization because the subjects are already formed in the class group. The research design used in this study was a non-equivalent control group design. This design is similar to the pretest-posttest in a true experiment but there is no random sample selection. The design in this research is presented in the following table.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experimental	O ₁	X ₁	O ₃
Control	O ₂	-	O ₄

In this research there are two variables, namely the outdoor learning model containing local culture as the independent variable and gross motor skills as the dependent variable. The sample in this study was children aged 5-6 years with a total sample of 42 children who were divided into two groups, namely the experimental group and the control group. The experimental group is the group that will be given treatment using an outdoor learning model containing local culture, while the control group is the group that is not given treatment in the research but still applies the methods usually used in learning.

The elements of motor learning that are the criteria for assessing children's gross motor skills include strength, speed, agility, balance, and coordination. The element of speed, the activity to be carried out is related to sprinting. The element of agility, the activity to be carried out is related to passing through traffic cone obstacles at the first post. The element of strength, the activity to be carried out is related to hurdles at the first post and hoop jumping using one and two feet alternately at the second post. The element of balance, the activity of passing through the obstacle of the bridge at the third post. The element of coordination, the activity is carried out by playing *bakiak* which trains eye, hand, and foot coordination at the fourth post. The flow of research implementation using an outdoor learning model containing local culture is presented in the following image:

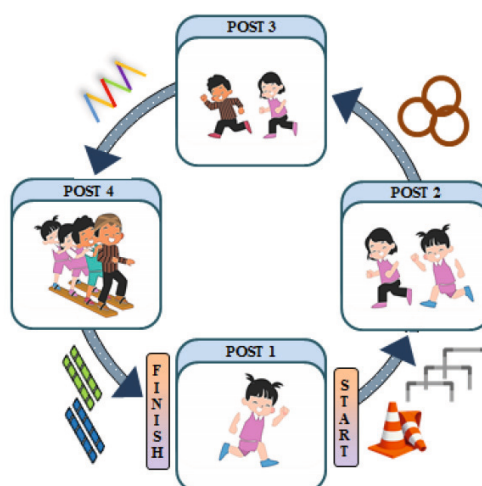


Figure 1. Outdoor Learning Model Containing Local Culture

1. At the first post, the first child sounds the 'ceng-ceng' art instrument and immediately runs zigzag through traffic on the condition that he does not drop it. Then the child jumps over three small hurdles in succession with a height of 20cm, 25cm, and 30cm with a width of 40cm.
2. At the second post, the children at the second post immediately put on the traditional trousers provided in the 'male/female' selection box, then hit the 'gong' art instrument and start jumping over the zigzag hoops with one and two feet alternately according to the color instructions of the hoops with a distance of 30cm between each hoop.
3. At the third post, the third child continues to wear the trousers given by the child at the second post and at the same time wears the traditional clothes that have been provided in the 'male/female' choice box, after finishing wearing them the child immediately hits the 'gamelan' art instrument then passes over a zig-zag bridge with a length of 15m.
4. At the fourth post, the fourth child continues to wear the trousers and traditional clothes of the child at the third post, then wears the 'blankon/headband' that has been provided in the 'male/female' selection box and when finished, goes straight to the front or first order of clogs followed by friends from the first to third posts behind him to go to the finish line.
5. The data obtained through the motor skills observation sheet will be analyzed using the SPSS program to determine whether the use of the local cultural outdoor learning model is effective for gross motor skills. In general, the research flow is described in the following scheme.

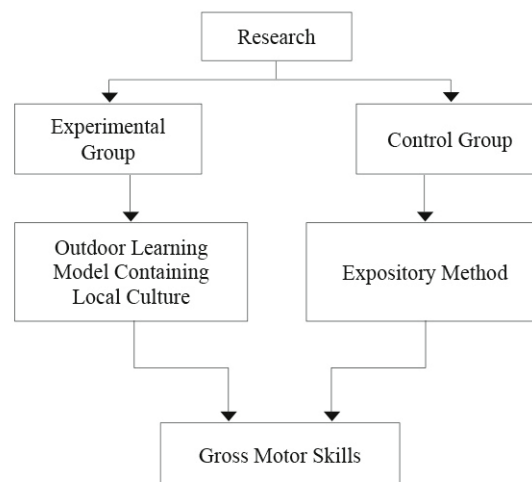


Figure 2. Research Scheme

RESULTS

Before data analysis is carried out, a data requirements test is first carried out, namely the normality of data distribution test and the homogeneity of variance test. Normality tests and homogeneity tests are carried out as a condition for carrying out effectiveness tests with the t-test. The data for the normality test of data distribution were obtained from the pretest and posttest of gross motor skills in the experimental group and control group. The results of the normality test for data distribution were tested using the SPSS program. The test results obtained by the Kolmogorov-Smirnov p-value can indicate whether the data is normally distributed or not. The condition for data to be normally distributed is if the p-value obtained from the calculation is greater than 5% significance (0.05). The results of the normality test for the distribution of pretest and posttest data on gross motor skills of the experimental group and control group are presented in the following table.

Table 2. Normality test results

Data	p	Description
Experimental group pretest	0.121	Normal
Experimental group posttest	0.170	Normal
Control group pretest	0.114	Normal
Control group posttest	0.153	Normal

Based on the results of calculating the normality of the distribution of pretest and posttest data on the gross motor skills of the experimental group and the control group, it can be seen that the p-value is greater than 5% significance, which means that the data collected from the pretest and posttest in children's gross motor learning shows a normal distribution.

Apart from testing the normality of data distribution, the data requirements test also carried out a homogeneity of variance test. With the help of the SPSS program, scores were obtained that showed homogeneous variance. The condition for a variant to be said to be homogeneous is if its significance is greater than 5% significance (0.05). The results of the homogeneity test calculation of pretest and posttest data variants are presented in the following table.

Table 3. Homogeneity test results

Data	p	Description
Experimental and control group pretest	0.608	Homogeneous
Experimental and control group posttest	0.266	Homogeneous

Based on the table above, the results of the homogeneity test calculation during the pretest and posttest of gross motor skills in the experimental group and control group can be seen in the p-values is 0.608 and 0.266. Thus, the pretest and posttest data on gross motor skills in the experimental and control groups in the research had homogeneous variance.

After the prerequisites were met, the free t-test pretest and posttest gross motor skills in the experimental and control groups were tested using the SPSS program. The results of the pretest and posttest independent t-tests of gross motor skills in the experimental and control groups are presented in the following table.

Table 4. Independent t-test results

Data	t_{count}	p	Description
Experimental and control group pretest	0.113	0.910	Not significant
Experimental and control group posttest	10.447	0.000	Significant

Based on the table above, the calculation of the independent t-test results of the pretest scores on gross motor skills for both groups shows that the p-value is 0.910 which is greater than the significance value of 0.05 and the t value is 0.113 which is smaller than the t table of 2.021. Thus, it can be interpreted that there is no difference between the gross motor skills of children in the experimental group and the control group during the pretest. Meanwhile, the posttest independent t-test of gross motor skills for both groups showed that the p-value was 0.000 which was smaller than the significance value of 0.05 and the t_{count} value was 10.447 which was greater than the t_{table} of 2.021. This means that there is a difference between the gross motor skills of children in the experimental group and the control group at the posttest. Thus, it can be concluded that the use of an outdoor learning model containing local culture has proven effective in improving children's gross motor skills.

DISCUSSION

The outdoor learning model containing local culture was declared effective through field trials. This is supported by research by Yıldırım & Akamca (2017), showing that psychomotor skills scores differ significantly between pre-

test and post-test. This means that children's motor skills improve significantly after outdoor learning activities. Meanwhile, teachers who carry out outdoor education have an average subjective well-being score that is much higher than their colleagues. This means that outdoor education is positively related to teachers' subjective well-being and has the potential to provide benefits for teachers and students (Deschamps et al., 2022).

Participating in an outdoor education program will have positive results on the psycho-physical well-being, connectedness with nature, and pro-social behavior of students in the intervention group compared to the control group (Pirchio et al., 2021). There is a definite trend that outdoor education programs based on the regular curriculum enable students to develop socially, academically, physically, and psychologically (Becker et al., 2017).

Outdoor play has been associated with important developmental advances, and a growing body of research confirms that the physical environment of a play space significantly influences the value and quality of play. Understanding the environmental features and conditions of play spaces that can encourage and create high-quality play experiences can help inform the redesign of play spaces that stimulate and promote health for children. (Loebach & Cox, 2022).

The number of outdoor games and facilities available plays a very important role in children's motor development. This means that the more outdoor play, the better the child's motor skills will be. Therefore, challenging outdoor environments can be viewed as optimal motor learning environments for children (Sääkslahti & Niemistö, 2021). By giving children more time in outdoor green spaces, nature-based early childhood learning and care can become a key approach to supporting children's physical, social, and emotional development (Traynor et al., 2022). Outdoor playtime was highly correlated with moderate to vigorous intensity physical activity and was also associated with decreased sitting time. Overall, children have the potential to be very active during outdoor play sessions in childcare centers (Truelove et al., 2018). Types of outdoor risky play opportunities fall into the categories of supporting motor skills, supporting free environmental exploration, and supporting risk assessment (McFarland & Laird, 2018).

Nature-based early childhood education will provide higher intensity physical activity and risky play will be able to improve several domains of motor competence (Johnstone et al., 2022). Apart from that, outdoor learning activities also greatly contribute to the cognitive, linguistic, and social-emotional development of preschool children. It can be recommended that the outdoor activities provided within the framework of the program should be increased in the preschool years. Teachers should be provided with information about outdoor education through teacher training programs before and during their tenure, and outdoor education should also be included in the teacher education curriculum (Yıldırım & Akamca, 2017).

Therefore, all parties must focus attention on the important pedagogical and educational role of adults who have the responsibility to design educational actions aimed at increasing children's physical and motor activity in sports participation. This outdoor education approach has a greater impact on children because it has the potential to promote not only motor skills and competencies but also children's cognitive, social, relational and affective development. Educational actions designed by adults must be oriented to the child's needs and can be carried out with structured or unstructured activities (Tortella et al., 2021).

CONCLUSION

Based on the research results, it can be concluded that the outdoor learning model containing local culture is effective for gross motor skills. This is proven by the differences in gross motor skills learning outcomes between the experimental group which used an outdoor learning model containing local culture and the control group which used the expository method. The use of an outdoor learning model containing local culture in learning is very beneficial for children's gross motor skills, where they become more active and responsible, collaborate with their friends, and indirectly also participate in preserving local culture.

Related to the research results, early childhood teachers can use outdoor learning models with local cultural content as a variation of learning models to improve various abilities in children, especially gross motor skills. Therefore, teachers must always increase knowledge, develop creativity, and use games in the learning process.

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HRV MONITORING AND RECOVERY RATES: AN EXPERIMENTAL STUDY ON YOUNG TENNIS ATHLETES

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Abstract: Heart rate variability (HRV) represents time variation between consecutive heartbeats and reflects the ability of the autonomic nervous system to adapt to different stimuli. Despite the growing focus on HRV as indicator of recovery in athletes, there is a lack in scientific literature on how HRV and recovery indices manifest and vary in young tennis athletes, limiting the understanding of physiological dynamics and strategies for optimizing recovery for these athletes. The aim is to identify specific patterns of physiological adaptation during the post-training and competition recovery process. The study aims to understand how HRV characteristics may reflect fatigue, recovery and response to physical stress, with the goal of developing strategies for recovery and performance optimization for this specific population. The study involved 120 young tennis athletes aged 16-18 years old, with 3 years of experience in the sport. The results showed a weak positive correlation with training performance (0.027) and a weak negative correlation with match performance (-0.010). The RMSSD shows weak positive correlations with both training performance (0.013) and match performance (0.031). The LF/HF ratio has a negative correlation with the training performance (-0.206) and there is a weak positive correlation with the match performance (0.110). The results underline the need for a holistic and multifactorial approach to optimize the performance of young tennis athletes. Regular monitoring of HRV provides valuable information on the balance of the autonomic nervous system and the athlete's recovery status but should be complemented by other assessments such as psychological assessments and skill-based tests.

Keywords: Heart rate variability, Tennis, young athletes, RMSSD.

INTRODUCTION

In the current context, sports are recognised for their many psychophysical benefits, which positively affect body and mind (Aliberti, 2023). In physical terms, exercise stimulates the cardiovascular system, promoting better blood circulation, lowering blood pressure and improving respiratory efficiency (Raiola, 2019ab). These effects result in increased endurance, muscle strength and flexibility, which reduce the risk of chronic non-communicable diseases (D'Elia, 2020). It is therefore important to consider the various factors that positively influence a subject's physical development and maintenance (Aliberti et al., 2025). These include heart rate variability (HRV), which represents the time variation between consecutive heartbeats and reflects the ability of the autonomic nervous system to adapt to different stimuli. This physiological parameter is of fundamental importance to evaluate the autonomous regulation of the heart. HRV is closely related to the balance between the two main branches of the autonomic nervous system: the sympathetic nervous system, which accelerates the heartbeat, and the parasympathetic nervous system, which slows it down (Esposito, 2024). Several factors can influence heart rate variability, including age, lifestyle, physical condition and the presence of disease (D'Isanto, 2019ab). For example, HRV tends to decrease with age, reflecting a decrease in the autonomous flexibility of the heart. Chronic stress, lack of sleep and excessive alcohol consumption can also lead to a reduction in HRV. On the other hand, regular physical activity as recommended by the World Health Organization may be useful to prevent HRV reduction (Raiola, 2025). To support the latter, there is also the sports activity, which can develop in the subject the benefits mentioned above (Raiola & Aliberti, 2021). Tennis is a sport that makes the most of these benefits. Tennis is characterized by intermittent and intense efforts, which require adequate preparation in psychophysical terms, focusing especially on skills such as resilience and mental endurance, as well as the capacity to recover energy due to rapid effort (D'Elia et al., 2021; Michel et al., 2023). Due to the type of sport,

which alternates moments of explosive activity with short rest periods, athletes are subjected to high physical and cardiovascular pressure, which directly affects their performance and post-match recovery capacity (Esposito et al., 2020; Salierno et al., 2021). In sports, including tennis, HRV is useful for monitoring the state of recovery of athletes, indicating the state of fatigue or overtraining, as well as providing indications to optimize training loads (Ni et al., 2022; Plews et al., 2013). Despite the growing focus on HRV as an indicator of recovery in athletes, current scientific literature has a lack of specific studies concerning young tennis athletes. There is a lack of research exploring how HRV and recovery indices manifest and vary in this specific population, limiting the understanding of physiological dynamics and strategies for optimizing recovery for these athletes. The aim of this study is to analyse in detail the heart rate variability (HRV) in young tennis athletes, in order to identify specific patterns of physiological adaptation during post-workout and post-competition recovery. The research will examine how changes in HRV may indicate fatigue, level of recovery and response to physical stress, with the ultimate aim of developing customized strategies to optimize recovery and improve performance in this athlete population.

METHODS

Study participants

The participants in the study are 120 young tennis athletes aged between 16 and 18, with at least 3 years of competitive experience and with a homogeneous level of training. Athletes with pre-existing pathologies that may affect cardiovascular parameters were excluded. The selection will be made through a rigorous process that will include a preliminary check of the general health status, evaluated by means of an exhaustive medical examination.

Study design

Participants have been subjected to a carefully planned monitoring protocol to ensure reliable and meaningful data collection. The methodology followed standardised procedures to ensure consistency and accuracy in the detection of key parameters related to HRV and recovery processes. Monitoring of HRV and recovery indices will be carried out using advanced devices such as wearable cardiac sensors. The monitoring sessions will be scheduled at different times: at rest, during training and during post-exercise recovery. The data collected will include baseline heart rate, HRV and other recovery indices such as heart rate recovery time. Figure 1 provides a level overview of the key elements of the protocol and expected results.

Aspect	Details
Study Duration	8 weeks
Measurement Frequency	Three times a week (Mon, Wed, Fri)
Tools Used	Wearable heart sensors, HRV analysis software, activity tracking apps
Rest Phase	Morning, 10 minutes, supine, wearable sensor
Training Phase	During training, continuous recording
Post-Exercise Recovery Phase	30 minutes post-training, continuous recording
Heart Rate Recovery Time	30 minutes post-training, monitor recovery to baseline
Post-Exercise HR Reduction	First 10 minutes post-exercise, monitor reduction speed
Measurement Tools	Firstbeat sensors, HRV software, tracking apps
Expected Results	Reduced baseline HR, increased HRV, HRV-performance correlation

Figure 1. Level overview of key elements of the protocol and expected results.

Several measuring tools were used, including wearable cardiac sensors, defined as accurate devices for heart rate and HRV measurement (Firstbeat).

then, HRV analysis software was used, with specialized applications for the analysis of HRV data (Firstbeat); Physical activity monitoring applications were used, that is tools to track and record training sessions (Firstbeat).

Statistical analysis

After data collection, descriptive statistical methods were applied to obtain an overview of the sample and the main physiological characteristics. Next, a correlation analysis was conducted to examine the associations between HRV parameters and athletic performance, both during training and competition. A correlation matrix was used to

evaluate the relationships between resting heart rate, RMSSD, LF/HF ratio, recovery time and reduction of post-exercise heart rate with sports performance.

RESULTS

Following sample recruitment, descriptive statistics were applied to better understand the sample itself, as can be analysed in Figure 2.

Statistic	Value
Number of Participants	120
Average Resting Heart Rate (bpm)	60.50
Average RMSSD (ms)	77.68
Average LF/HF Ratio	1.38
Average Recovery Time (min)	8.20
Average Post-Exercise HR Reduction (bpm)	20.40
Average Training Performance Score	86.02
Average Match Performance Score	89.49

Figure 2. Descriptive statistical application.

The correlation matrix was then used, as shown in Figure 3.

Variable	Resting HR	RMSSD	LF/HF	Recovery Time	Post-Exercise HR Reduction	Training Performance	Match Performance
Resting Heart Rate (bpm)	1.000	0.098	-0.110	-0.043	0.014	0.027	-0.010
RMSSD (ms)	0.098	1.000	0.126	-0.067	0.015	0.013	0.031
LF/HF Ratio	-0.110	0.126	1.000	-0.057	0.030	-0.206	0.110
Recovery Time (min)	-0.043	-0.067	-0.057	1.000	-0.014	-0.061	0.066
Post-Exercise Heart Rate Reduction (bpm)	0.014	0.015	0.030	-0.014	1.000	-0.127	0.024
Training Performance Score	0.027	0.013	-0.206	-0.061	-0.127	1.000	0.049
Match Performance Score	-0.010	0.031	0.110	0.066	0.024	0.049	1.000

Figure3. Correlation matrix

From Figure 3 it is possible to notice that for the heart beats at rest there is a very weak positive correlation with the performance in training of the value 0.027 and a very weak negative correlation with the performance in game of the value -0.010, indicating a minimal association with athletic performance. Next there is the RMSSD, which shows very weak positive correlations with both the performance in training with a value of 0.013, and in game with a value of 0.031, representing a minimal association with the performance. Continuing there is the LF/HF ratio, where there is a negative correlation with the training performance from the value of -0.206. In addition, there is a weak positive correlation with the performance of the 0.110 lot. Next, there is the recovery time section, which shows a very weak negative correlation with training performance from the value of 0.061 and a weak positive correlation with match performance from the value of 0.066. Finally, there is the section of the reduction of the heart rate post-exercise, which shows a very weak negative correlation with the performance in training by the value of -0.127 and a very weak positive correlation with the match performance of 0.024. Then, individual dispersion graphs were reported for each physiological variable with respect to the performance parameters, representing:

Resting heart rate (bpm) vs training performance score (Graph1); Resting heart rate (bpm) versus match performance score (Graph 2); RMSSD (ms) vs Training Performance Score (Graph 3); RMSSD (ms) versus match performance score (Graph. 4); LF/HF versus training performance score (Graph. 5); LF/HF vs Match Performance Score (graph. 6); Recovery time (min) vs performance score (Graph. 7); Recovery time (min) against the match performance score (Graph. 8); Reduction in post-exercise heart rate (bpm) compared to training performance score (Graph. 9); Reduction in post-exercise heart rate (bpm) compared to match performance score (Graph. 10).

DISCUSSION

The results of this study show weak correlations between physiological parameters and athletic performance, suggesting that although these indicators are useful for monitoring general physical condition and recovery, are not sufficiently predictive of performance in training or competition. One relevant aspect is the correlation between resting heart rate and athletic performance. The values obtained (0.027 for training and -0.010 for competition) indicate a negligible impact of this parameter on performance. This confirms previous results that demonstrate that HRV, while providing information on the state of fatigue and recovery, is not an isolated indicator to predict an athlete's performance. A more holistic approach is therefore needed, which considers several factors in addition to cardiovascular parameters. The RMSSD, considered an index of heart rate variability, showed equally weak correlations with both training performance (0.013) and match performance (0.031). Again, the high variability does not seem to translate directly into better athletic performance. Previous studies (Buchheit, 2014) have confirmed that a high HRV is indicative of better adaptability to physical stress, but this is not always reflected in field performance as other factors come into play. The LF/HF ratio, which reflects the balance between the sympathetic and parasympathetic nervous systems, showed a negative correlation with performance in training (-0.206) and a positive but weak correlation with match performance (0.110). This suggests that a better autonomic balance could help improve competitive performance, although the association is marginal. These results are in line with studies that highlight how autonomic stress management and post-workout recovery are crucial factors for athletes' preparation for competitions (Sandercock et al., 2005). Recovery time and reduced heart rate after exercise showed weak correlations with both training and match performance. This data supports the idea that, although HRV can provide useful indications for monitoring recovery status, athletic performance is the result of a complex interaction between physiological, psychological and technical factors (Stanley et al., 2013). One of the main limitations of this study is the sample. Although 120 participants represent a good data set, larger and more diverse samples could provide more robust and generalizable results. In addition, individual differences in physiology and training response may have affected the results, limiting the universal applicability of conclusions. Factors not considered in this study, such as diet, sleep, mental state and technical ability, also play a crucial role in determining athletic performance and could be explored in future research for a more complete understanding. Future research could focus on a multidimensional approach, combining physiological, psychological and technical data to develop more effective training and recovery strategies.

CONCLUSION

The study highlights the complex nature of athletic performance and the limited role that individual physiological parameters play in isolation. The HRV and recovery indices, although useful, are not sufficient in themselves to predict performance. The results underline the need for a holistic and multifactorial approach to optimize the performance of young tennis athletes. Regular monitoring of HRV provides valuable information on the balance of the autonomic nervous system and the athlete's recovery status but should be complemented by other assessments such as psychological assessments and skill-based tests. Coaches and sports scientists should use HRV data as part of a broader set of parameters to make informed decisions about training loads and recovery strategies. The study also highlights the importance of longitudinal monitoring. Collecting data over extended periods can help identify trends and patterns in an athlete's physiological responses, allowing better prediction and management of performance and recovery. This long-term approach is essential for the development of training methodologies that adapt to the changing needs of the athlete. By regularly monitoring HRV, coaches can identify signs of burn-out and take timely action to adapt training plans accordingly. In conclusion, the study provides valuable information on the use of HRV and recovery rates to optimize athletic performance. Although these parameters are important, they should be part of a comprehensive monitoring strategy that includes various physical, psychological and competency-based assess-

ments. Regular, personalized monitoring, combined with the use of advanced technologies, can increase training effectiveness, improve performance and ensure the well-being of young athletes.

Conflict of interest

The authors declare that there is no conflict of interest.

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KEY GAME-RELATED STATISTICAL PARAMETERS PREDICTING PERFORMANCE INDEX RATING FOR U16, U18, AND U20 BASKETBALL PLAYERS IN DIFFERENT PLAYING POSITIONS

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Abstract: The aim of this study was to determine which game-related statistical parameters could be used to predict the performance index rating of U16, U18, and U20 basketball players in different playing positions. A total of 167 games (box scores for 1813 players) of the finalists teams were analyzed at the FIBA Youth European Championships for men held from 2017-2022 across age categories: U16 (55 games, 595 players), U18 (56 games, 618 players) and U20 (56 games, 600 players). The game-related statistical parameters gathered as independent variables included: total points scored, free throw, 2 and 3-points attempts and made, rebounds, assists, steals, turnovers, personal fouls and blocks. The dependent variable was the Performance Index Rating. The basic descriptive statistics were calculated, while the models of dependency among the observed variables were defined using multiple regression analysis (backward method) at the significance level of $p \leq 0.05$. For players in outside positions, total points scored, assists, steals and offensive and defensive rebounds have a positive impact on their performance index rating. A number of 2-point and free throw attempts, turnovers, 3-point attempts, blocks against and personal fouls committed, have a negative impact. For players in inside positions, positive impact have a number of made 2 and 3-point shots, as well as assists, steals, defensive rebounds and blocks in favour. The negative impact included a 2-point shot attempts, turnovers, and personal fouls committed. These results can help coaches design more effective training programs, to prioritize offensive and defensive skills that positively impact a player's performance.

Keywords: basketball, quantitative indicators, national teams, youth, performance analyses.

INTRODUCTION

In recent years, the integration of advanced quantitative analysis in basketball has significantly transformed how teams evaluate performance and develop strategic approaches. A critical aspect of this transformation is the use of game-related statistics, which provide insights into player and team performance metrics. These statistics are important for understanding the game. The Performance Index Rating (PIR) is one of the primary metrics utilized in basketball analytics during official games (Sansone et al., 2021). It is a mathematical model used by the International Basketball Federation (FIBA) to quantify individual player performance, incorporating various commonly used performance indicators, enabling the comparison of players and teams. This also allows the analysis of how individual characteristics and contextual factors influence game outcomes (Brown et al., 2023).

Research on game-related statistics provides valuable insights into various contexts, such as winning versus losing teams (Gomez et al., 2020) in regular competitions (Cabarkapa, 2024) or major tournaments (Petreanu & Petreanu, 2016), seasonal performance trends ((Zhang et al., 2019; García et al., 2022) and strategic plays (Gómez et al., 2010). This information can enhance understanding of the sport and help coaches and players optimize their performance.

Analyzing individual game-related statistics in youth basketball players is crucial for understanding their performance development and identifying areas for improvement, especially in the context of their specific playing roles – playing positions. This quantitative approach to performance analysis allows coaches to tailor training and development strategies to individual players based on their specific strengths and weaknesses. Research indicates that several factors significantly influence PIR in youth basketball players, including biological maturation, training experience, anthropometric characteristics, physical fitness and playing positions. Older players tend to perform better in basketball due to biological maturation. Studies have shown that more mature players in youth categories demonstrate advantages in skills, decision-making, and overall performance metrics like PIR (Arrieta et al., 2015; Ibáñez et al.,

2018)). This suggests age and maturity are positively correlated with basketball success. Accumulated practice experience also is a strong predictor of performance in youth players, indicating that training hours enhance skill development and game understanding (Ramos et al., 2021; Carvalho et al., 2019; Carvalho et al., 2013). Anthropometric characteristics, such as height and body composition, are linked to basketball performance. Studies have found that physical attributes are critical for success in the sport, with changes in young players' anthropometric structures correlating with athletic performance (Canli et al., 2021). Additionally, body composition has been shown to influence match performance and enhance competitive outcomes as reflected in PIR (Zarić et al., 2020). Additionally, physical fitness, including aerobic fitness and strength, significantly impacts performance in youth basketball (Carvalho et al., 2013). Studies have shown these factors are crucial predictors of success, with point guards often exhibiting higher fitness levels than centers. This allows them to sustain a greater intensity throughout games, leading to more effective scoring and assists, which further enhances their PIR (Milanović et al., 2019). Deliberate training and tactical development can enhance basketball performance metrics, like PIR, by fostering essential cognitive and motor skills. Player positions also influence their respective performance outcomes, with inside players excelling in rebounding and scoring (García-Gil et al., 2018), and outside players contributing significantly through assists and playmaking (Zhai et al., 2021). Understanding these differences is crucial for coaches and analysts in developing strategies that maximize each player's strengths and enhance overall team performance.

The application of regression models has become increasingly prevalent in recent research on analyzing game-related statistics in basketball. These models help to highlight the importance of quantitative analysis in understanding individual and team performance during basketball matches (Simović et al., 2019), as well as predicting scoring trends (Zheng, Ma & Jia, 2023) and identifying key performance indicators that differentiate winning teams from losing ones (Madarambe, 2018). The evaluation of individual and team performance represents a crucial component for basketball coaches in the modern game. Determining the factors that can augment the effectiveness of player performance across different positions, and contribute to achieving victory, is a vital consideration for all basketball teams. Therefore, the purpose of this study was to determine which game-related statistical parameters could be used to predict the performance index rating of U16, U18, and U20 basketball players in different playing positions, identifying both positive and negative impacts.

METHODS

Sample

A total of 167 games (box scores for 1813 players) were analyzed from the FIBA Youth European Championships for men held in period from 2017-2022 across three different age categories: U20 category (56 games, n = 600): 2017 – Greece (14 games), 2018 – Germany (14 games), 2019 – Israel (14 games) and 2022 – Montenegro (14 games); U18 category (56 games, n = 618): 2017 – Slovakia (14 games), 2018 – Latvia (14 games), 2019 – Greece (14 games) and 2022 – Serbia (14 games) and U16 category (55 games, n = 595): 2017 – Montenegro (14 games), 2018 – Serbia (14 games), 2019 – Italy (14 games) and 2022 – Macedonia (13 games).

Box scores of players of the finalists teams (group and final stage) of the named competitions were analyzed. Data were selected from the official FIBA boxscores (www.fiba.com). Game-related statistics data for players who participated in the game for at least five minutes were included in the analysis. The players were divided into two groups: outside (perimeter) players positions (point guard, shooting guard and small forward) and inside (post) players positions (power forward and center) (Wooten, 1992).

Variables

The dependent variable was the Performance index rating. The other examined variables consisted of 16 independent variables, derived from standard individual indicators of game-related statistical parameters. The game-related statistics included: PTS - total points made; FTA - a number of free throw attempts; FTM - a number of made free throws; 2FGA - a number of 2-points attempts; 2FGM - a number of made 2-points shoot; 3FGA - a number of 3-points attempts; 3FGM - a number of made 3-points shoot; ROFF - offensive rebounds; RDEF - defensive rebounds; RTOT - total rebounds; AST - assists; STL - steals; TO - turnovers; PF - personal fouls committed, BLOCF – block in favour and BLOCA – block against.

Statistical analysis

The basic parameters of descriptive statistics (Mean and Standard deviation) were calculated for all variables. The models of dependency in the observed variables (Performance index rating and indicators of game – related statistical parameters) were defined using the multiple regression analysis (backward method). All the statistical operations were performed using software SPSS 24.0. (Chicago, IL, USA) and the level of significance was set at $p \leq 0,05$.

RESULTS

Tables 1-6 present the results of Multiple Regression Analyses examining the association between Performance index rating and game-related statistical parameters for different age categories and playing positions.

Table 1. Backward method Multiple – Regresion analyses of the association of PIR with significant predictor variables for U16 Players in outside positions (n=364)

Variables	Unstd.Beta	Beta	t	p
AST	1.79	0.27	5.62	0.00
PTS	1.37	0.79	8.34	0.00
STL	1.17	0.13	2.63	0.00
RDEF	0.94	0.16	3.18	0.00
2FGA	-1.67	-0.46	-6.49	0.00
3FGA	-1.37	-0.31	-5.08	0.00
TO	-1.35	-0.16	-3.31	0.00
FTA	-1.02	-0.18	-3.15	0.00
PF	-0.71	-0.08	-1.85	0.05
R=0.54	R²_{adjust} = 0.27	Std.Err.Est =9.71	F = 16.49	P = 0.00

Unstd.Beta = Unstandardized regression coefficients values, **Beta** = Standardized regression coefficients values, **t** = Standardized regression coefficients significance test, **p** = Standardized regression coefficients level of significance, **R** = Multiple correlation coefficient, **R²adjust** = Adjusted determination coefficient, **Std. Err. Est.** = Standard error of the estimate, **F** = Multiple regression analysis significance tests, **P** = Multiple correlation level of significance.

The Performance index rating for U16 players in outside positions can be estimated using the following formula:
PIR = 3.698 + (PTS * 1.372) – (2FGA * 1.676) – (3FGA * 1.371) – (FTM * 1.026) + (RDEF * 0.947) + (AST * 1.790) – (PF * 0.710) – (TO * 1.354) + (STL * 1.172)

The analyses identified nine game-related statistical parameters that predict the Performance Index Rating for U16 players in outside positions. Four of them have a positive impact, while five have a negative impact on PIR.

Table 2. Backward method Multiple – Regresion analyses of the association of PIR with significant predictor variables for U18 Players in outside oositons (n=392)

Variables	Unstd.Beta	Beta	t	p
STL	1.91	0.19	4.09	0.00
ROFF	1.26	0.13	2.83	0.00
PTS	0.92	0.46	7.27	0.00
AST	0.90	0.16	3.42	0.00
RDEF	0.86	0.15	2.95	0.00
BLOCA	-1.70	-0.12	-2.67	0.00
2FGA	-0.96	-0.24	-4.04	0.00
FTA	-0.86	-0.17	-3.27	0.00
R=0.53	R²_{adjust} = 0.26	Std.Err.Est =9.40	F = 18.91	P = 0.00

The Performance index rating for U18 players in outside positions can be estimated using the following formula:

$$\text{PIR} = -0.728 + (\text{PTS} * 0.921) - (2\text{FGA} * 0.962) - (\text{FTA} * 0.862) + (\text{ROFF} * 1.268) + (\text{RDEF} * 0.866) + (\text{AST} * 0.905) + (\text{STL} * 1.911) - (\text{BLOC} * 1.720)$$

The analyses identified eight game-related statistical parameters that predict the Performance Index Rating for U18 players in outside positions. Five of them have a positive impact, while three have a negative impact on PIR.

Table 3. Backward method Multiple – Regression analyses of the association of PIR with significant predictor variables for U20 Players in outside positions (n=370)

Variables	Unstd.Beta	Beta	t	p
STL	2.13	0.18	3.28	0.00
AST	1.57	0.26	5.30	0.00
PTS	1.22	0.57	7.04	0.00
3FGA	-1.58	-0.28	-4.63	0.00
TO	-1.13	-0.12	-2.58	0.01
FTA	-1.06	-0.20	-3.82	0.00
2FGA	-0.83	-0.18	-2.98	0.00
R=0.48	R²_{adjust} = 0.23	Std.Err.Est =10.69	F = 15.91	P = 0.00

The Performance index rating for U20 players in outside positions can be estimated using the following formula:

$$\text{PIR} = 1.174 + (\text{PST} * 1.225) - (2\text{FGA} * 0.837) - (3\text{FGA} * 1.584) - (\text{FTA} * 1.061) + (\text{AST} * 1.570) - (\text{TO} * 1.130) + (\text{STL} * 2.136)$$

The analyses identified seven game-related statistical parameters that predict the Performance Index Rating for U20 players in outside positions. Three of them have a positive impact, while four have a negative impact on PIR.

Table 4. Backward method Multiple – Regression analyses of the association of PIR with significant predictor variables for U16 Players in inside positions (n=204)

Variables	Unstd.Beta	Beta	t	p
2FGM	2.54	0.48	4.24	0.00
AST	2.20	0.24	3.68	0.00
3FGM	2.04	0.13	2.18	0.03
BLOCF	1.58	0.11	1.80	0.07
RDEF	0.59	0.13	1.89	0.07
2FGA	-1.28	-0.37	-3.16	0.00
R=0.52	R²_{adjust} = 0.25	Std.Err.Est =9.90	F = 12.51	P = 0.00

The Performance index rating for U16 players in inside positions can be estimated using the following formula:

$$\text{PIR} = -0.835 + (2\text{FGM} * 2.549) - (2\text{FGA} * 1.282) + (3\text{FGM} * 2.041) + (\text{RDEF} * 0.590) + (\text{AST} * 2.206) + (\text{BLOC} * 1.580)$$

The analyses identified six game-related statistical parameters that predict the Performance Index Rating for U16 players in inside positions. Five of them have a positive impact, while only one has a negative impact on PIR.

Table 5. Backward method Multiple – Regresion analyses of the association of PIR with significant predictor variables for U18 Players in inside positions (n=184)

Variables	Unstd.Beta	Beta	t	p
2FGM	2.24	0.52	3.79	0.00
AST	2.32	0.13	4.14	0.00
3FGM	2.05	0.13	2.14	0.03
BLOCF	1.99	0.16	2.46	0.01
PF	-0.96	-0.11	-1.77	0.07
2FGA	-0.73	-0.28	-2.05	0.04
R=0.53	R²_{adjust} = 0.25	Std.Err.Est =9.29	F = 11.66	P = 0.00

The Performance index rating for U18 players in inside positions can be estimated using the following formula:
PIR = 0.585 + (2FGM * 2.246) – (2FTA * 0.731) + (3FGM * 2.053) + (AST * 2.325) – (PF * 0.960) + (BLOC * 1.993)

The analyses identified six game-related statistical parameters that predict the Performance Index Rating for U18 players in inside positions. Four of them have a positive impact, while two have a negative impact on PIR.

Table 6. Backward method Multiple – Regresion analyses of the association of PIR with significant predictor variables for U20 Players in inside positions (n=201)

Variables	Unstd.Beta	Beta	t	p
STL	3.06	0.22	3.41	0.00
3FGM	1.69	0.12	1.92	0.05
RDEF	1.53	0.16	2.51	0.01
2FGM	1.35	0.25	3.77	0.00
TO	-1.62	-0.16	-2.51	0.01
R=0.46	R²_{adjust} = 0.19	Std.Err.Est =10.08	F = 10.87	P = 0.00

The Performance index rating for U20 players in inside positions can be estimated using the following formula:
PIR = -0.481 + (2FGM * 1.358) + (3FGM * 1.690) + (AST * 1.537) – (TO * 1.621) + (STL * 3.067)

The analyses identified five game-related statistical parameters that predict the Performance Index Rating for U20 players in inside positions. Four of them have a positive impact, while only one has a negative impact on PIR.

DISCUSSION

This study aimed to identify game-related statistical parameters that could be used to predict the performance index rating of U16, U18, and U20 basketball players of the finalists teams in different playing positions, based on analyses of European Championships from 2017 to 2022.

The findings indicate that as basketball players mature, the number of game-related statistics that predict their Performance Index Rating tends to diminish. A greater number of game-related statistical parameters predict the PIR for players in outside positions compared to those in inside positions. Differences in PIR between outside and inside players can be attributed to their distinct roles, physical attributes, and playing styles. The key game-related statistical parameters predicting PIR for U16, U18, and U20 basketball players in outside and inside playing positions were identified. For players in outside and inside positions, the number of game-related statistical parameters predicting PIR is similar across the analyzed age categories. However, in the U20 category for inside positions players, there are fewer game-related statistical predictors of PIR.

As players mature, the number of game-related statistics that predict their PIR decreases. This suggests that playing positions become more clearly defined, with players adopting more specialized offensive and defensive roles

and better understanding the demands of the game. Research shows that older basketball players, such as those in the U20 age group, tend to have better game statistics than their younger counterparts in the U16 and U18 age groups. This is likely due to the increased experience and understanding of the game that comes with age and continued participation (Erčulj et al., 2019). U18 players have been observed to demonstrate better cooperation and assertiveness in team play than U16 players, which is essential for effective teamwork in basketball (Pocius & Malinauskas, 2023). With increased maturity, U20 players demonstrate greater poise under pressure and adaptability to diverse game situations compared to their younger counterparts (Joseph et al., 2021).

Research indicates that outside players spent more time in game and also, have more ball possessions, cover greater distances and engage in higher intensity activities throughout a game, which correlates with their elevated PIR scores (Pojskić et al., 2015), and in this case with greater number of game related statistics parameters predicting PIR. For players in outside positions key predictors of PIR with positive influence were related with total points made, assists and steals, and in some categories rebounds (defensive and offensive), while for players in inside positions were related to 2-point and 3-point shots made, assists, steals, blocks, and defensive rebounds.

Key positive impact game-related statistics for both inside and outside players include shooting efficacy, assists, steals, and defensive rebounds. The shooting efficacy of outside and inside players in basketball suggests to be a critical factor that can significantly influence in individual PIR and a team's success in games. Choi et al. (2015) found that guards, in general, contributed positively to their teams' victories through higher 2-point and 3-point shooting percentages (total points scored), along with more assists and fewer turnovers. This suggests that outside players, who are often tasked with scoring, tend to have a more refined shooting technique and greater shooting volume, which enhances their overall effectiveness on the court (Wang & Zheng, 2022). While outside players typically exhibit higher shooting percentages due to their roles in perimeter shooting, centers and power forwards are often expected to convert a higher percentage of their 2-point shots from closer to the basket. Scoring efficiency is crucial, as it directly impacts a team's overall offensive effectiveness. Traditionally, inside positions were not primarily associated with long-range shooting; however, the modern game requires versatile players, including the ability to shoot effectively from beyond the arc. Research indicates that centers and power forwards, are increasingly required to extend their shooting range, so while centers often focus on shots within the paint, power forwards, have more opportunities to shoot from mid-range and beyond (Wang & Zheng, 2022). The positional differences between outside and inside players impact shooting accuracy, with power forwards generally demonstrating better 3-point shooting and more frequent involvement in perimeter shooting compared to other inside positions (Wang & Zheng, 2022), like this study results shows. Assists, particularly from outside players, are a critical discriminator of winning outcomes in basketball as they demonstrate teamwork and the ability to create scoring chances (Ektirici, 2023). Winning teams consistently had more assists than losing teams, highlighting the importance of collaborative play (Raval & Pagaduan, 2021). Guards, and especially point guards, typically have the primary responsibility of distributing the ball and facilitating offensive plays, which leads to them achieving higher assist numbers due to their role in orchestrating plays and distributing the ball (Zhai et al., 2021). This playmaking ability is crucial for their PIR, as assists are a key component of the rating. This role necessitates a high level of court awareness, decision-making skills, and the ability to execute precise passes under pressure, which are vital for offensive efficiency (Zhai et al., 2020). Experienced players, including guards, tend to achieve higher overall performance ratings, with higher assist numbers (Ibáñez et al., 2018). This suggests that as players mature, their ability to read the game and anticipate teammates' movements improves, leading to more successful assists, and this is in relation with founding of this research. Considering inside players, assists are especially relevant for power forwards, who operate in both the post and perimeter areas, facilitating ball movement and creating opportunities for their teammates. The role of steals by outside players in basketball is a significant factor. Steals represent a crucial defensive metric that reflects a team's ability to disrupt the opponent's offense. When outside players successfully steal the ball, it often leads to fast-break opportunities, which can result in easy scoring chances. Carvalho et al. (2017) highlighted that steals can lead to assists, creating a direct link between defensive actions and offensive success. Zhang et al. (2020) found that steals were effective in differentiating teams in closely contested matches during the FIBA Basketball World Cup. Outside players are typically more agile and quicker than players in other positions, which enhances their ability to generate steals, enabling them to engage in high-intensity defensive actions more frequently than forwards or centers (Bae, 2022). Centers and power forwards, besides their rebounding and scoring contributions, are increasingly involved in defensive plays that

generate steals. While centers and power forwards are traditionally associated with rebounding due to their size and positioning, outside players seem also play a critical role in this aspect of the game. The agility and speed of outside players allow them to effectively contest rebounds, especially in fast-paced games where quick transitions are essential. Both offensive and defensive rebounds are associated with positive match outcomes, emphasizing the importance of rebounding across all positions, including guards (Zhang et al., 2020). Inside players' rebounding ability is a critical statistic. Defensive rebounds distinguish between winning and losing teams (Mikić et al., 2018), especially in European competitions (Madaramé, 2018). Winning teams secure more defensive rebounds, limiting opponents' second-chance scoring and enabling faster offensive transitions. Effective rebounding is essential for maintaining possession and controlling the game's tempo (Canuto & Almeida, 2022). Inside players can effectively block shots due to their height and positioning, allowing them to anticipate opponents' actions and make more defensive plays, such as blocks and rebounds (Ibáñez et al., 2018). Inside players who excel at blocking shots can greatly affect the game's outcome. Their defensive presence can deter opponents from driving to the basket and force them to adjust their shooting strategies. (Ibáñez et al., 2018). Simović et al. (2020) pointed that teams with better blocking, rebounding, and scoring tend to win more games. This is because effective blocking and rebounding can lead to higher field goal percentages for the team.

A detrimental impact on PIR for players in outside positions have: 2-point, 3-point, free throw attempts, turnovers, personal fouls committed and blocks against. Therefore, based on offensive-oriented statistical parameters, it appears that poor shooting efficiency, including shots from within the paint and beyond the arc, along with poor free-throw conversion and inadequate shot selection, as well as imprecise passing and ball-handling skills, have a detrimental impact not only on individual PIR, but also on the overall team performance and outcomes. Excessive personal fouls can indicate poor defensive skills and decision-making. It is notable that free throws and personal fouls emerged as significant factors differentiating winning and losing teams, regardless of game pace (Gómez & Ibáñez, 2017). For inside players, factors that can have a detrimental impact on their PIR include excessive 2-point shot attempts, personal fouls committed, and turnovers. To optimize their performance, these players must focus on improving their shooting decision-making and efficiency, playing effective defense, and minimizing turnovers. Excessive turnovers can lead to lost scoring opportunities and transition points for the opposing team, negatively impacting the overall team outcome (Mikołajec et al., 2013). In summary, inside players must balance their offensive contributions with smart decision-making to maintain possession, capitalize on scoring chances and playing defense.

The study's limitations may include the relatively low probability level (19-27%) and prediction accuracy range (± 9.29 -10.87) of the obtained equations. This could be due to the sample consisting primarily of players from winning teams, and the probability might be higher if the sample included a more diverse range of teams and players.

Analyzing game-related statistics in youth basketball, especially for U16, U18, and U20 players, offers insights into performance factors that distinguish winning and losing teams. Regression models are useful tools for analyzing game statistics and their influence on outcomes. By considering various predictors like specific game stats, researchers can build comprehensive models to better understand success factors in basketball at different levels

CONCLUSION

In conclusion, as players age, the number of game-related statistical parameters that predict Performance Index Rating tends to decrease, indicating that playing positions become more defined, with players taking on more specialized roles in offense and defense. Players in outside positions have more game-related statistical parameters that influence their PIR, compared to players in inside positions. For outside players, the common positive influence on PIR across all age categories are total points scored, assists, and steals, and in some categories, offensive and defensive rebounds. Commonly, a high number of 2-point and free throw attempts, and in some categories turnovers, 3-point attempts, blocks against, and personal fouls committed, have a negative influence on PIR. For inside players, common positive predictors of PIR across age categories include made 2 and 3-point shots, as well as in some categories assists, steals, defensive rebounds, and blocks in favour. The negative impact varied by age group but generally included a 2-point shot attempts, turnovers, and personal fouls committed.

Practical Implications

This finding has practical applications, offering a statistical method based on a sample of finalists from recent European Championships to predict Performance Index Rating for U16, U18, and U20 players in different playing

positions (Table 1-6). The obtained equations allow coaches to calculate the Performance Index Rating of their players by inputting the values of the identified parameters.

These results can help coaches design more effective training programs by providing information about individual player performance. Coaches can use this knowledge to prioritize the development of offensive and defensive skills that positively impact a player's Performance Index Rating, while minimizing those with negative effects. This can contribute to the development of winning team strategies and enhanced individual player effectiveness.

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DISABILITY-BASED INEQUALITIES IN ELITE SPORT: THE PERSPECTIVE OF DEAF FEMALE ATHLETES IN CROATIA

NEJEDNAKOSTI U VRHUNSKOM SPORTU TEMELJENE NA INVALIDITETU: PERSPEKTIVA GLUHIH SPORTAŠICA U HRVATSKOJ

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Abstract: Many factors contribute to the disadvantage of women in sports, which are certainly even more pronounced when considering the position of women with disabilities. Hearing impairment is mostly defined as “hidden disability”, not only due to lack of visible symptoms, but also due to long-term stigmatisation and political neglect. The research problem of paper was to study possible inequality in the gender distribution between top Croatian athletes with disabilities (deafness) and without disabilities, and to direct further analysis towards the specificities of deaf female athletes. The sample of respondents consisted of 322 athletes of both gender who had a valid decision on allocating the athlete to the first category by the Croatian Olympic Committee and the Croatian Deaf Sports Association. The main results show that there are differences in gender distribution among top Croatian athletes with regard to the sports system. The difference obtained is in line with the assumption that there will be significantly fewer top deaf female athletes compared to top female athletes without disabilities. Special attention was given to the analysis of the specifics of deaf female athletes (age, region of residence, and number of sports with regard to classification, Olympic status and category). Women of all ages with any type of disability are generally among the more vulnerable and marginalized populations in society, therefore their problems need to be taken into account in all strategic processes in order to protect and promote their human rights and, where necessary, eliminate inequalities between women and men.

Keywords: female athletes, top-level sport, disability, specificities, deaf sport.

Sažetak: Nepovoljnom položaju žena u sportu doprinose mnogobrojni čimbenici koji su zasigurno još naglašeniji ukoliko se promatra položaj žena s invaliditetom. Oštećenje sluha pretežno se definira kao “skriveni invaliditet”, ne samo zbog nedostatka vidljivih simptoma, već i zbog dugotrajne stigmatizacije te strateškog i političkog zanemarivanja. Istraživački problem ovog rada bio je proučiti moguću nejednakost u raspodjeli spolova između vrhunskih hrvatskih sportaša s invaliditetom (gluhocom) i bez invaliditeta te daljnju analizu usmjeriti prema specifičnosti gluhih sportašica u odnosu na sportašice bez invaliditeta. Uzorak od 322 ispitanika činili su sportaši oba spola koji su u trenutku provođenja istraživanja imali važeće rješenje o kategorizaciji za sportaša I. kategorije izdano od strane krovnih sportskih udruženja, odnosno Hrvatskog olimpijskog odbora i Hrvatskog sportskog saveza gluhih. Glavni rezultati s potvrdom značajnosti uz χ^2 test pokazuju da postoje razlike u raspodjeli spolova između vrhunskih hrvatskih sportaša s obzirom na sustav sporta. Dobivena razlika u skladu je s pretpostavkom da će vrhunskih gluhih sportašica, u odnosu na vrhunske sportašice bez invaliditeta, biti značajno manje. Posebna pažnja posvećena je analizi specifičnosti gluhih sportašica (dob, regija prebivališta te broj sportova s obzirom na klasifikaciju, olimpijski status i kategoriju). Osobe ženskog spola svih dobi s bilo kojom vrstom invaliditeta općenito su među vulnerabilnijim i marginaliziranim populacijama društva, stoga je potrebno uzeti u obzir njihove probleme i specifične potrebe te ih riješiti u svim strateškim procesima kako bi se zaštitila i promicala njihova ljudska prava i, prema potrebi, eliminirale postojeće nejednakosti između žena i muškaraca s invaliditetom.

Ključne riječi: sportašice, vrhunski sport, invaliditet, specifičnosti, sport gluhih osoba.

INTRODUCTION

Disability is considered a social consequence of the interaction between an individual impairment and the social environment (World Health Organization, 2001; United Nations, 2006). There is strong evidence that women with disabilities face numerous barriers in their daily lives that can prevent them from fully and effectively participating in society on an equal basis with others. These barriers create a context of multiple and intersecting forms of discrimination against women with disabilities, particularly in relation to equal access to education, economic opportunities, social interaction and justice, equal recognition before the law and the ability to participate in the strategic planning of their own lives in a variety of contexts (United Nations Committee on the Rights of Persons with Disabilities, 2016).

Women of all ages with any type of disability are generally among the most vulnerable and marginalized populations in society, and their problems and specific needs should be taken into account and addressed in all policy processes to protect and promote their human rights and, where appropriate, eliminate existing inequalities between women and men with disabilities. One of the actions that should be taken at the national and international levels by governments, regional and international organizations is to ensure equal opportunities for women in cultural, recreational and sporting activities, as well as in participation in sports and physical activities at the national, regional and international levels, such as access, training, competition, compensation and rewards (United Nations General Assembly, 2000).

Many factors contribute to the disadvantage of women in sports, such as an unsupportive educational and cultural environment for the inclusion of girls and women in sport, lower involvement of women in sports and physical activities, underrepresentation of women in sport at all levels (for example female athletes, workers and journalists), underrepresentation of women's sports in the media, widespread gender stereotypes about the inappropriateness of sports activities for girls and women, insufficient investment in the development of women's sports, lower incomes of female athletes compared to male athletes, lower levels of competitiveness, lower levels of motivation and interest of women in sports, poorer conditions for sports (including access to sports infrastructure) and the risk of exposure to sexism or gender-based violence (including sexual harassment) (The Ombudsperson for Gender Equality, 2021; The Ombudsperson for Gender Equality, 2022; The Ombudsperson for Gender Equality, 2023). The above-mentioned negative social characteris-

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Invaliditet se smatra društvenom posljedicom interakcije između pojedinačnog oštećenja i socijalnog okruženja (World Health Organization, 2001; United Nations, 2006). Postoje snažni argumenti koji upućuju na to da se žene s invaliditetom susreću s brojnim preprekama u svakodnevnom životu koje mogu sprječavati njihovo potpuno i djelotvorno sudjelovanje u društvu na ravnopravnoj osnovi s drugima. Navedene prepreke razvijaju okolnosti višestrukih oblika diskriminacije protiv žena s invaliditetom koje se međusobno isprepliću, a posebice u pogledu jednakog pristupa obrazovanju, gospodarskih prilika, socijalne interakcije i pravde, jednakosti pred zakonom te mogućnosti sudjelovanja u strateškom planiranju vlastita života u brojnim kontekstima (United Nations Committee on the Rights of Persons with Disabilities, 2016).

Osobe ženskog spola svih dobi s bilo kojom vrstom invaliditeta općenito su među vulnerabilnijim i marginaliziranim populacijama društva, stoga je potrebno uzeti u obzir njihove probleme i specifične potrebe te ih riješiti u svim strateškom procesima kako bi se zaštitila i promicala njihova ljudska prava i, prema potrebi, eliminirale postojeće nejednakosti između žena i muškaraca s invaliditetom. Jedna od radnji koje se trebaju poduzeti na nacionalnoj i međunarodnoj razini od strane vlada, regionalnih i međunarodnih organizacija, jest osigurati jednake mogućnosti za žene u kulturnim, rekreacijskim i sportskim aktivnostima, kao i u sudjelovanju u sportskim i tjelesnim aktivnostima na nacionalnoj, regionalnoj i međunarodnoj razini, kao što su pristup, trening, natjecanje, naknade i nagrade (United Nations General Assembly, 2000).

Nepovoljnom položaju žena u sportu doprinose mnogobrojni čimbenici, poput nepoticajnog odgojno-obrazovnog i kulturološkog okruženja za uključivanje djevojčica i žena u sport, manje uključenosti žena u sportske i fizičke aktivnosti, podzastupljenosti žena u sportu na svim razinama (primjerice sportašice, djelatnice i novinarke), podzastupljenosti ženskog sporta u medijima, raširenosti rodni stereotipa o neprimjerenosti sportskih aktivnosti za djevojčice i žene, nedovoljnog ulaganja u razvoj ženskog sporta, nižih primanja sportašica u odnosu na sportaše, snižene razine konkurentnosti i kompetitivnosti, snižene razine motivacije i interesa žena za bavljenjem sportom, lošijih uvjeta za bavljenje sportom (uključujući pristup sportskoj infrastrukturi) te rizika za izloženost seksizmu ili rodno utemeljenom nasilju (uključujući spolno uznemiravanje) (Pravobraniteljica za ravnopravnost spolova, 2021; Pravobraniteljica za ravnopravnost spolova, 2022; Pravobraniteljica za

tics are certainly even more pronounced when considering the position of women with disabilities.

One of the causes of a person's disability can be hearing impairment, which belongs to the category of sensory impairment. It is predominantly defined as a "hidden disability", not only due to the lack of visible symptoms, but also due to long-term stigmatization and strategic and political neglect (World Health Organization, 2021). People with hearing impairments can participate in a separate sports system – deaf sports, which is legally equal to the regular sports system, respectively with the association of athletes who do not have disabilities (Sports Act, 2022). Highlighted implies the absence of differences in the evaluation of the achieved results between deaf athletes and athletes without disabilities, which represent the basis for the achievement of a certain category of athletes (from the 1st to the 6th category) in accordance with the rules of the main sports associations.

The research problem of this paper was to study the possible inequality in the gender distribution between top Croatian athletes with disabilities (deafness) and without disabilities, and to direct further analysis towards the specificities of deaf female athletes in comparison to female athletes without disabilities. A review of the existing scientific bibliography revealed a lack of publications on the topic (Gaweł et al., 2024), and for the purpose of reflecting on the issue, one of the special goals of the National Sports Program as a strategic document on the development of sports in the Republic of Croatia is highlighted – the promotion of gender equality in sports (The Croatian Central Office for Sport, 2019).

METHODS

The sample of respondents consisted of athletes of both gender who, at the time of the research, had a valid decision on allocating the athlete to the 1st category by the corresponding main sports associations, namely the Croatian Olympic Committee and the Croatian Deaf Sports Association. These are all categorizations whose application begins before July 2024 and are valid until the end of May 2028 at the latest. This criterion was met by 271 athletes and 51 deaf athletes.

The sample of variables used to analyze the specific characteristics of top female athletes with regard to the sports system consisted of data on gender, date of birth (determined age data as of 1 July 2024), county of residence (determined region of residence in accordance with the classification of spatial units for statistics – HR NUTS 2 (Croatian Bureau of Statistics, 2024)), sport (de-

ravnopravnost spolova, 2023). Navedene negativne društvene karakteristike zasigurno su još naglašenije u sportu ukoliko se promatra položaj žena s invaliditetom.

Jedan od uzroka invaliditeta osobe može biti i oštećenje sluha koje pripada kategoriji senzornih oštećenja. Pretežno se definira kao "skriveni invaliditet", ne samo zbog nedostatka vidljivih simptoma, već i zbog dugotrajne stigmatizacije te strateškog i političkog zanemarivanja (World Health Organization, 2021). Osobe s oštećenjem sluha mogu participirati u odvojenom sustavu sporta – sportu gluhih, koji je zakonski izjednačen s redovnim sustavom sporta, odnosno s udruženjem sportaša koji nemaju invaliditet (Zakon o sportu, 2022). Istaknuto podrazumijeva nepostojanje razlika u vrednovanju postignutih rezultata između gluhih sportaša i sportaša bez invaliditeta, a isti su temelj za ostvarivanje određene kategorije sportaša (od I. do VI. kategorije) u skladu s pravilnicima krovni sportskih udruženja.

Istraživački problem ovog rada bio je proučiti moguću nejednakost u raspodjeli spolova između vrhunskih hrvatskih sportaša s invaliditetom (gluhocom) i bez invaliditeta te daljnju analizu usmjeriti prema specifičnostima gluhih sportašica u odnosu na sportašice bez invaliditeta. Pregledom postojeće znanstvene bibliografije uočen je nedostatak publikacija s izloženom tematikom (Gaweł et al., 2024), a u svrhu promišljanja o problematici ističe se jedan od posebnih ciljeva Nacionalnog programa sporta kao strateškog dokumenta o razvoju sporta u Republici Hrvatskoj – poticanje spolne ravnopravnosti u sportu (Središnji državni ured za sport, 2019).

METODE

Uzorak ispitanika činili su sportaši oba spola koji su u trenutku provođenja istraživanja imali važeće rješenje o kategorizaciji za sportaša I. kategorije izdano od strane pripadajućih krovni sportskih udruženja, odnosno Hrvatskog olimpijskog odbora i Hrvatskog sportskog saveza gluhih. To su sve kategorizacije čija primjena počinje prije srpnja 2024. godine, a vrijede najkasnije do kraja svibnja 2028. godine. Navedeni kriterij zadovoljio je 271 sportaš i 51 gluhi sportaš.

Uzorak varijabli kojim su se analizirale specifičnosti vrhunskih sportašica s obzirom na sustav sporta činili su podaci o spolu, datumu rođenja (određen podatak o dobi s danom 1.7.2024. godine), županiji prebivališta (određena regija prebivališta u skladu s klasifikacijom prostornih jedinica za statistiku – HR NUTS 2 (Državni zavod za statistiku, 2024)), sportu (određen podatak o kategoriji i klasifikaciji s obzirom na strukturu) te olimpijskom statusu sporta.

terminated category and classification data with regard to the structure), and the Olympic status of the sport.

The research was conducted during July 2024. From the Register of Categorized Athletes, which is available on the website of the Croatian Olympic Committee, data on the first and last name of athletes of the 1st category, sport, Olympic status of the sport and county of residence were extracted, and the Croatian Deaf Sports Association was requested to provide the same data via e-mail. Additional internet searches collected data on competition in the female or male category and date of birth.

For the purposes of the research, both inferential and descriptive statistical methods were applied, depending on the size and characteristics of the subsamples. Since the main aim of the research was to determine whether there is unequal gender representation among top athletes with respect to the sports system, the χ^2 test was used to verify the statistical significance of the observed differences. Although the research was conducted on the entire available set of categorized athletes of the 1st category, the application of inferential statistics allows for additional confirmation of patterns that may have broader social and strategic implications. However, in the analysis of the specificities of deaf female athletes, descriptive methods were preferred for greater interpretative clarity and avoidance of incorrect conclusions given the small subsample. This ensured a methodological balance between the precision of the inferential analysis and the appropriateness of the descriptive presentation of the data.

The specificities of deaf female athletes were analyzed through descriptive methods in the context of age, region of residence, type of sport, classification, and Olympic status. Although the research did not include primary qualitative methods such as interviews, a previously conducted structured questionnaire (Vuljanić et al., 2024) served as a basis for contextualizing quantitative findings and interpreting the life experiences of deaf female athletes. The collected responses were analyzed using the qualitative descriptive analysis method, identifying thematic units that included hearing status, communication habits, educational path, sports initiation, family support, relationship with coaches, and preferences towards competitive systems. Thematic patterns obtained from the questionnaire analysis enabled a deeper interpretation of the experiences of deaf female athletes in relation to the social, organizational, and communication barriers they face, and served as a basis for developing recommendations aimed at improving their sports inclusion.

SPSS 20.0 (for Windows) was used for statistical data processing, and the significance level was set at $p < 0.05$.

Istraživanje je provedeno tijekom srpnja 2024. godine. Iz Registra kategoriziranih sportaša koji je dostupan na internet stranici Hrvatskog olimpijskog odbora prikupljeni su podaci o imenu i prezimenu sportaša 1. kategorije, sportu, statusu sporta i županiji prebivališta, a od Hrvatskog sportskog saveza gluhih su putem elektroničke pošte zatraženi istovrsni podaci. Dodatnim pretraživanjem interneta prikupljeni su podaci o natjecanju u ženskoj ili muškoj konkurenciji te datumu rođenja.

Za potrebe istraživanja primijenjene su i inferencijalne i deskriptivne statističke metode, ovisno o veličini i karakteristikama poduzoraka. Budući da je glavni cilj istraživanja bio utvrditi postoji li nejednaka spolna zastupljenost između vrhunskih sportaša s obzirom na sustav sporta, χ^2 test korišten je kako bi se provjerila statistička značajnost uočenih razlika. Iako je istraživanje provedeno na cjelokupnom dostupnom skupu kategoriziranih sportaša 1. kategorije, primjena inferencijalnih statistika omogućava dodatnu potvrdu obrazaca koji mogu imati šire društvene i strateške implikacije. Međutim, u analizi specifičnosti gluhih sportašica prednost su dobile deskriptivne metode radi veće interpretativne jasnoće i izbjegavanja netočnih zaključaka budući se radi o malom poduzorku. Time je osigurana metodološka ravnoteža između preciznosti inferencijalne analize i prikladnosti deskriptivnog prikaza podataka.

Specifičnosti gluhih sportašica analizirane su kroz deskriptivne metode u kontekstu dobi, regije prebivališta, vrste sporta, klasifikacije i olimpijskog statusa. Iako istraživanje nije uključivalo primarne kvalitativne metode poput intervjua, ranije provedeni strukturirani upitnik (Vuljanić et al., 2024) poslužio je kao temelj za kontekstualizaciju kvantitativnih nalaza i interpretaciju životnih iskustava gluhih sportašica. Prikupljeni odgovori analizirani su metodom kvalitativne deskriptivne analize, pri čemu su identificirane tematske cjeline koje su uključivale slušni status, komunikacijske navike, obrazovni put, sportsku inicijaciju, obiteljsku podršku, odnos s trenerima i preferencije prema natjecateljskim sustavima. Tematski obrasci dobiveni analizom upitnika omogućili su dublju interpretaciju iskustava gluhih sportašica u odnosu na društvene, organizacijske i komunikacijske prepreke s kojima se suočavaju te su poslužili kao osnova za izradu preporuka usmjerenih na poboljšanje njihove sportske uključenosti.

Za statističku obradu podataka korišten je program SPSS 20.0 (for Windows), a razina značajnosti određena je na $p < 0.05$.

RESULTS AND DISCUSSION

In order to answer the first part of the research problem, namely the problem of the existence of differences in the gender distribution among top athletes with respect to the sports system, a χ^2 test was conducted (Table 1), which showed that there are gender differences between top athletes with disabilities and athletes without disabilities (χ^2 (1, N=322)=4.86; $p<.05$). The difference obtained is in line with the expectation, namely with the assumption that there will be significantly fewer top deaf female athletes compared to top female athletes without disabilities.

Table 1. Analysis of gender differences among top athletes with regard to the sports system

TOP ATHLETES WITH REGARD TO THE SPORTS SYSTEM / VRHUNSKI SPORTAŠI S OBZIROM NA SUSTAV SPORTA			
GENDER / SPOL	Disabled (Deaf Athletes) N (%) / S invaliditetom (gluhi sportaši) N (%)	Non-disabled (Athletes) N (%) / Bez invaliditeta (sportaši) N (%)	Total (All athletes) N (%) / Ukupno (svi sportaši) N (%)
Male / Muški	41 (80,4)	175 (64,6)	216 (67,1)
Female / Ženski	10 (19,6)	96 (35,4)	106 (32,9)
Total / Ukupno	51 (100)	271 (100)	322 (100)

The main results with confirmation of significance using the χ^2 test show that in the Republic of Croatia, out of the total number of categorized top athletes of the 1st category, separately for each sport system, 19.6% are top deaf female athletes, and 35.4% are top female athletes without disabilities.

The structure of the sample of female athletes with regard to the sport system and their specificities are shown in Table 2. Given the very small number of deaf female athletes in the sample ($n=10$), the differences between them and female athletes without disabilities were presented primarily using descriptive statistics.

The median age of deaf female athletes was 29.5 years (range 19-50), while for female athletes without disabilities it was 26 years (range 17-52). In both groups, approximately half of the participants resided in the City of Zagreb. Deaf female athletes compete in a total of 5 individual sports. 7 deaf female athletes are involved in Olympic deaf sports: chess (3), taekwondo (2), athletics (1) and shooting (1), and 3 deaf female athletes are involved in non-Olympic sports (classic bowling). According to structural complexity, there are three monostructural sports (5 athletes) and 1 polystructural (2 athletes) and 1 mental sport (3 athletes). Female athletes without disabilities compete in a total of 25 sports, most of which are individual (78 female athletes in 23 sports). Olympic sports are played by 54 female athletes (11 sports): handball (17), taekwondo (10), athletics (8), judo (6), sailing (4), kayaking-canoeing (2), rowing

REZULTATI I RASPRAVA

U svrhu odgovora na prvi dio istraživačkog problema, odnosno na problem postojanja razlike u raspodjeli spolova između vrhunskih sportaša s obzirom na sustav sporta proveden je χ^2 test (Tablica 1), koji je pokazao da ima razlike u spolu između vrhunskih sportaša s invaliditetom i sportaša bez invaliditeta (χ^2 (1, N=322)=4,86; $p<.05$). Dobivena razlika je u skladu s očekivanjem, odnosno s pretpostavkom da će vrhunskih gluhih sportašica, u odnosu na vrhunske sportašice bez invaliditeta, biti značajno manje.

Tablica 1. Analiza spolnih razlika vrhunskih sportaša s obzirom na sustav sporta

Glavni rezultati s potvrdom značajnosti uz χ^2 test pokazuju da je u Republici Hrvatskoj, od ukupnog broja kategoriziranih vrhunskih sportaša 1. kategorije, zasebno za svaki sustav sporta, 19,6% vrhunskih gluhih sportašica, a 35,4% vrhunskih sportašica bez invaliditeta.

Struktura uzorka sportašica s obzirom na sustav sporta i njihove specifičnosti prikazane su u tablici 2. S obzirom na vrlo mali broj gluhih sportašica u uzorku ($n=10$), razlike između njih i sportašica bez invaliditeta prikazane su prvenstveno deskriptivnim statistikama.

Medijan dobi gluhih sportašica iznosio je 29,5 godina (raspon 19-50), dok je kod sportašica bez invaliditeta bio 26 godina (raspon 17-52). U obje skupine približno polovica ispitanica imala je prebivalište u Gradu Zagrebu. Gluhe sportašice natječu se u ukupno 5 pojedinačnih sportova. Olimpijskim sportovima gluhih bavi se 7 sportašica: šah (3), taekwondo (2), atletika (1) i streljaštvo (1), a neolimpijskim sportom (kuglanje) bave se 3 gluhe sportašice. Prema strukturalnoj složenosti tri su monostrukturalna sporta (5 sportašica) te po jedan polistrukturalni (2 sportašice) i mentalni sport (3 sportašice). Sportašice bez invaliditeta natječu se u ukupno 25 sportova, od kojih je većina pojedinačnih (78 sportašica u 23 sporta). Olimpijskim sportovima bave se 54 sportašice (11 sportova): rukomet (17), taekwondo (10), atletika (8), judo (6), jedrenje (4), kajak-kanu (2), skijanje (2), veslanje (2), boks (1), gimnastika (1) i tenis (1), a neolimpijskim sportovima 42 sportašice (14 sportova):

(2), skiing (2), boxing (1), gymnastics (1) and tennis (1). Non-Olympic sports are played by 42 female athletes (14 sports): karate (9), kickboxing (9), bocce (5), diving (4), savate boxing (3), wushu (3), nanbudo (2), body building (1), bowling (1), bridge (1), darts (1), ju-jitsu (1), rock and roll (1) and sambo (1). According to structural complexity, there are 11 polystructural (46 female athletes), 10 monostructural (30 female athletes), 2 conventional-aesthetic (2 female athletes) and 1 complex (17 female athletes) and 1 mental sport (1 female athlete).

Table 2. Structure of the sample of female athletes with regard to the sports system

karate (9), kick-boxing (9), boćanje (5), ronjenje (4), savate boks (3), wushu (3), nanbudo (2), body building (1), bridž (1), ju-jitsu (1), kuglanje (1), pikado (1), rock and roll (1) i sambo (1). Prema strukturalnoj složenosti 11 je polistrukturalnih (46 sportašica), 10 monostrukturalnih (30 sportašica), 2 konvencionalno-estetska (2 sportašice) te po jedan kompleksni (17 sportašica) i mentalni sport (1 sportašica).

Tablica 2. Struktura uzorka sportašica s obzirom na sustav sporta

VARIABLE / VARIJABLA	Deaf female athletes / Gluhe sportašice (n=10)	Female athletes / Sportašice (n=96)
Age (years) / Dob (godine)		
Median / Medijan	29.5	26
Range / Raspon	19-50	17-52
Region of residence / Regija prebivališta		
City of Zagreb / Grad Zagreb	5	47
Other (Adriatic, Pannonian and Northern Croatia) / Ostalo (Jadranska, Panonska i Sjeverna Hrvatska)	5 (3, 2 and 0)	49 (37, 4 and 8)
Sports classification / Klasifikacija sportova (n=30)		
Monostructural / Monostrukturalni	3 sports (5)	10 sports (30)
Polystructural / Polistrukturalni	1 sport (2)	11 sports (46)
Complex / Kompleksni	0 sports (0)	1 sport (17)
Conventional-aesthetic / Konvencionalno-estetski	0 sports (0)	2 sports (2)
Mental / Mentalni	1 sport (3)	1 sport (1)
Olympic status of sport / Olimpijski status sporta (n=30)		
Olympic / Olimpijski	4 sports (7)	11 sports (54)
Non-Olympic / Neolimpijski	1 sport (3)	14 sports (42)
Sports category / Kategorija sporta (n=30)		
Individual / Pojedinačni	5 sports (10)	23 sports (78)
Team / Ekipni	0 sports (0)	2 sports (18)

An analysis of gender differences in factors influencing participation in sports by top deaf athletes showed that there were no significant differences between male and female deaf athletes. The results of a questionnaire survey on a sample of 31 top deaf athletes (11 female athletes, 35%) showed that the majority of Croatian deaf athletes had hearing impairment at birth or developed within the first two years of life (9/11) and that the majority had hearing parents (9/11) and hearing siblings (8/11). Given the high frequency of using hearing aids or cochlear implants (9/11) to facilitate communication and better perception of sounds from the environment, the majority of deaf ath-

Analiza spolnih razlika među čimbenicima sudjelovanja vrhunskih gluhih sportaša u sportu ukazala je da nema značajnih razlika između gluhih sportaša i gluhih sportašica. Rezultati anketnog upitnika na uzorku od 31 vrhunskog gluhog sportaša (od čega 11 sportašica, 35%) pokazali su da se oštećenje sluha kod većine hrvatskih gluhih sportašica javilo pri rođenju ili se razvilo unutar prve dvije godine života (9/11) te da većina ima čujuće roditelje (9/11) i čujuću braću i sestre (8/11). S obzirom na visoku učestalost korištenja slušnih pomagala ili umjetne pužnice (9/11) zbog olakšane komunikacije i bolje percepcije zvukova iz okoline, većina gluhih spor-

letes rely on their ability to communicate using all communication (9/11). This is highlighted by the fact that deaf athletes who use sign language also rely on their ability to communicate through speech, facial and lip reading, and manual alphabet. Most deaf female athletes attended preschool for the deaf or in combination with regular preschool (8/11), primary school for the deaf or in combination with regular primary school (8/11) and regular secondary school (9/11). 4 top deaf female athletes have a higher education. The results of this study confirm the positive role of parents in supporting and developing their child's desire to participate in sports. Most parents of deaf female athletes were active in sports (8/11) and they make the largest contribution to their sports initiation (5/11). Most deaf female athletes have hearing coaches, which seems to be a key factor in providing support during their integration into the regular sports system. For Croatian elite deaf female athletes, the priority is not the coach's hearing status (10/11), but his professional competence, understanding and care he shows towards them, and his information and knowledge of how to communicate with deaf people. The results of the study indicate the desire of deaf female athletes for greater opportunities to practice their chosen sport, which often requires their integration into the standard sports system. All deaf female athletes who participated in the study compete in the regular competition system, and one of the main reasons for this could be the lack of domestic sports competitions for deaf female athletes. Several deaf female athletes (3/11) stated their preference for a separate competition system, which indicates negative socialization, as they believe that in a segregated competition system there are better conditions with regard to communication, as well as fair conditions for all athletes. Although deaf female athletes prefer to compete with other deaf female athletes due to the socialization and communication opportunities that arise, they also appreciate the opportunity to participate in a regular competition system with hearing female athletes. They believe that this helps them improve the quality of their training and preparation for domestic and international deaf competitions, and that it provides them with the opportunity to evaluate their sporting achievements during the competition season, as well as promote and increase the recognition of deaf athletes.

The total population of top deaf athletes who met the criteria for the study of factors influencing participation of top deaf athletes in sport consisted of 53 athletes, of which 16 were deaf female athletes (30%) (Vuljanić et al., 2024). 12 female athletes were members of clubs that only gather deaf athletes, 2 female athletes were members

tašica oslanja se na sposobnost komuniciranja koristeći cjelokupnu komunikaciju (9/11). Navedeno je istaknuto činjenicom da se gluhi sportaši koji koriste znakovni jezik također oslanjaju na svoju sposobnost komunikacije putem govora, očitavanja govora s lica i usana te ručne abecede. Većina gluhih sportašica pohađala je dječji vrtić za gluhe ili u kombinaciji s redovnim vrtićem (8/11), osnovnu školu za gluhe ili u kombinaciji s redovnom osnovnom školom (8/11) i redovnu srednju školu (9/11). Visoki stupanj obrazovanja imaju 4 vrhunske gluhe sportašice. Rezultati ovog istraživanja potvrđuju pozitivnu ulogu roditelja u podupiranju i razvoju djetetove želje za sudjelovanjem u sportu. Većina roditelja gluhih sportašica bila je sportski aktivna (8/11) i oni čine najveći udio u njihovoj sportskoj inicijaciji (5/11).

Većina gluhih sportašica ima čujuće trenere što se čini ključnim čimbenikom u pružanju podrške tijekom njihove integracije u redovni sustav sporta. Hrvatskim elitnim gluhim sportašicama nije prioritet slušni status trenera (10/11), već njegove stručne kompetencije, razumijevanje i briga koju pokazuje prema njima te informiranost i znanje kako komunicirati s gluhim osobama. Rezultati istraživanja ukazuju na želju gluhih sportašica za većim mogućnostima bavljenja odabranim sportom, što često zahtijeva njihovu integraciju u standardni sportski sustav. Sve gluhe sportašice koje su sudjelovale u navedenom istraživanju natječu se u redovnom sustavu natjecanja, a jedan od temeljnih razloga za to mogao bi biti nedostatak domaćih sportskih natjecanja za gluhe sportašice. Nekoliko gluhih sportašica (3/11) navelo je svoju preferenciju prema odvojenom sustavu natjecanja, što upućuje na negativnu socijalizaciju, jer smatraju da su u segregiranom sustavu natjecanja prisutni bolji uvjeti s obzirom na komunikaciju, kao i poštenu uvjeti za sve sportaše. Iako se gluhe sportašice radije natječu s drugim gluhim sportašicama zbog socijalizacije i komunikacijskih mogućnosti koje se javljaju, one također cijene mogućnost sudjelovanja u redovnom sustavu natjecanja s čujućim sportašicama. Vjeruju da im to pomaže u poboljšanju njihove kvalitete treninga i pripreme za domaća i međunarodna natjecanja gluhih, zatim da im pruža mogućnost vrednovanja sportskih postignuća tijekom natjecateljske sezone, kao i promicanje i povećanje prepoznatljivosti gluhih sportaša.

Ukupnu populaciju vrhunskih gluhih sportaša koji su zadovoljavali kriterije istraživanja čimbenika sudjelovanja vrhunskih gluhih sportaša u sportu činilo je 53 sportaša, od čega je bilo 16 gluhih sportašica (30%) (Vuljanić et al., 2024). U klubove koji okupljaju samo gluhe sportaše učlanjeno je 12 sportašica, u klubove re-

of clubs with a regular competition system, and the other 2 female athletes had dual registration, respectively they were simultaneously members of a deaf sports club and a regular competition system sports club. Only 7 out of 16 deaf female athletes had access to training preparation and instruction from a coach, while 20 out of 37 deaf athletes had this opportunity. All 4 female athletes who trained in clubs with a regular competition system had a coach (a hearing coach).

The sports and life experiences of top deaf female athletes do not differ significantly from those of deaf male athletes, suggesting the need for further research into the specific factors that contribute to the disadvantage of deaf women in sport. A review of gender equality research in sport reveals that the majority of the literature has examined the experiences, participation and representation of adult athletes in elite contexts. Inequalities in participation and experience have been noted, often influenced by the intersection of notions of ableist and masculinity (Culver et al., 2022).

Disability has only recently been included as a relevant identity category in the discussion of intersectionality, which is usually oriented towards identities such as race and gender. Everyone has multiple identities with different statuses, and there are differences within groups, so not all people with disabilities will experience the same level of stigma within the community. Disability, like other identities, is subject to misrepresentation and is separated from other issues and experiences, and so someone's identification as a person with a disability may not be recognized as related to other identities. An intersectional approach helps to understand the situation of individuals or groups and how their lives are shaped by these interwoven factors. If someone is a member of several disadvantaged groups, their experience of exclusion may be exacerbated. It is clear that the opportunities and challenges for women and men with disabilities echo those within the general population, where women are often disadvantaged, but arguably when someone has a disability as an identity too, such inequalities are magnified and the unequal power gradients between men and women and between non-disabled and disabled people combine and interact powerfully. People who self-identify or are labelled as disabled by others seem to be at risk of two opposing misunderstandings that can put them at a disadvantage. Either their disability status is overemphasized and other aspects of their identity are neglected (e.g. giving too much attention to a child's difficulties). Or they are forgotten and under-recognised and therefore not included when other groups of which they are members are considered (e.g. women

dovnog sustava natjecanja 2 sportašice, a ostale 2 sportašice imaju dvojni registraciju, odnosno istodobno su učlanjene i u sportski klub gluhih te sportski klub redovnog sustava natjecanja. Samo 7 od 16 gluhih sportašica ima dostupnu trenažnu pripremu i poduku od strane trenera, dok kod gluhih sportaša navedeno ima priliku njih 20 od 37 sportaša. Sve 4 sportašice koje treniraju u klubovima redovnog sustava natjecanja imaju trenera (čujući trener).

Sportsko i životno iskustvo vrhunskih gluhih sportašica ne razlikuje se značajno u odnosu na gluhe sportaše što ukazuje na potrebu provedbe dodatnih istraživanja određenijih čimbenika utjecaja na nepovoljniji položaj gluhih žena u sportu. Pregledno istraživanje rodne ravnopravnosti u sportu otkriva da je većina zapisa ispitivala iskustva, sudjelovanje i zastupljenost odraslih sportaša u elitnim kontekstima. Zabilježena je nejednakost u sudjelovanju i iskustvu, često pod utjecajem raskrižja pojmova ableizma i maskuliniteta (Culver et al., 2022).

Invaliditet je tek nedavno uključen kao relevantna kategorija identiteta u razmatranju interseksionalnosti, koja je obično orijentirana na identitete poput rase i spola. Svatko ima višestruke identitete s različitim statusima, a postoje i razlike unutar skupina, tako da neće sve osobe s invaliditetom doživjeti istu razinu stigme unutar zajednice. Invaliditet je poput ostalih identiteta podlozan pogrešnom predstavljanju i razdvojen od drugih problema i iskustava, pa tako nečija identifikacija kao osobe s invaliditetom možda neće biti prepoznata kao suodnos s drugim identitetima. Interseksijski pristup pomaže u razumijevanju situacije pojedinaca ili skupina i kako su njihovi životi oblikovani tim čimbenicima koji se međusobno isprepliću. Ako je netko član nekoliko skupina u nepovoljnom položaju, njegovo iskustvo isključenosti može biti pogoršano. Jasno je da mogućnosti i izazovi za žene i muškarce s invaliditetom odjekuju onima unutar opće populacije, gdje su žene često u nepovoljnom položaju, ali nedvojbeno kada netko ima i invaliditet kao identitet, tada se takve nejednakosti povećavaju i nejednaki se gradijenti moći između muškaraca i žena te između osoba bez invaliditeta i osoba s invaliditetom međusobno kombiniraju i snažno djeluju. Čini se da su ljudi koji se sami identificiraju ili ih drugi označavaju kao osobe s invaliditetom izloženi riziku od dva suprotna nesporazuma koji ih mogu dovesti u nepovoljan položaj. Ili je njihov status osobe s invaliditetom previše naglašen, a drugi aspekti njihova identiteta su zanemareni (npr. pridavanje previše pozornosti djetetovim teškoćama). Ili su zaboravljeni i nedovoljno priznati te stoga nisu uključeni kada se razmatraju druge skupine čiji su

with disabilities during women's events). Thus, one identity is privileged over others, and people's complex and changing identities and roles are not recognised. There is still a tendency for policy makers and practitioners to compartmentalise disability issues into separate activities rather than introducing a comprehensive approach that includes disability. Policy and practice planning should not shy away from the complexity of people's multiple identities, but should address them systematically. Otherwise, for some individuals, their subject position (if they are seen as having one identity rather than several) could make them ineligible for certain interventions. This can lead to various forms of segregation. Although this aspiration is still considered a difficult intention to achieve and will cost resources that have not been allocated for this purpose, it indicates the need for a major shift in thinking (Wickenden, 2023).

There is relatively little empirical research that uses a broader intersectional approach to gender inequalities in sport and physical activity (DePauw, 1999 and Sparkes et al., 2018, according to Richard et al., 2023). The participation of women with disabilities in sport creates a complex structure. As sport is a stronghold of masculinity, there are still numerous forms of discrimination that women can experience in the field of sport (Terret 2005, according to Richard et al., 2023). Research on femininity tests illustrates the complex and sometimes symbolically very violent connections between sport and femininity (Bohuon, 2008, according to Richard et al., 2023). Generally, female athletes face the paradox of being successful in a 'masculine' environment, while adhering to norms of femininity in order to be recognized as women (Richard et al., 2017, in Richard et al., 2023). Intersectional analysis has revealed that disability and sport are two elements that can undermine femininity, thus female athletes with disabilities redouble their efforts to 'prove' their femininity, while maintaining their legitimacy in the eyes of other athletes and the public (Schell & Rodriguez, 2001, in Richard et al., 2023).

A systematic literature review identified eight types of barriers (personal, physical, psychological, managerial, coach role, economic, others attitudes and social support) that women with disabilities face when engaging in sports (Olasagasti-Ibargoien et al., 2023). The main practical implications of the analysis of relevant factors for the engaging women in various sports in Croatia are that women like sports and want to engaged in sports, which in turn enables personal growth and offers them a sense of achievement, and the main barriers to their engagement and retention in sports are obligations related to work and

članovi (npr. žene s invaliditetom tijekom ženskih događaja). Tako je jedan identitet privilegiran u odnosu na druge, a složeni i promjenjivi identiteti i uloge ljudi nisu priznati. Još uvijek postoji tendencija da kreatori politika i praktičari dijele pitanja invaliditeta u zasebne aktivnosti umjesto da uvide sveobuhvatan pristup koji uključuje invaliditet. U planiranju politika i praksi ne bi trebalo bježati od složenosti višestrukih identiteta ljudi, već bi se njima trebalo sustavno pozabaviti. U protivnom, za neke pojedince, njihov položaj subjekta (ako se smatra da imaju jedan identitet, a ne nekoliko) mogao bi ih učiniti neprihvatljivim za određene intervencije. To može dovesti do različitih oblika segregacije. Iako se navedena težnja još uvijek smatra teško ostvarivom intencijom i koja će koštati sredstva koja nisu dodijeljena za tu svrhu, ukazuje na potrebu za velikim promjenama u razmišljanju (Wickenden, 2023).

Postoji relativno malo empirijskih radova koji koriste širi intersekcijski pristup spolnim nejednakostima u sportu i tjelesnoj aktivnosti (DePauw, 1999 i Sparkes et al., 2018, prema Richard et al., 2023). Bavljenje sportom žena s invaliditetom kreira složenu strukturu. Kako je sport uporište muskuliniteta još uvijek postoje brojni oblici diskriminacije koje žene mogu doživjeti u području sporta (Terret 2005, prema Richard et al., 2023). Istraživanje testova femininiteta ilustrira složene i ponekad simbolično vrlo nasilne veze između sporta i femininiteta (Bohuon, 2008, prema Richard et al., 2023). Općenito se sportašice suočavaju s paradoksom da budu uspješne u 'muškom' okruženju, dok se pridržavaju normi ženstvenosti kako bi bile prepoznate kao žene (Richard et al., 2017, prema Richard et al., 2023). Intersekcijaska analiza otkrila je da su invaliditet i sport dva elementa koji mogu dovesti u pitanje ženstvenost, tako sportašice s invaliditetom udvostručuju svoje napore kako bi 'dokazale' svoju ženstvenost, istovremeno održavajući svoj legitimitet u očima drugih sportaša i javnosti (Schell & Rodriguez, 2001, prema Richard et al., 2023).

Sustavni pregled literature identificirao je osam vrsta prepreka (osobne, fizičke, psihološke, upravljačke, uloga trenera, ekonomske, stavovi drugih i društvena podrška) s kojima se susreću žene s invaliditetom prilikom bavljenja sportom (Olasagasti-Ibargoien et al., 2023). Glavne praktične implikacije analize relevantnih čimbenika za angažman žena u različitim sportovima u Hrvatskoj su da žene vole sport i žele se njime baviti, što zauzvrat omogućuje osobni rast i nudi im osjećaj postignuća, a glavne prepreke u njihovom bavljenju i zadržavanju u sportu su poslovne i obiteljske obveze (Sindik et al., 2016).

family (Sindik et al., 2016).

The intersection of gender inequality and the social and communication barriers of deafness exacerbates the discrimination faced by deaf women. Research on the level of participation of deaf female athletes and the reasons for their continued underrepresentation has highlighted the following barriers and challenging issues such as negative stigma towards deafness or hearing loss, lack of opportunities and programs for participation, training, sports instruction and competition, lack of financial support from local, regional and national authorities to help organize training and workshops, lack of research and documented facts about deaf/hard of hearing women at all levels in sport and lack of national policy and legislation in sport by organizers and decision-makers at all levels for athletes with hearing impairment (Clark & Mesch, 2018). The above characteristics emphasize that participation in sports practice does not depend only on the participant but that society must be aware of all the difficulties in order to provide more specific support and guidance to women with disabilities.

The findings of this research are important from the aspect of awareness and information and can be applied in the design and implementation of policies and programs to overcome the specific needs of deaf women and girls in order to ensure their equal access to sports at all levels.

Although there are legal and strategic frameworks that seemingly promote equality and the inclusion of persons with disabilities in sports activities, a critical analysis reveals a number of shortcomings in their implementation, particularly when it comes to deaf female athletes. The Sports Act (2022) nominally equalizes the rights and obligations of athletes with disabilities with those without disabilities, but in practice, this equality remains largely declarative. The system for evaluating achievements, access to funding, and the visibility of female athletes with disabilities in the public sphere remain significantly less favorable compared to female athletes without disabilities.

The National Sports Program 2019-2026 (The Croatian Central Office for Sport, 2019) recognizes the promotion of gender equality as one of its goals, but it lacks a focus on multiple marginalized groups, such as women with disabilities. The program does not contain specific implementation mechanisms (e.g. quotas, performance indicators, monitoring and reporting), nor does it specifically address the challenges of "hidden" disabilities such as deafness, which escape traditional models of categorization and support. Such an approach reflects a lack of intersectional sensitivity, that is, it does not take into account the overlap of gender and disability inequalities. In

Međusobno ispreplitanje spolne nejednakosti i društvenih i komunikacijskih prepreka gluhoće pogoršava diskriminaciju s kojom se suočavaju gluhe žene. Istraživanje o razini sudjelovanja gluhih sportašica i razlozima njihove kontinuirane podzastupljenosti ukazalo je na sljedeće prepreke i izazovna pitanja poput negativne stigme prema gluhoći ili gubitku sluha, nedostatka mogućnosti i programa za sudjelovanje, treniranje, sportsku poduku i natjecanje, nedostatka financijske potpore lokalnih, regionalnih i nacionalnih vlasti za pomoć u organiziranju treninga i radionica, nedostatka istraživanja i dokumentiranih činjenica o gluhim/nagluhim ženama na svim razinama u sportu te nedostatka nacionalne politike i zakonodavstva u sportu od strane organizatora i donositelja odluka na svim razinama za sportaše s oštećenjem sluha (Clark & Mesch, 2018). Navedene karakteristike i čimbenici naglašavaju da sudjelovanje u sportskoj praksi ne ovisi samo o sudioniku, već se društvo mora upoznati sa svim teškoćama kako bi se pružila određenija podrška i usmjeravanje ženama s invaliditetom.

Dobivene spoznaje ovog istraživanja važne su s aspekta osvješćivanja i informiranja te se mogu primijeniti u osmišljavanju i provedbi politika i programa za prevladavanje specifičnih potreba gluhih žena i djevojaka kako bi se osigurao njihov jednak pristup sportu na svim razinama.

Iako postoje zakonski i strateški okviri koji naizgled promiču jednakost i uključivanje osoba s invaliditetom u sportske aktivnosti, kritičkom analizom uočava se niz nedostataka u njihovoj provedbi, osobito kada je riječ o gluhim sportašicama. Zakon o sportu (2022) nominalno izjednačava prava i obveze sportaša s invaliditetom s onima bez invaliditeta, no u praksi ova jednakost ostaje deklarativna. Sustav vrednovanja postignuća, pristup financiranju i vidljivost sportašica s invaliditetom u javnom prostoru i dalje su znatno nepovoljniji u odnosu na sportašice bez invaliditeta.

Nacionalni program sporta 2019. - 2026. (Središnji državni ured za sport, 2019) prepoznaje poticanje spolne ravnopravnosti kao jedan od svojih ciljeva, ali pritom izostaje fokus na višestruko marginalizirane skupine, poput žena s invaliditetom. Program ne sadrži konkretne mehanizme provedbe (npr. kvote, indikatore uspješnosti, praćenje i izvještavanje), niti se posebno osvrće na izazove "skrivenih" invaliditeta poput gluhoće, koji izmiču tradicionalnim modelima kategorizacije i podrške. Takav pristup odražava nedostatak intersekcionalne osjetljivosti, odnosno ne uzima u obzir preklapanje rodne i invaliditetne nejednakosti. U tom kontekstu nužno je istaknuti vulnerabilnost osoba s invaliditetom i njihovo često suo-

this context, it is necessary to highlight the vulnerability of people with disabilities and their frequent encounter with barriers, which can cause significant negative impacts, therefore a complex approach is needed to implement changes in the current situation in order to increase the base of female athletes with disabilities.

A particular challenge is the lack of participation in the process of adopting sports policies. Deaf athletes, as well as women with disabilities in general, are rarely included in advisory bodies, research and evaluation of sports programs. In this way, the value of their direct experience is ignored, while solutions are shaped without the active participation of those they affect, which often results in measures that do not meet the real needs of female athletes. Ultimately, these obstacles not only limit access to sports, but also further reinforce the social marginalization of deaf women. In order to systematically address the above challenges, it is necessary to develop concrete action plans with clear goals, measures and indicators, which include the mandatory participation of representatives of the target population in all phases – from policy formulation to implementation. Without concrete changes, there is a real danger that normative frameworks will remain disconnected from reality, further deepening the gap between legal rights and real opportunities for deaf athletes.

All stakeholders need to integrate a gender perspective and an intersectional approach into their actions due to the overlapping causes of inequality (European Commission, 2022). The findings of this research imply the implementation of concrete strategies and measures to increase the participation of deaf women in sport, such as gender-responsive funding where sports organizations allocate budgets for gender equality and the inclusion of the male population as partners to contribute to change. Deaf sport has been strongly dominated by men at all levels for years, especially in decision-making positions, and in the Republic of Croatia only 4 (27%) women are in positions that enable decision-making in the main sports federation of the deaf (two women in the executive and supervisory boards). This is significantly less than the European Commission's proposal to set a 50% representation quota for women in all decision-making bodies. Gender equality is considered one of the fundamental principles of good governance in European sports organizations (European Commission, 2022).

Given the results obtained and the observed systemic, organizational and social obstacles that affect the inclusion and retention of deaf women in top-level sports, it is necessary to propose specific recommendations that can serve as a basis for shaping public policies aimed at

čavanje s preprekama, a koje mogu prouzročiti značajnije negativne utjecaje, stoga je potreban kompleksni pristup pri realizaciji promjene trenutnog stanja kako bi se povećala baza sportašica s invaliditetom.

Poseban izazov predstavlja i nedostatak participativnosti u procesu donošenja sportskih politika. Gluhe sportašice, kao i žene s invaliditetom općenito, rijetko su uključene u savjetodavna tijela, istraživanja i evaluacije sportskih programa. Na taj se način zanemaruje vrijednost njihovog neposrednog iskustva, dok se rješenja oblikuju bez aktivnog sudjelovanja onih na koje se odnose, što često rezultira mjerama koje ne odgovaraju stvarnim potrebama sportašica. U konačnici, ove prepreke ne samo da ograničavaju pristup sportu, već dodatno učvršćuju društvenu marginalizaciju gluhih žena. Kako bi se navedeni izazovi sustavno rješavali, nužno je razviti konkretne akcijske planove s jasnim ciljevima, mjerama i indikatorima, koji uključuju i obavezno sudjelovanje predstavnica ciljane populacije u svim fazama – od oblikovanja do provedbe politika. Bez konkretnih promjena, postoji stvarna opasnost da normativni okviri ostanu odvojeni od stvarnosti, čime se dodatno produbljuje razlika između zakonskih prava i stvarnih prilika gluhih sportašica.

Svi dionici u svoja djelovanja moraju integrirati rodnu perspektivu i intersekcionalni pristup radi preklapanja uzroka nejednakosti (European Commission, 2022). Nalazi ovog istraživanja impliciraju na provedbu konkretnih strategija i mjera za povećanje sudjelovanja gluhih žena u sportu, kao što su rodno osviješteno financiranje gdje sportske organizacije namijenjuju proračunska sredstva rodnoj ravnopravnosti i uključivanje muške populacije kao partnera kako bi pridonijeli promjeni. Sportom gluhih osoba već godinama snažno dominiraju muškarci na svim razinama, a posebno na pozicijama donošenja odluka, pa se tako u Republici Hrvatskoj samo 4 (27%) žene nalaze na pozicijama koje omogućuju donošenje odluka u krovnom sportskom savezu gluhih (po dvije žene u izvršnom i nadzornom odboru). Navedeno je značajno manje u odnosu na prijedlog Europske komisije o postavljanju kvote zastupljenosti od 50% za žene u svim tijelima koja donose odluke. Ravnopravnost spolova smatra se jednim od temeljnih načela dobrog upravljanja u europskim sportskim organizacijama (European Commission, 2022).

S obzirom na dobivene rezultate te uočene sustavne, organizacijske i društvene prepreke koje utječu na uključivanje i ostanak gluhih žena u vrhunskom sportu, nužno je predložiti konkretne preporuke koje mogu poslužiti kao temelj za oblikovanje javnih politika usmjerenih na

achieving greater representation of deaf female athletes:

- *Development of targeted sports programs for girls and young women with hearing impairments.* It is necessary to ensure systematic and coordinated co-operation between educational institutions, sports clubs and associations/unions of persons with disabilities in order to create early opportunities for the inclusion of deaf girls in sports.
- *Financial incentives for organizations that actively include deaf female athletes.* In order to encourage inclusion, it is recommended to allocate additional funds, benefits or points advantages when applying for competitions to clubs and sports associations that include deaf women and girls in their work.
- *Education of sports workers on the specifics of working with deaf people.* Professional training and awareness-raising of sports professionals on the specificities of communication with deaf people, on accessibility and on intersectional challenges arising from the intertwining of gender and disability is essential for creating a more supportive sports environment.
- *Reducing regional disparities and ensuring equal access to sports opportunities throughout Croatia.* It is necessary to encourage stronger promotion and inclusion of girls and young women with hearing impairments in sports in all Croatian regions, and not only in urban centers such as the City of Zagreb. It is recommended to conduct information and educational campaigns for parents and sports experts about the possibilities of inclusion in the dual system of sports and to ensure the availability of experts (kinesiologists and coaches educated to work with people with disabilities) from the earliest stage of initiation all the way to the level of top sport.
- *Actively involving deaf female athletes in the processes of adopting sports policies and programs.* It is recommended to institutionalize the participation of deaf female athletes in advisory and program bodies responsible for the development of sports at the local, regional and national levels, in order to ensure that measures respond to the real needs of target groups.
- *Developing indicators for monitoring progress in the field of equality.* In order to evaluate the effectiveness of public policies and programs, it is recommended to establish specific and measurable performance indicators, such as the number of deaf female athletes involved, the number of educated coaches, the level of accessibility of sports content and visibility in the media.
- *Encourage cooperation with international organizations, such as International Committee of Sports for the Deaf and European Deaf Sports Organi-*

postizanje veće zastupljenosti gluhih sportašica:

- *Razvoj ciljano usmjerenih sportskih programa za djevojčice i mlade žene s oštećenjem sluha.* Neophodno je osigurati sustavnu i koordiniranu suradnju između obrazovnih ustanova, sportskih klubova i udruga/saveza osoba s invaliditetom radi stvaranja ranih prilika za uključivanje gluhih djevojaka u sport.
- *Financijski poticaji za organizacije koje aktivno uključuju gluhe sportašice.* U svrhu poticanja inkluzije, preporučuje se dodjela dodatnih sredstava, olakšica ili bodovnih prednosti pri prijavama na natječaje klubovima i sportskim udrugama koje u svoj rad uključuju gluhe žene i djevojke.
- *Edukacija sportskih djelatnika o specifičnostima rada s gluhim osobama.* Stručno usavršavanje i senzibilizacija sportskih djelatnika o specifičnostima komunikacije s gluhim osobama, o pristupačnosti te o intersekcionalnim izazovima koji proizlaze iz ispreplitanja roda i invaliditeta ključno je za stvaranje poticajnijeg sportskog okruženja.
- *Smanjenje regionalnih razlika i osiguranje ravnopravnog pristupa sportskim mogućnostima u cijeloj Hrvatskoj.* Potrebno je poticati snažniju promociju i uključivanje djevojčica i mladih žena s oštećenjem sluha u sport na području svih hrvatskih regija, a ne samo u urbanim središtima poput Grada Zagreba. Preporučuje se provođenje edukativnih kampanja za roditelje i sportske stručnjake o mogućnostima uključivanja u dvojni sustav sporta te osiguranje dostupnosti stručnjaka (kineziologa i trenera educiranih za rad s osobama s invaliditetom) od faze inicijacije pa sve do razine vrhunskog sporta.
- *Aktivno uključivanje gluhih sportašica u procese donošenja sportskih politika i programa.* Preporučuje se institucionalizacija participacije gluhih sportašica u savjetodavnim i programskim tijelima nadležnima za razvoj sporta na lokalnoj, regionalnoj i nacionalnoj razini, kako bi se osiguralo da mjere odgovaraju stvarnim potrebama ciljanih skupina.
- *Razvoj pokazatelja za praćenje napretka u području ravnopravnosti.* U cilju evaluacije učinkovitosti javnih politika i programa, preporučuje se uspostava konkretnih i mjerljivih indikatora uspješnosti, poput broja uključenih gluhih sportašica, broja educiranih trenera, razine dostupnosti sportskih sadržaja i vidljivosti u medijima.
- *Poticati suradnju s međunarodnim organizacijama, poput International Committee of Sports for the Deaf i European Deaf Sports Organization, u cilju razmjene dobrih praksi i jačanja međuna-*

zation, in order to exchange good practices and strengthen international support for the inclusion of deaf sportswomen. Involvement in international networks and platforms enables the exchange of good practices, access to modern models of inclusion, and improves the ability of national organizations to effectively implement inclusive measures.

The implementation of the above recommendations requires a multisectoral approach and continuous institutional support, and their implementation can significantly contribute to reducing existing inequalities and ensuring equal access to top-level sport for all women, regardless of the presence of disability.

CONCLUSION

The main finding of this research on gender inequality in elite deaf athletes and athletes without disabilities contributes to the indicators of the disadvantaged position of the female population in sport, especially women whose disability is hearing impairment. Accordingly, it is necessary to facilitate understanding of the issues unique to deaf female athletes in order to encourage the creation of favorable and equal conditions in the sports environment. The research confirms that deaf female athletes remain marginalized in multiple ways and points to the necessity of systematic and inclusive policies that will ensure the active participation of women with disabilities in all segments of sport – from initial inclusion to strategic decision-making.

rodne podrške inkluziji gluhih sportašica. Uključivanje u međunarodne mreže i platforme omogućuje razmjenu dobrih praksi, pristup suvremenim modelima inkluzije te poboljšava sposobnost nacionalnih organizacija za učinkovitu provedbu inkluzivnih mjera.

Primjena navedenih preporuka zahtijeva multisektorski pristup i kontinuiranu institucionalnu podršku, a njihova provedba može značajno doprinijeti smanjenju postojećih nejednakosti te osigurati ravnopravan pristup vrhunskom sportu za sve žene, neovisno o prisutnosti invaliditeta.

ZAKLJUČAK

Glavni nalaz ovog istraživanja o nejednakosti u spolnoj raspodjeli kod vrhunskih gluhih sportaša i sportaša bez invaliditeta doprinosi pokazateljima nepovoljnog položaja populacije žena u sportu, posebice žena čiji uzrok invaliditeta je oštećenje sluha. U skladu s tim, potrebno je omogućiti razumijevanje problematike jedinstvene za gluhe sportašice kako bi se potaknulo stvaranje povoljnih i ravnopravnih uvjeta u sportskom okruženju. Istraživanje potvrđuje da gluhe sportašice ostaju višestruko marginalizirane te ukazuje na nužnost sustavnih i uključivih politika koje će osigurati aktivnu participaciju žena s invaliditetom u svim segmentima sporta – od početnog uključivanja do strateškog odlučivanja.

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RELATION BETWEEN PHYSICAL EDUCATION QUALITY AND TEACHERS' COMMUNICATION STYLE – DIFFERENTIAL ANALYSIS

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Abstract: The conducted research was focused on the communication aspect of the implementation of Physical Education (PE) with the main goal of determining the influence of different communication dimensions on the implementation quality of individual parts of the lesson. The sample of respondents consisted of 120 student teachers of kinesiology, who taught classes with upper primary school students. Data on teaching quality and communication modality were collected using the direct observation method with the application of the Questionnaire for the assessment of the teaching process quality (QT) and Questionnaire for the evaluation of interpersonal communication modality (QC). The influence of communication dimensions on the quality of individual parts of the PE lesson was determined by applying a series of regression analyses. The obtained findings confirmed the significant relations between the communication dimensions and the implementation quality of all lesson parts. The size of the relations grew with the increase in the duration and complexity of the individual lesson part, where the main parts of the lesson, in which the learning and teaching of more complex kinesiology content and the application of different methods and methodical organizational forms of work come to the fore, required more pronounced communication skills. The research confirmed the importance of quality communication in teaching with special emphasis on the need to develop these skills in future teachers, as a prerequisite for quality work in all aspects of the educational process.

Keywords: PE lesson; lesson articulation; educational communication; primary school children.

INTRODUCTION

Every human activity, no matter how complex it may be and no matter how chaotic and unpredictable it may seem at first glance, follows a certain course that has a kind of regularity in its internal genesis. So, although the number of degrees of freedom in such activities is practically infinite, and therefore the number of possible directions in its development is infinite as well as the number of outcomes, still in this case we are dealing with a system of deterministic chaos. Also, it is important to bear in mind the fact, and the same is confirmed by practice, that the educational process is a complex system (Bilić et al., 2005; Findak et al., 2003; Findak & Prskalo, 2003; Vlahović et al., 2015, 2020), which is very difficult to manage and keep under control. As stated in the introductory remarks, the teaching process can be viewed as a communication process between its main subjects, teachers and students. In this way, the teaching process is defined as a process of exchanging information, i.e. transferring content and defining interpersonal relationships between teaching subjects, through interpersonal communication.

Taking into account that the quality of the educational process depends on the quality of the established relationships between its participants, and since these are formed through the processes of pedagogical communication, it is crucial to define optimal communication models by establishing a balance of its dimensions in order to improve the teaching process (Lorger et al., 2013). Education is described (in the broader sense of the word, A/N) as an interaction-communicative process, thus locating it in the field of interpersonal relations (Bratanić, n.d.). The author refers to the definition of Malić and Mužić, who define educational activity as a communication process in which subjects interact with each other, with the basic purpose of influencing the development of children (Malić & Mužić, 1983). Communication itself in the process of education is understood, in this context, as a process of creating meaning between two or more persons (Bratanić, n.d.). Some authors defined positive linear relationships between the teacher's non-verbal and verbal directness and cognitive, affective and imitative learning as well as the level of motivation crucial for learning (Christensen & Menzel, 1998). It is possible to conclude that a successful educational process requires the establishment of quality communication between subjects. Obviously, pedagogical communication takes place both on an intraper-

sonal, interpersonal and social level. In fact, the success of educational activity will depend to the greatest extent on the quality of interaction and the degree of interactional connection in the communication of all its participants (Bratanić, n.d.). It is clear, therefore, that the educational process can only be successful within the context of quality communication, so the question arises: “How do we communicate with students and is such communication a prerequisite for a successful educational process?” (T. Bavčević et al., 2005). This is precisely where the key to optimizing the education process as a whole lie. In this research, the analysis of the quality of the teaching process focused on the individual PE lesson, since it represents the basic formative unit of the education process in all areas, including kinesiology (Androja et al., 2023; D. Bavčević et al., 2022; T. Bavčević et al., 2006; Prskalo et al., 2010). Therefore, the teacher's success in teaching as well as the realization of learning outcomes depends directly on the organization and realization of the lesson itself (Androja et al., 2020; Feito et al., 2018; Findak et al., 2011; Pejčić et al., 2021; Prskalo et al., 2010). In accordance with the didactical articulation, the Physical Education lesson lasts 45 minutes in total, and includes five successive parts, namely: Introductory lesson part, Preparatory lesson part, Main A and B lesson part and Closing lesson part.

The aim of this research was to analyse the communication aspects of Physical Education as generative factors in the educational process. The influence of the communication dimensions on the implementation quality of the individual lesson parts was examined in particular.

MATERIALS AND METHODS

Study design and participants

The research included 120 participants, of which 55 were female students and 65 male students of the Faculty of Kinesiology, University of Split, Republic of Croatia. The students involved in the research previously passed the General kinesiological didactics course and underwent a professional-pedagogical practice in Physical education in primary and secondary schools lasting fifteen days. The respondents joined the project voluntarily after being informed about the subject of the research and the examination procedure.

Data collection

In order to determine the quality of the implementation of the PE teaching process, the *Questionnaire for the assessment of the teaching process quality (QT)* was applied (T. Bavčević, 2010). The questionnaire consists of 20 qualitative parameters divided into five groups according to the articulation of the PE lesson: *Quality of introductory lesson part (ILP)*, *Quality of preparatory lesson part (PLP)*, *Quality of main A lesson part (MALP)*, *Quality of main B lesson part (MBLP)*, *Quality of closing lesson part (CLP)*. In this way, each part of the lesson was evaluated with four grades on a five-point Likert scale, where the grades value the quality of the organization of the teaching process, the quality (adequacy) of the teaching content, the quality of the presentation of the teaching content, and the quality of the realization of the teaching content. Questionnaire *QT* is available as supplementary file S1.

The evaluation of interpersonal communication modality in the teacher/student-student relationship was carried out using the *Questionnaire for the evaluation of interpersonal communication modality (QC)*. The questionnaire includes 27 communication parameters, divided into three groups according to communication dimensions defined as *Technical and content communication dimension (TCD)*, *Assertiveness and formality dimension (AFD)* and *Emphatic and closeness dimension (ECD)*. In this way, each of the dimensions was evaluated with nine points using a five-point Likert scale. Questionnaire *QC* is available as supplementary file S2.

The research was conducted in a primary school in the city of Split, Croatia, where students of kinesiology conducted PE lessons with fifth-grade students as part of the Kinesiological didactics course.

Data on the teaching process quality, as well as on the modalities of interpersonal communication, were collected by the method of direct observation of students' lectures and evaluation of the defined parameters using evaluation questionnaires by five evaluators, graduated kinesiologists. The evaluators were familiarized with the evaluation parameters and methodology before participating in the examination procedure.

The research is part of the research project “*The integrative and developmental role of kinesiological education in the educational system – facing the challenges of modern schooling*” approved by the Faculty Council of the Faculty of Kinesiology, University of Split (No.: 2181-205-02-01-23-0166, 15 December 2023). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data analysis

Descriptive statistics parameters were calculated on the collected data, including the following indicators: mean (M), minimum result (min), maximum result (max), standard deviation (SD), skewness (α_3), kurtosis (α_4). Testing the normality of the data distribution was performed using the Kolmogorov-Smirnov test (KS-test). As part of the testing, the maximum deviation between the empirical and theoretical relative cumulative frequency (max d) was calculated. By comparing this parameter with the critical value of the KS-test (d) for the corresponding number of respondents at the error level of 0.05, the shape of the distribution was determined. In order to determine the dependence of particular dimensions of the teaching process in relation to the dimensions of the interpersonal communication process as an independent set of predictors, a multiple regression analysis was applied. As part of the analysis, the following parameters were calculated: multiple correlation coefficient (R), coefficient of determination (R^2), standard error of prediction (σ_e), F-test value (F), standardized regression coefficient (β), coefficient of linear correlation (r), t-test value (t), significance level for F-test and t-test (p). The software STATISTICA v.14.0.1.25 was used for data processing (TIBCO Software Inc, USA).

RESULTS

Table 1 shows the parameters of descriptive statistics and the Kolmogorov-Smirnov test of normality of data distribution for the subsample of female students.

Table 1. Parameters of descriptive statistics and KS-test, female students.

	M	min	max	SD	α_3	α_4	max d
ILP	3.94	2.50	4.95	0.65	-0.10	-1.04	0.101
PLP	3.65	2.00	4.65	0.63	-0.61	-0.10	0.090
MALP	3.72	2.35	4.85	0.63	-0.22	-0.71	0.080
MBLP	3.60	1.35	4.85	0.87	-0.73	-0.05	0.115
CLP	3.96	1.90	5.00	0.69	-0.93	0.69	0.128
TCD	3.87	2.33	4.78	0.65	-0.74	-0.38	0.142
AFD	3.52	2.33	4.80	0.50	-0.33	0.34	0.113
ECD	3.48	2.51	4.38	0.49	-0.15	-0.77	0.066

Note: Critical KS-test value ($p < 0.05$; $n = 55$) = 0.180.

The mean values of the teaching process variables range from 3.65 to 3.96 with a standard deviation of 0.63 up to 0.87. In the set of interpersonal communication process variables, the mean values range from 3.48 to 3.87 with standard deviations from 0.49 to 0.65. After conducting the K-S test, a normal distribution was determined for all tested variables.

Table 2. Parameters of descriptive statistics and KS-test, male students.

	M	min	max	SD	α_3	α_4	max d
ILP	3.61	1.70	4.90	0.90	-0.25	-1.31	0.137
PLP	3.33	2.00	4.90	0.67	0.32	-0.56	0.074
MALP	3.61	2.65	4.95	0.57	0.26	-0.75	0.092
MBLP	3.51	1.35	4.90	0.81	-0.37	-0.56	0.083
CLP	3.79	2.25	4.90	0.73	-0.51	-0.65	0.095
TCD	3.65	2.38	4.73	0.54	-0.00	-0.47	0.064
AFD	3.33	2.56	4.58	0.45	0.31	-0.34	0.072
ECD	3.34	1.82	4.33	0.53	-0.24	0.06	0.087

Note: Critical KS-test value ($p < 0.05$; $n = 65$) = 0.166.

Table 2 shows the parameters of descriptive statistics and the Kolmogorov-Smirnov test of normality of data distribution for the subsample of male students.

The mean values of the teaching process variables range from 3.33 to 3.79 with a standard deviation of 0.57 up to 0.90. In the set of interpersonal communication process variables, the mean values range from 3.33 to 3.65 with standard deviations from 0.45 to 0.54. After conducting the K-S test, a normal distribution was determined for all tested variables.

In order to determine the linear dependence between the dimensions of the teaching process and the process of interpersonal communication, a correlation analysis was applied. Table 3 shows the intercorrelations matrix between the two sets of variables, separately for female and male students.

Table 3. Intercorrelations matrix, female and male students.

	Female			Male		
	TCD	AFD	ECD	TCD	AFD	ECD
ILP	0.34	0.23	0.41	0.62	0.43	0.57
PLP	0.45	0.52	0.42	0.68	0.55	0.76
MALP	0.74	0.70	0.58	0.74	0.64	0.73
MBLP	0.67	0.53	0.50	0.64	0.50	0.55
CLP	0.66	0.46	0.51	0.48	0.32	0.44

Correlation analysis for the subsample of female students indicated, in general, the existence of a positive correlative connection between the variables of the teaching process and the variables of interpersonal communication. The mentioned connections range from weak ($r = 0.23$) to medium strong ($r = 0.74$) correlations. Similar results were recorded in the sub-sample of male students. The values of Pearson's linear correlation coefficients are thus in the range from weak ($r = 0.32$) to medium strong ($r = 0.76$) correlation. In order to determine the relations between the dimensions of the teaching process and the dimensions of interpersonal communication as an independent set of predictors, a multiple regression analysis was applied. Table 4 shows the results of the multiple regression analysis for the criterion variable *Quality of introductory lesson part (ILP)*, separately for female and male students.

Table 4. Multiple regression analysis; criterion variable - *Quality of introductory lesson part (ILP)*.

	Female				Male			
	Multiple regression							
	R = 0.424	R ² = 0.180	$\sigma_e = 0.601$		R = 0.638	R ² = 0.407	$\sigma_e = 0.708$	
	F = 3.734	p = 0.017			F = 13.983	p < 0.001		
	β	r	t	p	β	r	t	p
TCD	0.00	0.34	0.02	0.98	0.46	0.62	2.62	0.01
AFD	0.11	0.23	0.67	0.50	0.00	0.43	0.02	0.99
ECD	0.37	0.41	1.98	0.05	0.21	0.57	1.33	0.19

The results of the multiple regression analysis for the subsample of female students indicate a significant level of relation between the predictor set and the variable *Quality of introductory lesson part (ILP)*. The multiple correlation coefficient ($R = 0.424$) confirms that a significant part of the variability of the criterion variable can be attributed to the influence of the predictor set. The statistical significance of the regression model was confirmed using the *F-test* ($F = 3.734$; $p = 0.017$), so it is possible to consider the model as predictively valid. The value of the coefficient of determination ($R^2 = 0.180$) indicates a statistically significant amount of common variance of the predictor set and the criterion variable. The value of the standard error of the prediction ($\sigma_e = 0.601$), as an indicator of the standard deviation of the dispersion of the measured results around the regression line, indicates a satisfactory degree of representativeness of the regression model. The analysis of the partial influence of individual variables did not indicate a

statistically significant contribution of any of the three variables of the predictor set on significance of the regression model. The obtained values of the standardized regression coefficients are not significant (β : [0.00, 0.37]), and the values of the linear correlation coefficients of individual predictor variables and criteria are in the interval of weak correlation (r : [0.23, 0.41]). The obtained findings were confirmed using *t-test* (t : [0.02, 1.98]; p : [0.05, 0.98]). The results of the multiple regression analysis for the subsample of male students indicate a significant relation between the predictor set of variables and the criterion variable *Quality of introductory lesson part (ILP)*. The coefficient of multiple correlation ($R = 0.638$) shows that a significant amount of the variance of the criterion variable can be attributed to the influence of the predictor set. The statistical significance of the regression model was confirmed using the *F-test* ($F = 13.983$; $p < 0.001$), which points to the conclusion that the defined set of predictors enables a valid prediction of the value of the criterion variable. The coefficient of determination ($R^2 = 0.407$) indicates a significant amount of common variance of the predictor set of variables and the criterion variable. The obtained value of the standard error of the prediction ($\sigma_e = 0.708$) indicates a satisfactory degree of representativeness of the defined regression model. The analysis of the partial influence of individual variables of the predictor set indicated a statistically significant contribution of the variable *Technical and content communication dimension (TCD)* to the validity of the regression model. The value of the standardized regression coefficient ($\beta = 0.46$) indicates a significant influence of the observed variable on the criterion values. The mentioned variable has a moderately strong correlative relationship with the criterion variable ($r = 0.62$). The stated results were confirmed using the *t-test* ($t = 2.62$; $p = 0.01$).

Table 5 shows the results of the multiple regression analysis for the criterion variable *Quality of preparatory lesson part (PLP)*, separately for female and male students.

Table 5. Multiple regression analysis; criterion variable - *Quality of preparatory lesson part (PLP)*.

	Female				Male			
Multiple regression	$R = 0.588$	$R^2 = 0.346$	$\sigma_e = 0.523$		$R = 0.777$	$R^2 = 0.604$	$\sigma_e = 0.431$	
	$F = 8.998$	$p < 0.001$			$F = 31.065$	$p < 0.001$		
	β	r	t	p	β	r	t	p
TCD	-0.05	0.45	-0.27	0.79	0.16	0.68	1.11	0.27
AFD	0.45	0.52	3.11	0.00	0.12	0.55	1.07	0.29
ECD	0.32	0.42	1.88	0.07	0.57	0.76	4.44	0.00

The obtained results of the multiple regression analysis for the subsample of female students indicate a significant relation between the predictor set and the variable *Quality of preparatory lesson part (PLP)*. The multiple correlation coefficient ($R = 0.588$) confirms that a significant amount of the variance of the criterion variable can be attributed to the influence of the predictor set. The statistical significance of the regression model was confirmed using the *F-test* ($F = 8.998$; $p < 0.001$), so it is possible to conclude that the defined set of predictors enables a valid prediction of the value of the criterion variable *Quality of preparatory lesson part (PLP)*. The coefficient of determination ($R^2 = 0.346$) indicates a satisfactory amount of common variance of the predictor set and the criterion variable. The value of the standard error of the prediction ($\sigma_e = 0.523$) indicates a satisfactory degree of representativeness of the defined regression model. The analysis of the partial influence of individual variables of the predictor set indicated a statistically significant contribution of the *Assertiveness and formality dimension (AFD)* variable to the significance of the regression model. The value of the standardized regression coefficient ($\beta = 0.45$) indicates a significant influence of the mentioned variable on the criterion values. The specified variable has a moderately strong correlative relationship with the criterion variable ($r = 0.52$). The obtained results were confirmed using the *t-test* ($t = 3.11$; $p < 0.01$). The results of the multiple regression analysis for the subsample of male students indicate a statistically significant relation between the predictor set of variables and the criterion variable *Quality of preparatory lesson part (PLP)*. The multiple correlation coefficient ($R = 0.777$) confirms that the variability of the criterion variable is significantly influenced by the variables of the predictor set, so the defined regression model can be considered predictively valid. The obtained findings were confirmed by the results of the *F-test* ($F = 31.065$; $p < 0.001$). The value of the coefficient of determination ($R^2 = 0.604$) indicates a significant amount of common variance of the predictor set and the crite-

tion variable. The standard error of the prediction ($\sigma_e = 0.431$) indicates a satisfactory degree of representativeness of the defined regression model. The analysis of the partial influence of individual variables indicated a statistically significant contribution of the variable *Emphatic and closeness dimension (ECD)* to the significance of the regression model. The value of the standardized regression coefficient ($\beta = 0.57$) indicates a significant influence of the specified variable on the value of the criterion variable. The analysis also revealed a medium-strong correlation between these two variables ($r = 0.76$). The statistical significance of the partial influence of the predictor variable was confirmed using the *t-test* ($t = 4.44$; $p < 0.01$). Table 6 shows the results of the multiple regression analysis for the criterion variable *Quality of main A lesson part (MALP)*, separately for female and male students.

Table 6. Multiple regression analysis; criterion variable - *Quality of main A lesson part (MALP)*.

	Female				Male			
Multiple regression	R = 0.817	R ² = 0.667	$\sigma_e = 0.372$		R = 0.797	R ² = 0.635	$\sigma_e = 0.355$	
	F = 34.113	p < 0.001			F = 35.323	p < 0.001		
	β	r	t	p	β	r	t	p
TCD	0.35	0.74	2.44	0.02	0.28	0.74	2.05	0.04
AFD	0.43	0.70	4.13	0.00	0.24	0.64	2.29	0.03
ECD	0.19	0.58	1.60	0.12	0.37	0.73	3.02	0.00

The results of the multiple regression analysis for the subsample of female students indicate a statistically significant relation between the predictor set of variables and the criterion variable *Quality of main A lesson part (MALP)*. The multiple correlation coefficient ($R = 0.817$) confirms that the variability of the criterion variable is significantly influenced by the set of predictors. The aforementioned findings were confirmed using the *F-test* ($F = 34.113$; $p < 0.001$), so the defined regression model can be considered predictively valid. The value of the determination coefficient ($R^2 = 0.667$) indicates a significant amount of common variance of the predictor set and the criterion variable. The standard error of the prediction ($\sigma_e = 0.372$) indicates a satisfactory degree of representativeness of the regression model.

The analysis of partial influence indicated a significant contribution of two variables to the validity of the regression model. The value of the standardized regression coefficient for the variable *Assertiveness and formality dimension (AFD)* ($\beta = 0.43$) indicates a significant influence of the specified variable on the results of the criterion variable. The analysed predictor variable has a moderately strong correlation with the criterion ($r = 0.70$). The obtained findings were confirmed using the *t-test* ($t = 4.13$; $p < 0.01$). A statistically significant influence on the results of the criterion variable is also achieved by the variable *Technical and content communication dimension (TCD)*, which confirms the value of the associated standardized regression coefficient ($\beta = 0.35$). The observed predictor is moderately strongly correlated with the criterion variable ($r = 0.74$). The aforementioned findings were confirmed using the *t-test* ($t = 2.44$; $p = 0.02$). Multiple regression analysis for a subsample of male students indicates a statistically significant relation between the predictor set of variables and the criterion variable *Quality of main A lesson part (MALP)*. The value of the multiple correlation coefficient ($R = 0.797$) confirms that the variability of the criterion variable is significantly influenced by the variables of the predictor set. The obtained findings were confirmed using the *F-test* ($F = 35.323$; $p < 0.001$), which points to the conclusion about the predictive validity of the defined regression model. The coefficient of determination ($R^2 = 0.635$) indicates a significant amount of shared variance of the predictor set of variables and the criterion variable. The value of the standard error of the prediction ($\sigma_e = 0.355$) indicates a satisfactory degree of representativeness of the regression model. The analysis of the partial influence indicated a statistically significant contribution of all three variables of the predictor set on significance of the regression model. The variable *Emphatic and closeness dimension (ECD)* has the greatest partial influence on the values of the results of the criterion variable, which confirms the value of the associated partial regression coefficient ($\beta = 0.37$). The observed variable has a moderately strong correlation with the criterion variable ($r = 0.73$). The obtained findings were confirmed using the *t-test* ($t = 3.02$; $p < 0.01$). The variable *Technical and content communication dimension (TCD)* also has a statistically significant partial influence on the values of the results of the criterion variable, as indicated by the value of the

partial regression coefficient ($\beta = 0.28$). The mentioned variable is moderately strongly correlated with the criterion ($r = 0.74$). The findings were confirmed using the *t-test* ($t = 2.05$; $p = 0.04$). The value of the associated standardized regression coefficient ($\beta = 0.24$) shows that the results of the criterion variable are also significantly influenced by the third variable of the predictor set, the variable *Assertiveness and formality dimension (AFD)*. The observed variable has a moderately strong correlative relationship with the criterion ($r = 0.64$). The aforementioned findings were confirmed using the *t-test* ($t = 2.29$; $p = 0.03$).

Table 7 shows the results of the multiple regression analysis for the criterion variable *Quality of main B lesson part (MBLP)*, separately for female and male students.

Table 7. Multiple regression analysis; criterion variable - *Quality of main B lesson part (MBLP)*.

	Female				Male			
Multiple regression	R = 0.688	R ² = 0.474	$\sigma_e = 0.652$		R = 0.651	R ² = 0.424	$\sigma_e = 0.633$	
	F = 15.300	p < 0.001			F = 14.994	p < 0.001		
	β	r	t	p	β	r	t	p
TCD	0.48	0.67	2.66	0.01	0.46	0.64	2.66	0.01
AFD	0.21	0.53	1.64	0.11	0.11	0.50	0.81	0.42
ECD	0.09	0.50	0.57	0.57	0.13	0.55	0.87	0.39

The results of the multiple regression analysis for the subsample of female students indicate a statistically significant relation between the predictor set of variables and the criterion variable *Quality of main B lesson part (MBLP)*. The multiple correlation coefficient ($R = 0.688$) confirms that a significant part of the variability of the criterion variable can be attributed to the influence of the predictor set. The statistical significance of the regression model was confirmed using the *F-test* ($F = 15.300$; $p < 0.001$), so the defined regression model can be considered predictively valid. The value of the determination coefficient ($R^2 = 0.474$) indicates a significant amount of common variance of the predictor set and the criterion variable. The standard error of the prediction ($\sigma_e = 0.652$) indicates a satisfactory degree of representativeness of the regression model. The analysis of the partial influence of individual variables of the predictor set indicated a statistically significant contribution of the variable *Technical and content communication dimension (TCD)* to the validity of the regression model. The value of the standardized regression coefficient ($\beta = 0.48$) indicates a significant influence of the mentioned predictor on the value of the criterion variable. The specified variable has a moderately strong correlative relationship with the criterion variable ($r = 0.67$). The obtained findings were confirmed using the *t-test* ($t = 2.66$; $p = 0.01$). The findings of the multiple regression analysis for the subsample of male students indicate a statistically significant relation between the predictor set of variables and the criterion variable *Quality of main B lesson part (MBLP)*. The multiple correlation coefficient ($R = 0.651$) shows that a significant amount of the variance of the criterion variable can be attributed to the influence of the predictor set. The statistical significance of the regression model was confirmed using the *F-test* ($F = 14.994$; $p < 0.001$), which points to the conclusion that the defined set of predictors enables a valid prediction of the value of the criterion variable. The value of the coefficient of determination ($R^2 = 0.424$) indicates a significant amount of common variance of the predictor set of variables and criteria. The obtained value of the standard error of the prediction ($\sigma_e = 0.633$) indicates a satisfactory degree of representativeness of the defined regression model. The analysis of the partial influence of individual variables indicated a statistically significant contribution of the variable *Technical and content communication dimension (TCD)* to the significance of the regression model. The value of the standardized regression coefficient ($\beta = 0.46$) indicates a significant influence of the mentioned variable on the value of the criterion variable. Furthermore, the analysis established a medium strong correlation between the two mentioned variables ($r = 0.64$). The statistical significance of the partial influence of the predictor variable was confirmed using the *t-test* ($t = 2.66$; $p = 0.01$).

Table 8 shows the results of the multiple regression analysis for the criterion variable *Quality of closing lesson part (CLP)*, separately for female and male students.

Table 8. Multiple regression analysis; criteria variable - *Quality of closing lesson part (CLP)*.

	Female				Male			
Multiple regression	R = 0.666	R ² = 0.443	$\sigma_e = 0.530$		R = 0.494	R ² = 0.244	$\sigma_e = 0.653$	
	F = 13.528	p < 0.001			F = 6.552	p = 0.001		
	β	r	t	p	β	r	t	p
TCD	0.53	0.66	2.91	0.01	0.37	0.48	1.84	0.07
AFD	0.11	0.46	0.79	0.43	-0.02	0.32	-0.15	0.88
ECD	0.08	0.51	0.54	0.59	0.17	0.44	0.95	0.35

Multiple regression analysis for the subsample of female students indicates a statistically significant relation between the predictor set of variables and the criterion variable *Quality of closing lesson part (CLP)*. The value of the multiple correlation coefficient ($R = 0.666$) confirms that a significant amount of the variance of the criterion variable can be attributed to the influence of the predictor set of variables. The obtained findings were confirmed using the *F-test* ($F = 13.528$; $p < 0.001$), so the defined regression model can be considered predictively valid. The coefficient of determination ($R^2 = 0.443$) indicates a significant amount of shared variance of the predictor set of variables and the criterion variable. The value of the standard error of the prediction ($\sigma_e = 0.530$) indicates a satisfactory degree of representativeness of the regression model.

The analysis of the partial influence of individual variables of the predictor set indicated a statistically significant contribution of the variable *Technical and content communication dimension (TCD)* to the significance of the regression model. The value of the standardized regression coefficient ($\beta = 0.53$) indicates a significant influence of the mentioned predictor on the value of the criterion variable. The specified variable has a moderately strong correlative relationship with the criterion variable ($r = 0.66$). The obtained findings were confirmed using the *t-test* ($t = 2.91$; $p = 0.01$). The results of the multiple regression analysis for the subsample of male students indicate a statistically significant level of relation between the predictor set of variables and the variable *Quality of closing lesson part (CLP)*. The multiple correlation coefficient ($R = 0.494$) confirms that a significant part of the variability of the criterion variable can be attributed to the influence of the predictor set. The statistical significance of the regression model was confirmed using the *F-test* ($F = 6.552$; $p = 0.001$), so it is possible to conclude that the defined regression model enables a valid prediction of the results of the criterion variable. The coefficient of determination ($R^2 = 0.244$), despite the lower value, indicates a statistically significant amount of common variance of the predictor set and the criterion variable. The obtained value of the standard error of the prediction ($\sigma_e = 0.653$) indicates a satisfactory degree of representativeness of the defined regression model. The analysis of the partial influence of individual variables did not indicate a statistically significant contribution of any of the three variables of the predictor set on significance of the regression model. The obtained values of the standardized regression coefficients are not significant (β :[-0.02, 0.37]), and the values of the linear correlation coefficients of individual predictor variables and criteria are in the interval of weak correlation (r :[0.32, 0.48]). The obtained findings were confirmed by using *t-test* (t :[-0.15, 1.84]; p :[0.07, 0.88]).

DISCUSSION

By analysing the parameters of the correlation analysis, a significant positive correlation was recorded between all the variables of the teaching process and the process of interpersonal communication in both subsamples of respondents. The obtained values of correlation coefficients range from weak ($r_{\text{female}} = 0.23$; $r_{\text{male}} = 0.32$) to medium strong ($r_{\text{female}} = 0.74$; $r_{\text{male}} = 0.76$). It is possible to state that, on the general level, there is a positive connection between the quality of individual parts of the lesson and the manifestation of individual communication dimensions.

The aforementioned findings are clearly shown in Figure 1, separately for female and male student teachers. Also, the curve of the theoretical intellectual load in the PE lesson according to Fetz is superimposed on the graphs (Findak, 2003, p. 200). This allows us to create a general picture of the relationship between the level of influence of the communication dimensions on individual parts of the lesson with regard to their intellectual demands.

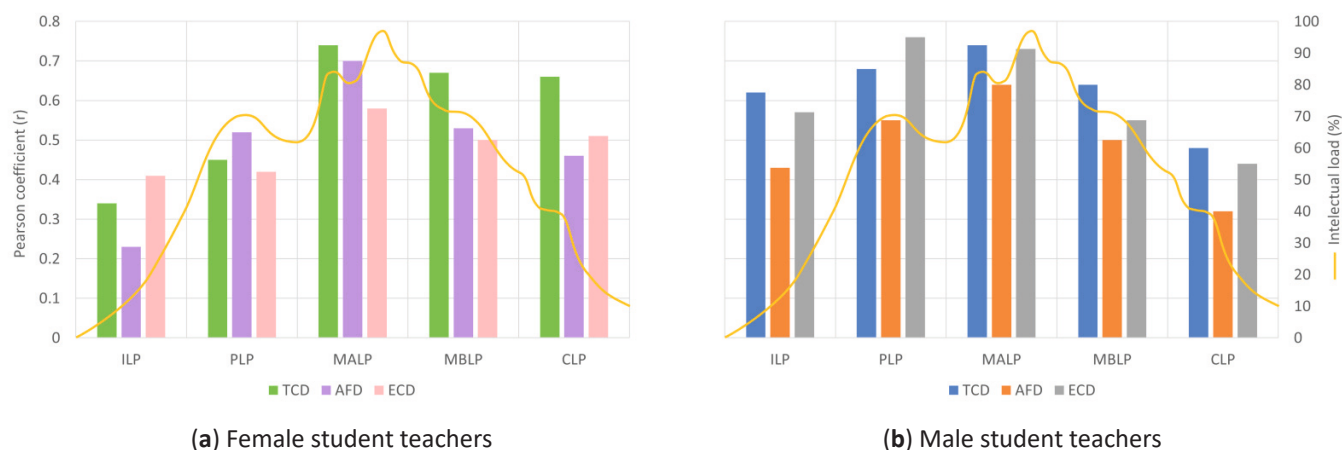


Figure 1. Correlation between quality of the lesson parts and communication dimension and theoretical intellectual load of PE lesson

Analysing the graphic representation, it is possible to see that the level of influence of communication dimensions basically follows the dynamics of the intellectual load in the PE lesson on both female and male student teachers. Of course, the presented conclusions must be treated with caution, since the correlation results outline the partial connection of the observed dimensions. Nevertheless, it is impossible not to notice how the parts of the lesson which, in terms of content and organization, represent a greater intellectual challenge, to a greater extent require better communication skills in order to optimize the educational effects.

Generally speaking, the connection of individual variables of the PE teaching process and the process of interpersonal communication at the level of correlation coefficients, as well as their relationship in the context of the theoretical model of intellectual load, points to the existence of complex interrelationships between the quality of the implementation of the teaching process and the dimensions of interpersonal communication. The obtained findings can be based on the research of other authors (T. Bavčević, 2012; García-Fariña et al., 2022).

The implementation quality of the introductory lesson part is significantly dependent on the manifestations of the interpersonal communication process dimensions, in both subsamples of respondents ($R_{\text{female}} = 0.424$; $F_{\text{female}} = 3.734$; $p_{\text{female}} = 0.017$; $R_{\text{male}} = 0.638$; $F_{\text{male}} = 13.983$; $p_{\text{male}} < 0.001$).

The analysis of the partial influence in the subsample of female students did not indicate a statistically significant contribution of any of the three variables. The obtained findings point to the conclusion that despite the existence of dependence at the general level, none of the defined dimensions partially significantly determines the quality of the implementation of this part of the PE lesson.

In the case of the male student subsample, a statistically significant contribution to the regression model is made by the variable *Technical and content communication dimension (TCD)* ($\beta = 0.46$; $t = 2.62$; $p = 0.01$). It is obvious that technically and qualitatively articulated communication significantly contributes to the quality of organization, presentation and implementation of the introductory lesson part. Considering the content that is applied in this part of the lesson, and especially the implementation methodology, the introductory lesson part primarily requires a high-quality explanation of the content with clearly defined rules and performance criteria. Therefore, the obtained findings are fully in accordance with the methodical articulation of this part of the PE (T. Bavčević et al., 2018).

The quality of the implementation of the preparatory lesson part is significantly dependent on the manifestations of interpersonal communication dimensions in both subsamples of respondents ($R_{\text{female}} = 0.588$; $F_{\text{female}} = 8.998$; $p_{\text{female}} < 0.001$; $R_{\text{male}} = 0.777$; $F_{\text{male}} = 31.065$; $p_{\text{male}} < 0.001$).

Analysing the results of the subsample of female students, a statistically significant partial contribution of the *Assertiveness and formality dimension (AFD)* variable to the significance of the regression model was observed ($\beta = 0.45$; $t = 3.11$; $p < 0.01$). It is possible to conclude that communication characterized by an increased degree of authoritarianism, determination in expressing views and positional fixation, i.e. communication asymmetry, has a positive impact on the success of the organization, presentation and implementation of the preparatory lesson part. The obtained findings are in accordance with the methodical articulation of this part of the lesson. The preparatory lesson part requires a clearly defined formation and a proper change of verbal explanation, demonstration of the content, and

implementation and control of the physical exercise process. It is obvious that female students who managed to create an appropriate communication climate were more successful in the implementation of this part of the PE lesson.

A partial analysis of the subsample of male students showed a significant contribution of the *Emphatic and closeness dimension (ECD)* variable to the significance of the regression model ($\beta = 0.57$; $t = 4.44$; $p < 0.01$). Communication based on openness, cooperation, mutual respect and a friendly communication climate significantly contributes to the quality of organization, presentation and realization of the preparatory lesson part. This leads to the conclusion that this modality of communication has a positive effect on the motivation and degree of student involvement in the exercise process.

The implementation quality of the main A lesson part is significantly dependent on the manifestations of the interpersonal communication process dimensions, in both subsamples of respondents ($R_{\text{female}} = 0.817$; $F_{\text{female}} = 34.113$; $p_{\text{female}} < 0.001$; $R_{\text{male}} = 0.797$; $F_{\text{male}} = 35.323$; $p_{\text{male}} < 0.001$).

Analysis of the partial influence in the subsample of female students indicated a significant contribution of two variables to the significance of the regression model. The variable *Assertiveness and formality dimension (AFD)* make the biggest contribution ($\beta = 0.43$; $t = 4.13$; $p < 0.01$). It is possible to conclude that communication characterized by an increased degree of authoritarianism, determination in expressing views and positional fixation, i.e. communication asymmetry, positively affects the implementation of the main A lesson part. Considering the high level of complexity in terms of content, exercise formations, methodical organizational forms of work as well as the overall methodology of implementation and control of work, quality implementation of this part of the class requires the establishment of such relationships. The size of the partial influence is followed by the variable *Technical and content communication dimension (TCD)* ($\beta = 0.35$; $t = 2.44$; $p = 0.02$). The obtained findings indicate the importance, in terms of content and technique, of well-articulated communication in the implementation of the main A lesson part. Since this part of the PE lesson involves learning and repeating the teaching topics provided by the curriculum, a high-quality verbal description and clarification of the content is a necessary prerequisite for its successful realization.

All of the above can be compared with the findings of other studies that dealt with the content and quality of the teaching process (T. Bavčević, 2015, 2016; Dyson, 2014; Genurianto et al., 2021).

In the male student subsample, a significant contribution of all three variables of the interpersonal communication process to the significance of the regression model was recorded. The greatest partial contribution is achieved by the variable *Emphatic and closeness dimension (ECD)* ($\beta = 0.37$; $t = 3.02$; $p < 0.01$). Communication marked by openness, cooperation, mutual respect and a friendly communication climate has a positive impact on the success of the organization, content presentation and implementation of the main A lesson part. Considering the content, organizational and implementation complexity, this part of the lesson requires a high degree of attention, motivation and active engagement of students (T. Bavčević et al., 2006, 2018; Pop, 2014). Kinesiology students who manage to create a stimulating communication climate are more successful in this part of the lesson. According to the size of the partial influence on the regression model, the variable *Technical and content communication dimension (TCD)* follows in second place ($\beta = 0.28$; $t = 2.05$; $p = 0.04$). As with the subsample of female students, the organization, presentation of content and implementation of this part of the lesson requires, technically and content-wise, well-articulated communication in order to successfully describe and clarify the teaching content. Kinesiology students whose communication is comprehensible, syntactically appropriate and logically meaningful are also more successful in the actual implementation of the main A lesson part. The variable *Assertiveness and formality dimension (AFD)* also make a significant contribution to the regression model ($\beta = 0.24$; $t = 2.29$; $p = 0.03$). It is possible to conclude that, considering the level of organizational, content and implementation complexity, the successful implementation of the main A lesson part requires a certain degree of authoritarianism, determination in expressing one's own views, as well as positional fixity, i.e. communication asymmetry (Babin et al., 2013; T. Bavčević et al., 2018).

The quality of the implementation of the main B lesson part is significantly dependent on the manifestations of the interpersonal communication process dimensions in both subsamples of respondents ($R_{\text{female}} = 0.688$; $F_{\text{female}} = 15.300$; $p_{\text{female}} < 0.001$; $R_{\text{male}} = 0.651$; $F_{\text{male}} = 14.994$; $p_{\text{male}} < 0.001$).

The partial contribution analysis indicated a significant contribution of the variable *Technical and content communication dimension (TCD)* to the significance of the regression model both in the subsample of female students ($\beta = 0.48$; $t = 2.66$; $p = 0.01$) and in the sample male students ($\beta = 0.46$; $t = 2.66$; $p = 0.01$). The obtained findings point to the conclusion that technically and qualitatively articulated communication significantly contributes to the quality of the implementation of the main B lesson. Since the main B lesson part, in addition to high organizational requirements, is also characterized

by the application of complex content and the necessity of constant control of the implementation, communication qualities such as clarity, comprehensibility, syntactic appropriateness and logical meaningfulness are necessary prerequisites for the quality implementation of this part of the lesson (T. Bavčević, 2016; T. Bavčević et al., 2018). Both female and male students of kinesiology who achieve higher results in the variable *Technical and content communication dimension (TCD)*, transfer information to students more easily and efficiently in this part of the PE lesson.

The quality of the implementation of the closing lesson part is significantly dependent on the manifestations of the interpersonal communication dimensions in both subsamples of respondents ($R_{\text{female}} = 0.666$; $F_{\text{female}} = 13.528$; $p_{\text{female}} < 0.001$; $R_{\text{male}} = 0.494$; $F_{\text{male}} = 6.552$; $p_{\text{male}} = 0.001$).

Analysis of the partial influence in the subsample of female students indicated a statistically significant contribution of the variable *Technical and content communication dimension (TCD)* to the significance of the regression model ($\beta = 0.53$; $t = 2.91$; $p = 0.01$). It is possible to conclude that technically and substantively articulated communication significantly contributes to the quality of the implementation of the closing lesson part. Considering the organizational, content and implementation specifics, this part of the lesson as one of the most important factors of successful implementation requires a quality description and clarification of the content (Findak et al., 2011). Therefore, it is understandable that kinesiology students who manage to achieve clear, comprehensible, syntactically appropriate and logically meaningful communication ultimately achieve better effects in this part of the lesson.

In the subsample of male students, no statistically significant influence of any of the three variables of the interpersonal communication process on the significance of the regression model was recorded. The findings point to the conclusion that, despite the dependence on the global level, none of the dimensions of interpersonal communication by itself significantly affect the implementation quality of the closing lesson part. We can support the conclusions with the findings of other studies (Ariyani & Hadiani, 2019; T. Bavčević, 2016; Findak et al., 2011; Kilby, 2023; Krahe et al., 2021).

CONCLUSION

The process of communication appears as an important factor in all aspects of teaching work and represents a significant factor in the quality of the education process as a whole. Investigating the role of communication in the teaching process, three main discursive roles of communication were identified: imparting knowledge to students, teaching students with the aim of improving their achievements, and providing support to students in the learning process (Oh, 2005). Previous research also highlights the importance of communication in improving students' motivation for active participation in classes and maintaining a positive teaching environment (Brown, 2005). Communication appears as one of the crucial factors in the management of the teaching process (Reese, 2007). Furthermore, study highlights the importance of teaching communication as a significant factor in preventing problems in teaching (Pedota, 2007).

The importance of quality communication as a significant determinant of a successful education process is evident from all of the above. Therefore, it is recommended to implement these findings into immediate teaching practice through the improvement of university curricula for future teachers, as well as through lifelong education intended for teachers. The main goal of such activities would be to raise awareness among teachers about the importance of communication skills in working with students and thereby to improve the general quality of the educational process.

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TEACHERS' VIEWS ON THE SPECIFICITY OF THE RELATIONSHIP BETWEEN DEVELOPMENTALLY APPROPRIATE PRACTICE AND SPORTS-TALENTED STUDENTS WITHIN THE INDIVIDUAL CURRICULUM

STAVOVI NASTAVNIKA O SPECIFIČNOSTI RELACIJE RAZVOJNO PRIMJERENE PRAKSE I SPORTSKI NADARENH UČENIKA UNUTAR INDIVIDUALNOG KURIKULUMA

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Abstract: The research was conducted on a sample of 102 respondents (teachers) employed in primary schools in the Zenica-Doboj Canton of the Federation of Bosnia and Herzegovina. The main objective of the research is to determine the attitudes and opinions and possible differences of the respondents on the specifics of the relationship between developmentally appropriate practice and gifted students who move from classroom to subject teaching within the individual curriculum, considering the gender, employment status, age and level of education of the respondents. The research used a five-point Likert scale questionnaire in which each statement was marked with 5 answers (1-I completely disagree, 2-I disagree, 3-I have no opinion/I am neutral, 4-I agree, 5-I completely agree). The questionnaire included general data on the respondents (gender, workplace/position, age, level of education) and 5 indicators of developmentally appropriate practice with a scale of indicators of developmentally appropriate practice in supporting students' giftedness. For all indicators of teachers' attitudes about the specificity of the relationship between developmentally appropriate practice and gifted students in sports who move from classroom to subject teaching within the individual curriculum, basic descriptive statistical parameters (arithmetic mean -AS and standard deviation -St. Dev.) were calculated and determined. To determine the statistical significance of differences between groups of respondents, the results of the t-test and analysis of variance of different groups with LSD Post Hoc comparison tests were applied. The arithmetic mean (AS) of all indicators of 3.92 shows that teachers/educators agree very well with the statements about developmentally appropriate practice.

Sažetak: Istraživanje je provedeno na uzorku od 102 ispitanika (učitelja/nastavnika) zaposlenih u osnovnim školama Zeničko-dobojskog kantona Federacije Bosne i Hercegovine. Osnovni cilj istraživanja je utvrđivanje stavova-mišljenja i eventualnih razlika ispitanika o specifičnosti relacije razvojno primjerene prakse i sportski nadarenih učenika koji prelaze iz razredne u predmetnu nastavu unutar individualnog kurikuluma s obzirom na spol, radni status, dob i stepen obrazovanja ispitanika. U istraživanju je primijenjen anketni upitnik petostepene Likertove skale u kojem je svaka tvrdnja označena sa 5 odgovora (1-uopšte se ne slažem, 2-ne slažem se, 3-nemam mišljenje/neutralan sam, 4-slažem se, 5-potpuno se slažem). Anketni list je obuhvatao opšte podatke o ispitanicima (spol, radno mjesto/poziciju, starosnu dob, stepen obrazovanja) i 5 indikatora razvojno primjerene prakse sa skalom pokazatelja razvojno primjerene prakse podržavanja učenikove nadarenosti. Za sve indikatore stavova nastavnika o specifičnosti relacija relacije razvojno primjerene prakse i nadarenih učenika u sportu koji prelaze iz razredne u predmetnu nastavu unutar individualnog kurikuluma izračunati su i utvrđeni osnovni deskriptivni statistički parametri (aritmetička sredina -AS i standardna devijacija -St. Dev.). Za utvrđivanje statističke značajnosti razlika između grupa ispitanika primijenjeni su rezultati t-testa i analiza varijanse različitih grupa sa LSD Post Hoc testovima poređenja. Aritmetička sredina (AS) svih indikatora od 3,92 pokazuje da se učitelji/nastavnici veoma dobro slažu s tvrdnjama o razvojno primjerenoj praksi. Vrijednost standardne devijacije (SD) od 0,82 ukazuje da je rasipanje oko aritmetičke

The standard deviation (SD) value of 0.82 indicates that the dispersion around the arithmetic mean is very weak, which is confirmed by the coefficient of variability (CV) of 20.92% and thus the very good homogeneity of the results obtained for this sample of respondents. The results of the T test and analysis of variance with LSD Post Hoc comparison tests indicate that there is no statistically significant difference in the attitudes of the respondents about the specificity of the relationship between developmentally appropriate practice and gifted students in sports who move from classroom to subject teaching within the individual curriculum with regard to gender, age and level of education of the respondents. The difference was determined only among the respondents with regard to employment status. In general, it can be concluded that teachers/educators have uniform attitudes about the specificity of the relationship between developmentally appropriate practice and gifted students in sports who move from classroom to subject teaching within the individual curriculum. The significance of the results obtained is that in this way, continuous and quality development of gifted students in sports who move from classroom to subject teaching can be ensured.

Key words: analysis of variance, t-test, LSD Post Hoc comparison tests, attitudes, respondents, sports talent, students.

INTRODUCTION

Quality growth and development of a child in modern society represents a great challenge for parents and teachers in educational institutions (Šagud, 2014). The foundations for quality growth and development of a child, or the conditions that enable comprehensive development, are laid early in life by encouraging physical, emotional, social and intellectual development (Valjan Vukić, 2012).

Black et al. (2017) define child development as a process of maturation and interaction that results in the advancement of motor, cognitive, linguistic, social-emotional and self-regulatory abilities. Although the developmental process is similar across cultures, children progress in different directions with respect to the acquired skills specific to their culture. The acquisition of skills and learning in middle childhood, during adolescence and in adulthood builds on the fundamental abilities acquired during early childhood. Therefore, school education can stimulate, strengthen, but also reduce the potential that a child has, which is exactly why culture and curriculum in a school institution are extremely important (Šagud, 2014).

Curriculum is defined as precisely defined and systematically planned upbringing and education that includes goals, tasks, strategies, organization, methods and evaluation of learning. The curriculum should be scientifically based on the principles of interdisciplinarity and multidisciplinary (Rosandić, 2013). Curriculum in school education represents a theoretical development concept that shapes

sredine veoma slabo, što potvrđuje i koeficijent varijabilnosti (CV) od 20,92% a time i veoma dobru homogenost dobivenih rezultata za ovaj uzorak ispitanika. Rezultati T testa i analiza varijanse sa LSD Post Hoc testovima poređenja ukazuju da nema statistički značajne razlike u stavovima ispitanika o specifičnosti relacija razvojno primjerene prakse i nadarenih učenika u sportu koji prelaze iz razredne u predmetnu nastavu unutar individualnog kurikuluma s obzirom na spol, starosnu dob i stepen obrazovanja ispitanika. Razlika je utvrđena jedino kod ispitanika s obzirom na radni status. Generalno, može se zaključiti da učitelji/nastavnici imaju ujednačene stavove o specifičnosti relacije razvojno primjerene prakse i nadarenih učenika u sportu koji prelaze iz razredne u predmetnu nastavu unutar individualnog kurikuluma. Značaj dobivenih rezultata je u tome što se na taj način može obezbijediti kontinuirani i kvalitetni razvoj nadarenih učenika u sportu koji prelaze iz razredne u predmetnu nastavu.

Gljučne riječi: analiza varijanse, t – test, LSD Post Hoc testovi poređenja, stavovi, ispitanici, sportska nadarenost.

UVOD

Kvalitetan rast i razvoj djeteta u savremenom društvu predstavlja veliki izazov za roditelje i učitelje/nastavnike u odgojno-obrazovnim ustanovama (Šagud, 2014). Temelji za kvalitetan rast i razvoj djeteta, odnosno uslovi koji omogućuju cjelovit razvoj postavljaju se već u početku života tako da se potiče tjelesni, emocionalni, socijalni i intelektualni razvoj (Valjan Vukić, 2012).

Black i sar. (2017) razvoj djeteta definišu kao proces sazrijevanja i interakcije koji rezultira napredovanjem motoričkih, kognitivnih, jezičnih, socijalno-emocionalnih i samoregulirajućih sposobnosti. Iako je razvojni proces sličan među različitim kulturama, djeca napreduju u različitim smjerovima s obzirom na stečene vještine specifične za njihovu kulturu. Sticanje vještina i učenje u srednjem djetinjstvu, tokom adolescencije i u odrasloj dobi nadograđuje se na temeljne sposobnosti stečene tokom ranog djetinjstva. Stoga školsko obrazovanje može potaknuti, osnažiti, ali i umanjiti potencijale koje dijete ima, upravo zbog toga izrazito su važni kultura i kurikulum u školskoj ustanovi (Šagud, 2014).

Kurikulum se definiše kao precizno definisan i sistemski planirani odgoj i obrazovanje koje obuhvata ciljeve, zadatke, strategije, organizaciju, metode i evaluaciju učenja. Kurikulum treba biti naučno utemeljen na načelima interdisciplinarnosti i multidisciplinarnosti (Rosandić, 2013). Kurikulum u školskom odgoju i obrazovanju predstavlja teorijsku razvojnu koncepciju kojom

and changes practice, in order to find the best possible way to support children's education. Through the curriculum, teachers monitor and can understand the dynamics of children's activities and evaluate the educational process (Slunjski, 2012).

An important part of elementary education is observation, monitoring of the development and progress of students. Teachers, based on careful observation, plan and define the curriculum, and thereby change and expand the ways of teaching children so that they can move more easily to the next stages of development. Careful observation can help the teacher to define the strengths and/or weaknesses of the child and thus adapt teaching to their abilities (Curtis and O'Hagan, 2003).

The main goal of a school institution is to encourage and develop all the abilities and skills of a child, but each school institution has its own program, or curriculum. Each school institution, depending on the curriculum, places greater emphasis on the social, cognitive or physical development of the child (Tatalović-Vorkapić, 2013). The curriculum is defined by the content and methods that support the development and learning of children. The curriculum answers the questions "what to teach?" and "how to teach?" (NIEER, 2007, according to Quality Matters in Early Childhood Education and Care: Sweden, 2013).

The development of educational practice and curriculum in primary school is achieved through a process of joint reflection and work, which is why the process of developing the curriculum itself is long-term and demanding and cannot be achieved partially and mechanically, without connection with other parts.

The curriculum in a primary school institution therefore represents an educational concept that is developed in cooperation with primary school institutions through the totality of educational interactions between children and adults. Each primary school institution implements the curriculum as a unique and unrepeatable theoretical concept, thus enabling autonomy and space for pluralism of pedagogical ideas and concepts, which are based on developmentally appropriate practice and humanistic ideas (Slunjski, 2012).

The school institution, with its curriculum, environment and professionals, must contribute to the child's development and respect his needs. The environment in which the child grows up must be stimulating for the child's learning, growth and development, because this is a prerequisite for the child's development in accordance with his personal potential (Mlinarević, 2000).

As stated by Katz (1990), the implications for teaching strategies and curriculum in early childhood can be found

se oblikuje i mijenja praksa, kako bi se pronašao najbolji mogući način kojim će se podržati odgoj i obrazovanje djece. Kroz kurikulum učitelji/nastavnici prate i mogu razumijeti dinamiku aktivnosti djece te evaluirati odgojno-obrazovni proces (Slunjski, 2012).

Važan dio osnovnoškolskog odgoja i obrazovanja predstavlja posmatranje, praćenje razvoja i napretka učenika. Učitelji na osnovu pažljivog posmatranja, planiraju i definišu nastavni plan i program, a samim time i mijenjaju i šire načine poučavanja djece kako bi ona što lakše prelazila u slijedeće faze razvoja. Pažljivo posmatranje može pomoći učitelju da definiše prednosti i/ili slabosti djeteta i samim time prilagodi poučavanje njihovim sposobnostima (Curtis i O'Hagan, 2003).

Osnovni cilj školske ustanove je poticati i razvijati sve sposobnosti i vještine kod djeteta, no svaka školska ustanova posjeduje vlastiti program, odnosno kurikulum. Svaka školska ustanova zavisno od kurikulumu stavlja veći naglasak na socijalni, kognitivni ili tjelesni razvoj djeteta (Tatalović-Vorkapić, 2013). Kurikulum je definisan sadržajem i metodama koji podupiru razvoj i učenje djece. Kurikulum odgovara na pitanja „šta poučavati?“ i „kako podučavati?“ (NIEER, 2007, prema Quality Matters in Early Childhood Education and Care: Sweden, 2013).

Razvoj odgojno-obrazovne prakse i kurikulumu u osnovnoj školi postiže se procesom u kojem se zajednički promišlja i radi, zbog čega je proces razvoja samog kurikulumu dugotrajan i zahtjevan te se ne može postići parcijalno i mehanički, bez povezanosti sa ostalim dijelovima.

Kurikulum u osnovnoškolskoj ustanovi zbog toga predstavlja odgojno obrazovnu koncepciju koja se razvija u saradnji sa osnovnoškolskim ustanovama kroz ukupnost odgojno obrazovnih interakcija između djece i odraslih. Svaka osnovnoškolska ustanova provodi kurikulum kao jedinstvenu i neponovljivu teorijsku koncepciju te na taj način omogućava autonomiju i prostor za pluralizam pedagoških ideja i koncepcija, koje se temelje na razvojno primjerenoj praksi i humanističkim idejama (Slunjski, 2012).

Školska ustanova svojim kurikulumom, okolinom i stručnim osobama mora doprinijeti djetetovom razvoju te uvažavati njegove potrebe. Sredina u kojoj dijete odrasta mora biti poticajna za učenje, rast i razvoj djeteta, jer je to pretpostavka za dječji razvoj u skladu sa ličnim potencijalima (Mlinarević, 2000).

Kako navodi Katz (1990) implikacije za strategije podučavanja i kurikulum u ranom djetinjstvu mogu se pronaći u brojnim istraživanjima o društvenom i inte-

in numerous studies on social and intellectual development, however, in practice it most often happens that teachers are not sufficiently educated and that the teaching method often lags behind what is known. Primary education has a positive impact on the later development of the child, it is not only teaching children cognitive skills, but also empowering the child and providing the child with the opportunity to “learn how to learn”. It also enables the child to cope with everyday challenges and difficulties and helps him understand that achievement is the result of perseverance and motivation more than intelligence (Curtis and O’Hagan, 2003).

Miljak (2005) points out that the organization, structure and pedagogical context in institutions not only reflect educational values but also shape them. The curriculum should therefore clarify pedagogical goals, take into account the child’s progress and focus on the most important aspects of child development and adequately respond to children’s needs. The curriculum acts as a link between lower and upper primary education, providing children with continuity, but also with the knowledge and skills they need in the further course of education (Quality Matters in Early Childhood Education and Care: Sweden, 2013).

Although there are many definitions of curriculum, they all include goals and plans for acquiring skills through activities, experiences and opportunities. Some refer to facilitating learning or direct teaching by the teacher, who must ensure and adapt the daily plan to early learning standards, while at the same time focusing on the individual needs of each child. The curriculum for primary education begins the moment a child walks through the door, and teachers who understand this can provide an environment and activities in which learning takes place throughout the day (Dougherty, 2017). As stated by the National Council for the Promotion of Education and Training (NKRPOO) (2014), educational practice provides the foundation for the creation of curricula, which is why their development must take place in accordance with changes in society, that is, in accordance with the development of new values, understanding and knowledge. These changes take place through educational reforms, from which it can generally be concluded that the greatest attention during the implementation of reforms was paid to the development of legal acts, curricula, documents or government and school administration, and much less to practices in education and training (Miljak, 2005).

As stated by Slunjski (2012), the curriculum and its characteristics are determined differently due to different interpretations of its goal, purpose and purpose.

Curricula are differently oriented, considering the culture and context of their creation, and there are four orientations. The humanistic orientation is based on the develop-

ment in intellectual development, however, in practice it most often happens that teachers are not sufficiently educated and that the teaching method often lags behind what is known. Primary education has a positive impact on the later development of the child, it is not only teaching children cognitive skills, but also empowering the child and providing the child with the opportunity to “learn how to learn”. It also enables the child to cope with everyday challenges and difficulties and helps him understand that achievement is the result of perseverance and motivation more than intelligence (Curtis and O’Hagan, 2003).

Miljak (2005) ističe kako organizacija, struktura i pedagoški kontekst u ustanovama ne odražavaju samo obrazovne vrijednosti nego ih i oblikuju. Kurikulum tako treba razjasniti pedagoške ciljeve, voditi računa o napretku djeteta i usredotočiti se na najvažnije aspekte razvoja djeteta i adekvatno odgovarati na potrebe djece. Kurikulum djeluje kao poveznica između nižeg i višeg osnovnoškolskog obrazovanja, pružajući djeci kontinuitet, ali i znanja i vještine koje su im potrebne u daljnjem tijeku obrazovanja (Quality Matters in Early Childhood Education and Care: Sweden, 2013).

Iako postoje mnoge definicije kurikuluma, sve one uključuju ciljeve i planove za stjecanje vještina kroz aktivnosti, iskustva i mogućnosti. Neke se odnose na olakšavanje učenja ili direktno podučavanje od strane učitelja, koji mora osigurati i prilagoditi dnevni plan standarda ranog učenja, a istovremeno se usmjeravati na individualne potrebe svakog djeteta. Nastavni plan i program za osnovnoškolsko obrazovanje počinje u trenutku kada dijete prođe kroz vrata, a učitelji koji to razumiju mogu pružiti okruženje i aktivnosti u kojima se učenje odvija kroz cijeli dan (Dougherty, 2017). Kako navodi NKRPOO (2014) odgojno-obrazovna praksa daje temelje za stvaranje kurikuluma, zbog čega se njihov razvoj mora odvijati u skladu sa promjenama u društvu, odnosno u skladu sa razvojem novih vrijednosti, razumijevanja i znanja. Ove promjene odvijaju se kroz odgojno-obrazovne reforme iz čega se generalno može zaključiti kako se najveća pažnja kroz provođenje reformi pridavala izradi zakonskih akata, kurikuluma, dokumenata ili vladinoj i školskoj administraciji, a puno manje praksi u odgoju i obrazovanju (Miljak, 2005).

Kako navodi Slunjski (2012) kurikulum i njegove karakteristike različito su određeni zbog različitog tumačenja njegovog cilja, svrhe i namjene.

Kurikulumi su s obzirom na kulturu i kontekst nastajanja različito usmjereni te postoje četiri orijentacije. Humanistička orijentacija temelji se na razvoju kapaciteta djeteta, postmodernistička se fokusira na socijalni i

ment of the child's capacities, the postmodernist focuses on the social and political context, the technological on preparing students for work and their social role, while the developmental one focuses on the personal development of the child, their needs and interests.

METHOD OF WORK

Sample of respondents

The sample of respondents consisted of primary school teachers and physical education and health education teachers from the Zenica-Doboj Canton of the Federation of Bosnia and Herzegovina. The total number of respondents was 102 teachers, 82 primary school teachers and 20 physical education and health education teachers.

In terms of gender, the research included 80 or 78.40% of female respondents (teachers) and 22 or 21.60% (teachers) of male respondents.

In terms of employment status/job position, the research included 82 or 80.40 primary school teachers and 20 or 19.60% physical education and health education teachers.

In relation to age, the respondents were divided into four categories: up to 25 years old 4 respondents (teachers) or 3.90%, from 26-35 years old 17 respondents (teachers) or 16.70%, from 36-45 years old 59 respondents (teachers) or 57.80% and from 46-55 years old 22 respondents (teachers) or 21.60%.

In relation to the level of education, 68 or 66.70% of respondents with a university degree participated in the study, 25 respondents or 24.50% with a higher education degree and 9 or 8.80% of respondents with a master's or doctorate degree.

Sample of variables

The measuring instruments used in the study were a questionnaire and an assessment scale. The questionnaire for the assessment of attitudes was constructed according to the Likert scale model, where each statement is marked with five modalities (1-I do not agree at all, 2-I do not agree, 3-I have no opinion/I am neutral, 4-I agree, 5-I completely agree.). The questionnaire included general information about the respondents (gender, workplace/position, age, level of education) and 5 indicators of a developmentally appropriate strategy with a scale of indicators of a developmentally appropriate strategy for supporting student talent in sports.

Statistical data processing

Data processing and analysis was carried out according to the Methodology of Research on Education (Mužić, 2004). Basic descriptive statistical parameters were calcu-

politički kontekst, tehnološka na pripremanje učenika za rad i njegovu društvenu ulogu, dok se razvojna usmjerava na lični razvoj djeteta, njegove potrebe i interese.

METOD RADA

Uzorak ispitanika

Uzorak ispitanika činili su učitelji razredne nastave i nastavnici tjelesnog i zdravstvenog odgoja osnovnih škola sa području Zeničko-dobojskog kantona Federacije Bosne i Hercegovine. Ukupan broj ispitanika činilo je 102 učitelja/nastavnika i to 82 učitelja razredne nastave i 20 nastavnika tjelesnog i zdravstvenog odgoja.

U odnosu na spol istraživanjem je obuhvaćeno 80 ili 78,40% ispitanika (učitelja/nastavnika) ženskog spola i 22 ili 21,60% (učitelja/nastavnika) muškog spola.

U odnosu na radni status/radno mjesto istraživanjem je obuhvaćeno 82 ili 80,40 učitelja razredne nastave i 20 ili 19,60% nastavnika tjelesnog i zdravstvenog odgoja.

U odnosu na starosnu dob ispitanici su podijeljeni u četiri kategorije i to: do 25 godina 4 ispitanika (učitelja/nastavnika) ili 3,90%, od 26-35 godina starosti 17 ispitanika (učitelja/nastavnika) ili 16,70%, od 36-45 godina 59 ispitanika (učitelja/nastavnika) ili 57,80% i od 46-55 godina 22 ispitanika (učitelja/nastavnika) ili 21,60%.

U odnosu na stepen obrazovanja u istraživanju je učestvovalo 68 ili 66,70% ispitanika sa visokom stručnom spremom 25 ispitanika ili 24,50% sa višom stručnom spremom i 9 ili 8,80% ispitanika master ili doktor nauka.

Uzorak varijabli

Mjerni instrumenti koji su korišteni u istraživanju predstavljali su anketni list i skala procjene. Anketni list za procjenu stavova konstruisan je po modelu Likertove skale pri čemu je svaka tvrdnja označena sa pet modaliteta (1-uopšte se ne slažem, 2-ne slažem se, 3-nemam mišljenje/neutralan sam, 4-slažem se, 5-potpuno se slažem.). Anketni list je obuhvatao opšte podatke o ispitanicima (spol, radno mjesto/poziciju, starosnu dob, stepen obrazovanja) i 5 indikatora razvojno primjerene strategije sa skalom pokazatelja razvojno primjerene strategije podržavanja nadarenosti učenika u sportu.

Statistička obrada podataka

Obrada i analiza podataka izvršena je prema Metodologiji istraživanja odgoja i obrazovanja (Mužić, 2004). Za sve primijenjene indikatore razvojno primjerene prakse izračunati i utvrđeni osnovni deskriptivni statistički parametri. Od mjera centralne tendencije izračunata je

lated and determined for all applied indicators of developmentally appropriate practice. Arithmetic mean (AS) was calculated from measures of central tendency, and standard deviation (St. Dev.) from measures of variability.

To determine the attitudes and significance of any differences between teachers on the specificity of the relationship between developmentally appropriate practice and gifted students in sports who move from classroom to subject teaching within the individual curriculum, the results of the t-test and analysis of variance of different groups with LSD Post Hoc comparison tests were applied.

Scale of indicators of the level of agreement with statements about developmentally appropriate practice

The scale of indicators of the level of agreement with statements about developmentally appropriate practice in identifying and encouraging giftedness in children consisted of five attitudes, which the respondents should rate as: 1 = I completely disagree, 2 = I disagree, 3 = I have no opinion/I am neutral, 4 = I agree and 5 = I completely agree.

The respondents could declare or opt for one of five modalities. The content of the indicator of the level of agreement with the statements about developmentally appropriate practice in supporting student talent and identifying and treating athletically gifted students during the transition from classroom to subject teaching in elementary schools referred to:

1. For working with gifted students, the most important thing is to set high goals within the individual curriculum TRPP1
2. The most important need of a gifted student is to socialize with peers of the same developmental age.... TRPP2
3. It is desirable that every elementary school design a curriculum for gifted students TRPP3
4. Gifted students quickly reach the set curriculum goals TRPP4
5. Pedagogical work with gifted students places high demands on the classroom and subject teachers in designing learning and teaching strategies TRPP5

During the research, the respondents (teachers/professors) were given clear and precise instructions on how to answer unclear statements and questions (survey questionnaire and assessment scale).

RESULTS AND DISCUSSION

Analysis of the basic statistical parameters of the indicators of developmentally appropriate practice and support for student giftedness and identification and treatment of gifted students in sports.

aritmetička sredina (AS), a od mjera varijabilnosti standardna devijacija (St. Dev.).

Za utvrđivanje stavova i značajnosti eventualnih razlika između učitelja/nastavnika o specifičnosti relacije razvojno primjerene prakse i nadarenih učenika u sportu koji prelaze iz razredne u predmetnu nastavu unutar individualnog kurikulumu primijenjeni su rezultati t-testa i analiza varijanse različitih grupa sa LSD Post Hoc testovima poređenja.

Skala pokazatelja nivoa slaganja s tvrdnjama o razvojno primjerenoj praksi

Skalu pokazatelja nivoa slaganja s tvrdnjama o razvojno primjerenoj praksi u identifikaciji i podsticanju nadarenosti kod djece činilo je pet stavova, koje bi ispitanici trebali ocijeniti kao: 1= uopće se ne slažem, 2 = ne slažem se, 3 = nemam mišljenja/neutralan sam, 4 = slažem se i 5 = potpuno se slažem.

Ispitanici su se mogli izjasniti odnosno opredijeliti za jedan od pet modaliteta. Sadržaj pokazatelja nivoa slaganja s tvrdnjama o razvojno primjerenoj praksi podržavanja učenikove nadarenosti i identifikacije i tretmana sportski nadarenih učenika pri prijelazu iz razredne u predmetnu nastavu u osnovnim školama se odnosio na:

1. Za rad s nadarenim učenicima najvažnije je postavljanje visokih ciljeva unutar individualnog kurikulumuTRPP1
2. Najvažnija potreba nadarenog učenika je druženje s vršnjacima iste razvojne dobiTRPP2
3. Poželjno je da svaka osnovna škola osmisli kurikulum za nadarene učenike.....TRPP3
4. Nadareni učenici brzo dostižu zadane kurikulumske ciljeve.....TRPP4
5. Pedagoški rad s nadarenim učenicima pred nastavnika razredne i predmetne nastave stavlja visoke zahtjeve u osmišljavanju strategija učenja i poučavanjaTRPP5

U toku istraživanja ispitanicima (nastavnici/professori) su data jasna i precizna uputstva o načinu davanja odgovora, nejasnih tvrdnji i pitanja (anketni upitnik i skala procjene).

REZULTATI I DISKUSIJA

Analiza osnovnih statističkih parametara indikatora razvojno primjerene prakse i podržavanja učenikove nadarenosti i identifikacije i tretmana sportski nadarenih učenika.

Table 1 shows the calculated values of the measures of central tendency, variability and frequency distribution of the characteristics of the statement about developmentally appropriate practice of supporting student giftedness (TRPP). The arithmetic mean (AS) of all indicators of 3.92 shows that teachers/teachers agree very well with the statements about developmentally appropriate practice. The value of standard deviation (SD) of 0.82 indicates that the dispersion around the arithmetic mean is very weak, which is confirmed by the coefficient of variability (CV) of 20.92% and thus the very good homogeneity of the results obtained for this sample of respondents.

Based on the results obtained (Table 1), we note that 65.70% of respondents agree and completely agree with the statement that setting goals within the individual curriculum is the most important thing for working with gifted students. 19.60% of respondents had no opinion, while 14.70% of teachers/professors responded negatively.

The majority of respondents (45.10%) were neutral regarding the second statement. 32.40% of respondents responded positively, while 22.50% of respondents disagreed and strongly disagreed that the most important need of a gifted student is to socialize with peers of the same developmental age.

The majority of respondents (93.20%) agreed that it is desirable for every primary school to design a curriculum for gifted students. 5.90% of teachers had no opinion and one disagreed with the stated statement.

The results show that 84.30% of respondents agreed that gifted students quickly reach curriculum goals. 13.70% of respondents were neutral, while 2.00% disagreed with the offered statement.

The majority of respondents (90.20%) believe that pedagogical work with gifted students places high demands on the classroom and subject teachers in designing learning and teaching strategies. 3.00% of respondents disagree with this statement, while 6.90% are neutral.

The results show that the respondents gave the most answers for the third statement, i.e. that it is desirable for every school to design a curriculum for gifted students.

U tabeli 1 prikazane su izračunate vrijednosti mjera centralne tendencije, varijabilnosti i distribucije frekvencije obilježja tvrdnje o razvojno primjerenoj praksi podržavanja učenikove nadarenosti (TRPP). Aritmetička sredina (AS) svih indikatora od 3,92 pokazuje da se učitelji/nastavnici veoma dobro slažu s tvrdnjama o razvojno primjerenoj praksi. Vrijednost standardne devijacije (SD) od 0,82 ukazuje da je rasipanje oko aritmetičke sredine veoma slabo, što potvrđuje i koeficijent varijabilnosti (CV) od 20,92% a time i veoma dobru homogenost dobivenih rezultata za ovaj uzorak ispitanika.

Na osnovu dobivenih rezultata (Tabela 1) uočavamo da se 65,70% ispitanika slaže i potpuno slaže s tvrdnjom da je *za rad s nadarenim učenicima najvažnije postavljanje ciljeva unutar individualnog kurikula*. Bez mišljenja je 19,60% ispitanika, dok je negativno odgovorilo 14,70% nastavnika/profesora.

Za drugu tvrdnju najviše ispitanika (45,10%) bilo je neutralno. Pozitivno je odgovorili 32,40% ispitanika, dok se 22,50% ispitanika ne slaže i uopće ne slaže da je *najvažnija potreba nadarenog učenika druženje s vršnjacima iste razvojne dobi*.

Većina ispitanika (93,20%) se slaže da je poželjno da *svaka osnovna škola osmisli kurikulum za nadarene učenike*. Bez mišljenja je 5,90% učitelja/nastavnika i jedan se ne slaže s navedenom tvrdnjom.

Rezultati pokazuju da se 84,30% ispitanika slaže da *nadareni učenici brzo dostižu kurikulumske ciljeve*. Neutralno je 13,70% ispitanika, dok se 2,00% ne slaže s ponuđenom tvrdnjom.

Ispitanici u većini (90,20%) smatraju da *pedagoški rad s nadarenim učenicima pred nastavnika razredne i predmetne nastave stavlja visoke zahtjeve u osmišljavanje strategija učenja i poučavanja*. S navedenom tvrdnjom se ne slaže 3,00% ispitanika, dok je 6,90% neutralno.

Rezultati pokazuju da su ispitanici najviše odgovorili za treću tvrdnju tj. da je *poželjno da svaka škola osmisli kurikulum za nadarene učenike*.

Table 1. Measures of central tendency, variability, and frequency distribution of features of the claim about developmentally appropriate practice

Indicator	M	AS	St.Dev.	1 %	2%	3%	4%	5%
TRPP1	102	3.65	.99	2.90	11.80	19.60	49.00	16.70
TRPP2	102	3.17	1.02	4.90	17.60	45.10	20.60	11.80
TRPP3	102	4.34	.64	0.00	1.00	5.90	51.00	42.20
TRPP4	102	4.11	.70	0.00	2.00	13.70	55.90	28.40
TRPP5	102	4.31	.77	1.00	2.00	6.90	45.10	45.10

Legend: TRPP-statements about developmentally appropriate practice 1-5; N-total number of respondents; AS-arithmetic mean; St.Dev.-Standard deviation

Analysis of differences in respondents' attitudes using T-test results and LSD Post Hoc comparison tests

Table 2 shows the results of the t-test of the interpretation of the claim about developmentally appropriate practice in relation to the gender of the respondents.

Table 2 shows the results of the t-test of the interpretation of the claim about developmentally appropriate practice in relation to the gender of the respondents. The value of $t = .853$ and its significance $\text{Sig.} = .396$ (Table 2) show us that there is no statistically significant difference in the attitudes of teachers with respect to their gender in the levels of agreement with the statements about developmentally appropriate practice. Female respondents have more positive opinions compared to male respondents. The deviation from the arithmetic mean (St.Dev.) is greater in male subjects. Based on the results obtained, we conclude that there is no statistically significant difference in teachers' attitudes about the specifics of the relationship between developmentally applied practice and gifted children within the individual curriculum, with respect to the gender of the respondents.

Table 2. Statements about developmentally appropriate practice - comparison by gender (t-test)

Parameters / Parametri	Sex / Spol	N	AS	St.Dev.	Difference AS / Razlika AS	F	Znač.	t-vrijednost	Sig.
TRPPZ	F / Ž	80	3.93	.38	.08	.086	.770	.853	.396
	M / M	22	3.85	.39					

Legend: TRPPZ-assertions about developmentally appropriate practice (collective); N-total number of respondents; AS-arithmetic mean; St.Dev.-standard deviation; Different AS-difference of arithmetic means; F and Means - Levene's test of equality of variances; t-value. and Significance - the value of the t-test and its significance

Tabela 1. Mjere centralne tendencije, varijabilnosti i distribucije frekvencije obilježja tvrdnje o razvojno primjerenoj praksi

Indicator	M	AS	St.Dev.	1 %	2%	3%	4%	5%
TRPP1	102	3.65	.99	2.90	11.80	19.60	49.00	16.70
TRPP2	102	3.17	1.02	4.90	17.60	45.10	20.60	11.80
TRPP3	102	4.34	.64	0.00	1.00	5.90	51.00	42.20
TRPP4	102	4.11	.70	0.00	2.00	13.70	55.90	28.40
TRPP5	102	4.31	.77	1.00	2.00	6.90	45.10	45.10

Legenda: TRPP-tvrdnje o razvojno primjerenoj praksi 1-5; N-ukupan broj ispitanika; AS-aritmetička sredina; St.Dev.-Standardna devijacija

Analiza razlika u stavovima ispitanika primjenom rezultata T - testa i LSD Post Hoc testova poređenja

U tabeli 2 prikazani su rezultati t-testa tumačenja tvrdnje o razvojno primjerenoj praksi u odnosu na spol ispitanika.

U tabeli 2 prikazani su rezultati t-testa tumačenja tvrdnje o razvojno primjerenoj praksi u odnosu na spol ispitanika. Vrijednost $t = .853$ i njegova značajnost $\text{Sig.} = .396$ (Tabela 2) nam pokazuju da ne postoji statistički značajna razlika u stavovima učitelja/nastavnika s obzirom na njihov spol u nivoima slaganja s tvrdnjama o razvojno primjerenoj praksi. Ispitanici ženskog spola imaju pozitivnija mišljenja u odnosu na ispitanike muškog spola. Odstupanje od aritmetičke sredine (St.Dev.) veće je kod ispitanika muškog spola. Na osnovu dobivenih rezultata zaključujemo da ne postoji statistički značajna razlika u stavovima nastavnika o specifičnosti relacije razvojno primjenjene prakse i nadarene djece unutar individualnog kurikuluma s obzirom na spol ispitanika.

Tabela 2. Tvrdnje o razvojno primjerenoj praksi – upoređivanje po spolu (t-test)

Parameters / Parametri	Sex / Spol	N	AS	St.Dev.	Difference AS / Razlika AS	F	Znač.	t-vrijednost	Sig.
TRPPZ	F / Ž	80	3.93	.38	.08	.086	.770	.853	.396
	M / M	22	3.85	.39					

Legenda: TRPPZ-tvrdnje o razvojno primjerenoj praksi (zbirno); N-ukupan broj ispitanika; AS-aritmetička sredina; St.Dev.-standardna devijacija; Razl. AS-razlika aritmetičkih sredina; F i Znač.- Levenov test jednakosti varijansi; t-vrijed. i Znač.- vrijednost t-testa i njegova značajnost

Table 3 shows the t-test values of the interpretation of the claim about developmentally appropriate practice based on work status. The value $t = 2.363$ and its significance $Sig. = .020$ shown in table 4 show that there is a statistically significant difference (at the level of $p < 0.05$) in the attitudes of teachers/professors regarding work status/position in the levels of agreement with the statements about developmentally appropriate practice. Based on the arithmetic mean (AS), we see that teachers have more positive opinions compared to professors. Based on the obtained results, we conclude that there is a statistically significant difference in teachers' views on the specificity of the relationship between developmentally applied practice and gifted children within the individual curriculum, with regard to the work status of the respondents.

Table 3. Statements about developmentally appropriate practice - comparison by work status (t-test)

Parameters / Parametri	Sex / Spol	N	AS	St.Dev.	Difference AS / Razlika AS	F	Znač.	t-vrijednost	Sig.
TRPPZ	Teacher / Nastavnik	82	3.96	.36	.22	.729	.395	2.363	.020
	Professor / Professor	20	3.74	.43					

Legend: TRPPZ-assertions about developmentally appropriate practice (collective); N-total number of respondents; AS-arithmetic mean; St.Dev.-standard deviation; Different AS-difference of arithmetic means; F and Means - Levene's test of equality of variances; t-value. and Significance - the value of the t-test and its significance

Table 4 shows the values of the F-test of the interpretation of the statement about developmentally appropriate practice based on the age of the respondents. The value of the F-test (.291) and its significance (Sig. .832) show that there is no statistically significant difference between teachers/teachers with regard to age in the levels of agreement with the statements about developmentally appropriate practice.

Table 4. Statements about developmentally appropriate practice - comparison with regard to age (F-test)

Parameters / Parametri	N	df	F	Sig.
TRPPZ	102	3	.291	.832

Legend: TRPPZ-assertions about developmentally appropriate practice (collective); N-total number of respondents; df- number of degrees of freedom; F and Sig.- the value of the F-test and its significance

U tabeli 3 prikazane su vrijednosti t-testa tumačenja tvrdnje o razvojno primjerenoj praksi u odnosu na radni status. Vrijednost $t = 2,363$ i njegova značajnost $Sig. = .020$ prikazane u tabeli 4 pokazuju da postoji statistički značajna razlika (na nivou $p < 0,05$) u stavovima nastavnika/profesora s obzirom na radni status/poziciju u nivoima slaganja s tvrdnjama o razvojno primjerenoj praksi. Na osnovu aritmetičke sredine (AS) vidimo da nastavnici imaju pozitivnija mišljenja u odnosu na profesore. Na osnovu dobivenih rezultata zaključujemo da postoji statistički značajna razlika u stavovima nastavnika o specifičnosti relacije razvojno primjenjene prakse i nadarene djece unutar individualnog kurikuluma s obzirom na radni status ispitanika.

Tabela 3. Tvrdnje o razvojno primjerenoj praksi – upoređivanje po radnom statusu (t-test)

Legenda: TRPPZ-tvrdnje o razvojno primjerenoj praksi (zbirno); N-ukupan broj ispitanika; AS-aritmetička sredina; St.Dev.-standardna devijacija; Razl. AS-razlika aritmetičkih sredina; F i Znač.- Levenov test jednakosti varijansi; t-vrijed. i Znač.- vrijednost t-testa i njegova značajnost

U tabeli 4 prikazane su vrijednosti F-testa tumačenja tvrdnje o razvojno primjerenoj praksi u odnosu na dob ispitanika. Vrijednost F-testa (.291) i njegova značajnost (Sig. .832) pokazuju da ne postoji statistički značajna razlika između učitelja/nastavnika s obzirom na dob u nivoima slaganja s tvrdnjama o razvojno primjerenoj praksi.

Tabela 4. Tvrdnje o razvojno primjerenoj praksi - upoređivanje obzirom na dob (F-test)

Legenda: TRPPZ-tvrdnje o razvojno primjerenoj praksi (zbirno); N-ukupan broj ispitanika; df- broj stepena slobode; F i Sig.- vrijednost F-testa i njegova značajnost

Table 5 shows the results of the LSD Post Hoc test of the interpretation of the claim about developmentally appropriate practice - comparison with respect to the age of the respondents (LSD). Based on the obtained results, we see that there are no statistically significant differences between the respondents regarding age in the interpretation of a developmentally appropriate strategy. Based on the obtained results of the Post Hoc test, we see that there are no statistically significant differences between the respondents regarding age in the levels of agreement with the statements about developmentally appropriate practice. Therefore, the third part of the fourth sub-hypothesis was confirmed, that there is no statistically significant difference in teachers' views on the specificity of the relationship between developmentally applied practice and gifted children within the individual curriculum with regard to gender, work status, age and level of education of the respondents.

Table 5. Statements about developmentally appropriate practice - age comparison (LSD)

Age / Dob		Difference AS / Razlika AS	SE	Sig.
up to 25 years / do 25 godina	26 to 35 years / 26 do 35 godina	-.076	.213	.720
	36 to 45 years / 36 do 45 godina	.012	.198	.952
	46 to 55 years / 46 do 55 godina	-.045	.208	.828
26 - 35 years old / 26 - 35 godina	up to 25 years old / do 25 godina	.076	.213	.720
	36 to 45 years old / 36 do 45 godina	.088	.105	.404
	46 to 55 years old / 46 do 55 godina	.031	.124	.803
36 - 45 years old / 36 - 45 godina	up to 25 years old / do 25 godina	-.012	.198	.952
	26 to 35 years old / 26 do 35 godina	-.088	.105	.404
	46 to 55 years old / 46 do 55 godina	-.057	.096	.551
46 - 55 years old / 46 - 55 godina	up to 25 years old / do 25 godina	.045	.208	.828
	26 to 35 years old / 26 do 35 godina	-.031	.124	.803
	36 to 45 years old / 36 do 45 godina	.057	.096	.551

Legend: MD – difference of arithmetic means; SE- standard error; SIG.- statistical significance; * - there is a statistically significant difference at the $p < 0.05$ level

Table 6 shows the results of the F-test of the interpretation of the claim about developmentally appropriate practice in relation to the level of education of the respondents and its statistical significance. The value of the F-test (.455) and its significance (Sig.) (.636) show that there is no statistically significant difference between teachers/professors with regard to the level of education in the levels of agreement with the statements about developmentally appropriate practice.

U tabeli 5 prikazane su rezultati LSD Post Hoc testa tumačenja tvrdnje o razvojno primjerenoj praksi - upoređivanje s obzirom na dob ispitanika (LSD). Na osnovu dobivenih rezultata vidimo da ne postoje statistički značajne razlike između ispitanika obzirom na dob u tumačenju razvojno primjerene strategije. Na osnovu dobivenih rezultata Post Hoc testa vidimo da ne postoje statistički značajne razlike između ispitanika obzirom na dob u nivoima slaganja s tvrdnjama o razvojno primjerenoj praksi. Prema tome, potvrđen je treći dio četvrte podhipoteze da ne postoji statistički značajna razlika u stavovima nastavnika o specifičnosti relacije razvojno primjenjene prakse i nadarene djece unutar individualnog kurikulumu s obzirom na spol, radni status, dob i stepen obrazovanja ispitanika.

Tabela 5. Tvrdnje o razvojno primjerenoj praksi – upoređivanje obzirom na dob (LSD)

Legenda: MD –razlika aritmetičkih sredina; SE- standardna greška; SIG.- statistička značajnost; * - postoji statistički značajna razlika na nivou $p < 0,05$

U tabeli 6 prikazani su rezultati F-testa tumačenja tvrdnje o razvojno primjerenoj praksi u odnosu na stepen obrazovanja ispitanika i njegova statistička značajnost. Vrijednost F-testa (.455) i njegova značajnost (Sig.) (.636) pokazuju da ne postoji statistički značajna razlika između nastavnika/profesora s obzirom na stepen obrazovanja u nivoima slaganja s tvrdnjama o razvojno primjerenoj praksi.

Table 6. Statements about developmentally appropriate practice - comparison with regard to the level of education (F-test)

Parameters / Parametri	N	df	F	Sig.
TRPPZ	102	2	.455	.636

Legend: TRPPZ-assertions about developmentally appropriate practice (collective); N-total number of respondents; df- number of degrees of freedom; F and Sig.- the value of the F-test and its significance

Table 7 shows the results of the LSD Post Hoc test of the interpretation of the claim about developmentally appropriate practice - comparing it with the level of education of the respondents (LSD Post Hoc test). Analyzing the results of the Post Hoc test, it is evident that there are no statistically significant differences between the teachers/teachers with regard to the highest achieved level of education in the levels of agreement with the statements about developmentally appropriate practice. Therefore, it can be concluded that there is no statistically significant difference in teachers' views on the specificity of the relationship between developmentally applied practice and sports-gifted children within the individual curriculum with regard to the level of education of the respondents.

Based on the obtained results, it can be concluded that there is no statistically significant difference in the teachers' views on the specificity of the relationship between developmentally appropriate practice and sports-gifted children within the individual curriculum with regard to the gender, age and level of education of the respondents.

Table 7. Comparison of significance with regard to the level of education (LSD)

Education Level / Stepen obrazovanja		Difference AS / Razlika AS	SE	Sig.
VŠS	VSS	.002	.089	.986
	MR i DR	.128	.148	.390
VSS	VŠS	-.002	.089	.986
	MR i DR	.126	.135	.352
MR i DR	VŠS	-.128	.148	.390
	VSS	-.126	.135	.352

Legend: Difference AS-difference of arithmetic means; SE-standard error; Sig.-statistical significance * - there is a statistically significant difference at the $p < 0.05$ level

DISCUSION

Previous research on the problem of identifying and supporting gifted students in sports has mainly dealt with determining the attitudes of teachers towards support and work with gifted students, work programs for gifted stu-

Tabela 6. Tvrdnje o razvojno primjerenoj praksi - upoređivanje obzirom na stepen obrazovanja (F-test)

Legenda: TRPPZ-tvrdnje o razvojno primjerenoj praksi (zbirno); N-ukupan broj ispitanika; df- broj stepena slobode; F i Sig.- vrijednost F-testa i njegova značajnost

U tabeli 7 prikazani su rezultati LSD Post Hoc testa tumačenja tvrdnje o razvojno primjerenoj praksi - upoređivanje s obzirom na stepen obrazovanja ispitanika (LSD Post Hoc test). Analizom rezultata Post Hoc testa vidljivo je da ne postoje statistički značajne razlike između učitelja/nastavnika obzirom na najviši postignuti stepen obrazovanja u nivoima slaganja s tvrdnjama o razvojno primjerenoj praksi. Prema tome, može se konstatovati da ne postoji statistički značajna razlika u stavovima nastavnika o specifičnosti relacije razvojno primjenjene prakse i sportski nadarene djece unutar individualnog kurikulumu s obzirom na stepen obrazovanja ispitanika.

Na osnovu dobivenih rezultata može se konstatovati da nema statistički značajne razlike u stavovima nastavnika o specifičnosti relacije razvojno primjerene prakse i sportski nadarene djece unutar individualnog kurikulumu s obzirom na spol, dob i stepen obrazovanja ispitanika.

Tabela 7. Upoređivanje značajnosti obzirom na stepen obrazovanja (LSD)

Legenda: Razlika AS-razlika aritmetičkih sredina; SE-standardna greška; Sig.-statistička značajnost * - postoji statistički značajna razlika na nivou $p < 0,05$

DISKUSIJA

Dosadašnja istraživanja problema prepoznavanja i podržavanja sportski nadarenih učenika uglavnom su se bavila utvrđivanjem stavova učitelja/nastavnika prema podršci i radu sa nadarenim učenicima, programima

dents within the individual curriculum. The largest number of such studies (Miljak, 2005; Milić, 2007; Bajrić, 2019) show positive attitudes of teachers towards gifted students in sports, especially in schools that carry out the identification of gifted students. However, there is research that generally indicates a neutral attitude and support for such students, i.e. it shows that teachers recognize the needs, support and social value of gifted students, but do not have clearly expressed attitudes towards methodological procedures with gifted students (acceleration and grouping according to abilities) or towards the consequences of positive support for gifted students (Perković Krijan et al., 2015). Also, some researchers have investigated the situation, problems and needs in the area of identification and work with gifted students in the primary school system. The results show that there is a very pronounced interest and need for professional development in the area of giftedness among primary school teachers, because identification and work with gifted students is very important at a younger developmental age (Vojnović, 2008).

Dorđević and Maksić, (2005) point out that the most important role in the encouragement, support and development of sports gifted students is played by the family and the school, because parents, teachers and students are very interested in creating conditions that would ensure adequate education and treatment of gifted students.

George (2005) points out that every school should have a person-teacher who would be in charge of implementing educational forms for the needs and support of gifted students, because this would ensure a better position and better progress of gifted students. Lazarević et al., (2020) believe that it would be necessary to study the work of teachers from the perspective of gifted students in order to gain insight into their experience and the implications it can have on the work of teachers and the quality of educational practice. Jokić (2013) believes that the problem of identification and support of athletically gifted students should be enriched to a large extent in physical education classes by applying adequate and appropriate forms of work. Sturza-Milić (2008) believes that physical education is the foundation of the sports maturation of elementary school students and that school is the environment in which the vast majority of athletically gifted children begin their sports journey, in physical education classes. Motivations for playing sports are formed very early, so playing sports in early childhood is a path to the status of a top athlete. Furthermore, Sturza Milić (2014) points out that the most important period for the motor development of students is the younger school age (from 7 to 12 years), which is why it is called the "window of opportu-

rada za nadarene učenike unutar individualnog kurikula. Najveći broj takvih istraživanja (Miljak, 2005; Milić, 2007; Bajrić, 2019) pokazuju pozitivne stavove učitelja/nastavnika prema nadarenim učenicima u sportu posebno u školama koje provode identifikaciju nadarenih učenika. Međutim, ima istraživanja koja generalno upućuju na neutralan stav i podršku takvim učenicima odnosno pokazuju da učitelji/nastavnici prepoznaju potrebe, podršku i društvenu vrijednost nadarenih učenika, ali nemaju jasno izražene stavove prema metodičkim postupcima sa nadarenim učenicima (akceleracija i grupisanje prema sposobnostima) ni prema posljedicama pozitivne podrške nadarenih (Perković Krijan i sur., 2015). Takođe, neki istraživači su istraživali stanje, probleme i potrebe u području identifikacije i rada s darovitim učenicima u osnovnoškolskom sistemu. Rezultati pokazuju da postoji vrlo izražen interes i potreba za stručnim usavršavanjem u području darovitosti i to među nastavnicima osnovnih škola jer je identifikacija i rad sa nadarenim učenicima vrlo važna u mlađoj razvojnoj dobi (Vojnović, 2008.).

Dorđević i Maksić, (2005) ističu da najvažniju ulogu u podsticanju, podršci i razvoju sportski nadarenih učenika imaju porodica i škola jer su roditelji, učitelji/nastavnici i učenici veoma zainteresovani za stvaranje uslova koji bi obezbijedili adekvatno obrazovanje i tretman nadarenih učenika.

George (2005.) ističe da bi svaka škola trebala imati osobu-nastavnika koja bi bila zadužena za sprovođenje odgojno-obrazovnih oblika za potrebe i podršku nadarenih učenika, jer bi se tako obezbijedio bolji položaj i kvalitetnije napredovanje nadarenih učenika. Lazarević i sar., (2020.) smatraju da bi bilo potrebno proučiti rad učitelja/nastavnika iz perspektive darovitih učenika kako bi se dobio uvid u njihovo iskustvo tako i implikacije koje ono može imati na rad učitelja i kvalitet odgojno-obrazovne prakse. Jokić (2013) smatra da bi problem identifikacije i podrške sportski nadarenih učenika u velikoj mjeri trebao biti obogaćen na časovima tjelesnog odgoja primjenom adekvatnih i primjerenih oblika rada. Sturza-Milić (2008) smatra da je tjelesni odgoj temelj sportskog sazrijevanja učenika osnovnih škola i da je škola sredina u kojoj velika većina sportski nadarene djece započinje svoje sportsko putovanje i to na časovima tjelesnog odgoja. Vrlo rano se formiraju motivi za bavljenje sportom pa je bavljenje sportom u ranom djetinjstvu put ka statusu vrhunskog sportiste. Nadalje, Sturza Milić (2014) ističe da je za motorički razvoj učenika najvažniji period mlađi školski uzrast (od 7 do 12 godina) zbog čega se i naziva „prozorom mogućnosti“

nity" because during this period children are more internally motivated (intrinsic motivation, which is important in the manifestation of talent), ready to learn, intellectually ready to get the best out of physical education and health education. The same author states that in order to ensure a broad basis of movement within the physical education program, and in order to develop motor experience and encourage motor creativity in students, it is necessary to organize and have an enriched environment that includes an interesting, creative and stimulating environment for students, which provides challenges and raises the standards of student success, and it is necessary to have the willingness and education of adults to engage in this part of educational work.

Findak (2011) emphasizes that when organizing and implementing physical education classes, teachers should achieve the anthropological, educational and educational tasks of physical education classes and, at the same time, arouse students' interest in and love for exercise, taking into account the age and abilities of the students.

Some research (Grandić and Letić, 2009) indicates that the openness and focus of teachers on the personal and professional development of gifted students is a formula for their successful work with such students. Practice has shown that those teachers who have undergone some form of training or professional development for working with gifted students in sports show a greater dose of patience and sensitivity in working with them.

Considering the results of the aforementioned research, it is noticeable that teachers, schools as educational institutions and parents should participate and find their place in the process of identifying, developing and supporting gifted students.

However, it should be noted that it is very questionable to what extent schools as they exist in our country today enable gifted children to express their specific abilities, development and progress, given that the traditional form of knowledge transfer and skill acquisition is still prevalent, in which students with average abilities progress at their own pace.

The progress of gifted children in sports imposes the need to develop an adequate support and development strategy in terms of developing individual plans and programs in accordance with their characteristics and abilities.

In this sense, we believe that schools should enrich the environment in which gifted children live, enrich and adapt the curriculum, techniques, methods and forms of work. It is also necessary to educate teachers in this regard, because unfortunately, a significant percentage of teachers are not trained to work and interact with gifted students.

jer su u tom periodu djeca više unutrašnje motivisana (intrinzička motivacija koja je važna kod ispoljavanja darovitosti), spremna na učenje, intelektualno spremna da izvuku najbolje iz tjelesne i zdravstvene kulture. Ista autorica navodi da bi se u okviru programa tjelesnog odgoja, a u cilju razvoja motoričkog iskustva i poticanja motoričke kreativnosti učenika osigurala široka osnova kretanja, neophodna je organizacija i prisustvo obogaćene sredine koja podrazumijeva zanimljivu, kreativnu i poticajnu okolinu za učenike, koja pruža izazove i podiže standarde uspješnosti učenika te je potrebna spremnost i edukacija odraslih da se angažuju u ovom dijelu odgojno-obrazovnog rada.

Findak (2011) ističe da bi učitelji pri organizaciji i ostvarivanju nastave tjelesnog odgoja trebali ostvariti antropološke, obrazovne i odgojne zadatke časa tjelesnog odgoja te pri tom kod učenika pobuditi interes za vježbanje i ljubav prema vježbanju imajući u vidu dob i sposobnosti učenika.

Neka istraživanja (Grandić i Letić, 2009) ukazuju da otvorenost i usmjerenost učitelja/nastavnika na lični i profesionalni razvoj nadarenih učenika predstavlja formulu za njegov uspješan rad sa takvim učenicima. Praksa je pokazala da oni učitelji/nastavnici koji su bili obuhvaćeni nekim vidom obuke ili stručnog usavršavanja za rad sa nadarenim učenicima u sportu pokazuju veću dozu strpljenja i senzibiliteta u radu sa njima.

Imajući u vidu rezultate navedenih istraživanja uočljivo je da u procesu identifikacije, razvoja i podrške sportski nadarenih učenika trebaju učestvovati i svoje mjesto naći učitelji/nastavnici, škola kao vaspitno obrazovna ustanova i roditelji.

Međutim, treba istaći da je vrlo upitno koliko škola kakva je danas u našoj zemlji, omogućava nadarenoj djeci da iskažu svoje specifične mogućnosti, razvoj i napredovanje obzirom da je još uvijek zastupljen tradicionalni oblik prenošenja znanja i usvajanja vještina u kome učenici osrednjih sposobnosti napreduju svojim tempom.

Napredovanja sportski nadarene djece nameće potrebu izrade adekvatne strategije podržavanja i razvoja u smislu izrade individualnih planova i programa u skladu sa njihovim karakteristikama i sposobnostima.

U tom smislu smatramo da bi škola morala obogatiti sredinu u kojoj borave nadarena djeca, obogatiti i prilagoditi nastavni plan i program, tehnike, metode i oblike rada. Takođe, neophodno je edukovati nastavnike u tom pogledu jer nažalost, značajan procenat nastavnika nije osposobljen za rad i djelovanje sa nadarenim učenicima.

CONCLUSION

Analysis of the arithmetic mean (AS) of all indicators of 3.92 shows that teachers/professors agree very well with the statements about developmentally appropriate practice. The standard deviation (SD) value of 0.82 indicates that the dispersion around the arithmetic mean is very weak, which is confirmed by the coefficient of variability (CV) of 20.92% and thus the very good homogeneity of the results obtained for this sample of respondents.

Based on the results obtained, it can be concluded that there is no statistically significant difference in the attitudes of teachers and professors about the specificity of the relationship between developmentally appropriate practice and sports-gifted children within the individual curriculum with regard to the gender, age and level of education of the respondents. The value $t = 2.363$ and its significance $\text{Sig.} = .020$ show that there is a statistically significant difference (at the $p < 0.05$ level) in the attitudes of teachers/professors with regard to their working status/position in the levels of agreement with the statements about developmentally appropriate practice. Based on the arithmetic mean (M), we see that teachers have more positive opinions compared to professors.

In general, it can be stated that there is no statistically significant difference in the attitudes of teachers and teachers about the specificity of the relationship between developmentally applied practice and sports-gifted students within the individual curriculum with regard to the gender, work status, age and level of education of the respondents.

The determination to study the identification and encouragement of sports talent in students implied research of a theoretical-empirical character. Such an approach creates a good basis for overcoming certain vagueness and one-sided understandings regarding the possibility of cooperation between classroom teachers in the lower (class teaching) and physical and health education teachers in the upper (subject teaching) classes of primary schools in the identification, encouragement and development of sports talent in students. Research on this issue is very complex because work with gifted children is still viewed with suspicion and with great reserve.

Based on this fact, this paper should offer a link between the theoretical approach to the problem and empirical research, in order to penetrate the essence and character of the identification, encouragement and development of giftedness in children in the best possible way, using an inductive-deductive way with as much success as possible. The results of theoretical-empirical research on the identification, encouragement and developmentally appropriate practice of sports-gifted children are based on these

ZAKLJUČAK

Analiza aritmetičke sredine (AS) svih indikatora od 3,92 pokazuje da se nastavnici/profesori veoma dobro slažu s tvrdnjama o razvojno primjerenoj praksi. Vrijednost standardne devijacije (SD) od 0,82 ukazuje da je rasipanje oko aritmetičke sredine veoma slabo, što potvrđuje i koeficijent varijabilnosti (CV) od 20,92% a time i veoma dobru homogenost dobivenih rezultata za ovaj uzorak ispitanika.

Na osnovu dobivenih rezultata može se konstatovati da ne postoji statistički značajna razlika u stavovima učitelja i nastavnika o specifičnosti relacije razvojno primjerene prakse i sportski nadarene djece unutar individualnog kurikuluma s obzirom na spol, dob i stepen obrazovanja ispitanika. Vrijednost $t = 2,363$ i njegova značajnost $\text{Sig.} = ,020$ pokazuju da postoji statistički značajna razlika (na nivou $p < 0,05$) u stavovima nastavnika/profesora s obzirom na radni status/poziciju u nivoima slaganja s tvrdnjama o razvojno primjerenoj praksi. Na osnovu aritmetičke sredine (M) vidimo da učitelji imaju pozitivnija mišljenja u odnosu na profesore.

Generalno, može se konstatovati da ne postoji statistički značajna razlika u stavovima učitelja i nastavnika o specifičnosti relacije razvojno primijenjene prakse i sportski nadarenih učenika unutar individualnog kurikuluma s obzirom na spol, radni status, dob i stepen obrazovanja ispitanika.

Opredjeljenje za proučavanje identifikacije i podsticanja sportske nadarenosti kod učenika podrazumijevalo je istraživanje teorijsko-empirijskog karaktera. Takav pristup stvara dobar temelj da se prevaziđu određene nedorečenosti i jednostrana shvatanja u pogledu mogućnosti saradnje profesora razredne nastave u nižim (razredna nastava) i profesora tjelesnog i zdravstvenog odgoja u višim (predmetna nastava) razredima osnovnih škola u identifikaciji, podsticanju i razvoju sportske nadarenosti kod učenika. Istraživanja ove problematike su veoma složena jer se još uvijek rad sa nadarenom djecom gleda sa podozrenjem i veoma rezervisano.

Polazeći od te činjenice ovaj rad bi trebao ponuditi sponu između teorijskog pristupa problemu i empirijskog istraživanja, kako bi se na najbolji mogući način induktivno-deduktivnim putem sa što više uspjeha proniklo u suštinu i karakter identifikacije, podsticanja i razvoja nadarenosti kod dece. Na ovim osnovama temelje se i rezultati teorijsko - empirijskog istraživanja o identifikaciji, podsticanju i razvojno primjerenoj praksi sportski nadarene djece. U ovom radu pažnja je prvenstveno usmjerena na utvrđivanje stavova-mišljenja i eventualnih razlika ispitanika o specifičnosti relacija razvojno pri-

foundations. In this paper, the attention is primarily focused on determining the attitudes-opinions and possible differences of respondents on the specificity of relations between developmentally applied practice and sports-gifted students who move from classroom to subject teaching within the individual curriculum with regard to the gender, work status, age and level of education of the respondents. What is of particular importance are the basic needs of children during primary school education and the way in which these needs are met through plans and programs for primary school education.

The results of this research provided insight into the attitudes and differences of teachers and subject teachers regarding the specifics of the relationship between developmentally appropriate practices and gifted students who move from classroom to subject teaching within the individual curriculum in the Federation of Bosnia and Herzegovina, with regard to the gender, employment status, age and level of education of the respondents. However, the authors of this paper believe that in future research on this topic it would be desirable to include a larger sample of respondents in order to potentially obtain broader and more diverse attitudes and possible differences in the attitudes of classroom teachers and subject teachers regarding the creation and implementation of developmentally appropriate practices for supporting gifted students in sports.

mjenjene prakse i sportski nadarenih učenika koji prelaze iz razredne u predmetnu nastavu unutar individualnog kurikulumu s obzirom na spol, radni status, dob i stepen obrazovanja ispitanika. Ono što je od posebnog značaja jesu osnovne dječje potrebe tokom osnovnoškolskog odgoja i obrazovanja te način na koji se te potrebe zadovoljavaju kroz planove i programe za osnovnoškolski odgoj i obrazovanje.

Rezultati ovog istraživanja pružili su uvid o stavovima i razlikama učitelja i nastavnika o specifičnosti relacija razvojno primjenjene prakse i sportski nadarenih učenika koji prelaze iz razredne u predmetnu nastavu unutar individualnog kurikulumu u Federaciji BiH s obzirom na spol, radni status, dob i stepen obrazovanja ispitanika. Međutim, autori ovog rada smatraju da bi u budućim istraživanjima ove tematike bilo poželjno obuhvatiti veći uzorak ispitanika kako bi se potencijalno dobili širi i različitiji stavovi i eventualne razlike u stavovima učitelja u razrednoj i nastavnika u predmetnoj nastavi o izradi i primjeni razvojno primjerene prakse podržavanja nadarenih učenika u sportu.

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THE EFFECT OF SIX WEEKS PLYOMETRIC BOX JUMP AND DROP JUMP TRAINING ON LEG MUSCLE EXPLOSIVE POWER AND STRENGTH

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Abstract: The purpose of this study is to enhance the performance of athletic athletes through plyometric box jump and plyometric drop jump training methods. Thirty selected athletes meeting the criteria underwent a pretest to determine the grouping into the plyometric box jump, plyometric drop jump, and control groups. A back leg dynamometer was used to measure leg muscle strength, while the jump MD test was used to assess leg muscle explosive power. Each group underwent progressive training for six weeks, with three training sessions per week. The results of the paired sample t-test showed that the plyometric box jump training method had a significant effect on both leg muscle strength and explosive power. Meanwhile, the plyometric drop jump training method demonstrated a significant effect on leg muscle strength. It can be concluded that both plyometric box jump and plyometric drop jump training methods are effective for improving the two key physical components: leg muscle strength and explosive power.

Keywords: Strength, Explosive Power, Plyometric.

INTRODUCTION

The process of sports training and development plays a crucial role in bringing recognition to an institution, organization, or nation. Athletes who undergo training are required to continuously improve their performance (Islam, Khan, Khan, & Khan, 2019). Every coach strives to ensure that the athletes they train achieve their maximum potential. This goal is pursued through effective and efficient training methods (Rachman, Kurniawan, & Syarifodin, 2024). The primary objective of training is to enhance an athlete's physical fitness through selected activities that improve both their skills and knowledge (Zhang, 2023). Athletes with good physical condition tend to deliver better performance, which is why training must be tailored to the specific demands of their respective sports (Winartin, Manihuruk, Krisdayanti, & Manihuruk, 2023). Performance in every physical activity, including sports, is largely influenced by biomotor components. According to (Mañalac & Dominado, 2024), "athletic performance is dominated by combinations of strength, speed, and endurance, which are biomotor abilities." Each sport has its own dominant biomotor components.

Previous studies have examined the positive relationship between lower limb strength and measures of strength and performance in the box jump (Sari, Yuniarti, & Armanjaya, 2023). Likewise, research by (Cahya, Mulyana, & Tafaqur, 2024) show that the level of lower limb power and reaction in young badminton athletes. These studies revealed a positive correlation in improving leg muscle performance. Therefore, the current research is expected to contribute valuable insights that can be utilized for enhancing leg muscle performance in various sports requiring lower limb strength and power. Additionally, this study may help coaches incorporate these training methods to optimize athletes' performance during competitions.

Popular training methods in the modern era are widely used in various training centers and sports communities that aim to improve physical fitness through structured training programs (Afonso, Sadeghi, Razi, Martins, & Parnow, 2021) & (Moazzami & Khoshraftar, 2011). Some of the most commonly adopted training methods include plyometrics, high-intensity interval training (HIIT), strength training, and others (Santos, Turner, & Bycura, 2022). Plyometric training is a form of exercise used by athletes across various sports to enhance agility and speed. It is

widely recognized as an effective method to improve biomotor fitness components such as strength and speed, making it highly applicable to sports performance (Junior, 2025).

Variation in training methods and exercise selection helps keep athletes motivated and adaptable to different training stimuli (Kruszewski et al., 2017) & (Mack, Anzovino, Sanderson, Dotan, & Falk, 2023). This is one of the reasons why sports practitioners continuously explore new training methods with the same goal enhancing athletic performance (Pedrosa & Lacerda, 2021). Training programs should not only be effective but also capable of motivating athletes and improving muscle performance according to the demands of their specific sport (Bompa & Buzzichelli, 2019). One such method is the plyometric box jump, which involves jumping onto a sturdy platform (box) positioned at varying heights, typically ranging from 30 cm to 80 cm (Arifan, Barlian, & Afrizal, 2021). This exercise is performed on a flat surface while wearing soft-soled athletic shoes for safety (Hamdi, Putera, Setijono, & Wiriawan, 2023). Plyometric box jumps serve as a fundamental exercise for developing lower limb strength and power (Permana, Kusnanik, & Raharjo, 2022). The training consists of a series of quick and explosive jumps designed to maximize strength and power output in the legs and thighs (Puriana, Pelamonia, & Suryansyah, 2022).

Training programs are tailored to the needs of each athlete, using pre-test and post-test data to assess their progress relative to their maximum capabilities (Taxildaris, Aggelousis, Kostopoulos, & Buckenmeyer, 2000). The ultimate goal is to enhance leg muscle strength and power through structured plyometric exercises. According to (Bompa & Buzzichelli, 2019), an understanding of biomechanics and exercise physiology reveals that while many new training methods claim to improve physical performance, some may instead be detrimental if not properly applied. Explosive power refers to the ability to generate maximal force in the shortest possible time (Sinaga, Tosun, Siregar, & Longakit, 2025). In the context of leg muscles, it is the capability of the lower limb muscle groups to perform explosive movements, such as jumping (Permana, Kusnanik, & Setijono, 2022). Based on the background described above, this study aims to determine the effects of plyometric box jump and drop jump training on leg muscle strength and explosive power. The expected contribution of this research is to identify the most effective training method for improving both leg muscle strength and explosive power through structured plyometric box jump and drop jump exercises.

MATERIALS AND METHODS

This study employs a quasi-experimental and descriptive research design aimed at examining the effects of plyometric box jump and drop jump training on leg muscle strength and explosive power. The research follows a pretest-posttest one-group design, in which measurements are taken twice before the experiment (pretest) and after the experiment (posttest) using a single group of subjects. The sampling technique used in this study is purposive sampling, a method in which the sample is selected based on predetermined characteristics that align with the population's traits. The criteria for participant selection were established by the researcher to ensure the efficiency of the study. The specific selection criteria male athletes include:

1. Male athletes (Body height > 165 cm, Body weight < 80 kg, and Body Mass Index (BMI) 20-23 kg/m²)
2. At least four years of training experience
3. Biological age between 16-17 years
4. No history of chronic lower limb injuries

Based on these criteria, a total of 30 track and field athletes from a specialized sports school in East Java were selected. These 30 athletes underwent pretests to measure leg muscle strength and explosive power before training interventions were applied. Data analysis was conducted using Z-score calculations, which categorized subjects into three experimental groups receiving different training treatments, while one group served as the control group.

Each intensity zone selected by the athletes led to different neuromuscular adaptations. The strength training program in this study was performed at 50-70% of the athletes' one-repetition maximum (1RM) to enhance leg muscle power and strength (Bompa & Buzzichelli, 2019). The applied training intensities ranged between 60-80% of 1RM, aligning with the recommended 55-85% of 1RM for optimal plyometric training results (Bompa & Buzzichelli, 2019). The number of sets in the training regimen was carefully determined based on exercise repetition volume, as high repetitions may hinder the ability to complete more than three sets (Casado, González-mohino, González-ravé, & Foster, 2022). All periodized strength training programs begin with an anatomical adaptation phase, which prepares the body for subsequent training phases. The training was conducted over a six-week period, as research

suggests that training programs yield effective results when conducted for a minimum of four to five weeks (Pass, Murias, Sacchetti, & Nicolò, 2022).

Table 1. Training Program

Week	Session	Intensity	Repetitions	Sets	Rest Between Sets
1	1	60%	8	3	3 minute
	2				
	3				
2	4	70%	6	3	4 minute
	5				
	6				
3	7	80%	4	3	5 minute
	8				
	9				
4	10	80%	4	3	5 minute
	11				
	12				
5	13	80%	4	3	5 minute
	14				
	15				
6	16	80%	4	3	5 minute
	17				
	18				

The method used in this study involves providing different treatments to each group to compare the effectiveness of the selected training methods.

Visibilty as in Table 1 illustrates the progression and differentiation of training intensity and volume across the three groups. It highlights how Group I and Group II followed a structured plyometric training regimen with gradually increasing intensities over six weeks, while Group III adhered to a moderate-load strength training protocol aimed at enhancing leg muscle strength and explosive power.

Group I performed box jump training and group II performed drop jump training. Both groups performed the exercises three times a week according to the training program specified in Table 2.

Table 2. Description of Training Program

Description	Group I	Group II
First and second weeks	Box jumps at 60% of their maximum jump height (RM)	Drop jumps at 60% of their maximum drop height (RM)
Third and fourth weeks	Box jumps at 70% of their maximum jump height (RM)	Drop jumps at 70% of their maximum drop height (RM)
Fifth and sixth weeks	Box jumps at 80% of their maximum jump height (RM)	Drop jumps at 80% of their maximum drop height (RM)
Sets	3 sets	3 sets
Repetition	4-8 repetitions per set	4-8 repetitions per set
Rest periods	3-5 minutes	3-5 minutes

As the control group, in order to develop a successful strength training program, coaches and athletes manipulated several training variables, such as volume and intensity (Sandbakk, Walther, Solli, Tønnessen, & Haugen, 2023). Only a few athletes are capable of performing strength training with supramaximal loads, and this is typically due to their strong background in strength training. Each intensity zone selected by an athlete displays different neuromuscular adaptations. A moderate load (50-70% RM) was selected because this study focused on two dependent variables: leg muscle strength and explosive power (Sitko et al., 2025) & (Vos et al., 2005).

Data Analysis

The data analysis in this study was conducted using SPSS version 20 with a 5% significance level. The analysis process included assumption tests, consisting of normality and homogeneity tests:

1. The normality test was performed to determine whether the data distribution was normal, which is crucial for selecting the appropriate statistical test.
2. The homogeneity test was used to assess whether the population variances were equal.
3. The Shapiro-Wilk test was used for normality testing with a significance level of 5%. If the significance level in the Shapiro-Wilk test was greater than 0.05, the data were considered normally distributed.
4. The Box's Test of Equality of Covariance Matrices was used for the homogeneity test. If the homogeneity of variances statistic was greater than 0.05, the data were considered homogeneous.

Once the assumption tests were satisfied, hypothesis testing was conducted using the paired t-test and Multivariate Analysis of Variance (MANOVA) with the assistance of SPSS version 20.

RESULTS

Normality Test

The normality distribution test was conducted using the Shapiro-Wilk test. The results are shown in Table 3.

Table 3. Normality Test Results

Normality Test			
Shapiro-Wilk			
	Statistic	df	Sig.
pre_power1	0.960	10	0.796
post_power1	0.955	10	0.737
power_diff1	0.983	10	0.982
pre_strength1	0.883	10	0.143
post_strength1	0.872	10	0.109
strength_diff1	0.978	10	0.959
pre_power2	0.905	10	0.253
post_power2	0.907	10	0.264
power_diff2	0.965	10	0.848
pre_strength2	0.961	10	0.805
post_strength2	0.933	10	0.487
strength_diff2	0.977	10	0.952
pre_power3	0.882	10	0.139
post_power3	0.879	10	0.132
power_diff3	0.965	10	0.849
pre_strength3	0.933	10	0.489
post_strength3	0.929	10	0.447
strength_diff3	0.982	10	0.977
*.This is a lower bound of the true significance.			
a. Lilliefors Significance Correction			

Homogeneity Test

Table 4. Homogeneity Test

Homogeneity of Variance Test				
	Levene Statistic	df1	df2	Sig.
delta_Explosive Power	0.580	2	26	0.565
delta_Strength	0.084	2	26	0.917

To examine whether there is an effect of the treatment on the variables used, a paired t-test was conducted. The results of the difference test for each group are presented below.

Table 5. Box Jump Group Difference Test

Paired Sample Test		
		Sig.(2tailed)
Box Jump	Pre – Post Power	0.004
	Pre – Post Strength	0.36

The paired sample test findings in Table 4 indicate a significant difference between the pre-test and post-test values for the power variable in the Box Jump group, with a significance value (Sig. 2-tailed) of 0.004 ($p < 0.05$). This signifies that box jump training substantially enhances leg muscular power. Simultaneously, there is no notable variation in the strength variable, with a significance value of 0.36 ($p > 0.05$), suggesting that box jump training does not significantly influence leg muscular strength prior to the execution of multivariate analysis.

Table 6. Drop Jump Group Difference Test

Paired Sample Test		
		Sig.(2tailed)
Drop Jump	Pre – Post Power	0.014
	Pre – Post Strength	0.118

From the results in Table 6, the significance value obtained for the power variable is 0.014 or sig. < 0.05 , which indicates a significant effect of drop jump training on leg muscle power. Meanwhile, the significance value for the strength variable is 0.118 or sig. > 0.05 , meaning there is no significant effect of drop jump training on increasing leg muscle strength.

Table 7. Control Group Difference Test

Paired Sample Test		
		Sig.(2tailed)
Control	Pre – Post Power	0.342
	Pre – Post Strength	0.214

From the results in Table 7, the significance value obtained for the power variable is 0.342, and for the strength variable, it is 0.214, both of which are greater than 0.05. This indicates that there is no significant effect of the control group on the improvement of leg muscle strength and power.

DISCUSSION

Sports are a form of physical exercise that is beneficial for maintaining and improving physical fitness (Saefulah, Hidayana, & Cahyandari, 2024). Physical fitness refers to a person's ability to perform physical activities requiring strength, endurance, and flexibility (Oliveira, Gisele, Lopes, & Domingues, 2023). Moreover, activities such as jogging and football enhance aerobic fitness, cardiovascular health, and diminish obesity (Oja et al., 2015). From a biomechanical and exercise physiology perspective, many new products that initially claim to enhance strength, speed, and power may actually be detrimental to athletes (Bompa & Buzzichelli, 2019). According to (Puchalska-sarna et al., 2022), sports are defined as physical activities in the form of games that involve struggles against natural elements, other people, and oneself, with a complex organizational structure. Sports may be defined as an officially sanctioned competitive activity characterised by its lack of productivity, emphasis on competition, and formal recognition (Lebed, 2022). Training methods continue to evolve, demonstrating the correct concept of movement execution and implementation (Gadiant & Deutsch, 2020). The progressive training methodologies may be exemplified by prolonged movement training, which will reconfigure the motor circuits, liberating the motor cortex capable of automating the execution of acquired motions (Hwang, Dahlen, Mukundan, & Komiya, 2021).

This study is an experimental action research designed to identify the most effective training method for improving lower body muscle performance. The aim is to help athletes undergoing athletic training enhance their performance in competitions. Coaches have noted that the strength and explosive power of athletes' leg muscles are still not optimal. Athletes exhibiting superior explosive strength demonstrate enhanced nerve conduction velocity, increased lower limb muscular strength, and elevated vertical stiffness (Li & Zhou, 2024). Plyometric box jump and drop jump exercises were performed for six weeks to improve lower body performance (Cahya et al., 2024) & (Pedley et al., 2017). According to (Espinal-ruiz et al., 2023), training influences biomotor performance when conducted for at least four weeks. Plyometric box jump training improves biomotor abilities such as strength and explosive power of the leg muscles (Singh, Singh, & Azeem, 2024). Plyometric box jump training enhances the strength and power of the leg muscles, with tuck jump workouts yielding the most significant improvements in these attributes (Thariqi, Wiriawan, & Muhammad, 2023). Meanwhile, plyometric drop jump training enhances explosive power but does not significantly affect leg muscle strength.

This finding is supported by research conducted by (Bastholm & Olsen, 2024), which states that box jump exercises significantly impact the explosive power of leg muscles because they involve continuous forward contraction of the legs. Similarly, (Hasanuddin, Hasanuddin, Irfan, & History, 2023) found that box jump training contributed to a 6,3% increase in leg muscle explosive power. Plyometric training affects leg muscle strength in volleyball players (Novita, Oka Harahap, Sahputera Sagala, & Natas Pasaribu, 2022). 6 weeks of plyometric training affects volleyball players' explosive power (Jastrzebski, Wnorowski, Mikolajewski, Jaskulska, & Radziminski, 2014). Plyometric training affects agility, speed, strength and explosive power of leg muscles (Utamayasa, Setijono, & Wiriawan, 2020). Plyometric training and leg muscle strength have an effect on the leg power of wrestling athletes (Sabillah, Tomoliyus, Nasrulloh, & Yuniana, 2022). Plyometric front cone hops and counter movement jump exercises affect the power and strength of leg muscles (Pratiwi, Setijono, & Fuad, 2018). Additionally, a study by (Anversha, Ramalingam, Kumari, & Sugumaran, 2024) showed that plyometric training contributes to improvements in vertical jump performance by enhancing speed, strength, and power simultaneously with movement awareness. This type of training engages fast-twitch muscle fibers and improves the neuromuscular coordination necessary for explosive movements (Linnamo et al., 2000). Therefore, plyometric exercises are considered effective for increasing lower body strength and explosive power. (Permana, Kusnanik, & Setijono, 2022) also support this claim, stating that plyometric training is a method designed to enhance strength and explosive power. As a result, athletes can expect better overall athletic performance, particularly in sports that require jumping and sprinting (Ramirez-Campillo et al., 2020).

Research by (Aksović, Bjelica, Milanović, & Jovanović, 2021) on leg muscle explosive power, running speed, and agility in basketball players aims to assess the level of explosive power, running speed, and agility in basketball athletes. The research findings indicate a good link between the implemented training program and the enhancement of lower limb muscle performance. These data confirm that the utilisation of suitable training methodologies, encompassing exercise diversity as well as the intensity and number of repetitions, significantly influences training results (Sautov & Tyshchenko, 2024). A planned training regimen customised to the specific requirements of players can expedite neuromuscular adaptation and enhance movement efficiency in the sports (Batrakoulis et al., 2021; Cormie,

McGuigan, & Newton, 2011; Lamas et al., 2012). The enhanced explosive power of the leg muscles enables athletes to achieve greater jump heights, accelerate more rapidly, and change direction with more agility, all of which are critical components of basketball success (Duan et al., 2024; Garatachea et al., 2014; Lamas et al., 2012; Pan, 2025). Consequently, the choice of appropriate training techniques is crucial for facilitating the optimal physical development of athletes.

Thus, it can be concluded that plyometric training is an effective method for enhancing leg muscle strength and explosive power. Therefore, it can serve as a reference for developing training programs aimed at improving leg muscle power, particularly in sports that rely on lower limb explosive strength, with a special emphasis on plyometric box jump training.

CONCLUSION

Based on the results and discussion, plyometric box jump training is more efficient for improving both explosive power and leg muscle strength, while drop jump training only affects explosive power. This is because plyometric exercises tend to have a greater impact on explosive power rather than muscle strength. However, training programs should be designed based on individual principles, as each athlete has different muscle characteristics and abilities. Additionally, incorporating a variety of strength training exercises is essential for optimal performance development.

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THE RELATION BETWEEN DISRUPTIVE FACTORS AND SUCCES IN SAILING

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Abstract: *There are many factors that affect the success of sailors. Psychological factors are some of the unavoidable ones that are connected to the sports performance. One of the key factors is anxiety which is changing according to the experience and the situation the sportsmen find themselves in. The goal of this paper was to determine the effect of disruptive factors on the success in sailing conducted on 29 students of Kinesiology faculty in Zagreb. In the research wave height, visibility, wind strength and anxiety level were measured and analysed. Anxiety was analysed through multidimensional approach to anxiety as a temporary state of the examinee, and the anxiety as a personality trait. Every examinee has filled out the Endler EMAS-T questionnaire which evaluates the anxiety as a personality trait, while everyday they were filling out EMAS-S questionnaire prior to every regatta, so that current anxiety could be compared to the regatta results. Statistically significant correlation between anxiety and success in sailing was proved in 2 out of 8 regattas, so it can hardly be said that the hypothesis was proved. Statistical significance was proved in lessening of the somatic anxiety level of sailors in correlation with the number of days and the exposure to the stressor. It can be concluded that the level of anxiety is changing the more days passes and the more the sailor is exposed to the stressor and that some indications of the correlation of anxiety and the success in regatta sailing exist.*

Keywords: *anxiety, education, regatta, students, water sports.*

INTRODUCTION

Sport sailing is very hard to observe from the scientific aspect. Sailing is a complex activity demanding a plethora of competencies, which in turn necessitates conducting of multidisciplinary research in order to envelope the great number of factors affecting the success (Sjøgaard, 2015). Reason for that is a multitude of external influences producing new and different conditions continually, conditions to which sailors need to continually adapt. To achieve top sports performance, beginner sailors, the same as more advanced ones, have to fulfill not only motor and functional demands, but also psychological ones, which will enable the sailor unhindered participation in the activity, especially in the conditions of competition. Besides different external influences, internal ones, such as the level of cognitive or autonomous anxiety, motor and functional abilities, experience, fatigue, hunger or dehydration, arousal of the nervous system, also affect the success in sailing (Ilić et al., 2022). Arousal of the nervous system represents neutral psychological phenomenon which can be connected to the negative (anxiety) and positive (thrill) affects but is not synonymous to the either of them (Cox, 1998). Any activity, depending on its structure and complexity, demands specific level of arousal to achieve the ideal result. Any sports skill has its theoretical optimal level of arousal. This optimal arousal level varies as a function of complexity of the task and the skill level of the athlete, i.e., highly skilled athletes and athletes performing simple task need moderately elevated level of arousal for maximum performance. Less skilled athletes and those performing complex task require a relatively low level of arousal (Cox, 1998). In former research the optimal level of arousal in sailing has not been researched, but, as in other sports, the inverted U theory is applied – performance is at lowest level if arousal is extremely high or extremely low, it is at highest level if arousal is moderate, or optimum. There are a few theories explaining the effect of inverted Manzanares et al. (2017) confirmed an inverted-U theory in sailing, linking performance to attentional focus. Studying the Optimist class, they found that successful sailors maintain focus on key start factors, while less successful sailors shift attention to irrelevant cues. Almost every athlete is under the influence of competition anxiety which, depending on the intensity and type of activity he or she performs, can help or be a disruptive factor in reaching his/her potential and success. This shows that anxiety significantly affects athlete sports performance, which introduces the need for anxiety with the

aim of reaching better results (Dinter et al., 2021). Based on his research, Kos (2018) points out that optimal level of stress and exposure to stressors is preferable, with aim of professional and private growth in different aspects of life, which can be closely related to the sports activities too. In competitive sailing the main stressor is regatta, comprising the fear of failure, fear of social evaluation or other factors. Psychologists are researching anxiety through two spheres. Anxiety can be seen as a personality trait, and as such is defined as predisposition to perceive certain environmental situations as threatening and to respond to these situations with increased anxiety level. On the other hand, anxiety can be seen as a state, defined as immediate emotional state characterized by apprehension, fear, tension, and increase in physiological arousal (Spielberger, 1971). Anxiety can be divided into cognitive and somatic. Cognitive state anxiety refers to the mental component caused by fear of failure, fear of negative social evaluation, and other factors (Cox, 1998) that are certainly affecting the actions of sailors and their ability to reach quality prompt and right decisions during regattas. Somatic state is a physical component pertaining to the physiological body reactions (Cox, 1998). To observe precompetitive anxiety and influence of that disruptive factor on success in sailing as precisely as possible, and in order to compare it to the results, anxiety should be observed both as a personality trait and through the multidimensional model of state anxiety. Having in mind that success in sailing is mainly connected to the different motor abilities, negative influence of anxiety on the physical demands of regatta can greatly affect the final placement. The aim of this research is to determine if the level of cognitive and autonomous anxiety and anxiety as a personality trait is a predictor of the success in regatta sailing together with the influence of different external factors such as wave height, wind strength and visibility.

METHODS

The sample consisted of 29 fourth and fifth year kinesiology students specializing in sailing at the University of Zagreb. To obtain more quality observance and assessment of the results, top sailors were excluded from the research. Disruptive factors variables in sailing observed in the research were: wind strength (WS), wave height (WH), visibility (V), level of anxiety as personality trait (ANXtrait), level of cognitive anxiety state (anxCOG) and level of autonomous/somatic anxiety state (anxAUTON). Also, summative ranking for individual athletes in several regattas were observed, in which higher value represents inferior result. Weather conditions (wind strength, visibility, wave height) were recorded using online sources and adjusted when necessary based on regatta field observations. The last two measuring instruments in the research are Endler's questionnaires for anxiety out of which EMAS-T and EMAS-S questionnaires were used in the research. EMAS-T assesses the level of anxiety as a personality trait in an examinee. EMAS-S is used to measure the current anxiety state. The questionnaire is constructed of 20 parts, out of which 10 parts assesses cognitive anxiety, while the rest of 10 parts assesses autonomous- emotional component of anxiety as a state. In both questionnaires assessment of dimensions is done through the Likert 5-point scale. Also, average values for trait anxiety (ANXtrait), and state anxiety in two dimensions (anxCOG, anxAUTON) were calculated. Further data analysis was performed in SPSS (Statistical Package for Social Sciences) program. In the research two protocols were implemented. The first involved completing the EMAS-T questionnaire to assess trait anxiety, which students filled out online on the second day of classes to reduce the influence of first impressions. The second protocol spanned 4 days. Before sailing, students completed the online EMAS-S questionnaire to assess state anxiety, and the number of students per sailboat was recorded. After 2-3 hours of training, one or more regattas were held, and final rankings of the helmsman were recorded.

RESULTS

During the research, variables visibility (V) and wave height (WH) (Table 1) showed very similar values, and therefore were excluded from the further analysis due to the small variations. Wind strength, according to the Beaufort scale, 4 to 6 knots represent level 2 and is defined as a breeze. Most of the research was conducted in that wind strength range, or ± 0.5 knots, which does not make a significant difference for beginner sailing on Laser Stratos sailboats. Average level of trait anxiety (Table 2) is relatively low in the sample, and its values are more on low or medium level.

Table 1. Descriptive values of weather conditions.

Variables	Day 1	Day 2	Day 3	Day 4
Visibility (km)	10-20	12-16	10-16	10-12
Wave height (m)	0.3	0.5	0.4	0.3
Wind strength (kts)	6.5	3.8	4.0	4.5

Table 2. Trait Anxiety in Different Groups of Examinees

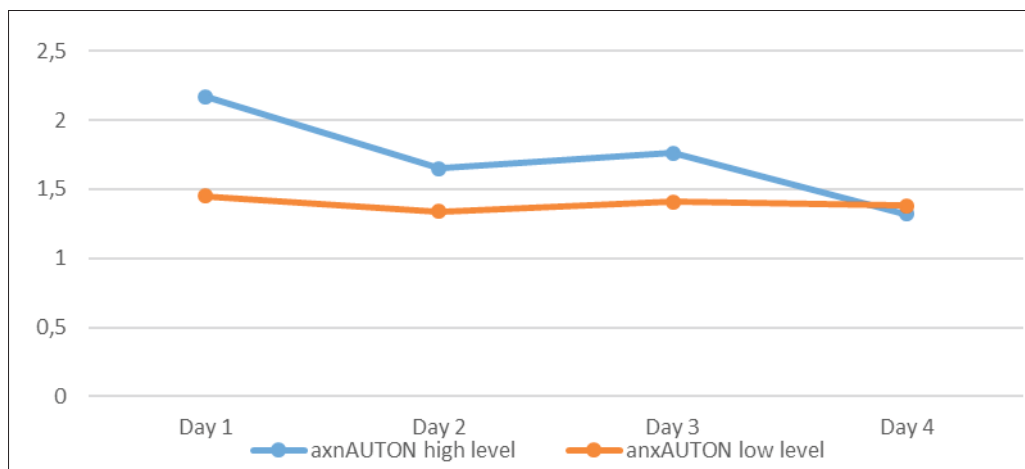
Examinee group	Average level of trait anxiety
Men	2.66/5
Women	3.00/5
The entire sample	2.73/5 – St.dev 0.58

Autonomous state anxiety is significantly varying in the function of ordinal number of days, and that condition is even more significant in examinees assessed with higher levels of trait anxiety. Cognitive state anxiety varies depending on the function of ordinal number of days, but that variations are not systematic, and post-hoc tests have showed that days cannot be differentiated among themselves with any level of certainty. Also, it can be observed that assessed level of trait anxiety statistically significantly and in a better way predicts the level of cognitive state anxiety of the examinee, while gives only marginal predictions on the level of autonomous state anxiety (Table 3).

Table 3. Results of Covariance Analysis Taking the Ordinal Number of Days as a Source of Variability Inside the Group, Trait Anxiety as a Source of Variability Between the Groups and Cognitive and Autonomous Anxiety as Dependent Variables

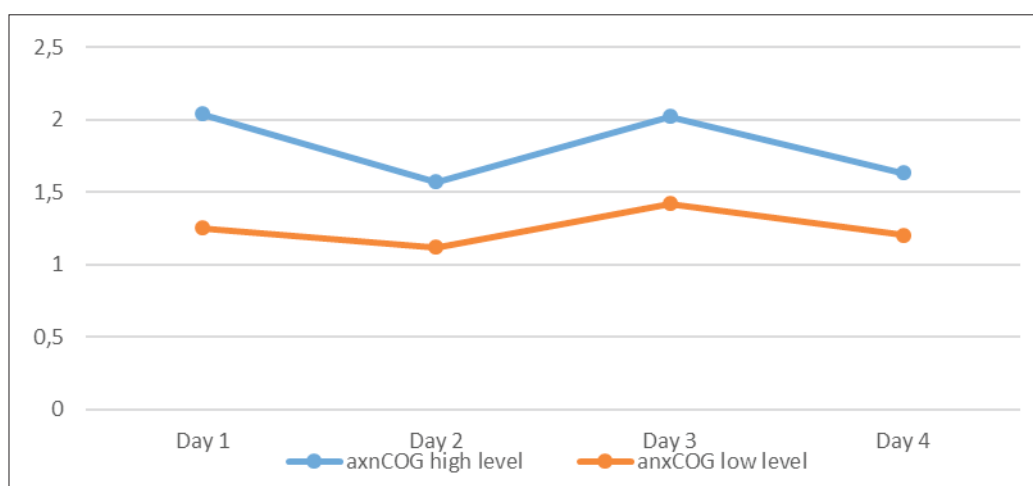
Source of variance	measure	df	F	p
Ordinal number of days	Cognitive anxiety	3 / 66	8.79	<.001
	Autonomous anxiety	3 / 66	5.90	<.001
Trait anxiety	Cognitive anxiety	1 / 22	9.27	<.01
	Autonomous anxiety	1 / 22	3.81	.06
Ordinal number of day x trait anxiety	Cognitive anxiety	3 / 66	1.24	.30
	Autonomous anxiety	3 / 66	9.93	<.01

In graph 1, a statistically significant decrease in autonomous anxiety (anxAUTON) can be observed as a function of the ordinal day number and the level of trait anxiety. The decrease of value is more significant in examinees that were assessed with higher level of trait anxiety.



Graph 1. Assessed mean value for variable anxAUTON

In graph 2 assessed mean value for the level of cognitive state anxiety (anxCOG) is varying with the function of ordinal number of day depending on the disruptive factors for that day. Also, it can be noted that in the examinees with higher level of trait anxiety, higher level of cognitive state anxiety is assessed. In the regattas during the first and second day of measuring, there was no statistical significance in any of the disruptive factors.



Graph 2. Assessed mean value for variable anxCOG

In Table 4 values of statistical significance for individual disruptive factor on the third day are represented for the success in the third day regattas. Marginal effects were shown for influence of state anxiety (variables anxCOG and anxAUTON) which shows that the examinees with the higher level of anxiety, especially cognitive component of it, had lower result in regattas of the third day. Trait anxiety in this case was not significant.

Table 4. Relation of the Level of State Anxiety on the Third Day to the Success in Sailing on the Third Day With the Dependant Variable Suma.rank_03

Source of variance	df	F	p
ANXtrait	1 / 22	0.80	.38
Cognitive state anxiety on the third day	1 / 26	4.72	.04
Autonomous state anxiety on the third day	1 / 26	3.08	.09

Table 5 shows that, as in first two days, on the fourth day there is no statistical significance in relation of some of disruptive factors to the success in sailing either. During the data analysis, an interesting regularity was noticed ($r=0.44$, $p<0.03$) in which the final ranking of the third day predicted the level of cognitive, but not autonomous state anxiety of examinees the following day.

Table 5. Relation of the Level of State Anxiety on the Fourth Day to the Success in Sailing on the Fourth Day With the Dependant Variable Suma.rank_04

Source of variance	df	F	Sig.
ANXtrait	1 / 22	0.03	.87
Cognitive state anxiety on the fourth day	1 / 26	0.08	.78
Autonomous state anxiety on the fourth day	1 / 26	0.03	.87

DISCUSSION

Competitive sports have a potential for developing a certain level of stress, and also anxiety, so the importance of intervention is stressed in such sports, with the aim of decreasing negative emotional states and increasing of success (Hanton et. al 2015; Weinberg, 2015). Different conditions to which sailors have to constantly adapt are directly influencing the results in regatta sailing (Oreb, Prlenda and Kolega, 2013). Some of these conditions, such as wind strength, wave height and visibility, were directly observed in this research too, but due to their low values and variations couldn't affect the success, and therefore were excluded from the research. Results have confirmed that the level of cognitive and somatic anxiety can affect the success in regatta sailing with statistical significance, but this hypothesis was confirmed in only 2 out of 8 regattas. It can hardly be concluded on the basis of such a small number of results in questionnaires connected to the success in regatta sailing, that there is a valid confirmation of that constataction. There is a number of external factors which could influence forming of the results. Considering that all the results of questionnaires had to be connected to the results of regatta sailing, the research could not be conducted anonymously, but the data was available only to the mentor and the examiner. Due to the inanonymity of the questionnaire it can be questioned to what extent it influenced the thruthfulness of answers, or did examinees adapt their answers to their everyday social role. Also, data concerning the level of anxiety show very low values, attipical for athletes, especially if they are viewed in the context of experience that examinees had in sailing, so the validity of those results can also be questionable. Through this research it was confirmed with statistical significance ($p < 0.05$) the decrease of state anxiety through constant exposure to the stressor, which was proved especially in somatic anxiety of the examinees. In training with beginners greater progress can be expected in the later days of training, when the athletes will be accustomed to the new and unknown environment. For cognitive state anxiety statistical significance was also determined, but it changed over the days unsystematixcally, which can be assigned to the other disruptive factors, such as fitness, fatigue or hunger that were present during the regattas at the end of the training day. One of the factors affecting the level of measured cognitive, but not autonomous anxiety on the fourth day, was the overall ranking of the examinees in the regattas on the third day. The examinees with the better result at the end of the third day, had lower level of cognitive anxiety on the fourth day, and the examinees with lower result on the third day had higher level of cognitive anxiety the following day. It showed a potential disruptive factor that should be taken into consideration in the further researches. Regattas were allways, due to the teaching of other elementary knowledge, conducted at the end of teaching process, and therefore the period between questionnaires and first regattas was 2 to 3 and a half hours, which can result in different data concerning anxiety. The time period between filling out the questionnaire and conducting the activity greatly affects the result, especially in somatic anxiety (Cox, 1998). Also, the decrease of somatic anxiety after the beginning of the competition is pointed out, in this case after the first regatta. In the occurence of anxiety in sailing Maynard (2006) points out possibilities of conducting unimodal or multimodal interventions, depending on the type of anxiety. If there is a perception of one of the anxiety types (cognitive or somatic), in most cases unimodal intervention is applied, but if both types of anxiety occur, multimodal intervention is conducted, under condition that there is enough time to apply quality intervention. Among unimodal interventions most significant are applied relaxation (Ost, Jerremalm and Johanson, 1988) and positive mind control (Suin, 1987), while among multimodal interventions stress management training stands out (Smith, 1980). Further research is necessary to define factors affecting the cognitive state anxiety of examinee, the dimension of anxiety which showed in a part of this research to be able to predict sometimes ($p < 0.041$) the final result of the regatta. Considering that sailing consists of wide spectre of classess that therefore use different vesels, different demands are occuring in relation to different positions. Consequently, future research should be focused on specific positions on sailboats. It especially refers to big class regattas, in which great number of different possitions exists, and certain positions demand fast and strong crew to perform certain elements (Neville, Pain & Folland, 2009). Such positions would expectedly demand slightly higher level of arrousal, while, on the other hand, position of helmsman or tactitian for right and prompt decision making would demand slightly lower level of arrousal so the focus can be turned to the greater number of environment factors. Some authors are pointing out that the number of days spent on the water and number of perfomances on regattas positively affect the success in sailing (Tan & sur., 2006; Caraballo, González-Montesinos & Alías, 2019). Considering that in the research students of 4th and 5th year were included, it can be assumed that their level of skill is not the same, but due to the structure of teaching process it was not possible to group the sample according to the experience and skill which would ensure more reliable results. Most of the fifth year students participated in more practical classes,

which brings them advantage over fourth year students. Some of the examinees perfected their skills by working in sailing clubs, putting them in advantageous position compared to other colleagues.

CONCLUSION

Research of the disruptive factors in the complex sport as sailing, requires great effort and applying of different aspects. Therefore the fact that similar or connected research could not be found is not surprising. Besides numerous, unpredictable external disruptive factors, internal disruptive factors of the sportsmen are very difficult to measure in the environment and the proces the examinees are in. On the other side, laboratory conditions are difficult or even impossible to simulate due to the very high number of affecting factors. Surely, one solution is to conduct numerous similary researches excluding most of the disruptive factors and focusing on few selected ones, contributing thus to the reliability of results. Based on these results, a connection between anxiety and performance in sailing can be observed in only 25% of the conducted regattas; however, this does not allow for theoretical conclusions regarding the relationship. However, the reduction in anxiety levels through continuous exposure to the stressor was confirmed with statistical significance. Therefore, when working with beginners, greater progress can be expected in the later stages of training, as athletes adapt to the new environment.

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ELEVATING USER EXPERIENCE AND SERVICE EXCELLENCE IN SPORTS FACILITIES VIA INTEGRATED MANAGEMENT INFORMATION SYSTEMS: A SYSTEMATIC REVIEW

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Abstract: With the growing public interest in sports, sports facility management is facing increasing demands to improve the quality of its services and enhance the user experience. To address these challenges, this paper comprehensively discusses the development of an integrated management information system (MIS). This discussion is based on existing literature and aims to contribute to the advancement of sports facility management. This study investigates the development of an Integrated Management Information System (IMIS) to improve user experience and service quality in sports facilities. Employing a systematic review (2018-2023) of 7 articles from Scopus, Google Scholar, and Semantic Scholar, the research explores how IMIS can address evolving industry needs. The system facilitates user access to information, online transactions, and feedback mechanisms, while enabling personalization and recommendations. Implementation involves evaluating facility needs, staff training, and user introduction. Data security and privacy are crucial. Future integration of AI, IoT, and mobile applications holds promise for further enhancing IMIS effectiveness. Overall, IMIS implementation has demonstrably improved user experience and service quality. By prioritizing user experience and adapting to technological advancements, sports facilities can remain competitive in a digital age.

Keywords: Management Information System, user experience, service quality, sports facilities.

INTRODUCTION

Effective and efficient sports facilities are crucial in meeting the users' needs and providing a satisfying experience during sports activities (Alkhateeb, S. *et al.*, 2019). However, managing sports facilities well is not an easy task. Challenges such as lack of coordination, difficulties in monitoring inventory, and limited access to relevant information can hinder efforts to improve the user experience and service quality in sports facilities.

In recent years, integrated management information systems have emerged as a proManagement Information Systems ing solution to address the challenges in managing sports facilities. Integrated management information systems take a holistic approach, integrating various management aspects, including inventory management, facility reservations, cleanliness supervision, and performance reporting (Vitliemov, 2019). By implementing integrated management information systems, it is expected that sports facilities can enhance operational efficiency, improve service quality, and provide a better experience for users.

Several previous studies have revealed the benefits of implementing integrated management information systems in enhancing user experience and service quality in various sectors, including sports facilities. For example, research by V. Zaloga (2019) shows that the implementation of integrated management information systems in fitness centers resulted in a significant improvement in user experience and operational efficiency (Zaloga, 2019). Similarly, research by Zhang (2019) found that integrated management information systems can enhance information accessibility and optimize resource utilization in sports facilities, thereby improving their sports offerings (Zhang, 2019).

Although several studies have been conducted, there is no systematic review that comprehensively gathers and analyzes the studies and literature related to the implementation of integrated management information systems in the context of sports facilities and their impact on user experience and service quality. Therefore, the aim of this research is to conduct an in-depth systematic review to gain a better understanding of how integrated management information systems can enhance user experience and service quality in sports facilities.

In this research, we will analyze various previous studies and literature regarding the implementation of inte-

grated management information systems in sports facilities. We will identify the strengths and weaknesses of integrated management information system implementations and analyze their impact on user experience and service quality. The results of this systematic review are expected to provide valuable insights for stakeholders in developing and improving existing sports facilities.

METHODS

The selection and screening process for articles used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method in 2020. This method also helps minimize selection bias based on research variables and research protocols. The article selection process that aligns with the research objectives went through the following steps: a search process using the keywords “Integrated Management Information System” AND “User Experience” OR “Quality of Service” OR “Sports Facilities” on Scopus, Google Scholar, and Semantic Scholar databases, including articles published from 2018 to 2023.

The article selection was performed through analysis and synthesis based on inclusion and exclusion criteria. Inclusion criteria for article selection encompass research reports, experimental studies, systematic reviews, and literature reviews related to the development of integrated management information systems. Exclusion criteria applied included articles not in English and publications that were not full-text articles or non-academic journals. The article search was conducted in July 2023.

Based on the initial search from the databases, a total of 6,705 articles were retrieved, and duplicate articles were removed, resulting in 6,363 articles. These articles were further screened based on the suitability of their titles and abstracts, resulting in a total of 1,910 articles. The number of articles used in this research, meeting the feasibility study criteria, amounted to 7 articles. The search process sequence is presented in the following figure.

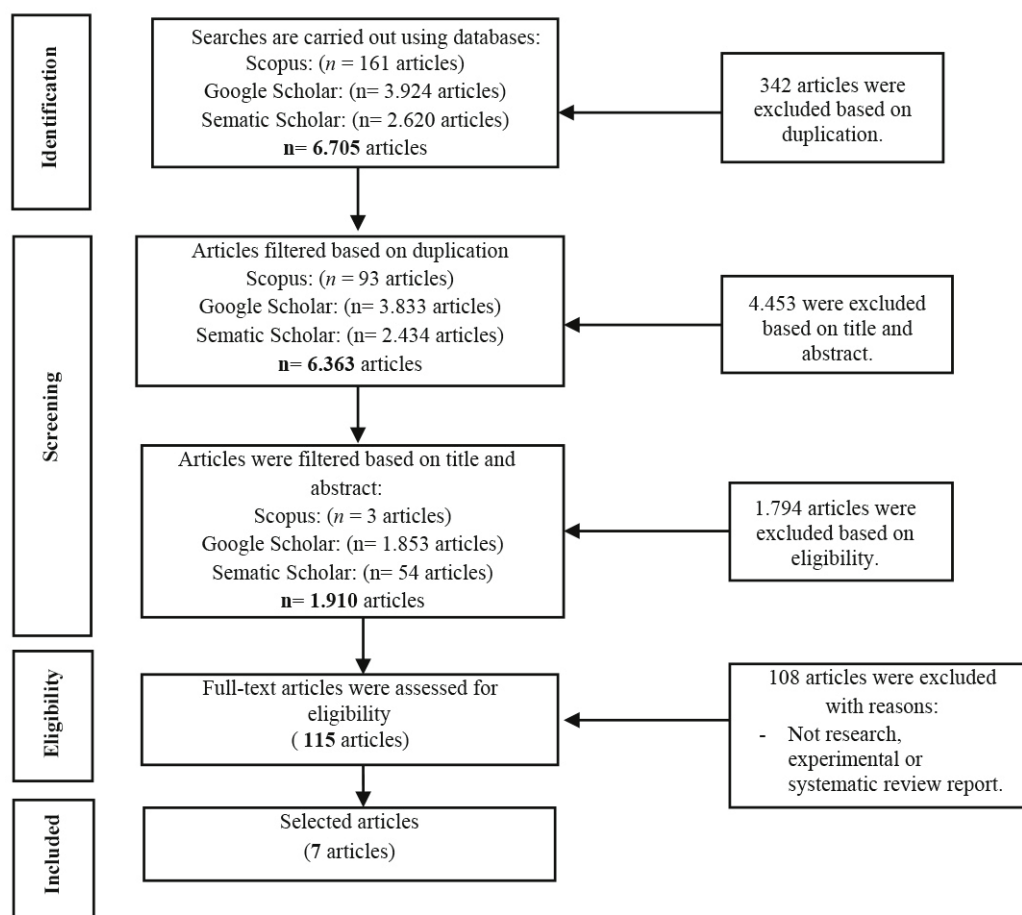


Figure 1. Process flow diagram for the identification, screening, eligibility, and included selection of articles

RESULTS

The results of the review of articles from several research studies that meet the criteria are presented in the following table:

Table 1. Article Characteristics

Author	Title, Publisher	Study Design and Methods	Results
Puspitasari et al., 2019	<i>An application of the UTAUT model for analysis of adoption of integrated license service information system.</i> Procedia Computer Science, 161, pp. 57–65. doi: 10.1016/j.procs.2019.11.099.	The method used is the Unified Theory of Acceptance and Use of Technology (UTAUT), which has been modified to include variables such as performance expectations, business expectations, social influence, facilitating conditions, technology utilization, usage behavior, gender, and age.	One factor that has a big impact on how well information systems are accepted and used is performance expectations. Especially when it comes to allowing services, an Integrated Permit Service Information System might improve the standard of public services. This system is now a necessary necessity to support the efficacy and efficiency of work.
Masri et al., 2020	<i>Assessing the effects of information system quality and relationship quality on continuance intention in e-tourism.</i> International Journal of Environmental Research and Public Health, 17(1). doi: 10.3390/ijerph17010174.	The survey study was designed with reference to previous studies on information system success and Information Technology (IT) development in the context of e-commerce. The focus of this study includes the evaluation of service quality, system quality, perceived quality, trust, user satisfaction, and the continuity of information system usage.	Customers' inclination to stick around is positively impacted by the quality of their customer relationships. consumer happiness, however, also plays a role in the relationship between maintained intention and consumer trust. Furthermore, there is a strong correlation between consumer happiness, trust, perceived value, and continued intention and the quality of the information system. Additionally, there is a strong correlation between customer happiness and trust and customer-perceived value.
Fiaz, Ikram and Ilyas, 2018	<i>Enterprise resource planning systems: Digitization of healthcare service quality.</i> Administrative Sciences, 8(3). doi: 10.3390/admsci8030038	In improving the quality of services at community health centers (puskesmas), healthcare personnel's perceptions are evaluated using an Enterprise Resource Planning (ERP) platform. The overall impact of the integrated planning system on healthcare service quality is assessed through individual attributes, organizational impressions, information, and ERP system quality. A mixed-method approach is employed to gather and examine data through triangulation.	The research results indicate a positive impact of using Enterprise Resource Planning (ERP) on service quality in the healthcare sector. All dimensions related to ERP consistently provide a positive contribution to healthcare service quality. The use of enterprise planning systems has a positive impact on individuals, organizational information quality, and system quality in the context of healthcare services.

Kurniawan, 2018	<i>Integrated Information System for Radio Frequency Identification Based AdMinistration and Academic Activities on Higher Education.</i> IOP Conference Series: Materials Science and Engineering, 407(1). doi: 10.1088/1757-899X/407/1/012097	The waterfall method was chosen because it involves a step-by-step approach, where each phase must be completed before moving on to the next phase in sequence. The research methodology in this study includes steps such as problem identification, research objective formulation, data collection and processing, system design, system development, testing, and improvement.	The use of an RFID-based integrated information system at the University will help users and officials in managing and monitoring every student activity, both academically and administratively, in a structured and centralized manner. Furthermore, data processing and services in the University's academic administration application that utilizes RFID will become more efficient and effective through the adoption of an integrated RFID-based information system. With this system in place, management can process data through a single system, thereby automatically updating data on the server, reducing unnecessary data redundancy.
Hermanto and Supangat, 2018	<i>Integration of EA and IT service to improve performance at higher education organizations.</i> MATEC Web of Conferences, 154, pp. 8–11. doi: 10.1051/mateconf/201815403008	The information technology architecture used in this project references TOGAF, and subsequently, integration and mapping of that architecture with ITIL are carried out.	Polytechnic XYZ may align services and accomplish business goals and technology alignment by integrating ITIL with TOGAF. This is made feasible by the fact that TOGAF offers a methodology and structure that helps business and IT stakeholders change IT across the enterprise, while ITIL offers a framework that helps businesses deliver IT services.
Yu, 2018	<i>Platform Design of Sports Meeting Management System for Regular Colleges and Universities Based on B / S.</i> Wireless Personal Communications. 102(2), DOI: 10.1007/s11277-017-5178-z.	Modular design is a method in the system design process that prioritizes the design of modules before the overall system design. Modular design involves the classification and design of a series of functional modules based on the functional analysis of the product, with each module having different functions or similar functions but different performance or specifications within a certain range. By using this approach, various products can be created by selecting and combining suitable modules to meet various market demands.	A web-based sports game management system was designed and developed in three phases: interface design, functional module design, and database design. Automatically collecting training results and managing training and competition information, this system safeguards and enhances the efficiency of personal data storage. Through a wireless network, system administrators and users can easily search for and access data. Furthermore, the system features an attractive and user-friendly interface, saving energy and material resources and allowing the use of electronic equipment at game locations for data entry.

Yu <i>et al.</i> , 2022	<i>Research on the Construction of Intelligent Sports Health Management System Based on Internet of Things and Cloud Computing Technology.</i> Wireless Communications and Mobile Computing, 2022(1):1-12, DOI: 10.1155/2022/7133810.	The Internet of Things (IoT) technology in the smart grid primarily involves three main components, namely the application layer, the network layer, and the perception layer.	This study develops an intelligent sports health management system that considers a wide range of student health-related variables. The system enables course scheduling, course selection, and interactive teacher-student contact. It is built on the Internet of Things (IoT) and cloud computing technologies. Additionally, the system integrates sustainable health management for students and enables sports health information management.
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The initial literature search yielded a total of 6,705 articles (161 from Scopus, 3,924 from Google Scholar, and 2,620 from Semantic Scholar). After reviewing the abstracts for relevance and matching with the inclusion criteria, 115 articles were selected for full-text review, and ultimately, 7 articles were chosen for further examination.

DISCUSSION

The Role of Integrated Management Information Systems in Enhancing User Experience

The primary goal of an Integrated Management Information System is to improve the accessibility of sports facilities for users. A computer-based integrated management system, capable of combining internet resources, enables users to access the latest and comprehensive sports information. The integrated management information system allows students to view the most accurate standard sports displays, enabling them to grasp the essential points of each item and improve their sports skills (Zhang, 2019). Easier access allows visitors to plan and organize their sports activities more effectively, resulting in a better on-site experience (Shan and Han, 2021).

Furthermore, integrated management information systems can also enhance the services provided by sports facilities to their users (Ndayisenga and Tomoliyus, 2019; Yu *et al.*, 2022). Through interactive platforms or online surveys, facility management can collect and analyze real-time user feedback to assess user satisfaction, identify areas for improvement, and take necessary actions. This information can be used to evaluate user satisfaction, identify areas for improvement, and take appropriate measures. In addition, integrated management information systems can integrate monitoring and security systems to ensure safe and comfortable use of sports facilities for all users (Zhang, 2019; García-Pascual *et al.*, 2021).

Integrated management information systems can also be used to personalize the user experience at sports facilities. They can create user profiles with their interests and preferences for specific sports, which can be used to make recommendations and offers that better align with user interests, increasing engagement and satisfaction. Additionally, integrated management information systems can track user usage history and performance in sports, providing better monitoring and support in achieving their sports goals (Yu, 2018).

Moreover, integrated management information systems help sports facility management efficiently manage resources, inventory, and maintenance. Integrated information within the integrated management information system allows facility management to schedule, monitor availability, and optimize facility usage (Yu *et al.*, 2022). This helps avoid overlapping and scheduling conflicts, enabling users to easily access facilities as per their needs. Furthermore, integrated management information systems can also integrate maintenance and repair systems, ensuring that sports facilities remain in good and safe conditions (Talapatra, Uddin and Rahman, 2018).

Impact of Integrated Management Information Systems on Service Quality in Sports Facilities

Integrated management information systems improve the accessibility of sports facilities. Online booking systems and integration with information systems allow customers to reserve facilities, view availability schedules, and

make quick payments (Kurniawan, 2018; Yu *et al.*, 2022). This reduces waiting times and enhances the user experience.

Integrated Management Information Systems enhances the operational efficiency of sports facilities by simplifying administrative and management processes (Zhang, 2019). For example, integrated membership management systems can manage user databases, including payment records, schedules, and membership data (Zhang, 2019). Integrated management information systems enable employees to quickly access relevant information and perform administrative tasks more efficiently. This reduces the workload of employees and gives them more time to serve customers (Fiaz, Ikram and Ilyas, 2018).

Moreover, improved service quality can be achieved through the use of integrated management information systems (Fiaz, Ikram and Ilyas, 2018; Puspitasari *et al.*, 2019; Masri *et al.*, 2020). Integrated customer management systems enable facilities to track customer preferences and needs, allowing for customized services based on individual preferences, such as recommendations for relevant classes or sports programs. Integrated Management Information Systems also allows user feedback through evaluation and review features, which can be used to continually enhance services.

In this digital era, Integrated Management Information Systems have been proven to have a positive impact on the quality of services at sports facilities. By enhancing accessibility, operational efficiency, and personalized services, integrated management information systems enable sports facilities to provide users with a better experience. However, it is important to note that the successful implementation of integrated management information systems requires strong support from management, adequate investment in technology infrastructure, and proper training for the involved staff.

Challenges and Barriers in the Implementation of an Integrated Management Information System

The Implementation of Integrated Management Information Systems in sports facilities aims to enhance user experience and service quality. However, there are several challenges and obstacles that must be addressed in the process of implementing Integrated Management Information Systems. Here are some of the main challenges identified based on recent literature:

- a. **Resource Limitations:** Implementing integrated management information systems requires adequate resources, such as budget, personnel, and technology infrastructure (Yu *et al.*, 2022). The challenge lies in the limitation of resources that can impact the comprehensive implementation of integrated management information systems. Lack of budget for hardware, software, and human resource training can hinder the successful implementation of integrated management information systems.
- b. **Need for Organizational Culture Change:** Implementing integrated management information systems often involves a change in organizational culture (Puspitasari *et al.*, 2019). Using integrated information systems requires a change in how the organization operates and manages data and information. This challenge can arise due to resistance to change, entrenched old habits, or lack of support and awareness from management and staff. Building awareness, effective communication, and employee engagement can help overcome these barriers.
- c. **System Integration Complexity:** Integrated management information systems involve integrating various different systems and modules, such as membership management, facility booking, inventory, and finance (Widiastuti, 2020). Challenges occur when there are difficulties in integrating existing systems with the new system due to differences in data structure, communication protocols, or the specificity of existing systems. Significant efforts are required to ensure compatibility and compatibility among the various systems involved.
- d. **Data Security and Privacy:** Implementing integrated management information systems can lead to increased risks related to data security and privacy (Yu, 2018). Sensitive data, such as membership information or financial data, must be adequately protected to prevent unauthorized access or Management Information Systems use. Challenges in this regard include protection against cyber threats, compliance with privacy regulations, and safeguarding against data loss or breaches.
- e. **Knowledge and Skill Limitations:** Implementing integrated management information systems requires a good understanding of information technology and management systems (Fiaz, Ikram and Ilyas, 2018; Trunina *et al.*, 2018). The challenge that arises is the limited knowledge and skills of the staff involved in the implementation of integrated management information systems. Effective training and adequate technical support are required to strengthen the staff's capabilities in managing and utilizing integrated management information systems effectively.

In addressing these challenges, sports facilities need to consider key factors such as proper resource allocation, effective management support and communication, staff training, and the selection of appropriate technology to ensure the successful implementation of integrated management information systems. The successful implementation of integrated management information systems can have a positive impact on user experience and service quality in sports facilities, thereby adding value to the entire organization.

Recommendations and Implementation of Integrated Management Information Systems in Future Sports Facilities

Sports facilities will face challenges and opportunities to enhance customer experience and service quality in the future. Implementing an Integrated Management Information System is a great way to achieve these goals. Sports facilities can optimize user experiences by incorporating the latest technologies such as the Internet of Things (IoT), mobile-based applications, and Artificial Intelligence (AI) (Yu *et al.*, 2022). By implementing an AI-based integrated management information system, sports facilities can learn user preferences and make recommendations for them. Additionally, IoT integration allows real-time facility condition monitoring, improving operational efficiency and user convenience (Yu *et al.*, 2022).

Mobile-based applications serve as a means to provide easy and quick access for users to find information, make reservations, and provide feedback (Hermanto and Supangat, 2018). However, amid technological advancements, data security and user privacy must be prioritized. Implementing integrated management information systems in the future should ensure the security and protection of user data to build trust and enhance user satisfaction. By following technology trends and focusing on a better user experience, sports facilities can continue to evolve and provide superior services in an increasingly advanced digital era.

CONCLUSION

The implementation of an Integrated Management Information System in sports facilities has been proven to play a significant role in enhancing user experience and service quality. Through the integrated management information system, users can easily access information, make online reservations and payments, and provide feedback to improve services. Furthermore, the integrated management information system also allows for user experience personalization and tailored recommendations. The process of implementing the integrated management information system requires an evaluation of facility needs and objectives, staff training, and user system introduction. Data security and privacy are also crucial factors in the use of integrated management information systems. Looking to the future, the adoption of the latest technologies such as Artificial Intelligence (AI), Internet of Things (IoT) integration, and mobile-based applications will be key to enhancing the effectiveness of the integrated management information system. However, awareness of user data protection and privacy must be maintained. By focusing on user experience and adapting to technological advancements, sports facilities can continue to evolve and provide superior services in an increasingly advanced digital era.

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Conflicts of interest

– No conflicts of interest are disclosed by the writers.

Future investigations

From the results of these studies, practical implications can be applied in future research on marketing strategies that focus on service quality to create customer satisfaction and create loyal customers.

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STRATEGIES FOR DEVELOPING LOCAL WISDOM-BASED SPORT TOURISM TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS (SDGS) IN SOUTH SULAWESI PROVINCE

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Abstract: This study explored the development strategies of sport tourism based on local wisdom in South Sulawesi Province to achieve the Sustainable Development Goals (SDGs), particularly in poverty reduction. The SDGs, adopted in Indonesia through Presidential Regulation No. 59 of 2015, prioritized poverty alleviation as a primary goal. This research assessed the potential of sport tourism by leveraging the diversity of nature and local culture to enhance the rural economy. South Sulawesi, rich in natural and cultural resources, offered significant potential for sport tourism. Activities such as marathons at the Maros GeoPark, mountain biking in Malino Pine Forest, and jet ski festivals at Tanjung Bira Beach attracted tourists and stimulated the local economy. However, the decline in tourist visits highlighted the need for new strategies. A qualitative method was used to analyze the potential and obstacles in sport tourism development. The results showed that sport tourism based on local wisdom could reduce poverty through job creation and increased income from tourist spending. The elements of “something to see,” “something to do,” and “something to buy” in South Sulawesi enhanced tourism appeal and the local economy. Challenges such as infrastructure, stakeholder coordination, and community training needed to be addressed. This study suggested better traffic systems, effective communication, and the enhancement of local human resource capacities. An inclusive approach in planning and managing tourist destinations was expected to maximize economic benefits while preserving the local environment and culture, making sport tourism based on local wisdom a sustainable development model for South Sulawesi.

Keywords: Sport, Tourism, Development, Local wisdom.

INTRODUCTION

Sustainable Development Goals (SDGs) is a new global development platform agreed upon by 193 member countries of the United Nations (UN). The SDGs serve as a continuation of the Millennium Development Goals (MDGs), which ended in 2015 (Aji & Kartono, 2022). The globally scoped Sustainable Development Goals were later adopted in Indonesia as part of the sustainable development goals outlined in Presidential Regulation No. 59 of 2015. These goals have been integrated into national and regional development agendas, extending down to the village level (Natalia & Maulidya, 2023).

One of the primary objectives of the Sustainable Development Goals (SDGs) is “No Poverty,” aimed at eradicating poverty. Poverty is a multidimensional issue that has broad impacts on individuals and society. It not only affects the economic aspect but also leads to other social problems (Komalasari, 2023). Poverty remains a major issue in Indonesia, with the number of poor people reaching 26.36 million (BPS Indonesia, 2023). This figure indicates that poverty levels in Indonesia are still quite high, with much of it concentrated in rural areas (Purwanti, 2024).

The high level of poverty in rural areas has driven urbanization, with residents migrating from villages to cities in an attempt to escape poverty, drawn by job opportunities and higher wages in the industrial and service sectors of urban areas. This phenomenon aligns with Todaro’s Migration Theory, which states that the primary motivation for workers to migrate is the expectation of higher wages (Todaro & Smith, 2006). Excessive urbanization can lead to various issues, not only in the destination cities but also in the rural areas left behind. Problems in cities include

increasing poverty rates, the rise of slum settlements, higher urban crime rates, air and noise pollution, among other issues (Syafira & Triani, 2021). In rural areas, the depletion of human resources due to migration to cities can hinder significant development (Yanuar et al., 2023).

One strategy to reduce rural poverty is by optimizing the local potential in each region (Setiadi & Pradana, 2022). Tourism is one sector that can be leveraged, as it can generate demand in both consumption and investment, which in turn drives the production of goods and services (Hidayatullah & Suminar, 2021). Tourists spend money, which directly increases market demand for tourism-related goods and services. This creates new opportunities to boost rural incomes and generate employment (Eddyono, 2021). South Sulawesi is a province with significant tourism potential, as evidenced by its geographic conditions, which offer abundant natural resources. In addition to these natural assets, South Sulawesi's rich cultural diversity is also a major attraction for cultural tourism, enticing international tourists to visit (Surur et al., 2014). However, according to data from BPS South Sulawesi (2023), the number of tourists visiting the province decreased by 28.76%. In January 2023, only 1,090 international tourist arrivals were recorded, compared to 1,530 in December 2022.

One strategy to attract both domestic and international tourists to South Sulawesi is by developing new tourism markets, such as sport tourism. Sport tourism, a combination of sports and tourism, is a growing sector that has been drawing increasing numbers of tourists worldwide (Jiménez-García et al., 2020). As a branch of sustainable tourism, sport tourism offers a solution that balances conservation needs with economic demands, particularly for communities surrounding tourist destinations (Zhao & Xia, 2020). This highlights the importance of exploring and developing strategies to optimize the benefits of sport tourism. Such an approach involves local communities not only as beneficiaries but also as active stakeholders in managing and developing sport tourism (Ridwanullah et al., 2021). Through direct participation, communities can contribute to environmental conservation while simultaneously enhancing their economic well-being (Hidayat et al., 2024). By focusing on local economic empowerment, this approach is relevant not only to the global sustainable development agenda but also to local needs for job creation and economic diversification. Sport tourism, based on local wisdom, can become a development model that provides broad benefits, from poverty reduction to environmental preservation (K et al., 2023).

This research became highly relevant in the present context, as many local communities struggled to find economic development alternatives that were not only financially profitable but also sustainable and ethical. The increasing pressure on natural resources and the environment required innovative and inclusive approaches to tourism development that prioritized environmental sustainability and the socioeconomic well-being of local communities (Manurung et al., 2019). Based on the above background, the problem formulation of this research aimed to identify the obstacles faced by the government and local communities in utilizing tourism potential, as well as the effective strategies for developing sport tourism. By understanding the factors that influenced the success and failure of sport tourism development initiatives, stakeholders could develop more effective strategies to promote local economic empowerment through sustainable tourism.

RESEARCH INSTRUMENTS

This research employed a qualitative analysis method, which is a series of systematic, factual, and accurate investigations into social phenomena that provide a comprehensive and holistic overview of tourism potential as a location for sport tourism and the development strategies for sport tourism-based tourism in South Sulawesi. The study aimed to offer a better understanding of the situation or issue being studied. The research was conducted in the province of South Sulawesi. The steps to select the subjects as samples involved determining the areas for the study, considering locations that had the most frequent direct interaction with the local community as a clear selection criterion to ensure that the cases were relevant to the research problem. The research locations included the Maros GeoPark, where marathon running around the GeoPark could be developed as a form of sport tourism; the Malino Pine Forest in Gowa Regency, where mountain biking (MTB) could be promoted; and Tanjung Bira Beach in Bulukumba Regency, where a Jet Ski Festival could be established as a sport tourism event.

The stages of this research began with selecting the tourism locations: GeoPark in Maros Regency, Malino Pine Forest in Gowa Regency, and Tanjung Bira Beach in Bulukumba Regency. This was followed by the development of research instruments, including documentation, interview guidelines, and observation checklists, to collect data through in-depth interviews with community members from various levels and by observing their work processes and interac-

tions in the development of sport tourism. The collected data were analyzed using thematic analysis to identify themes, patterns, and relationships within the data, providing a holistic understanding of sport tourism development strategies. The data analysis technique employed was the interactive model of analysis, focusing on three components: data reduction, data display, and conclusion drawing, which included stages of inference and verification (Miles et al., 2019).

RESULT

The results of this research indicated that the development of sport tourism based on local wisdom in South Sulawesi Province offers significant potential to achieve the Sustainable Development Goals (SDGs), particularly in reducing poverty in rural areas. By leveraging local natural and cultural assets, such as the Maros GeoPark, Malino Pine Forest in Gowa Regency, and Tanjung Bira Beach in Bulukumba Regency, sport tourism can become an effective alternative to boost the local economy and create jobs. Activities like marathons, mountain biking, and jet ski festivals not only showcase the beauty of the local environment but also stimulate the economy through increased tourist spending and local market demand.

This research identified that the element of “something to see” in sport tourism based on local wisdom in South Sulawesi is highly appealing to tourists. One example is the Maros GeoPark, which offers unique and stunning geological scenery. The diverse rock formations and biodiversity in this area create a rich and educational visual experience. Visitors can enjoy the natural beauty while learning about the geological processes that shaped the region, making it a tourist destination that is not only attractive but also informative.

In addition to the breathtaking scenery, this research also highlighted the element of “something to do,” which involves various sporting activities at the Malino Pine Forest and Tanjung Bira Beach. At the Malino Pine Forest, visitors can enjoy the challenging activity of mountain biking, inviting them to explore beautiful natural trails. Meanwhile, Tanjung Bira Beach offers thrilling experiences through jet ski activities, providing tourists with the opportunity to enjoy excitement on the water. These activities are not only entertaining but also promote an active lifestyle, attracting visitors from diverse backgrounds.

The element of “something to buy” in the development of sport tourism also holds significant potential to boost the local economy. As the number of tourists increases, the demand for local products and services will also rise. Local communities can seize this opportunity to sell handicrafts, souvenirs, and regional delicacies. The sale of these products not only provides additional income but also allows the community to introduce local wisdom to tourists. Thus, the development of sport tourism based on local wisdom not only focuses on the tourism experience but also emphasizes the economic empowerment of the community through sustainable local trade.

Despite its significant potential, this research also identified several obstacles to the development of sport tourism. Key challenges include a lack of adequate infrastructure, coordination among stakeholders, and the need for training for local communities to enable them to participate effectively in this sector. Therefore, the main recommendations from this research emphasized the importance of establishing a good traffic management system, effective communication between the government and the community, and enhancing local human resource capacity to support sustainable sport tourism development.

The study also highlighted the need for an inclusive and sustainable approach to sport tourism. By actively involving local communities in planning and implementation, sport tourism can not only provide economic benefits but also aid in the preservation of the environment and local culture. Community participation in the management of tourist destinations can mitigate negative environmental impacts and ensure that the benefits of tourism are equitably shared among all parties involved.

Overall, the development of sport tourism based on local wisdom in South Sulawesi can serve as a beneficial and sustainable development model. With the right strategies, sport tourism can support the achievement of the Sustainable Development Goals (SDGs) by reducing poverty, protecting the environment, and enhancing the quality of life for local communities. This research provides valuable insights into how sport tourism can be optimized to achieve sustainable development goals while respecting and leveraging local wisdom.

DISCUSSION

The development of sport tourism based on local wisdom in South Sulawesi Province represents a promising strategy to support the achievement of the Sustainable Development Goals (SDGs), particularly in addressing poverty.

The SDGs, as a global agenda adopted in Indonesia through Presidential Regulation No. 59 of 2015 (Amirya & Irianto, 2023), emphasize poverty alleviation as one of the main objectives. In South Sulawesi, with its rich natural and cultural potential, the development of sport tourism can make a significant contribution to reducing poverty in rural areas. Sports activities combined with tourism, such as marathons, mountain biking, and jet ski festivals, offer opportunities to enhance the local economy and create new jobs, which can directly increase the income of local communities.

This research demonstrates that sport tourism in South Sulawesi can enhance tourism appeal through engaging elements such as “something to see,” “something to do,” and “something to buy.” The GeoPark of Maros offers unique geological beauty, the Pine Forest of Malino provides challenging mountain biking trails, and Tanjung Bira Beach presents exciting jet ski activities. These elements not only enrich the tourist experience but also have great potential to attract more visitors, thereby increasing the demand for local products and services. With the rise in tourist spending, local communities can gain greater economic benefits from the sale of handicrafts and regional delicacies.

This research aligns with the impact analysis of sport tourism conducted in the Thousand Islands, which showed that the development of sport tourism can have a significant positive effect on the well-being of local communities. The study found that sports activities integrated with tourism not only attract visitors but also increase local income through job creation and enhanced demand for local products and services. This reflects a similar potential in South Sulawesi Province, where sport tourism based on local wisdom can be an effective tool for poverty alleviation (Widy-aningsih et al., 2020).

However, the development of sport tourism is not without its challenges. This research identifies key obstacles such as inadequate infrastructure, poor coordination among stakeholders, and the need for training for local communities. These challenges must be addressed for sport tourism to develop optimally. Effective traffic management, clear communication between the government and the community, and capacity building for local human resources are essential steps to support the sustainable development of sport tourism. This will ensure that the potential of sport tourism can be maximized for the benefit of the local economy.

In line with the efforts to develop tourist villages in Klungkung Village, Jember Regency, which aim to enhance economic independence based on local potential, the development of sport tourism in South Sulawesi also focuses on leveraging local resources to stimulate the economy. Both studies emphasize the importance of recognizing and optimizing existing resources, whether in the form of tourist attractions, culture, or sports activities, to improve the welfare of local communities. Furthermore, the research in Klungkung indicates that optimal management of local potential involves various aspects such as amenities, accessibility, and information. This aligns with the challenges faced in the development of sport tourism, where adequate infrastructure and coordination among stakeholders are crucial. By conducting surveys and in-depth discussions, the study in Klungkung can provide valuable insights into how similar strategies can be applied in the context of sport tourism to address existing obstacles and ensure sustainable development (Mulyono et al., 2024).

This research identified that local wisdom-based sport tourism provides “something to see,” “something to do,” and “something to buy,” which can enhance the tourist appeal in South Sulawesi. For instance, GeoPark in Maros Regency offers unique geological views, while Pine Forest in Malino and Tanjung Bira Beach provide sports activities such as mountain biking and jet skiing. Additionally, these activities have the potential to improve local skills and increase community income through the sale of local products and services related to tourism.

This study aligns with the analysis of the tourism potential of Blue Lagoon Beach in Bali, which also emphasizes the importance of the components “something to see,” “something to do,” and “something to buy” in developing tourist attractions. At Blue Lagoon Beach, research indicated that despite its significant potential, management needed improvement to offer appealing attractions and adequate facilities. This reflects the necessity for a well-planned strategy to optimize tourist appeal, similar to the approach taken in the development of local wisdom-based sport tourism in South Sulawesi. Furthermore, the study of Blue Lagoon Beach identified various facilities that could support tourist activities, including shopping venues and additional services. This relates to the findings that indicate sport tourism not only offers sports activities but also creates opportunities for tourists to purchase local products. By developing suitable facilities in both Blue Lagoon Beach and in the context of sport tourism, these locations can enhance the tourist experience and provide economic benefits to the local community (Paramitha, 2022).

An inclusive and sustainable approach is crucial in the development of sport tourism. Active participation of local communities in the planning and implementation of sport tourism projects ensures that economic benefits are

also felt by the local community. Furthermore, involving the community in managing tourist destinations can aid in the preservation of local environment and culture. By engaging the community directly, negative impacts on the environment can be minimized, and the profits from tourism can be distributed fairly. This approach aligns with the principles of the Sustainable Development Goals (SDGs), which prioritize sustainability and social welfare.

The active participation of communities in managing tourist destinations not only supports economic sustainability, but also helps preserve the environment and local culture. This is in line with research findings in Bulukumba which show that the involvement of various stakeholders, including community groups such as Pokdarwis, is crucial for tourism sustainability and improvement (Ahmad et al., 2024). Overall, the development of local wisdom-based sports tourism in South Sulawesi has the potential to be an effective and sustainable development model. With the right strategy, sports tourism can not only support the achievement of the SDGs by reducing poverty and protecting the environment, but also improve the quality of life of local communities. This research provides valuable insights into how sports tourism can be optimized to achieve sustainable development goals while respecting and utilizing local wisdom. This positions sports tourism as a promising alternative for development in areas rich in natural and cultural potential, such as South Sulawesi. Especially in preserving traditional sports so that the next generation of the nation can maintain and utilize traditional sports as a vehicle in various aspects of development and education (Susanto et al., 2022).

CONCLUSION

The development of sport tourism based on local wisdom in South Sulawesi offered a potential solution to reduce poverty in rural areas. By leveraging the natural and cultural potential of locations such as GeoPark Maros Regency, Malino Pine Forest, and Tanjung Bira Beach, sport tourism could enhance the local economy through job creation and increased income from tourism. Sporting activities such as marathons, mountain biking, and jet ski festivals not only promoted the beauty of nature but also encouraged tourist spending, which positively impacted the local economy.

However, the development of sport tourism in South Sulawesi faced challenges such as inadequate infrastructure, poor coordination among stakeholders, and the need for training for local communities. Therefore, it was essential to implement inclusive and sustainable strategies by involving the community in the planning and management of tourist destinations. This approach would not only maximize economic benefits but also assist in the preservation of local environments and cultures. With the right strategies, sport tourism could serve as an effective and sustainable development model, aligned with the Sustainable Development Goals (SDGs), while providing long-term benefits for local communities.

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DEVELOPMENT OF IA TRAINER LEARNING MEDIA BASED ON ANDROID APPLICATION TO IMPROVE GROUNDSTROKE ABILITY OF BEGINNER TENNIS PLAYERS

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Abstract: The tennis lecture process that has been carried out so far is still conventional, so it is less effective in improving the learning outcomes of beginner tennis players. Therefore, a more effective learning media is needed and can trigger an increase in the learning outcomes of beginner tennis players. This study aims to develop learning media that suits the needs of beginner tennis players in tennis lectures. For this reason, researchers developed an android application-based IA trainer learning media to improve the groundstroke ability of beginner tennis players at FIK UNM. The feasibility test of the developed media was carried out by involving expert validators in conducting media validation, learning media validation, and material validation. Based on the average results of product validation, a score of 90.4% was obtained which was categorized as very feasible. So it can be concluded that the learning media IA trainer based on android applications to improve the groundstroke ability of beginner tennis players at FIK UNM is very feasible to use. Meanwhile, based on the results of the paired sample t test, the mean value of the beginner tennis player's groundstroke pre-test data is 13.55 and the mean groundstroke post-test data is 17.67, so that the mean difference is 4.117. So from the test results it is known that the groundstroke ability of beginner tennis players has increased. The results of the effectiveness test on the paired sample t test results above show that the difference in the pre-test and post-test results of beginner tennis player groundstroke skills. Based on the results of the study, it can be concluded that the android-based IA trainer media has an effect on improving the groundstroke skills of beginner tennis players.

Keywords: Development, Learning Media, Groundstroke, Tennis.

INTRODUCTION

The advancement of Science and Technology (IPTEK) has given rise to unique problems for education graduates in designing teaching materials that can improve the level of education. (Syafuruddin, 2023). Many educational institutions are currently utilizing advances in science and technology to create interactive learning materials that can be accessed via computers or Android smartphones. According to (Abdulrahman et al., 2020), (Van Den Beemt et al., 2020), And (Manca, 2020), existing research, studies, and literature support the idea that media is an effective instrument to enhance the learning process. Utilizing a variety of teaching resources in an engaging manner can help students overcome learning challenges, allowing them to acquire knowledge more easily, not limited by physical space and time constraints. The implementation of learning includes multimedia components in the form of Android applications to reduce student boredom during learning.

Makassar State University College located in Makassar City, South Sulawesi is an Educational Personnel Education Institution (LPTK) that specifically produces quality graduates in the field of sports education. The Faculty of Sports Science is one part of Makassar State University which aims to produce highly skilled graduates who are able to develop national sports that are ready to face global problems.

Tennis is a sport compulsory lectures in the study program of Sports Coaching Education, Physical Education, Health and Recreation-Elementary School Education, as well as the program of Physical Education, Health and Recreation of the Faculty of Sport Science, Makassar State University. Students who are classified as beginner tennis players are taught the theory and practice of playing tennis to develop their skills. In teaching groundstroke techniques in tennis, it is better to use effective and innovative learning materials. These materials must allow beginner

tennis players to learn independently, without being limited by time and location. Mastering groundstroke techniques is very important for beginner tennis players, because the technique is complicated but basic (Ngatman et al., 2022). By providing the opportunity to learn repeatedly, novice tennis players can better understand these techniques, considering the very limited duration of learning sessions on campus.

The main role of media in the learning process is as a tool that facilitates the creation of learning scenarios, thereby facilitating the teaching and learning process and helping students understand the messages conveyed. (Kustyarini et al., 2020). Likewise, in a learning process carried out at the Faculty of Sports Science, Makassar State University, it is still conventional with the use of textbooks, whiteboards and also power point slides that cannot be utilized by beginner tennis players efficiently and effectively independently.

Based on the author's observations as a lecturer in the tennis course in the Physical Education, Health, and Recreation Study Program, there are various obstacles faced in the lecture process such as, only a small number of students have experience playing tennis before starting college, the majority of students lack knowledge about the rules of the game and basic tennis strokes, most new students are seen holding tennis rackets and balls and based on measurements of students' tennis groundstroke abilities, only a small number show proficiency in these skills.

Needs analysis was also conducted in the form of distributing questionnaires via Google Form to beginner tennis players who had taken a tennis course program which received 79 responses indicating: (1). 1.3% very easy, 25.3% easy, 50.6% difficult, 22.8% very difficult to understand and practice forehand groundstrokes. (3) 0% very easy, 13.9% easy, 53.2% difficult, 32.9% very difficult to understand and practice backhand groundstrokes. (4) 0% very unnecessary, 3% unnecessary, 41.8% necessary, 54% very necessary for an IA trainer learning media based on an Android application that can be used independently without space and time limitations to improve forehand and backhand groundstroke skills.

This shows that the shortcomings or limitations of current tennis lectures lie in the need to introduce new teaching methods so that students can optimize the development of their groundstroke techniques. Researchers are motivated to produce tennis learning media based on Android applications to improve the groundstroke skills of beginner tennis players at FIK UNM. IA Trainer learning media based on Android applications is an educational product that offers the benefits of presenting factual scenarios through audio visuals accompanied by text, Slowmotion Groundstroke Movements, and evaluations. practical learning in Android applications. This makes it easier for novice tennis players to understand and absorb information through visual, auditory, and textual means.

METHOD

This research focuses on Research and Development (R&D) research. Borg & Gall (1983: 624) defines educational research and development (R&D) as a systematic procedure used to create and authenticate educational instruments. (Rasminto & Purwantini, 2024). According to Sugiyono (2013:407), Research and Development is a research approach used to create certain items and evaluate their efficacy. (Purwono et al., 2023). The purpose of this project is to create and evaluate Android-based IA coach learning materials that focus on improving the groundstroke skills of novice tennis players at the Faculty of Sport Science, Makassar State University.

Research Procedures

The stages in this research consist of searching and collecting data (Research and Information Collecting), planning (Planning), developing the initial product form (Develop Preliminary Form of Product), initial field testing (Preliminary Field Testing), revision of the initial field test results (Main Product Revision), main field testing (Main Field Testing), revision of the operational product (Operational Product Revision), operational field testing (Operational Field Testing), refinement of the final product (Final Product Revision), dissemination and implementation (Dissemination and Implementation). (Rahma, 2024).

The research design applied is the development of IA trainer learning media based on an Android application to improve the groundstroke abilities of beginner tennis players with the following steps: 1) Determining the research subjects that will be used as data sources; 2) Conducting a pre-test; 3) Testing the learning media model that has been developed; 4) Conducting a post-test; 5) Comparing the average values of the post-test and pre-test of the groundstroke ability of beginner tennis players; (6) Conducting a t-test analysis aimed at determining whether or not there is an influence of the learning media developed to improve the groundstroke ability of beginner tennis players. The sub-

jects of this study were 60 beginner tennis players from the Faculty of Sport Science, Makassar State University. The sampling technique was carried out using purposive sampling by considering several criteria such as 1) the sample had programmed a tennis course, 2) was in good health, 3) was willing to take part in the research process, 4) was aged 18 to 21 years, 5) was present when the research was carried out. Purposive sampling is a sampling technique with certain criteria.(Campbell et al., 2020).

Data collection technique

Data collection method for needs analysis using survey technique to beginner tennis players. Data collection technique in the form of questionnaire, instrument used is Likert Scale: (1) very inappropriate, (2) inappropriate, (3) quite appropriate, (4) appropriate, (5) very appropriate. Meanwhile, to determine the effectiveness of learning media, the Dyer Tennis Test instrument is used. Dyer tennis test revision is a test of shot accuracy skills with beginner tennis players as subjects at college level. Equipment and supplies needed in carrying out this test include: (1) wall or board with a flat or smooth surface with a height of 20 ft (6.096 m) and a width of 20 ft (6.096 m); (2) Meter to measure the target used in the test; (3) tape or chalk to mark the target (height: 20ft, width: 20ft, and distance between target height and floor: 3 ft (0.914 m)) and the distance between the ball hitting place and the target is 20 ft (6.096 m); (4) ball basket and tennis ball; (5) tennis racket, (6) stopwatch, and (7) score sheet and pencil/ballpoint to record test results.

The Dyer Tennis Test Revision procedure begins with a warm-up. Before performing the test, the research subjects began with a 15-minute dynamic warm-up followed by a 5-minute warm-up of rallying techniques with a partner. After completing the warm-up, the research subjects took turns performing the test. The research subjects began the test by placing themselves on the hitting boundary line, which was 20 ft from the target (wall/board). A spare ball was placed behind the research subjects. The test began by serving from behind the hitting boundary line (all types of serves were allowed). When the ball touched the target, the stopwatch started. If the research subjects lost the ball during the first rally, they could continue using another ball. Each time they started hitting, they were required to serve from behind the boundary line. The research subjects rallied with the target for 30 seconds.

The test was conducted twice during the lecture. The scoring of the Dyer Tennis Test Revision was carried out with the following provisions: 1) one point was counted each time the ball was hit and entered the target (above the 3 ft net line); 2) a ball that touched the target line still got a point; 3) a rally that did not start with a serve would not be counted; 4) a ball that was hit by the research subject in front of the boundary line did not get a point; 5) a ball that did not enter the target or outside the target line did not get a point(Alim & Nurfadhila, 2021).

Based on the results of the data analysis that has been done, the r value is 0.975. The reliability coefficient ranges from 0 to 1, with 0.7 as the standard threshold for adequate reliability for group comparisons and a stricter minimum threshold for individuals of 0.90.

Data Analysis Techniques

The effectiveness test used was an experiment with a one group pre-test and post-test design. Hypothesis testing used the Paired Sample T Test which had previously undergone prerequisite testing (normality test). The data collected were analyzed using the SPSS version 29 application.

RESULTS

The data presented in this study is groundstroke ability.beginner tennis players obtained through pre-test and post-test data aimed at determining the increase in groundstroke ability of beginner tennis players after being given IA trainer learning media based on android applications. To test the hypothesis, a T-Test was used which first went through a data normality test.

Descriptive Analysis

This descriptive analysis aims to provide an overview of the results of the groundstroke abilities of novice tennis players before and after being given treatment in the form of IA trainer learning media based on an Android application.

Table 1. Descriptive test results

	Mean	Median	Std. Deviation	Range	Max.	Min.	Sum
Pre-Test Groundstroke	13.55	14	2,190	10	18	8	813
Post-Test Groundstroke	17.67	18	2,176	9	22	13	1060

Based on the results of the descriptive test of the pre-test groundstroke and post-test groundstroke data, the results are as follows:following:

- The results of the descriptive test of the pre-test groundstroke data showed a mean value of 13.55; median of 14; standard deviation of 2.190; range of 10; lowest value of 8; highest value of 18; and sum value of 813.
- The results of the descriptive test of the post-test groundstroke data showed a mean value of 17.67; median of 18; standard deviation of 2.176; range value of 9; lowest value of 13; highest value of 22; and sum value of 1060.

Normality Test

Table 2. Data normality test results

	N	Sig.	Information
Pre-Test Groundstroke	60	0.225	Normal
Post-test Groundstroke	60	0.158	Normal

The results of the normality test of the pre-test groundstroke and post-test groundstroke data show that the Sig. value for the pre-test groundstroke data is 0.225. While the results of the normality test of the post-test groundstroke data show that the Sig. value is 0.158. Because the Sig. value of each data is > 0.05 , it can be concluded that the pre-test and post-test groundstroke data are normally distributed.

Hypothesis Testing

After the prerequisite test is fulfilled, the hypothesis test can be carried out. The hypothesis test is carried out using the Paired Sample T Test which aims to determine the effect of IA trainer learning media in improving the groundstroke ability of beginner tennis players.

Table 3. Results of the paired sample t-test

	N	Mean	Mean Difference	Sig.
Pre-Test Groundstroke	60	13.55	4,117	0.001
Post-Test Groundstroke	60	17.67		

Based on the results of the paired sample t-test, the mean value of the pre-test groundstroke data is known. beginner tennis players of 13.55 and the mean post-test groundstroke data of 17.67 so that the mean difference is 4.117. So from the test results it is known that the groundstroke ability of beginner tennis players has increased. The results of the effectiveness test on the results of the paired sample t test above show that the difference in the pre-test and post-test results of the groundstroke ability of beginner tennis players. So it can be concluded that the android-based IA trainer media has an effect on improving the groundstroke ability of beginner tennis players.

DISCUSSION

This research is a research on the development of learning media in tennis lectures. This tool aims to improve the groundstroke skills of beginner tennis players at FIK UNM. The development of this learning media was initiated to answer the challenges faced by beginner tennis players at the Faculty of Sports Science, Makassar State University. These players have difficulty in improving their groundstroke skills due to the lack of appropriate learning resources. The creation of IA trainer learning media based on Android applications through a systematic research and develop-

ment process, which involves various stages. Borg and Gall define educational research and development (R&D) as a systematic procedure used to create and authenticate teaching materials (Rahardjanto & Husamah, 2022). Based on this understanding, a series of research and development procedures are carried out in a continuous cycle. In each phase, the results of the previous process are consulted and utilized consistently, which ultimately results in the creation of new educational products.

The results of the analysis show that the IA trainer learning media based on android application is very feasible to be used to improve the groundstroke skills of beginner tennis players FIK UNM. This product shows very good quality and is very acceptable for use. Based on the validation and feasibility tests, it is clear that this learning media was developed specifically to improve the learning process of beginner tennis players in the physical education, health, and recreation study program. Students can use this educational media as a learning aid, so that they can increase motivation, foster interest in learning, understand the material offered easily, and practice it directly easily. Facilitate the process for teachers to disseminate information with maximum effectiveness and efficiency. The use of video media has been proven to increase the motivation of beginner tennis players to take lectures or courses, as shown by research conducted by (Barut Tugtekin & Dursun, 2022), (Noetel et al., 2021), And (Galatsopoulou et al., 2022).

The results of the analysis also show that the IA trainer learning media based on the Android application has an effect on improving groundstroke skills. beginner tennis players. This can be seen from the average post-test value of groundstroke ability which is better than the pre-test value of groundstroke ability. This is because the content of the learning media developed is able to present the implementation of groundstroke techniques in audio-visual and slow-motion movements. In addition to presenting audiovisual media, this application also provides evaluation materials to measure the progress of beginner tennis players in performing groundstroke techniques.

This android-based IA trainer learning media has an important role in improving the groundstroke ability of tennis players because it can provide a better understanding of game techniques and strategies. By using media such as instructional videos or match analysis, players can see examples of proper movements, correct body positions, and how to set the timing of the strokes directly. This allows them to visualize how effective groundstroke techniques are performed by professional players or coaches. In addition, audio-visual media allows players to replay the footage repeatedly, so they can analyze mistakes or deficiencies in their own techniques, and learn how to fix them in more detail and focus. (Tuma, 2020).

Furthermore, this audio-visual media can also be used as a feedback tool for players. Coaches can record training sessions and use it to show players areas for improvement in their groundstrokes. By seeing their own performance on video, players can more clearly understand suboptimal movements and correct inappropriate posture, footwork, or racket swing. The combination of visual and audio elements in this media provides a more comprehensive learning experience, which in turn accelerates the process of improving groundstroke ability and overall tennis skills.

In addition to assisting in visualization and feedback, this learning media is also effective for strengthening the cognitive aspects of players in learning strategies and game patterns related to groundstroke. For example, players can learn how groundstroke patterns are practiced in various game situations, such as long rallies or when facing opponents with different playing styles. Game strategy videos can help players understand when the time is right to hit a forehand or backhand groundstroke with the right placement on the court. The ability to anticipate an opponent's shot and respond with an effective groundstroke is essential in tennis, and audio-visual media can make it easier for players to hone this skill more systematically. The anticipatory attitude of the opponent's strategy needs to be analyzed so that later it can be used as a lesson for an athlete (Susanto et al., 2024), (Susanto et al., 2021).

In addition, audio-visual media allows simultaneous integration of theory and practice. Players not only learn groundstroke theory through the coach's explanation, but can also see first-hand how the theory is applied on the court. They can learn technical elements such as body rotation, weight transfer, and correct racket angle through detailed, slow-moving displays. As such, it helps create a stronger link between the understanding of theory and its application on the court, ultimately encouraging players to master effective and consistent groundstroke technique more quickly. In addition, the right media can help a player quickly master techniques and strategies (Susanto et al., 2022).

When taking practical lessons, Beginner tennis players will generally feel more comfortable copying the actions demonstrated in a video rather than relying solely on the information provided in a book or illustration. (Cojean & Jamet, 2022). Being involved in these activities will facilitate the teaching and learning process for both students and teachers. Video media improves students' understanding of educational materials by providing learning videos

that are played. In creating learning media, it is important to meet certain needs. Among them are creating basic, easy-to-understand, and interesting media in order to motivate students in learning. (Hardiansyah & others, 2022) And (Andriyani & Suniasih, 2021). Students consider digital learning materials in the form of videos to be more interesting than conventional media. (Harrison, 2020), (Lange & Costley, 2020), And (Queiroz et al., 2022). This media uses effective visuals to communicate the subject matter, which aims to increase student engagement and focus during the learning process. The implication of this study is that the resulting media can be further expanded until its effectiveness can be accurately assessed through data analysis, thus facilitating students' understanding of the teaching material. This will have a positive impact on improving student learning outcomes.

CONCLUSION

After going through a validation process of 5 (five) expert validators, consisting of media validation, learning media validation, material validation, tennis course lecturers, and FIK UNM beginner tennis players showed that the IA trainer learning media based on the android application to improve the groundstroke ability of FIK UNM beginner tennis players is very feasible to be used in the lecture process. Meanwhile, based on the results of the hypothesis test, it is known that the IA trainer learning media based on the android application has an effect on improving the groundstroke ability of beginner tennis players. Based on the results of the paired sample t test, the mean value of the pre-test groundstroke data for beginner tennis players is 13.55 and the mean value of the post-test groundstroke data is 17.67, so the mean difference is 4.117. So from the results of the test, it is known that the groundstroke ability of beginner tennis players has increased. The results of the effectiveness test on the results of the paired sample t test above show that the difference in the pre-test and post-test results of the groundstroke ability of beginner tennis players.

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EFFECT OF FINANCIAL SUPPORT OF THE FIRST COMPANION BRAND IN SOCIAL MEDIA ON THE QUALITY OF BRAND-CONSUMER RELATIONSHIP IN IRANIAN PREMIER FOOTBALL LEAGUE

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Abstract: The purpose of this research was to investigate the effect of supporting the first financial brand in social media on the quality of the brand-consumer relationship and brand-consumer compliance in Iranian premier football league. The current thesis was used in terms of intent, and the data was collected using descriptive survey research. This study's statistical demographic included both Iranian Premier League fans and spectators. Standard questionnaires were used to evaluate the study theories, and structural equation simulation with SPSS and Smart pls applications was used to collect data. Following the determination of the coefficient, 40 questionnaires were spread to Premier League viewers and followers. There were 332 samples for the dependent variable's stability and volatility, as well as its location in Cochran's formula. To be sure, 400 questionnaires were circulated to the audience in a non-probable manner, and the data from 332 questionnaires were analyzed. The results showed that the financial support of Hamrahe Aval brand of sports activities on social media affects brand-consumer compliance. Considering the significance coefficient of Z in the relationship between the financial support of Hamrahe Aval brand of sports activities on social media with the brand-consumer adaptation, which is equal to 19.915, this hypothesis has been confirmed the effect is similar to 0.654. To sum up, as Hamrahe Aval brand sponsorship of sports activities in social media and brand-consumer compliance increase, the brand-consumer relationship quality will improve.

Keywords: sports, Iran, social media, consumer, brand.

INTRODUCTION

Football is a social phenomenon and a suitable way to form people's identity. Football is considered one of the most popular sports, in particular, it can be considered a collective performance in which the team, players and fans are the symbol of a community, city or region, and in this environment, people find meaning and identity widely (Arakelian et al., 2020). Sports brands use social media to strengthen the consistency of their relationships with clients and communicate more efficiently (Kunkel, Biscaia, 2020). According to some research findings, sports sponsorship can impact the sponsor brand's brand value, brand recognition, brand properties, desire to buy, and self-compatibility. In reality, brands can improve the appeal of their products and their name by taking this step (Hudson et al., 2015). Brand-consumer adaptation seems to affect the consistency of the brand-consumer relationship. The sponsorship of the Hamrahe Aval brand of sports activities, especially football, is one of the things that must be tackled. A quick summary of the Premier League and FA Cup competitions can be seen in various forms (direct sponsorship of football clubs, commercial), promoting the Iranian football industry, and impacting a wide range of its target community. For example, during the draw ceremony for the 16th round of the Premier Football League (Persian Gulf Cup), Hamrahe Aval was announced as the Football Federation's most influential supporter and one of the league's most famous teams. Purpose of the study - clarify the critical question of whether the Hamrahe Aval brand's financial sponsorship influences the quality of brand-consumer relationship and brand-consumer compliance in sport.

METHOD

The current thesis was used in terms of intent, and data were collected using descriptive survey research. This study's statistical population included all spectators and followers of Iranian Premier League matches who followed

the league through stadium attendance or other media. Following the determination of the coefficient, 40 questionnaires were spread to Premier League viewers and followers. There were 332 samples for the dependent variable's stability and volatility, as well as its location in Cochran's formula. To be sure, 400 questionnaires were circulated to the audience in a non-probable manner, and the data from 332 questionnaires were analyzed. The following instruments were used to gather the necessary data (Do et al., 2015). Questions in the questionnaire: brand's sponsorship of sports activities on social media; brand-consumer compliance; brand-consumer relationship quality. The data collected from the questionnaire in this study is categorized after the study. Each variable's number or significance was calculated based on the data and scores obtained from the questionnaire to interpret the data and facts, following the proposed objectives. Then, by describing the details gathered in the form of descriptive tables and diagrams, a general picture of how they are distributed is created, which helps in various statistical patterns. The study hypotheses were then evaluated using the structural equation method in the following phase. This technique is most often used in multivariate data analysis, where multiple dependent variables are being evaluated simultaneously. Structural equation modelling is a multivariate and robust multivariate regression method and, more specifically, an extension of the general linear model that helps the researcher evaluate sets of regression equations simultaneously. Many of these tests were carried out using the SPSS24 and Smart Pls2 software packages.

RESULTS

This study aimed to investigate the effect of the Hamrahe Aval brand financial support of sports activities on social media affected brand-consumer relationship quality and brand-consumer compliance. Description of respondent's age, it can be seen that 51.5% of the respondents were under 25 years old, 37% were between 25 and 35 years old, 5.5% were between 35 and 45 years old, 1.2% were over 45 years old, and 8.4% did not answer this question. Description of respondent's education, it can be seen that the education's level of 35% of the respondents belongs to who didn't get their diploma, 30.4% diploma, 22% associate, 7.8% bachelor, 2.1% master, 0.3% doctoral and 2.4% did not answer this question. Description of Hamrahe Aval's history of using services, it can be seen that the rate of using Hamrahe Aval brand services is 0.6% of respondents under two years, 4.2% 2 to 3 years, 27.4% 3 to 4 years, 42.7% 5 Up to 6 years, 19.3% were 6 to 7 years old, and 2.4% were more than seven years old, and 3.4% did not answer this question. Number of games seen by Hamrahe Aval's respondents, it can be recognized that the number of games seen by Hamrahe Aval brand's respondents is 1.2% of the respondents fewer than five games, 44.8% 5 to 10 games, 48.8% 10 to 15 games 0.6% had played more than 15 games and 3.4% did not answer this question. For research hypotheses, the model is used as follows (Figure 1).

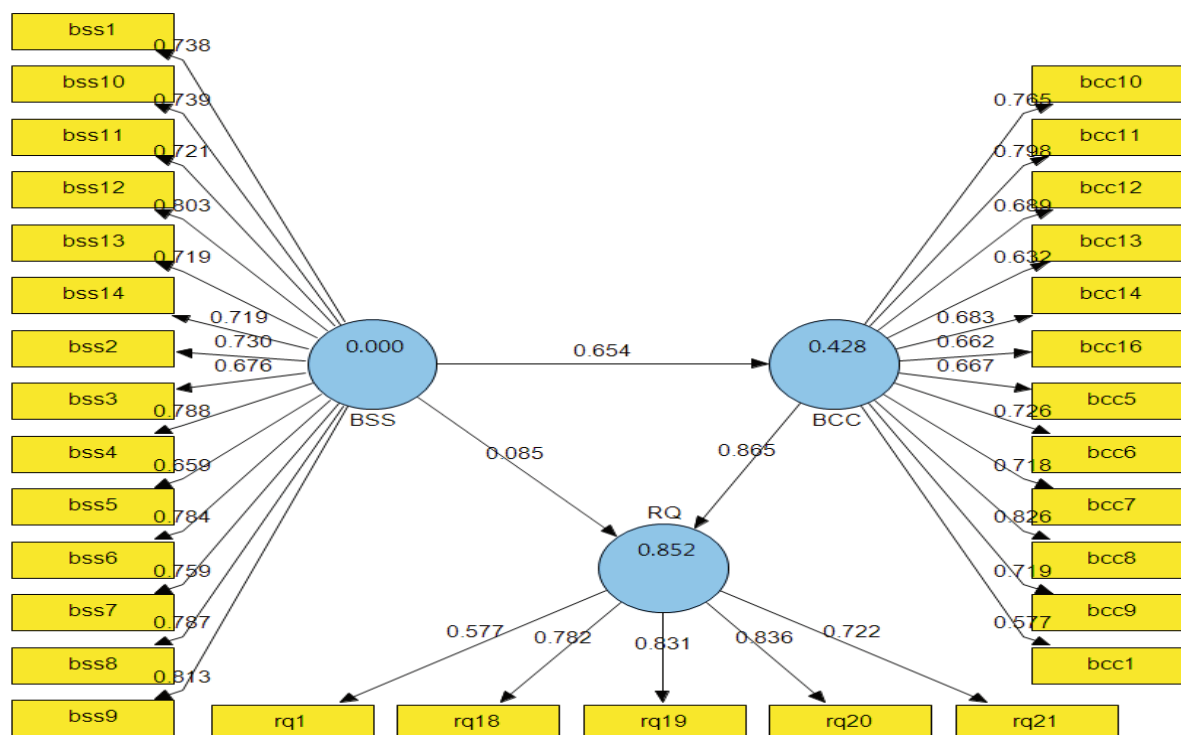


Figure 1. Structural equations' model in a significant state

According to the above figure can be obtained (Figure 2). Considering that the T-statistic in all cases is more than 1.96, so all the hypotheses of the present study were confirmed. The Hamrahe Aval brand financial support of sports activities on social media through brand-consumer adaptation affects the brand-consumer relationship quality. To test this hypothesis, the Sobel test and determining the intensity of the mediating effect should be used, which is discussed below.

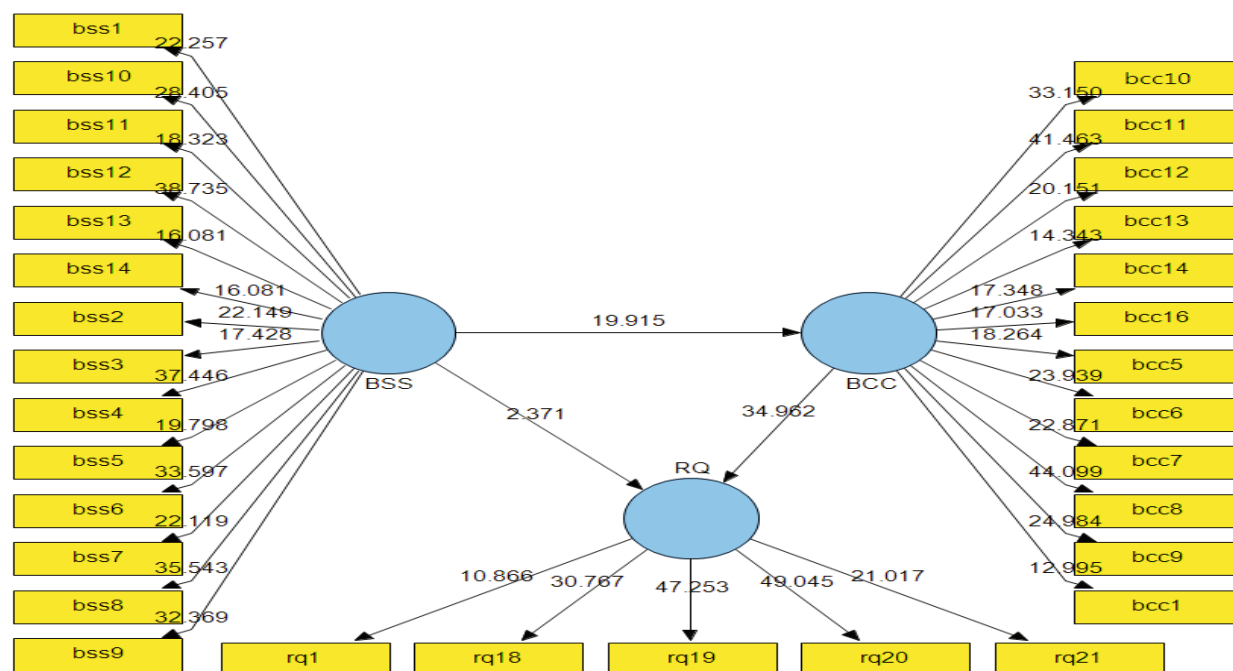


Figure 2. Structural equivalence modeling in standard mode

This test is used to examine the significance of one variable's mediating effect in the relationship between the other two variables.

$$Z\text{-value} = \frac{a \times b}{\sqrt{(b^2 \times s_a^2) + (a^2 \times s_b^2) + (s_a^2 \times s_b^2)}}$$

a - value of the path coefficient of the independent and mediating variables;

b - value of the path coefficient of the mediator and dependent variables;

Sa - standard error for independent and mediator variable path;

Sb - Standard error related to mediator and dependent variable path.

This value was calculated as 13401/17 about the role of partial mediation of brand-consumer compliance in the relationship between brand sponsorship of Hamrahe Aval brand of sports activities on social media and the quality of the brand-consumer relationship and at 95% confidence level can be said brand-consumer compatibility is confirmed in the relationship between brand-first support of sports activities on social media and the quality of the brand-consumer relationship.

The following information has been used to calculate this number:

$$S_b = 0.024765 \quad S_a = 0.033248 \quad b = 0.865 \quad a = 0.654$$

Beside the Sobel test, to determine the intensity of indirect effect through the mediating variable, a statistic called VAF is used, which is between 0 and 1, and the closer it is to 1, the stronger the effect of the mediating variable. The VAF formula is as follows:

$$VAF = \frac{a \times b}{(a \times b) + c}$$

a - value of the path coefficient of the independent and mediating variables; b - value of the path coefficient of the mediator and dependent variables; c - value of path coefficient of the independent and dependent variable.

This value was calculated to be 0.87 for the role of partial mediation of brand-consumer compliance in the relationship between brand sponsorship of Hamrahe Aval sports activity and the quality of the brand-consumer relationship, which means that approximately half of the total effect. The mediator variable of brand-consumer compliance indirectly explains Hamrahe Aval brand sponsorship of sports activities on social media and the quality of brand-consumer relationship.

DISCUSSION

The results showed that the financial support of Hamrahe Aval brand of sports activities on social media affects brand-consumer compliance. Considering the significance coefficient of Z in the relationship between the financial support of Hamrahe Aval brand of sports activities on social media with the brand-consumer adaptation, which is equal to 19.915, this hypothesis has been confirmed the effect is similar to 0.654. This finding is consistent with the results of (Do, Woodside, 2015; Segoro, 2013). This finding shows that the reflection of financial support for sports activities on social media affects the consumers of brand products and services, and in a way, a correlation is created between brand and sports activities image and athlete have received financial support; And consumers who feel there is a compliance between the image portrayed of the brand and the image they portray of themselves, a brand-consumer game is formed; Therefore, it can be told that there is a relationship between the financial support of Hamrahe Aval brand of sports activities on social media and brand-consumer compliance.

In another part of the study, the results showed that the financial support of Hamrahe Aval brand of sports activities on social media affects the brand-consumer relationship's quality. Considering the significance coefficient Z in the relationship between the financial support of Hamrahe Aval brand of sports activities on social media on the quality of the brand-consumer relationship, which is equal to 2.371, shows that this hypothesis has been confirmed and the effect is similar to 0.085. This finding is consistent with the results of (Tuškej et al., 2013; Fu et al., 2017). As in the previous hypothesis, it can be understood that with the brand's financial support of sports activities which is attractive for consumers, a good image of the brand is formed in the minds of consumers. When consumers feel their self image equal with their favorite brand image, the quality of brand-consumer relationship becomes stronger.

Also, part of the research results indicated that the Hamrahe Aval brand of brand-consumer adaptation affects the brand-consumer relationship's quality. Considering the significance coefficient of Z in the relationship between brand-consumer compliance with the quality of the brand-consumer relationship, which is equal to 34.962, shows that this hypothesis has been confirmed and the amount of this effect is similar to 0.865, which this finding the research of (Lee, Cho, 2017; Lou, Koh, 2017) is in line. According to this hypothesis, it can be concluded that when people feel that the image, they have in mind is in line with the idea of their favorite brand, they will establish a better relationship with the brand and, therefore, the quality of the brand-consumer relationship will be strengthened.

On the other hand, the results showed that the financial support of the Hamrahe Aval brand of sports activities on social media affects the quality of the brand-consumer relationship through brand-consumer adaptation. To test the hypothesis, the Sobel test and determination of the mediating effect's intensity were used. The Hamrahe Aval brand of sports activities on social media and the quality of the brand-consumer relationship was calculated to be 0.87, which is in line with the findings of (Yan et al., 2016). Considering the confirmation of the relationship between Hamrahe Aval brand sponsorship of sports activities on social media with the brand-consumer adaptation and the quality of the brand-consumer relationship, as well as the items related to the Hamrahe Aval brand sponsorship of sports activities on social media, It is suggested that the managers of Hamrahe Aval brand pay attention to other aspects in addition to the current sports support activities; For example, one of the things that can be more effective in the Hamrahe Aval is financial support in improving the province's sports infrastructure, such as the quality and quantity of sports facilities (stadiums, stadiums), which can increase the responsibility level.

Another factor that can effectively create a sense of brand-consumer compatibility is to provide an authentic and comprehensive brand image. Therefore, it is suggested that the managers of Hamrahe Aval brand try to present a clear idea of their brand so that the audience can communicate between the idea they know of themselves and the image of Hamrahe Aval brand formed in their minds, as well as sports managers by creating Personal traits in brand, attract customers and consumers to the brand so that they can make brands more attractive and desirable and improve the customers loyalty.

CONCLUSION

To sum up, as Hamrahe Aval brand sponsorship of sports activities in social media and brand-consumer compliance increase, the brand-consumer relationship quality will improve. By recognizing the importance of brand value and its influence on customer loyalty, sport managers investigate and invest in influencing factors such as social media advertising and creating brand awareness.

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FITNESS PROFILE OF CENTRAL JAVA PARAGLIDING ATHLETES

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Abstract: Background: Health and fitness, both physically and mentally, are very important in supporting achievements in the sport of paragliding.

Objective: to see the fitness level of Central Java paragliding athletes.

Method: quantitative survey on 30 paragliding athletes in Central Java. A total of 15 male athletes and 15 female athletes. Data collection techniques using a quality-of-life questionnaire survey and measurement of age, height, weight, blood pressure, HR, MHR, BMI, and endurance, strength and flexibility tests. Statistical analysis using SPSS.

Results: showed that the fitness level of Central Java athletes was good in terms of anthropometry, physical and mental health tests, and fitness tests.

Conclusion: The Central Java paragliding athlete test showed good health fitness, sufficient physical fitness, and good mental fitness.

Keywords: profile, physical, psychological, fitness, paragliding.

INTRODUCTION

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. It encompasses all aspects of a person's life, including lifestyle, environmental and genetic factors. (D. Listiarini et al., 2023b). Health does not only focus on the body, but also involves emotional, social, and spiritual well-being. (Stringer, 2023).

The health referred to includes physical and mental health. (Faulkner et al., 2021). Physical health includes optimal body function, resistance to disease, and the ability to carry out daily activities without significant obstacles. While mental health involves emotional balance, the ability to cope with stress, anxiety, and depression. Mental health also includes good cognition and a realistic perception of oneself and the world around us. (Pearson et al., 2013).

Health is the beginning to support physical activity, one of which is by doing sports activities. Sports are physical activities that are done with the aim of improving physical fitness and health. (Bailey, 2017). This activity involves body movements that contract and move muscles, which in turn improves the function of the heart, lungs, and other body systems. (D. Listiarini et al., 2023a). Exercise can also provide psychological benefits, such as reducing stress, improving mood, and increasing overall well-being. (Stubbs et al., 2017).

In addition to supporting health, sports also support achievement. Achievement sports, or competitive sports, are forms of physical activity that are oriented to achieving superior results in a competition or match. (Andrefson et al., 2023). The main focus of this sport is on the development of skills, physical abilities, strategy and superior performance. (Di Corrado et al., 2020). Athletes involved in competitive sports often train intensively to achieve high levels of skill and maintain their peak performance during competition.

One of the sports achievements is paragliding. Paragliding is an air sport that involves flying using a paraglider, a wing made of cloth that is hung on a tubular frame. (Paralayang, 2023). Paragliding is often done in mountainous or hilly areas that have enough wind to support flight. In addition to being an achievement, Paragliding offers a free and thrilling flight experience, and many people enjoy this sport as a hobby or recreational activity. (Wulandari et al., 2022). Nature lovers often find paragliding an exciting way to explore the scenery from above.

In carrying out paragliding sports activities as a support for achievement, athletes need to have good physical, psychological, and health conditions. The importance of knowing the level of athlete health is as a basis before doing physical activities, especially high-risk sports that are expected to have better fitness than other physical activities.

Therefore, researchers studied the health profile of paragliding athletes in Central Java. With the hope that if you already have initial data, it will be easier to provide training programs and see the health conditions of paragliding athletes in Central Java.

METHOD

This study uses survey quantitative. The research sample was 30 senior Central Java paragliding athletes aged 19-41 years. Questionnaire survey of name, gender, date of birth, age, race number, often participating in what race numbers, ever injured or not, health survey 12. Measurement of TB, BB, blood pressure, HR, MHR, BMI.

The survey is adjusted to the characteristics of the paragliding sport. The health survey consists of 12 questions that lead to a person's physical and psychological health level. Measurement of TB, BB, blood pressure, HR using tools that have been periodically validated and registered with the Indonesian Ministry of Health. Measurement of endurance using the VO2max beep test. Measurement of the back and legs using the back and leg dynamometer, arm strength using the push up test, and flexibility using the sit and reach measuring tool.

Analysis uses parametric statistics. Analyzes were conducted using the IBM SPSS Statistics for Macintosh, Version 27.0. Armonk, NY: IBM Corp, with a significance level of 0.05.

RESULTS

Characteristics of participants

Athlete survey

Table 1. Participant characteristics

Variables	Group n= 30		
	Mean	SD	p
Age (year)	27.6	5.6	0.494
Height (m)	1.67	0.05	0.064
Weight (kg)	64.5	9.5	0.489
BMI (kg/m ²)	23.3	2.06	1.000
MHR (bpm)	192.3	5.6	0.494

Notes. MHR – maximum heart rate, BMI – body mass index

The results of table 1 show that the characteristics of Central Java paragliding athletes have an average age of 27 years with a range of 19-41 years. This shows that this paragliding sport activity is in demand and carried out by various age categories. The results of the BMI of paragliding athletes show 23.3 kg / m² in the normal category. This shows that athletes are not underweight or overweight. The maximum heart rate (MHR) of athletes has an average of 192 bpm.

Health survey

In this study, a physical and psychological health survey was conducted which was combined into a questionnaire of 12 questions. The results can be seen in table 2.

Table 2. SF-12 Health survey

Variables	Group n= 30		
	Mean	SD	P
Physical	11.9333	1.55216	0.227
Mental	14.2333	1.54659	0.872

From table 2, it is found that there is no difference in physical and mental health of paragliding athletes in Central Java. This shows that the physical and mental conditions of paragliding athletes are normal. In paragliding, physical and mental must be in normal condition, because this sport is classified as an extreme sport so that in its implementation there should be no obstacles, let alone *human error*. Flight activities using this parachute adjust to weather conditions and altitude so that this health survey becomes a reference in the implementation of paragliding.

Athlete fitness profile

The health profile measured in this study is about physical and strength measurements. Measurements include endurance tests using beep tests, strength using back and leg dynamometers, push-ups, while flexibility tests using sit and reach. The parameters used are in accordance with gender and age. The results can be seen in table 3.

Table 3. Health profile of athletes

Variables	Group n= 30		
	Mean	SD	P
Vo2max	34.93	1,072	0 .018
Back strength	101.71	20,507	0 .040
Leg strength	136.57	34,736	0 .234
push up	17.00	3,961	0 .074
flexibility	38.21	4,949	0 .003

From the results of table 3, it can be concluded that the results of the paragliding athlete measurement test show that the average endurance is in the poor category. The strength test measurements for the back, legs, arms are in the good category, and flexibility is in the good category.

DISCUSSION

From the results of this study, it was found that the health level of Central Java paragliding athletes is in the good category, this is indicated by data $p > 0.05$. This is in line with the study that the health level of an athlete can be called good health, so that if they have received the attributes, the athlete already has better fitness than ordinary people. (D. Listiarini, Kurniawan, & Ma'arif, 2024). Another study states that athletes are people who do structured and measurable training programs so that they have better fitness than ordinary people. However, athletes do not always have good fitness, because many athletes do not maintain their bodies, they only do sports that are required for achievement. So many people ignore what sports are for fitness. While fitness is not only for physical but also for mental.

Height and weight were the anthropometric measurements in this study. The results showed that the height and weight of the athletes were normal. (D. Listiarini et al., 2023a). this is in line with the performance of athletes that athletes have normal body postures. but some athletes who have a lot of fat because of the characteristics of the sport sometimes not all are required to have an ideal body. by paying attention to body weight, doing sports will be more comfortable, especially paragliding using flying equipment that is adjusted to height and weight, if you do not pay attention to this it will interfere with flying (Paralayang, 2023).

Not only height and weight, but blood pressure and heart rate are very influential in paragliding. This study also explains that paragliding athletes have normal blood pressure and sufficient resting heart rate. This is in line with the health conditions of athletes who will have good blood pressure and resting heart rate. This study is also in line with paragliding, because paragliding uses parachutes and flies in the air, so it must have good health conditions such as blood pressure, heart rate, physical and psychological health conditions. These conditions will be affected if athletes experience unhealthy conditions, will be disturbed in training or championships. Health conditions will be very good if done regularly and continuously. This is used as monitoring and evaluation for coaches and sports management in helping athletes maintain body condition (D.-H. S. W.-A. N.-I.-N. Listiarini et al., 2024).

Not only that, in this study also conducted measurements of endurance and strength tests and flexibility (Bhutkar et al., 2011). the results of this study indicate that the level of endurance of paragliding athletes is lack-

ing and good strength. this is in line with the fact that exercise is important to maintain aerobic endurance. this is done to see a person's fitness level (D. Listiari, Kurniawan, & Shauma, 2024). athletes are sportsmen who must maintain their fitness because it supports the athlete's performance. (Tuttle et al., 2013). not only endurance, but strength is very important because paragliding is not easy to do and requires good strength and coordination, so that aerodynamics occur in flight. With this paragliding athlete fitness survey, it is hoped that the portion of training can be added to support paragliding. Added to the significant differences between male and female paragliding athletes in their checks.

Basically, sports have their own goals, such as paragliding which can be for recreation and also achievement. (Wulandari et al., 2022). paragliding sports have aspects such as aerobic endurance, speed, strength, coordination, and accuracy. therefore, physical condition is the main thing in preparing athletes for achievement, so that in providing training programs it is also based on the condition of the athlete individually (Balyi et al., 2013; D. Listiari, Kurniawan, & Shauma, 2024).

From the study above, there are several weaknesses, including the need for clinical checks to determine the biochemical conditions in the bodies of paragliding athletes. In addition, it is necessary to improve the performance of paragliding athletes in Central Java by carrying out training programs that are adjusted to the race numbers of each athlete. Further research is needed after the initial checks on paragliding athletes in Central Java, so that the training carried out can achieve the expected targets.

CONCLUSION

From this study, it can be concluded that the profile of paragliding athletes in Central Java is quite good, but there needs to be regular training, not only physical but also mental/psychological training so that the target achievement in a competition is achieved with maximum results.

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Rukopisi mogu biti odbijeni ako su napisani na lošem engleskom ili slovenskom jeziku. Autor je u potpunosti odgovoran za stil (formalan, nepristrasan u bilo kom smislu), jezik i sadržaj rada. Ipak, Urednički odbor ima pravo da komentariše formu i jezik rada prije nego što bude prihvaćen za objavljivanje. Očekuje se dobra, standardna upotreba gramatike u pisanom engleskom jeziku. Izbjegavajte nestandardne skraćenice.

LITERATURA

Potrebno je navesti sve izvore koji se koriste za vaš rad. Preporučuje se APA stil citiranja. Autori moraju da navedu kontakt podatke autora sa njegovim/njenim punim imenom, akademskim nazivom, institucijom, adresom, e-mail adresom i brojem telefona (opciono).

PROCEDURA RECENZIJE

Radovi poslani časopisu će najprije biti ocijenjeni od strane Uredništva imajući u vidu nekoliko kriterijuma: prikladnost teme i sadržaja časopisa; uređivanje (priprema rukopisa) i format; i “opšta” valjanost. Ako su ovi kriteriji ispunjeni, rad će biti poslat na dvostruku anonimnu recenziju od strane najmanje dva priznata i nezavisna recenzenta, a proces recenzije može trajati do 8 sedmica.

Samo radovi koji dobiju pozitivne recenzije će biti prihvaćeni. Jedan od presudnih razloga recenzije je navođenje citata i referenci relevantne literature. Urednički odbor ima pravo da komentariše formu rada prije nego što on bude prihvaćen za objavljivanje. Redakcija nije obavezna da objavljuje radove po hronološkom redosledu njihovog prijema ili po redoslijedu po kom su prihvaćeni za objavljivanje. Nijedan značajan dio rada ne treba da bude objavljen negdje drugdje. Prikazivanje rezultata u izvodima, sažecima, kratkim pregledima, disertacijama i magistarskim tezama, recenzijama i radovima sa konferencija (do tri stranice, koje sadrže sažetke, grafičke prezentacije i literaturu) ne smatra se objavljivanjem. Ako rukopis sadrži rezultate koji su već objavljeni, autor(i) moraju dobiti pristanak prvog izdavača i jasno citirati izvor.

ETHICS

Publication ethics, disclosure policy and malpractice statement

Publication and authorship

- All submitted articles are subject to strict peer-review process by at least two reviewers that are experts in the area of the particular paper.
- The factors that are taken into account in review are relevance, soundness, significance, originality, readability and language.
- The paper acceptance is constrained by such legal requirements as shall then be in force regarding libel, copyright infringement and plagiarism.
- For published articles, information on relevant potential conflicts of interest will be made available to the public.

Authors' responsibilities

- Authors must certify that their manuscripts are their original work.
- Authors must certify that the manuscript has not previously been published elsewhere.
- In case a submitted manuscript is a result of a research project, or its previous version has been presented at a conference in the form of an oral presentation (under the same or similar title), detailed information about the project, the conference, etc. shall be provided navesti gde se navode. A paper that has already been published in another journal cannot be reprinted in this journal.
- Authors must certify that the manuscript is not currently being considered for publication elsewhere.
- Authors must identify all sources used in the creation of their manuscript.
- It is the responsibility of each author to ensure that papers submitted in this journal are written with ethical standards in mind.

Reviewers' responsibilities

- Reviews should be conducted objectively, with no personal criticism of the author.
- Reviewers are required to provide written, competent and unbiased feedback in a timely manner on the scholarly merits and the scientific value of the manuscript.
- Reviewers should keep all information regarding articles confidential and treat them as privileged information.
- Reviewers must not have conflict of interest with respect to the research, the authors and/or the funding sources for the research. If such conflicts exist, the reviewers must report them to the Editor without delay.
- Any selected referee who feels unqualified to review the research reported in a manuscript or knows that its prompt review will be impossible should notify the Editor without delay.

Editors' responsibilities

- Editors have complete responsibility and authority to reject/accept an article.
- Editors are responsible for the contents and overall quality of the publication.
- Editors should always consider the needs of the authors and the readers when attempting to improve the publication.
- Editors should preserve the anonymity of reviewers.
- Editors should act if they suspect misconduct, whether a paper is published or unpublished, and make all attempts to persist in obtaining a resolution to the problem.
- Editors should not reject articles based on suspicions.

ETIKA

Etika objavljivanja, pravila objavljivanja i zloupotreba podataka

Objavljivanje i autorska prava

- Svi pristigli članci podliježu strogoj recenziji od strane barem dva recenzenta koji su stručnjaci iz oblasti naučnog rada.
- Faktori koji se uzimaju u obzir prilikom recenzije su relevantnost, ispravnost, značaj, originalnost, čitljivost i jezik.
- Prihvatanje rukopisa je ograničeno takvim zakonskim uslovima koje će se primijeniti u slučaju klevete, zloupotrebe autorskih prava i plagijata.
- Kod objavljenih članka, informacije o relevantnim potencijalnim sukobima interesa biće dostupne javnosti.

Odgovornosti autora

- Autori moraju da potvrde da je njihov rukopis njihovo autorsko djelo.
- Autori moraju da potvrde da njihov rukopis nije prethodno objavljen na nekom drugom mjestu.
- U slučaju da je poslati rukopis rezultat naučnoistraživačkog projekta ili da je, u prethodnoj verziji, bio izložen na skupu u vidu usmenog saopštenja (pod istim ili sličnim naslovom), detaljniji podaci o projektu, konferenciji i slično, navode se u navesti gdje se navode. Rad koji je već objavljen u nekom časopisu ne može biti preštampan u ovom časopisu.
- Autori moraju da potvrde da se njihov rukopis trenutno ne razmatra za objavljivanje negdje drugdje.
- Autori su dužni da navedu sve izvore koje su koristili u pisanju njihovog rukopisa.
- Autori su dužni da se pridržavaju etičkih standarda koji se odnose na naučnoistraživački rad.

Obaveze recenzenta

- Recenzija mora biti objektivna. Komentari koji se tiču ličnosti autora smatraju se neprimjerenim. Sud recenzenta mora biti jasan i potkrepljen argumentima.
- Recenzenti bi trebalo svoje stavove da iskažu jasno, sa pratećim argumentima.
- Recenzenti bi trebalo da čuvaju u povjerenju sve informacije u vezi članka i smatraju ih privilegovanim informacijama.
- Recenzent ne smije da bude u sukobu interesa sa autorima ili financijerom istraživanja. Ukoliko postoji sukob interesa, recenzent je dužan da o tome momentalno obavijesti urednika.
- Recenzent koji sebe smatra nekompetentnim za temu ili oblast kojom se rukopis bavi dužan je da o tome obavijesti urednika.

Obaveze urednika

- Urednici imaju punu odgovornost i ovlaštenje da odbiju/prihvate članak.
- Urednici su odgovorni za sadržaj i ukupni kvalitet publikacije.
- Urednici bi uvijek trebalo da razmotre potrebe autora i čitaoca pri pokušaju da se poboljša publikacija.
- Urednici bi trebalo da sačuvaju anonimnost pregledanog članka.
- Urednici bi trebali da osiguraju da je sav materijal koji objavljuju u skladu sa međunarodno prihvatljivim etičkim smjernicama.
- Urednici bi trebalo da djeluju ukoliko posumnjaju na zloupotrebu, bez obzira da li je rad objavljen ili ne, i preduzmu mjere kako bi uspjeli da riješe problem.
- Urednici ne bi trebalo da odbace članak na osnovu sumnje.

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