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Short notice
Kratko saopštenje

Influence of Programmed Exercise on Body Composition Indicators of Recreational Exercisers

Uticaj programiranog vežbanja na pokazatelje telesne kompozicije rekreativnih vežbača

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Abstract: *This research was conducted in order to determine whether and what to extent the three-month fitness program affect changjes in body composition on a sample of 42 exercisers, recreational athletes, ages between 21 and 35. The measurement was performed using a Tanita scale, model BC-543, and the following variables were applied: body weight, muscle mass and percentage of fat.*

After the initial measurement, a three-month fitness exercise program was applied, and then the final measurement in order to determine the achieved effects of training. Trainings were performed three times a week and were adjusted to each recreational athlete in proportion to the age and current state of training.

In the process of statistical data processing, descriptive and comparative statistics procedures were used. The basic statistical parameters for each subject were calculated individually and it was determined that there are statistically significant differences between the initial and final measurements.

Keywords: *body composition, recreational athletes, exercisers, fitness exercise programs.*

Sažetak: *Na uzorku od 42 vežbača, rekreativaca, starosti od 21 do 35 godina, izvršeno je istraživanje sa ciljem da se utvrdi da li i u kojoj meri tromesečni fitness program vežbanja utiče na promene u njihovoj telesnoj kompoziciji. Merenje je izvršeno uz pomoć Tanita vage, model BC-543, a primenjene su sledeće varijable: masa tela, mišićna masa i procenat masti.*

Nakon inicijalnog merenja primenjen je tromesečni fitness program vežbanja, a onda i finalno merenje kako bi se utvrdili postignuti efekti treninga. Treninzi su obavljani tri puta nedeljno i bili su prilagođeni svakom rekreativcu srazmerno godinama starosti i trenutnom stanju treniranosti.

U postupku statističke obrade podataka, koristili su se postupci deskriptivne i komparativne statistike. Izračunati su osnovni ststistički parametri za svakog ispitanika pojedinačno i utvrđeno je da postoje statistički značajne razlike između inicijalnog i finalnog merenja.

Ključne riječi: *telesna kompozicija, rekreativci, vežbači, fitness programi vežbanja.*

Introduction

Analyzing the quality of human health, it can be said that in addition to his genetics, it is largely conditioned by his way of life, and that the cause of various diseases is related to excessive and inadequate nutrition and insufficient physical activity.

The current living and working conditions, which are primarily conditioned by the scientific - technological revolution, mechanization and automation, directly lead

Uvod

Analizirajući kvalitet zdravlja čoveka, može se reći da je ono pored njegove genetike, umnogome uslovljeno i načinom njegovog življenja, te da je uzrok raznih bolesti vezan kako za preobilnu i neadekvatnu ishranu tako i nedovoljnu fizičku aktivnost.

Sadašnji uslovi života i rada koji su pre svega uslovljeni naučno - tehnološkom revolucijom, mehanizacijom i automatizacijom, direktno dovode do nedovoljne kretne

to insufficient motor activity, ie reduced physical activity, which often has a negative effect on the organism. For these reasons, it is necessary to choose an adequate recreational program content, which can primarily act preventively, but also effectively contribute to the alleviation and elimination of certain diseases, such as damage and diseases of the locomotor system, cardiovascular and respiratory system, nervous system and obesity (Acimovic, Spirtovic 2012).

Kinesiological activities must be carried out regularly, but care should be taken to ensure that the loads are appropriate for age, health and current physical fitness. Increased function, in the conditions of muscular work, accelerates numerous physiological processes and the development of organs, which work with less load in everyday life, thus reducing the risk of certain diseases. Exercise of programmed physical activities leads to various changes in morphological characteristics, especially on muscle tissue (Lohman, 1992; Malousaris et al. 2008).

Physical exercise in the broadest sense, and especially fitness activities are the right measure for human health, because each individual, in relation to their individual potentials, can choose the type of activity, time and place of physical activity, under the professional control of trainers and doctors. With programmed exercise, the muscular system becomes more elastic, stronger, more endurable. The work of the muscular system releases energy, and especially fats are burned easier and more efficiently (Nićin, 2003). According to Prskal (2004), appropriate physical exercise is an effective and irreplaceable means of improving and protecting health, especially in modern social and environmental conditions.

In many medical branches, as well as in the field of sports physiology, the assessment of body composition occupies an important place in the assessment of health risks. By studying the body composition of an individual, one can gain an impression of a lifestyle that includes both good and bad habits and reflects on the structure of the body, giving it a personal characteristic. (Maksimović, 2008). Determining the composition of body composition is a common method not only in medical disciplines but also in sports sciences. This increases the interest in new methods and modern procedures in determining the composition of body composition. The focus is most often on determining the amount of fat component, due to the analysis of health status and assessment of the existence of possible health risk (Ostojić, 2005).

Similar research has been done by many authors Reilly and Dorosty, 1999; Tsimeas et al., 2005; Ozdirenc et al., 2005; Relly, 2007; Petrić and Novak, 2007; Aberle

aktivnosti čoveka, odnosno smanjene fizičke aktivnosti, koja često negativno utiče na organizam. Iz tih razloga potrebno je odabrati adekvatan rekreativni programski sadržaj, koji pre svega može preventivno delovati, ali i efikasno doprineti ublažavanju i uklanjanju određenih obolenja, kao što su oštećenje i obolenje lokomotornog aparata, kardiovaskularnog i respiratornog sistema, nervnog sistema i gojaznosti (Aćimović, Špirtović 2012.).

Kineziološke aktivnosti moraju se sprovoditi redovno ali treba voditi računa da opterećenja budu primerena uzrastu, zdravstvenom stanju i trenutnoj fizičkoj pripremljenosti. Pojačanom funkcijom, u uslovima mišićnog rada, dolazi do pospešivanja brojnih fizioloških procesa i razvijanja organa, koji u svakodnevnom životu rade sa manjim opterećenjem, pa se na taj način smanjuje rizik od određenih bolesti. Upražnjavanjem programiranih fizičkih aktivnosti dolazi do raznih promena u morfološkim karakteristikama, posebno na mišićnom tkivu (Lohman, 1992; Malousaris i sar. 2008).

Telesno vežbanje u najširem smislu, a posebno fitness aktivnosti su upravo prava mera za čovekovo zdravlje, jer svaki pojedinac, u odnosu na svoje individualne potencijale, može da bira vrstu aktivnosti, vreme i mesto obavljanja telesnih aktivnosti, a pod stručnom kontrolom trenera i lekara. Programiranim vežbanjem mišićni sistem postaje elastičniji, snažniji, izdržljiviji. Radom mišićnog sistema oslobađa se energija, a posebno se masnoće sagorevaju lakše i efikasnije (Nićin, 2003.). Prema Prskalu (2004), primjereno tjelesno vježbanje je učinkovito i nezamjenjivo sredstvo unapređenja i zaštite zdravlja, posebno u savremenim društvenim uslovima i uslovima okoline.

U brojnim medicinskim granama, kao i u oblasti fiziologije sporta, procena telesne kompozicije zauzima važno mesto u proceni zdravstvenih rizika. Proučavajući telesnu kompoziciju pojedinca može se steći utisak o životnom stilu koji uključuje i dobre i loše navike, a odražava se na strukturu tela dajući njegovo lično obilježje. (Maksimović, 2008). Određivanje sastava telesne kompozicije česta je metoda ne samo u okvirima medicinskih disciplina već i u sportskim naukama. S toga se povećava interesovanje za nove metode i savremene postupke u određivanju sastava telesne kompozicije. Fokus je usmeren najčešće ka određivanju količine masne komponente, zbog analize zdravstvenog statusa i procene postojanja eventualnog zdravstvenog rizika (Ostojić, 2005).

Sličnim istraživanjima su se bavili mnogi autori Reilly i Dorosty, 1999; Tsimeas i sar., 2005; Ozdirenc i sar., 2005; Relly, 2007; Petrić i Novak, 2007; Aberle i sar., 2009; Horvat i sar., 2009; Tinazci i Emiroglu, 2009;

et al., 2009; Horvat et al., 2009; Tinazci and Emiroglu, 2009; Cetinić et al., 2011; Vasić et al., 2012; Momčilović V. and Momčilović Z., 2018; Vuckovic et al., 2019.

The aim of this study was to determine whether and to what extent a three-month fitness exercise program affects changes in the body composition of exercisers.

Material And Methods

The research was conducted on a sample of 42 exercisers, recreational athletes, aged between 21 and 35 years. Measurements were performed in the fitness center with the help of Tanita scales, model BC-543. The following variables were applied:

- body weight (AMAST),
- muscle mass (TSMMA) and
- fat percentage (TSUTM).

After the initial measurement, a three-month fitness exercise program was applied, and then the final measurement in order to determine the achieved effects of training. The training program was the same for all respondents and based on the initial condition, the intensity and scope of work were determined. Respondents were educated with performing basic exercises. The first month of training was with less load and simpler exercises so that the subjects could pass without stronger muscle inflammation, which could be the reason for giving up further exercise, and then, in order to achieve the effect of exercise, the load was gradually increased and practiced more complexly exercises. Trainings were performed three times a week, a total of 36 trainings and were adjusted to each recreational athlete in proportion to age and current state of physical fitness. Each training lasted 60 minutes and consisted of an introductory-preparatory, main and final part of the training. In the introductory-preparatory part of the training for warming up and stretching, were used cyclic trainers and shaping exercises which were lasting 10 minutes. The main part of the training lasted 45 minutes and it included the planned contents of exercises for strengthening the muscles of the arms and shoulder girdle, abdominal and back muscles, as well as leg muscles. In the first phase of the main part of the training, the trainees worked on trainers and props, while the second part was intended to work on aerobic endurance through walking and running of moderate intensity. In the final part of the training, exercises for relaxing the muscles and stretching were performed for 5 minutes.

Descriptive statistics and comparative statistics procedures were used to process the obtained data. Using descriptive statistics, the basic statistical parameters were calculated for each respondent individually.

Cetinić i sar., 2011; Vasić i sar., 2012; Momčilović V. i Momčilović Z., 2018; Vučković i sar., 2019.

Cilj ovog rada bio je da se utvrdi da li i u kojoj meri tromesečni fitness program vežbanja utiče na promene u telesnoj kompoziciji vežbača.

Materijal I Metode

Istraživanje je sprovedeno na uzorku od 42 vežbača, rekreativaca, starosne dobi između 21 i 35 godina. Merenja su vršena u fitness centru uz pomoć Tanita vage, model BC-543. Primenjene su sledeće varijable:

- masa tela (AMAST),
- mišićna masa (TSMMA) i
- procenat masti (TSUTM).

Nakon inicijalnog merenja primenjen je tromesečni fitness program vežbanja, a onda i finalno merenje kako bi se utvrdili postignuti efekti treninga. Program treninga je bio isti za sve ispitanike a na osnovu početnog stanja se odredjivao intenzitet i obim rada. Ispitanici su bili edukovani sa izvođenjem osnovnih vežbi. Prvi mesec treninzi su bili sa manjim opterećenjem i jednostavnijim vežbama kako bi ispitanici prošli bez jače upale mišića, što je mogao biti razlog odustajanja od daljeg vežbanja, a zatim, da bi se postigao efekat vežbanja, opterećenje se postepeno povećavalo i upražnjavale su se i složenije vežbe. Treninzi su obavljani tri puta nedeljno, ukupno 36 treninga i bili su prilagođeni svakom rekreativcu srazmerno godinama starosti i trenutnom stanju fizičke spremnosti. Svaki trening je trajao 60 minuta i sastojao se od uvodnog- pripremnog, glavnog i završnog dela treninga. U uvodno-pripremnom delu treninga za zagrevanja i razgibavanja koristili su se ciklični trenažeri i vežbe oblikovanja u trajanju od 10 minuta. Glavni deo treninga je trajao 45 minuta i u njemu su se odvijali planirani sadržaji vežbi za jačanje mišića ruku i ramenog pojasa, trbušnih i leđnih mišića, kao i mišića nogu. U prvoj fazi glavnog dela treninga vežbači su radili na trenažerima i sa rekvizitima, dok je drugi deo bio namenjen radu na aerobnoj izdržljivosti kroz hodanje i trčanje umerenog intenziteta. U završnom delu treninga u trajanju od 5 minuta su se provodile vežbe za opuštanje muskulature i istezanje.

Za obradu dobijenih podataka, koristili su se postupci deskriptivne statistike i komparativne statistike. Primenom deskriptivne statistike izračunati su osnovni statistički parametri za svakog ispitanika pojedinačno.

The Results

Results of descriptive analysis

Table 1. *Initial measurement of respondents*

	MAX	MIN	VW	Mean	SD	V (%)	SKEW	KURT
Body mass / Telesna masa	1o4	68	36	82	11.99	14.86	.519	-.793
Muscle mass / Mišićna masa	71	45	26	61	9.26	15.41	1.299	.790
Fat percentage / Procenat masti	45	27	18	35	7.42	21.98	-.073	-.250

Legend: MAX-maximum *result, MIN-minimum result, VW-variation width, SD-standard deviation, V-coefficient of variability, SKEW-curvature of distribution, KURT-flatness of distribution.*

As can be seen in Table 1, during the first measurement, before the start of the training process, the average weight of the subjects was 82 kg, the average muscle mass of the subjects was 61 kg, while the proportion of adipose tissue was on average 35 kg. Analyzing the dispersion parameters of the variables, it is clear that based on the standard deviation, the group of subjects is the most homogeneous in the percentage of fat (sd = 7.42), followed by muscle mass (sd = 9.26), and the most inhomogeneous in the variable body mass (sd = 11.99). Based on the coefficient of variability, the results vary the least in body mass (14.86%), slightly more in muscle mass (15.41%), and most in the percentage of fat (21,98%).

Skewness analysis clearly shows that the variable body mass has a symmetrical distribution, the variable adipose tissue has a negative moderate asymmetry while muscle mass (skew = 1.299) has a pronounced asymmetry.

According to the results of flatness - kurtosis there is no variable that shows the normal flatness of the results. We can only speak of greater flatness than normal in all variables where kurtosis ranges from -0.793 in the case of the body mass variable to a value of 0.790 in the case of the muscle mass variable.

Rezultati

Rezultati deskriptivne analize

Tabela 1. *Inicijalno merenje ispitanika*

Legenda: MAX-maksimalan *rezultat, MIN-minimalan rezultat, VŠ-varijaciona širina, Mean-srednja vrednost, SD-standardna devijacija, V(%)-koeficijent varijabilnosti, SKEW-zakrivljenost distribucije, KURT-spljoštenost distribucije.*

Kao što se vidi na tabeli 1, tokom prvog merenja, pre početka trenažnog procesa, prosečna masa ispitanika je iznosila 82 kg, prosek mišićne mase ispitanika iznosio 61 kg, dok je udeo masnog tkiva u proseku bio 35 kg. Analizirajući disperzione parametre varijabli, jasno se zapaža, da je na osnovu standardne devijacije grupa ispitanika najhomogenija u procentu masti (SD=7,42), zatim sledi mišićna masa (SD=9,26), a da su najnehomogeniji u varijabli telesna masa (SD=11,99). Na osnovu koeficijenta varijabilnosti rezultati najmanje variraju kod telesne mase (14,86%), nešto više kod mišićne mase (15,41%), a najviše kod procenta masti (21,98%).

Analiza Skewness-a, jasno pokazuje da varijabla telesna masa ima simetričnu distribuciju, varijabla masno tkivo ima negativno umerenu asimetriju dok mišićna masa (SKEW= 1,299) ima izrazitu asimetriju.

Prema rezultatima spljoštenosti – kurtosis ne postoji varijabla koja pokazuje normalnu spljoštenost rezultata. Možemo govoriti samo za veću spljoštenost od normalne u svim varijablama gdje se kurtosis kreće od -0,793 u slučaju varijable telesna masa pa do vrednosti od 0,790 u slučaju varijable mišićna masa.

Table 2. *Final measurement of respondents*

	MAX	MIN	VW	Mean	SD	V (%)	SKEW	KURT
Body mass / Telesna masa	100	65	35	78	11,23	14,41	.708	-.690
Muscle mass / Mišićna masa	74	46	28	63	8,49	13,63	1.107	.208
Fat percentage / Procenat masti	42	15	27	28	8,37	29,80	-.243	.284

Legend: MAX-maximum *result, MIN-minimum result, VW-variation width, SD-standard deviation, V-coefficient of variability, SKEW-curvature of distribution, KURT-flatness of distribution.*

Tabela 2. *Finalno merenje ispitanika*

Legenda: MAX-maksimalan *rezultat, MIN.minimalan rezultat, VŠ(%)-varijaciona širina, Mean-srednja vrednost, SD-standardna devijacija, V-koeficijent varijabilnosti, SKEW-zakrivljenost distribucije, KURT-spljoštenost distribucije.*

After the training process, which lasted for three months, the average body weight of the examinees was 78 kg, the average muscle mass was 63 kg, and the share of adipose tissue was on average 28 kg. Based on the standard deviation, the group of subjects is the most homogeneous in the percentage of fat (sd = 8.37), followed by muscle mass (sd = 8.49), and the most inhomogeneous are in the variable body weight (sd = 11.23). Based on the coefficient of variability, the results vary the least in muscle mass (13.63%), slightly more in body mass (14.41%), and most in the percentage of fat (29.80%).

In the Skewness analysis part, it is clear that the body mass variable has a symmetrical distribution, the adipose tissue variable has a negative moderate asymmetry and the muscle mass variable (skew = 1,107) has a pronounced asymmetry.

According to the results of flatness - kurtosis, there is no variable that shows the normal flatness of the results. We can only speak of greater flatness than normal in all variables where kurtosis ranges from -0.690 in the case of the variable body weight to a value of 0.284 in the case of the variable percentage of fat.

Results of comparative analysis

Table 3. *Determination of differences between initial and final T-test measurements at the significance level of 99% (p <0.01)*

Paired Samples Test

	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 weight - weight 2 / Pair 1 težina - težina 2	3.91000	1.76545	.38178	3.74139	5.11515	10.898	19	.000
Pair 2 muscles - muscles 2 / Pair 2 mišići - mišići 2	-2.11000	2.12544	.51128	-3.106324	-.913498	-3.120	19	.001
Pair 3 fat - fat 2 / Pair 3 mast - mast 2	6.22000	2.63631	.54337	5.11401	6.958463	11.244	19	.000

Legend: Mean-mean, *Std. Deviation-standard deviation, Std. Error Mean-standard error of the arithmetic mean, Confidence interval of the Difference-confidence interval, t-value of the test, Sig (2-tailed) -significance level.*

From Table 3, where the results of the t-test are shown, it can be clearly concluded that there are statistically significant differences in all variables, with an achieved level of statistical significance less than 0.01, ie. with a statistical inference error of less than 1%.

Nakon trenažnog procesa, koji je trajao tri meseca, prosečna telesna masa ispitanika iznosila je 78 kg, prosečna mišićna masa 63 kg, a udeo masnog tkiva u proseku je iznosio 28 kg. Na osnovu standardne devijacije grupa ispitanika najhomogenija je u procentu masti (SD=8,37), zatim sledi mišićna masa (SD=8,49), a najnehomogeniji su u varijabli telesna masa (SD=11,23). Na osnovu koeficijenta varijabilnosti rezultati najmanje variraju kod mišićne mase (13,63%), nešto više kod telesne mase (14,41%), a najviše kod procenta masti (29,80%).

U delu analize Skewness-a, jasno je uočljivo da varijabla telesna masa ima simetričnu distribuciju, varijabla masno tkivo ima negativno umerenu asimetriju, a varijabla mišićna masa (skew= 1,107) ima izrazitu asimetriju.

Prema rezultatima spljoštenosti – kurtosis, ne postoji varijabla koja pokazuje normalnu spljoštenost rezultata. Možemo govoriti samo za veću spljoštenost od normalne u svim varijablama gdje se kurtosis kreće od -0,690 u slučaju varijable tjelesna masa pa do vrijednosti od 0,284 u slučaju varijable procenat masti.

Rezultati komparativne analize

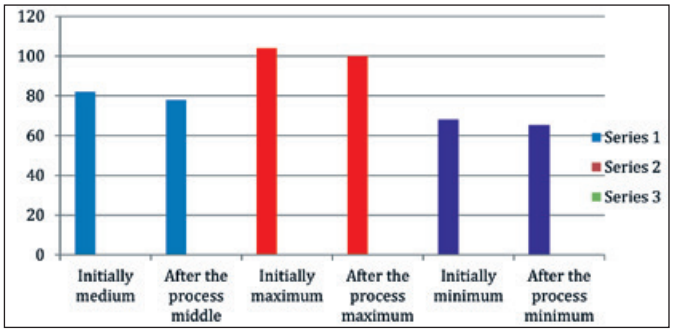
Tabela 3. *Utvrđivanje razlika između inicijalnog i finalnog merenja T-testom na nivou značajnosti od 99% (p<0,01)*

Paired Samples Test

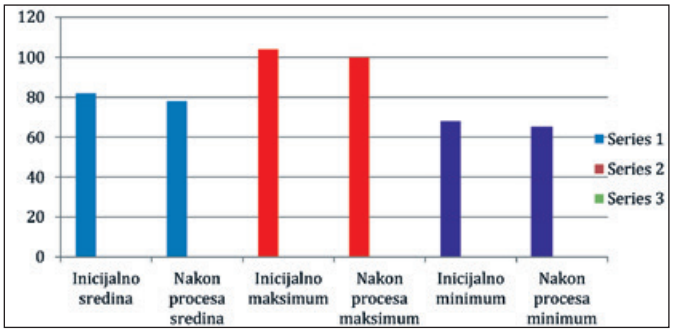
	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 weight - weight 2 / Pair 1 težina - težina 2	3.91000	1.76545	.38178	3.74139	5.11515	10.898	19	.000
Pair 2 muscles - muscles 2 / Pair 2 mišići - mišići 2	-2.11000	2.12544	.51128	-3.106324	-.913498	-3.120	19	.001
Pair 3 fat - fat 2 / Pair 3 mast - mast 2	6.22000	2.63631	.54337	5.11401	6.958463	11.244	19	.000

Legenda: Mean-srednja *vrednost, Std. Deviation-stardandna devijacija, Std. Error Mean-standardna greška aritmetičke sredine, Confidence interval of the Difference-interval pouzdanosti, t-vrednost testa, Sig (2-tailed)-nivo značajnosti.*

Iz tabele 3, gde su prikazani rezultati t-testa, se jasno može zaključiti da postoje statistički značajne razlike u svim varijablama, sa ostvarenim nivoom statističke značajnosti manjim od 0,01 tj. sa verovatnoćom greške pri statističkom zaključivanju manjom od 1%.



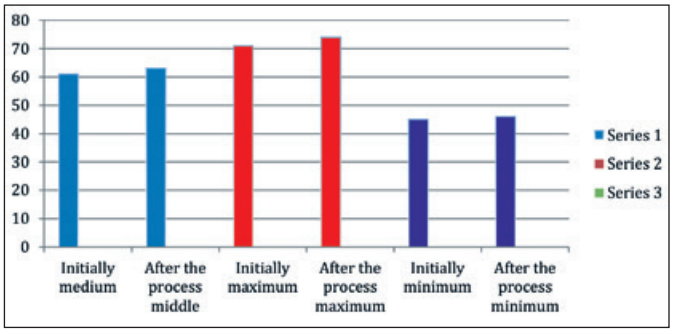
Graph 1. *Variable - body weight, before and after the training process*



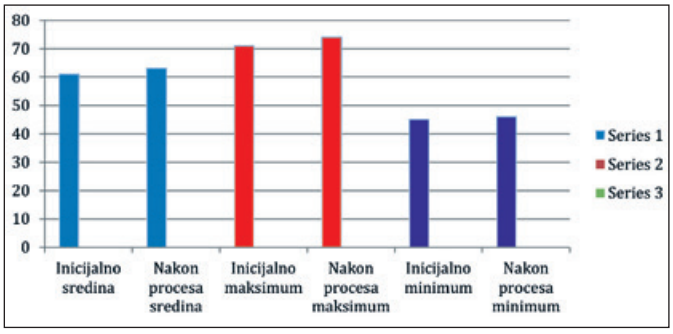
Slika 1. *Varijabla - telesna masa, pre i posle programiranog vežbanja*

The graph shows that the training process showed certain results in terms of body weight. Average weight decreased from 82 kg to 78 kg, minimum body weight was reduced from 68 kg to 65 kg. while the maximum value is reduced by 4 kg.

Iz slike 1. se vidi da je trenažni proces pokazao određene rezultate po pitanju telesne mase. Prosečna masa smanjena sa 82 kg na 78 kg, minimalna vrednost telesne mase je snižena sa 68 kg na 65 kg. dok je maksimalna vrednost snižena za 4 kg



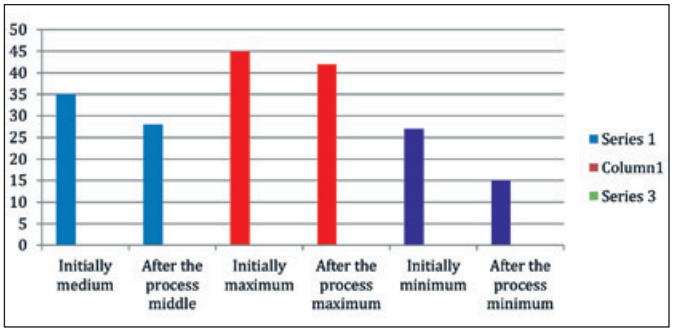
Graph 2. *Variable - muscle mass, before and after the training process*



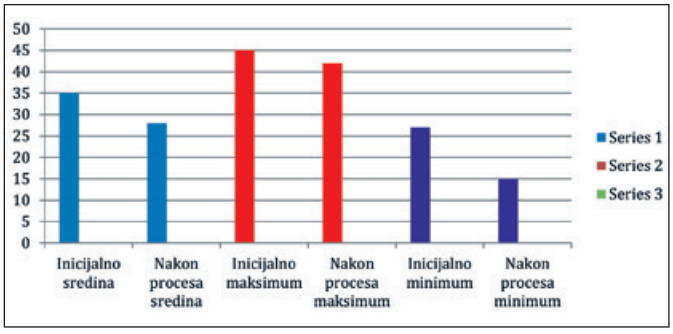
Slika 2. *Varijabla - mišićna masa, pre i posle programiranog vežbanja*

The average muscle mass was increased by 2 kg, the minimum value of muscle mass was increased from 45 kg to 46 kg. while the maximum value was increased from 71 kg to 74 kg.

Prosečna mišićna masa uvećana je za 2 kg, minimalna vrednost mišićne mase je uvećana sa 45 kg na 46 kg. dok je maksimalna vrednost uvećana sa 71 kg na 74 kg.



Graph 3. *Variable - adipose tissue, before and after the training process*



Slika 3. *Varijabla - masno tkivo, pre i posle programiranog vežbanja*

The graph shows that the programmed training process showed certain results in terms of adipose tissue. It is clear that the average value was reduced by 7 kg, the mini-

Iz slike 3. se vidi da je programirani trenažni proces pokazao određene rezultate i po pitanju masnog tkiva. Jasno se vidi da je prosečna vrednost smanjena za 7 kg,

mum value of adipose tissue was reduced by 12 kg, while the maximum value was reduced from 45 kg to 42 kg.

Discussion

Programmed exercise, in accordance with the needs of the individual, has a positive effect on weight loss and fat reduction in obese people, while the positive effect of training is seen in the improvement of muscle mass.

The results of the final measurement clearly show that the three-month fitness exercise program gave positive results on all three variables. It is visible that the trainees had a decrease in subcutaneous fat and an increase in muscle mass, which was exactly the goal of this training process and is a prerequisite for good health of the trainees.

Since the reduction of body fat is achieved, as in the fight against cellulite, adequate exercises that "affect" certain parts of the body, and which are the most vulnerable to fat deposits, the exercise program was designed so that strength exercises, which were performed in the main part of the training, were focused on those parts of the body where the formation of fatty subcutaneous tissue can occur to a greater extent. The work on the training was focused on removing fat deposits on the hips, waist, abdominal region, thighs, upper arms, which gave a positive result. The achieved positive effects show that programmed physical activities provide significant transformational effects when it comes to body composition, which could be observed in the works of other authors in whom this type of research was the subject of interest and who obtained similar results.

Research conducted by Hrgetić, Dadić, Milanović, Skoblar (2016) shows that after a three-month training process, statistically significant changes in the percentage of adipose tissue occurred in middle-aged women. Similar results were obtained in their research (Širić et al., 2005; Stojiljković et al., 2010; Obrovac, 2015).

Conclusion

The aim of this study was to determine whether and to what extent a three-month fitness exercise program affects changes in the body composition of exercisers.

The research was conducted on a sample of 42 exercisers, recreational athletes, aged 21 to 35 years. Measurements were performed by one meter using a Tanita scale, model BC-543, and the following variables were applied: body mass (AMAST), muscle mass (TSMMA) and fat percentage (TSUTM).

Based on the obtained results of this research, it can be concluded that programmed physical activities

minimalna vrednost masnog tkiva je snižena za 12 kg, dok je maksimalna vrednost snižena sa 45 kg na 42 kg.

Diskusija

Programirano vežbanje, u skladu sa potrebama pojedinca, pozitivno utiče na smanjenje telesne mase i redukciju masti kod gojaznih osoba, dok se pozitivan efekat treninga vidi u poboljšanju mišićne mase.

Rezultati finalnog merenja jasno pokazuju da je tromesečni fitness program vežbanja dao pozitivne rezultate na sve tri varijable. Vidljivo je da kod vežbača došlo do smanjenja masnog potkožnog tkiva i povećanja mišićne mase što je upravo i bio cilj ovog trenažnog procesa, a preduslov je za dobro zdravstveno stanje vežbača.

Obzirom da se redukovanje masnih naslaga na telu postiže, kao i kod borbe protiv celulita, adekvatnim vežbama koje "pogađaju" određene delove tela, a koje su najugroženije masnim naslagama, program vežbanja je bio koncipiran tako da su vežbe snage, koje su se izvodile u glavnom delu treninga, bile fokusirane upravo na te delove tela gde u većoj meri može doći do stvaranja masnog potkožnog tkiva. Rad na treningu je bio usmeren na skidanju masnih naslaga na bokovima, struku, trbušnoj regiji, butini, nadlaktici što je i dalo pozitivan rezultat. Ostvareni pozitivni efekti pokazuju kako programirane telesne aktivnosti osiguravaju značajne transformacijske učinke kada je u pitanju telesni sastav, što se moglo zapaziti i u radovima drugih autora kod kojih je ova vrsta istraživanja bila je predmet interesovanja i koji su dobili slične rezultate.

Istraživanja koje su sproveli Hrgetić, Dadić, Milanović, Skoblar (2016) pokazuju da su nakon provedenog trenažnog procesa u trajanju od tri meseca kod žena srednje životne dobi nastale statistički značajne promene u procentu masnog tkiva. Slične rezultate u svojim istraživanjima dobili su (Širićisar., 2005; Stojiljković i sar., 2010; Obrovac, 2015).

Zaključak

Cilj ovog rada bio je da se utvrdi da li i u kojoj meri tromesečni fitness program vežbanja utiče na promene u telesnoj kompoziciji vežbača.

Istraživanje je sprovedeno na uzorku od 42 vežbača, rekreativaca, starosti od 21 do 35 godina. Merenja je izvršio jedan merilac uz pomoć Tanita vage, model BC-543, a primenjene su sledeće varijable: masa tela (AMAST), mišićna masa (TSMMA) i procenat masti (TSUTM).

Na osnovu dobijenih rezultata ovog istraživanja može se zaključiti da programirane telesne aktivnosti mogu pozitivno uticati na promene u telesnom sastavu

can positively affect changes in body composition in recreational exercisers. By interpreting the comparative analysis between the initial and final measurement, it was determined that there are statistically significant differences in the body composition of recreational exercisers, ie that there is a difference in body mass, muscle mass and that there is a statistically significant difference in fat percentage after applying a three-month fitness program.

kod rekreativnih vežbača. Interpretacijom komparativne analize između inicijalnog i finalnog merenja utvrđeno je da postoje statistički značajne razlike u telesnoj kompoziciji vežbača rekreativaca, odnosno da postoji razlika u telesnoj masi, mišićnoj masi kao i da postoji statistička značajna razlika u procentu masnog tkiva nakon primene tromesečnog fitness programa vežbanja.

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