ROLE OF FITNESS PROGRAM IN A HEALTH IMPROVEMENT OF ADOLESCENTS

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Summary: Since physical activities affect the quality of life and activate a complete locomotor system, sports and physical activities can be treated as a determinant for a harmonious development of all child's characteristics and anthropological characteristics. Because, childhood and youth are the most important formative periods, and some segments of development, for example, specific motor skills can be developed only with means used in sports, this research was conducted to find out do the fitness program (aimed at improving strength) after eight weeks had a positive effect on body composition and mobility and stability of subjects. A control group consisted of 11 female subjects and experimental group were 11 female subjects aged 16 years. The effects of the program on the fitness condition of the subjects were determined by assessing the body composition parameters (data obtained using the Body composition analyser TANITA BC-418) - the total percentage of fat tissue (FAT), the percentage of fat tissue segmentally (percentage of fat tissue of the left leg (FATll), right leg (FATrl), left arm (FATla), right arm (FATra) and body (FATb)) and estimation of mobility and stability levels - based on the application of *Functional movement screening* (FMS) method (seven tests) before and after the program is implemented. The success of the implemented program was confirmed because the program showed a statistically significant difference between the mobility groups of the subjects in the experimental in relation to the control group (deep squat $t=3,464$ $p=0,006$, step over a hurdle $t=2,390$ $p=0,038$, active lift of a stretched leg $t=2,887$ $p=0,016$, rotatory body stability $t=3,130$ $p=0,011$ and FMS $t=5,721$ $p=0,000$), and a positive effect on the composition of the body in terms of reduction of the percentage of fatty body has been shown segmentally.

Keywords: fitness program, adolescents, body composition, FMS method

Introduction

Regular physical activity is very important for both men and women's health (US Department of Health and Human Services 1996), with a recommendation that adults and elderly people should actively participate in all aspects of physical activity of moderate intensity for at least 30 minutes daily in order to maintain mobility (WHO 2010). Doing some sports, whether professional or recreational, is important for all people because exercises and every sporting activity are predictors of healthy and long life (Torbarina 2011), and since physical activities activate a complete locomotor system crucial to a transformation of energy which is much needed for the activity of all cells in the body, sports and physical activities can be treated as a determinant for a harmonious development of all child's characteristics and anthropological characteristics (Krželj 2009). Physical activity affects the quality of life (Pucci, Rech, Fermino & Reis 2012). Childhood and youth are the most important formative periods, and some segments of development, for example, specific motor skills can be developed only with means used in sports (Doupona & Petrovič 1997), so it is important that a selected sporting activity is not burdensome, the one which will make them feel pleasure and joy (Martinčević 2010), and the one which will, at the same time, relieve stress and, above all, create from young age a habit of doing sports which will continue during growing up and become part of everyday life (Krželj 2009). The fact is that a large number of children are involved in organized sports programs, but, entering into puberty, it is evident that most of them quit those programs (Fraser-Thomas, Côté & Deakin 2008; Horga 2009). Adolescence is a formative period for adopting behaviors relevant to attitudes, habits and lifestyles (Lacković-Grgin 2006). In youth, under the influence of hormones, the appearance of the body changes in girls (the high activity of lipoprotein lipase during puberty causes fat storage and problems with losing it) fat tissue is accumulated under the skin, the body becomes rounded, more feminine and they take on the characteristics of adult women), so a physical growth ends at the end of puberty, and weight gain can continue and is not in proportion to height (Prebeg & Prebeg 1985). Today, discontent with appearance, especially in girls, is considered a frequent occurrence, most notably in adolescent girls ((Đurović, Mohorić i Pokrajac-Bulian 2007). Physical activity plays an important role in the satisfaction of individuals' lives (Melin, Fugl-Meyer & Fugl-Meyer 2003), and one of the valuable means of increasing life satisfaction is physical activity (Maher, Pincus, Ram & Conroyd 2015). Physiological, anatomical, psychological and socio-cultural specifics of

the female sex require special consideration in all spheres of their physical activities (Greydanas & Patel 2002). The term fitness is used in the process of development, raising or maintenance at the optimal level of general psychophysical abilities and characteristics of a body, and it implies a thorough preparation of bodies for efforts and goals of people who are engaged in physical activities for recreational reasons (Omrčen, Andrijašević & Štefić 2007).

It has been established that aerobic programs have a transformational effect on morphological and motor status, running and walking programs on changes in functional abilities (Sekulić, Rausavljević & Zenić 2003), while weight exercises have invaluable benefits for the development and maintenance of bone mass of women at all ages (Hagen 2005). The American College of Sports Medicine (ACSM 2010) recommends a cumulative of 20 – 60 minutes of moderate aerobic activity 3-5 times per week and resistance training 2-3 times a week by varying the general type of exercise to include muscular strength, muscular endurance, aerobic endurance, anaerobic endurance, flexibility, and mobility. According to the World Health Organization (Global recommendations on Physical activity for health, WHO 2010), physical activity in adults involves leisure activities, transportation (walking or cycling), work activities, housekeeping, games, sports, organized and individual exercise, and all activities that take place within a family, school and sports community.

In order to find ways to include young girls in sports activities, a fitness program aimed at improving strength was implemented in order to determine its effects after eight weeks on the fitness of subjects by comparing changes in their body composition and mobility and stability (FMS method) whose changes in a positive sense are indicators of health what can be a guideline in choosing activities that can be part of a fitness program of this population.

Methods

The study was conducted on a sample of 22 female subjects of young age (16 years $\pm$ 6 months), of which a control group consisted of 11 female subjects and experimental group were 11 female responders. Prior to the implementation of the program, respondents were not included in any sports-recreational activities and were of optimal health without injuries to the locomotor apparatus. The program was conducted over eight weeks and was focused on improving muscular endurance and fitness. The ACSM (2010) recommends 3 sets of 8-12 repetitions of strength training exercises, two to three times a week. The time, or duration, of a cardiovascular workout

should be at least 20 – 30 minutes of continuous, rhythmic exercise of large muscle groups. “Time” for a strength-training workout is best quantified in repetitions and sets. The type of training, broken into large categories, includes muscular strength, muscular endurance, aerobic endurance, anaerobic endurance, flexibility, and mobility. The type of training should vary daily throughout a training week. Many athletes find heart-rate training beneficial to ensure proper intensity. The ACSM (2010) recommends an intensity of 65 % - 90 % maximum heart rate (HRmax) during aerobic exercise. The ACSM (2010) recommends an intensity of 50 % to 85 % of HRR for aerobic exercise. This program has been developed by an Exercise Physiologist for those who have a basic level of fitness (that is, they are able to walk comfortably for 30 minutes) (more details at https://getontrackchallenge.com.au/assets/exercise-phys-guides/beginner_final_lowres.pdf). The training is designed to last 45 minutes. It is designed to use your own body weight (table 1). The effects of the program on the fitness condition of the subjects were determined by assessing the body composition parameters (data obtained using the Body composition analyser TANITA BC-418) - the total percentage of fat tissue (FAT), the percentage of fat tissue segmentally (percentage of fat tissue of the left leg (FATll), right leg (FATrl), left arm (FATla), right arm (FATra) and body (FATb)) and estimation of mobility and stability levels - based on the application of *Functional movement screening* (FMS) method (seven tests) before and after the program is implemented.

The statistical program SPSS 16,0 and the following statistical methods were used to obtain valid results: the basic descriptive statistics, the KS test-analysis of the normality of results, the independent t-test - analysis of differences between groups and the dependent t-test-analysis of differences within a group.

Table 1
Fitness program

exercises		Week→	1			2			3			4		
		Session→	1	2	3	1	2	3	1	1	2	3	2	3
flexibility	Calf stretch	15 sec hold per leg												
	Lying hamstring stretch	15 sec hold per leg												
	Lying hip flexor stretch	15 sec hold per side												
	Lying glute-medius stretch	15 sec hold per side												
cardio	walking	5 mins												
resistance	Sit to stand no weights OR with 2 kg weight	Week 1=10 reps Week 3=15 reps												
	Bench push-ups	Week 5=20 reps Week 7=25 reps												
	Wall plank	Hold up to 1 min												

[illegible]

Results and discussion

Table 2

Descriptive parameters of body composition segmentally at initial and final measurements for both groups of subjects

groups			N	M	S. D	Ks test
experimental	initially	FATrl	11	36,9545	6,13178	0,741
		FATll	11	36,1727	6,75812	0,711
		FATra	11	31,7636	8,53642	0,990
		FATla	11	32,6455	8,72667	0,995
		FATb	11	29,9727	9,54307	0,977
		FAT%	11	23,5210	4,8700	0,852
	final	FATrl	11	33,9100	6,17368	0,857
		FATll	11	33,9300	5,56398	0,691
		FATra	11	28,4700	6,34106	0,932
		FATla	11	28,6900	6,86399	0,657
		FATb	11	29,4909	9,13252	0,992
		FAT%	11	21,7840	5,8700	0,852
control	initially	FATrl	11	34,7500	5,85591	0,857
		FATll	11	34,4000	5,35828	0,627
		FATra	11	28,9000	6,31489	0,954
		FATla	11	29,1500	6,83963	0,741
		FATb	11	36,5000	9,74394	0,905
		FAT%	11	23,7210	3,8700	0,852
	final	FATrl	11	36,5545	5,69304	0,963
		FATll	11	35,6182	6,28567	0,887
		FATra	11	32,7818	8,12672	0,996
		FATla	11	32,2636	8,79276	0,983
		FATb	11	33,5000	7,13754	0,634
		FAT%	11	23,2210	5,8700	0,852

From the values shown in Table 2 it can be seen that there was a change in the average values at both groups of subjects - in the experimental group there was a decrease in all the fat tissue values segmentally, and in the control group there was an increase in all fat tissue values, except for body fat tissue.

Table 3

Descriptive test parameters for assessing mobility and body stability-FMS method

groups			N	M	S. D	Ks test
experimental	initially	deep squat	11	1,5455	,52223	0,548
		hurdle step	11	1,5455	,52223	0,704

		Inline lunge	11	1,4545	,52223	0,452
		shoulder mobility	11	2,1818	,60302	0,356
		active straight-leg raise	11	2,0909	,83121	0,548
		trunk stability pushup	11	2,0000	,77460	0,704
		rotatory stability	11	2,3636	,67420	0,548
		FMS total	11	12,818	2,31595	0,704
	final	deep squat	11	2,0909	,53936	0,452
		hurdle step	11	1,8182	,75076	0,356
		Inline lunge	11	1,8182	,75076	0,548
		shoulder mobility	11	2,4545	,68755	0,704
		active straight-leg raise	11	2,5455	,68755	0,548
		trunk stability pushup	11	2,6364	,50452	0,704
		rotatory stability	11	2,8182	,40452	0,356
		FMS total	11	15,181	2,60070	0,548
control	initially	deep squat	11	1,6000	,51640	0,548
		hurdle step	11	1,7000	,48305	0,704
		Inline lunge	11	1,5000	,52705	0,452
		shoulder mobility	11	2,3000	,82327	0,356
		active straight-leg raise	11	2,5000	,52705	0,548
		trunk stability pushup	11	1,9000	,87560	0,704
		rotatory stability	11	2,4000	,51640	0,548
		FMS total	11	13,100	2,02485	0,704
	final	deep squat	11	1,5455	,52223	0,452
		hurdle step	11	1,4545	,52223	0,356
		Inline lunge	11	1,4000	,51640	0,452
		shoulder mobility	11	2,3000	,48305	0,356
		active straight-leg raise	11	2,0909	,83121	0,548
		trunk stability pushup	11	2,1000	,73786	0,704
		rotatory stability	11	2,3000	,82327	0,452
		FMS total	11	10,100	1,10050	0,356

Table 3 shows the values of descriptive statistics of the mobility variables and body stability the FMS method at the initial and final measurement for both groups of subjects. It can be seen from the values shown in Table 3 that there were changes in the average values for both groups of subjects - in the experimental group there was an increase in the average values of the results of mobility and body stability, and in the control group there was a decrease in the average values of mobility results and body stability.

Table 4 shows the results of the statistical analysis of the T-test for independent samples at the initial measurement. On the basis of significance, it can be concluded that there is no statistically significant difference in the initial measurement between the groups of subjects at the

results of all tests. This shows that the groups are well selected, and the influence of unwanted factors in the further analysis is excluded.

Table 4
Difference between groups initial measurement of the results of all tests

	t-test	Sig.
FATrl	0,168	0,868
FATll	0,271	0,789
FATra	0,638	0,531
FATla	0,841	0,411
FATb	0,661	0,516
FAT%	0,796	0,445
deep squat	0,866	0,397
hurdle step	1,014	0,323
Inline lunge	0,825	0,420
shoulder mobility	0,209	0,837
active straight-leg raise	0,780	0,445
trunk stability pushup	1,021	0,320
rotatory stability	0,649	0,524
FMS total	-0,295	0,771

Table 5
Difference between groups final measurement of the results of all tests

	t-test	Sig.
FATrl	3,218	0,009
FATll	2,498	0,032
FATra	0,721	0,479
FATla	1,030	0,316
FATb	4,059	0,002
FAT%	4,662	0,001
deep squat	3,464	0,006
hurdle step	2,390	0,038
Inline lunge	0,721	0,479
shoulder mobility	1,472	0,157
active straight-leg raise	2,887	0,016
trunk stability pushup	1,936	0,082
rotatory stability	3,130	0,011
FMS total	5,721	0,000

Table 5 shows the results of the statistical analysis of the T-test for independent samples at the final measurement. On the basis of significance, it can be concluded that there is no statistically

significant difference in the final measurement between the groups of subjects at the results of the tests which analyzed the percentage of fat tissue of the upper extremities (FATra and FATIa) and in the part of the tests which analyzed the mobility and stability of the body (step forward at the sagittal level, shoulder mobility and push-up stability), while on all other tests (FATrI, FATIi, FATb, FAT%, FMS total - at tests: deep squat, step over a hurdle, active lifting of a stretched leg, rotatory body stability) a significant difference was observed. Based on the average values of the results that the groups of subjects showed at the final measurement, it can be concluded that after the application of the fitness program there was an improvement in the experimental group compared to the control group.

Figure 1

The difference between the results of the experimental and control group at the final measurement regarding variables that measured the body composition segmentally

The success of the implemented program was confirmed because the program showed a statistically significant difference between the mobility groups of the subjects in the experimental in relation to the control group (deep squat $t = 3,464$ $p = 0,006$, step over a hurdle $t = 2,390$ $p = 0,038$, active lift of a stretched leg $t = 2,887$ $p = 0,016$, rotatory body stability $t = 3,130$ $p = 0,011$ and FMS $t = 5,721$ $p = 0,000$) (Figure 2), and a positive effect on the composition of the body in terms of reduction of the percentage of fatty body has been shown segmentally (FATrI $t = 3,218$ p

= 0.009, FATI t = 2.498 p = 0,032, FATb t = 4,059 p = 0,002 i FAT % t = 4,662 p = 0,001) (Figure 1).

Figure 2

The difference between the results of the experimental and control group at the final measurement regarding the variables that measured stability and mobility

Stojiljković, Mandarić, Todorović & Mitić (2010) state that the aerobics program led to significant changes in the morphological and motor skills of female examinees. It also states that programmed systematic exercise influences the transformation of a body composition of women (Fogelholm, Kukkonen-Harjula, & Oja 1999), and in particular a reduction of body fat percentage in an organism (Širić, Prelčec & Brčić 2005). It has also been found that in physically active individuals the level of fat oxidation is higher during training (Tremblay, Coveney, Despres, Nadeau & Prud'homme 1992).

By analyzing the group fitness program it can be noticed that the program was designed for beginners, and that the trainings consisted of several components that affect the morphological and functional characteristics - stretching which improves the mobility of the joints, a cardio part during which the examinees prepared for the main part of the training in which they worked on their strength using the exercise of resistance, and repeated stretching. The characteristic manifestation of the overall morphologically-anatomical, functional and psychological organization of the organism reflects the overall appearance of the human body, giving importance to the overall

morphological status (Ross, Ward, Leahy & Day 1982), and in women, a greater percentage of body fat accumulates under the influence of estrogen hormone, which stimulates deposition of fat in the subcutaneous tissue, breast tissue and especially in the gluteal region and thighs. The program has selected exercises for improving mobility and strength improvement training exercises that required an active operation of body muscles and lower extremities. It is known that stretching reduces muscle tension, increases an amplitude of a movement, prevents injuries to muscles and joints, back, stimulates circulation, increases joint mobility, cardio training helps to reduce fat tissue, strengthens the heart muscle and lungs, increases bone density, reduces stress, and that resistance exercises improve muscle strength and increase muscle tone and also increase muscle and fat ratio - when it gets muscles, the body continues to burn fat even at rest. All trainings were moderate to high intensity, and the main feature of high-intensity training is its efficiency in accelerating metabolism and practical application due to time efficiency compared to traditional aerobic exercise (Astorino, Allen, Roberson & Jurancich 2012). Besides the fact that high intensity training positively influences the reduction of body fat and massless body mass, it also produces positive results on the muscle mass of female subjects (Tremblay, Després, Leblanc, Craig, Ferris, Stephens & Bouchard 1990; Bryner, Toffle, Ullrich & Yeater 1997; Sijie, Hainai, Fengying & Jianxiong 2012; Guiraud, Nigam, Gremeaux, Meyer, Juneau & Bosquet 2012; Bacon, Carter, Ogle & Joyner 2013; Smith-Ryan, Trexler, Wingfield & Blue 2016), which has been shown in this study when it comes to the percentage of fat tissue because the percentage of fatty tissue of body, percentage of trunk fat, and the percentage of lower extremities fat tissue significantly decreased in subjects of the experimental group after the exercise of the fitness program. The body composition of women is characterized by a lower total mass and a smaller percentage of muscle tissue and a larger of fat mass. Women have less ability to generate absolute force, especially in the upper extremities, which is even 50 % lower than men (Kenney, Wilmore & Costil 2012), which is in line with the results obtained in this study, because although exercises were applied in order to improve the strength of the whole body, the percentage of fat tissue of the upper extremities did not significantly change in the female subjects of the experimental group compared to the subjects of the control group. Reducing fatty tissues of the lower extremities and body can be attributed to the selection of strength exercises because the exercises required the active operation of the muscles of the body and lower extremities. Since it was found that the selected stretching exercises and strength exercises acted positively on muscle activation and reduced fat tissue of the

body and lower extremities, it was expected that mobility would improve and that a significant difference would be shown among the respondents of the experimental group compared to the subjects of the control group in mobility and stability tests in which muscles of the lower extremities and muscles of the abdomen were more active.

Đug & Mikić (2007), using the fitness program of step aerobics, both in the anthropometric and motor characteristics of female students, achieved significant partial changes, and Pavić & Žuvela (2004) found that aerobic exercise led to reduced subcutaneous fat tissue, which confirms that the selection of activities compliant with the goal and age and sex with which it works, results in positive effects. This has also been shown in this research because the selection of a group fitness program, designed by experts and intended for beginners and focused on a comprehensive work of moderate intensity in parts of training dedicated to stretching and cardio programs with a moderately high intensity in improving strength resulted in positive changes in subjects of the adolescent age. As such, it has proven to be a good recreational activity at this age, because it can motivate one to engage further in some group or individual fitness program, because motivation is the main determinant of defining the intensity and depth of involvement in sports and recreational activities.

Conclusion

Proper understanding of what motivates people to participate will cause effective program planning and implications for health (Snepenger, King, Marshall & Uysal 2006), because physical activity improves the quality of life for both young and older adults (Joseph, Royse, Benitez & Pekmezi 2014) , and the selection of activities in line with the goal, age and gender which it works with results in positive effects. Adolescence is a period suitable for adopting behaviors relevant to attitudes, habits and lifestyles, because at that age changes in body appearance occur, and girls take on the characteristics of adult women, and physical growth ends at the end of puberty, and weight gain can continue. As more and more girls entering the puberty stops doing sports or recreational activities, it is desirable to motivate them to exercise some kind of physical activity of the type of such a group fitness program for beginners that is aimed at improving strength, since it has been shown that in the youth age of girls this had a positive effect on the reduction of percentage of fatty tissue, but also on increased mobility and stability whose changes in positive sense are indicators of health. All this points to the need to conduct research of a similar nature in order to enable girls

to engage in sports-recreational activities of a type of group fitness program which do not require too much efforts and which have a positive impact on their health status.

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