Original Article

Effect of the quarterly training program on key morphological and functional parameters of females

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Abstract

Taking into consideration the health effects of the obesity epidemic and research that are suggesting that weight loss can improve these problems, there have been numerous calls for optimal obesity treatment strategies. Numerous expert panels consistently suggest that a caloric deficit of 500- 1000 kcal per day, associated with dietary strategies and along with 45 minutes of physical activity up to 5 days a week has a significant impact on weight loss and improvement of health level especially in third age. The purpose of this study is to identify the differences in some parameters measured in overweight people after a 3 month fitness plan and food diet to the females. In the sample of this study are included a total of 100 overweight females. The results obtained from their processing show that tested females have different morphological and functional features which is verified through asymmetry test. Based on the obtained results we see that the differences have been evident (albeit small) since the introduction of the basic statistical parameters where we see that the female group, values and number of differences have been somewhat evident.

Key words: fitness, morphology, functional parameters, program, differences.

Introduction

Obesity has reached epidemic levels in recent decades, and at the same time with this many different diseases are on the rise, including heart diseases, certain types of cancer and diabetes. The cornerstone of therapeutic interventions to treat or prevent these diseases is weight loss through lifestyle modification, including hypocaloric diet and increased physical activity along with behavioral techniques to support these changes.

Typical weight loss that is resulting from the lifestyle changes is between 5-10% of base weight, so such approaches rarely bring a healthy person to a normal body weight. However, losing of this modest weight loss brings health benefits. Numerous non-randomized interventions have shown improvements in human health, and in particular those that are related to diabetes, cardiovascular diseases and cancer risk.

Modern times and the development of technology, on the one hand, have made living much easier, but on the other hand, it has alienated man from his nature and physical activities that in earlier times were necessary for the fulfillment of his daily duties.

A huge flow of information and a constant pursuit of contemporary improvement and progress people today put themselves under immense stress and cause many stressful situations they face at any given moment. Inability to eliminate stress enough, people nowadays are faced with forgetfulness which poses major problems in their daily tasks.

Smaller scale studies of lifestyle changes to promote weight loss have shown improvements in hypertension and metabolic syndrome.

Having into the consideration health effects of the obesity epidemic and researches that are suggesting that losing weight can improve these problems. There have been numerous calls for optimal obesity treatment strategies. Numerous expert panels consistently suggest that a caloric deficit of 500- 1000 kcal per day, associated with dietary strategies and along with 45 minutes of physical activity up to 5 days a week has a significant impact on weight loss and improvement of the level of health especially in the third.

“Body fat mass is in direct proportion to physical activity that is longer time lasting, which means, fat mass is affected by aerobic endurance exercises.” (Myrtaj & Shkodra, 2019, p. 56).

The American Center for Disease Control suggests a minimum of 30 min of moderate-intensity exercises most days of the week.

The recommendations of these agencies are based on the experts opinion supported by the available data. Although numerous studies have examined the impact of lifestyle interventions on body weight, few have focused on women with postmenopausal problems and one group experiencing particularly high of overweight

and obesity using a tested intervention such as that undertaken by the DPP, a program known to reduce the risk of disease in other populations, and the effects measured over a 12 month period.

Material & methods

In the sample of this research are included a total of 100(females) persons with overweight. **THE TESTS ARE CARRIED OUT IN 4 STAGES:**

Phase 1 – initial measurements on the first day of the starting program

Phase 2- second measurement, after 1 month of exercises

Phase 3- third measurement, after 2 months of exercises

Phase 4- last measurement, after 3 months of exercises.

These tests were done at the Fitness Center, ALBA- GYM in Gjilan, Kosovo.

Anthropometric variables:For the identification of morphological characteristics are applied the following anthropometric parameters: Body Height (BH), Body Weight (BW), Waist Circumference (WC), Arm Circumference (AC), Thigh circumference (THC), Thigh bone circumference (THBC), Subcutaneous fatty tissue of the abdomen (SFTAB), Subcutaneous fatty tissue of the back (SFTB), Subcutaneous fatty tissue of the arm (SFTA), Subcutaneous fatty tissue of the thigh (SFTTH), Subcutaneous fatty tissue of the thigh bone (SFTTHB).

Functional parameters:

For the identification of morphological characteristics are applied the following functional anthropometric parameters: Percentage of the body fat (PBF), Muscular Mass (MM), Body mass Index (BMI), Amount of water in the body (AWB), Visceral fats (VF).

Statistical analysis

The data were processed in such a way that first will be calculated central and distribution parameters for each variable such as: Minimum and maximum values (R.min-R.maks), Arithmetical average (Ma), Standard deviation (Ds) and Asymmetry parameters (SKEW dhe KURT). Discriminatory Analysis (T- testi). The results will be processed through SPSS software version 23.

Results and discussion

Basic statistical parameters of the morphological and morphological-functional variables are presented in Table 1.

Table 1. Basic statistical parameters of morphological and functional variables for initial measurements (Weight loss- Females)

	N	Min	Max	MA	DS	Skew	Kurt
BH	100	165.00	177.00	170.20	4.07	.705	.197
BW	100	80.00	110.10	96.24	13.42	-.261	-2.11
WC	100	79.00	105.00	94.00	9.38	-.658	-.606
AC	100	30.50	38.00	34.60	2.73	-.410	-1.01
THC	100	55.00	75.00	62.30	7.16	1.21	.473
THBC	100	36.00	46.00	41.60	4.14	-.372	-1.87
SFTAB	100	28.00	49.00	40.80	8.44	-.659	-1.39
SFTB	100	25.00	40.00	33.20	6.37	-.368	-2.03
SFTA	100	18.00	28.00	24.20	3.55	-1.09	.310
SFTTH	100	5.00	30.00	17.40	8.39	.045	-.047
SFTTHB	100	5.00	17.00	10.20	4.07	.705	.197
PBF	100	37.90	48.00	44.04	3.66	-.891	-.244
MM	100	48.70	56.40	52.72	3.12	-.163	-1.85
BMI	100	28.60	37.60	33.76	3.57	-.514	-1.59
AWB	100	33.00	46.60	40.10	4.60	-.238	-.128
VF	100	5.00	10.00	8.00	1.76	-.911	.080

In the group of females that are undergoing to a program for weight loss, we presented a more pronounced heterogeneity in the thigh circumference variable. (THC) with Skew= 1.219 and it is understandable as it relates to an unselected sample and that females have the mass of subcutaneous fatty tissue concentrated specifically on the thigh area.

We have the same heterogeneity situation also in the variable of subcutaneous fatty tissue of arm (SFTA) Skew= -1.097 which subcutaneous fatty tissue in females usually concentrates in these parts of the body to the females and is also worth of mentioning that we have to deal as well with an unselected group.

Table 2. basic statistical parameters of morphological and functional variables for measurements after one month (Weight loss- Females)

	N	Min	Max	Ma	DS	Skew	Kurt
BH	100	165	177	170.2	4.07	.705	.197
BW	100	75	107	93.4	12.94	-0.22	-1.86
WC	100	74	100	89.3	9.21	-0.53	-1.06
AC	100	30	35	32.4	1.84	0.20	-1.12
THC	100	52	60.5	57.3	2.89	-0.88	-0.08
THBC	100	33	45	40.2	4.33	-0.58	-0.93
SFTAB	100	27	45	36.9	7.36	-0.49	-2.00
SFTB	100	22	37	29.9	6.08	-0.40	-2.01
SFTA	100	15	28	22.3	4.42	-0.65	0.11
SFTTH	100	5	24	15.4	6.5	-0.48	-0.13
SFTTHB	100	5	15	8.9	3.48	1.09	0.48
PBF	100	35.8	44.6	41.52	3.21	1.27	0.45
MM	100	48	57.7	52.44	3.85	0.36	-1.73
BMI	100	28.6	36.7	32.14	3.38	0.29	-1.85
AWB	100	31	48.2	39.98	6.41	-0.26	-1.27
VF	100	5	8	6.8	1.03	1.03	0.49

Also in the table 2 are presented the basic statistical parameters of the morphological and morphological –functional variables for the measurements after one month.

During the inspection of table 2 we observe a difference in weight because the minimum and maximum result shows a decrease in kg, but the heterogeneities are different in the subcutaneous fatty tissue of thigh bone (SFTTHB), Skew= 1.094 in contrast to the final measurements that homogeneity was obtained in this parameter.

As fats concentrated in the body, such as vesicles, are the cause of many different diseases, and according to the maximum result we notice that unlike the first measurements we have a decrease in fat of this kind, therefore it was obtained the heterogeneity in the variable Percentage of Body Fat (PBF), Skew= 1.268 and variable Visceral Fats (VF), Skew= 1.029.

Table 3. basic statistical parameters of morphological and functional variables for measurements after two months (Weight loss- Females)

	N	Min	Max	Ma	DS	Skew	Kurt
BH	100	165.00	177.00	170.20	4.08	.705	.197
BW	100	72.00	98.30	91.34	12.37	-.411	-1.82
WC	100	72.00	98.00	89.00	8.98	-.781	-.523
AC	100	28.00	36.00	31.60	2.95	.328	-1.45
THC	100	51.00	60.00	56.20	2.94	.084	-.326
THBC	100	31.00	43.00	39.10	4.18	-.752	-.449
SFTAB	100	25.00	47.00	36.00	8.88	-.297	-2.00
SFTB	100	20.00	38.00	29.20	7.30	-.312	-2.01
SFTA	100	13.00	26.00	20.90	4.89	-.667	-.544
SFTTH	100	5.00	18.00	13.60	4.81	1.300	.490
SFTTHB	100	5.00	13.00	8.70	2.75	.391	-.289
PBF	100	34.00	45.00	40.02	3.66	-.717	-.188
MM	100	46.00	58.00	52.62	4.11	-.021	-1.22
BMI	100	26.00	35.60	31.46	3.71	-.258	-1.81
AWB	100	29.00	48.80	41.08	7.51	-.687	-1.30
VF	100	4.00	8.00	6.30	1.42	-.660	-.378

By inspecting Table 3 we see that we have a greater number of variables from which we obtained homogeneity and that we achieved a normal distribution of results and a tendency to approach the normal distribution value compared to the initial and one month measurements. The arithmetic average variable Subcutaneous Fat Tissue (SFTTH) is 13.60. Minimum result is 5.00 mm, whereas the maximum result is 18.00 mm. In this case, it is presented heterogeneity also with Skew= 1.300, and from this we understand that the mass of fat tissue in this body area has its difficulties in eliminating it.

Table 4. Basic statistical parameters of morphological and functional variables for measurements after three months-final (Weight loss- Females)

	N	Min	Max	Ma	DS	Skew	Kurt
BH	100	165.00	175.00	169.80	3.35	.216	-.015
BW	100	70.00	96.00	88.50	12.44	-.431	-1.92
WC	100	71.00	96.00	87.00	8.75	-.693	-.927
AC	100	28.50	35.00	31.00	2.33	.590	-1.15
THC	100	50.00	59.00	55.20	3.22	-.175	-1.17
THBC	100	30.00	43.00	39.00	4.23	1.081	.801
SFTAB	100	22.00	46.00	32.20	9.08	.372	-1.55

SFTB	100	17.00	38.00	26.30	7.22	.256	-1.05
SFTA	100	13.00	25.00	18.40	4.16	.015	-1.20
SFTTH	100	5.00	16.00	11.00	5.29	-.326	-2.19
SFTTHB	100	5.00	11.00	7.30	2.40	.577	-1.11
PBF	100	31.60	44.00	38.66	4.19	-.862	-.060
MM	100	45.00	59.10	51.98	4.84	.347	-1.09
BMI	100	25.00	34.30	30.38	3.73	-.387	-1.71
AWB	100	28.00	51.10	41.46	8.81	-.499	-1.47
VF	100	3.00	8.00	6.10	1.79	1.054	.164

Në table 4, in contrast to other variables that we obtained homogeneity among the female group, in which we obtained normal distribution and tendency for approximation by normal distribution values, we observe that in the morphological variable Thigh bone circumference(THBC)shows a significant difference between the groups in this anthropometric parameter.The marked difference between the minimum and maximum result indicates that the asymmetry test (Skewness) has pronounced asymmetry and that the convexity of the distribution or top of the curve (Kurtosis) is Platycurtic.

Also in the variable visceral fats(VF), shows significant difference between the group in this anthropometric parameter.The marked difference between the minimum and maximum result indicates that the asymmetry test (Skewness) has pronounced asymmetry and that the convexity of the distribution or top of the curve (Kurtosis) is Platycurtic.

Table 5. Differences in morphological and functional variables between between initial and after one month of measurements (Weight loss- females)

	F	Sig.	t	df	t-test for Equality of Means				
					Sig. (2-t)	MA	Std. Diff	95% C of Diff	
BH	0.00	1.00	0.00	18	1.00	0.00	1.82	-3.83	3.83
			0.00	18.00	1.00	0.00	1.82	-3.83	3.83
BW	.151	.702	.482	18	.136	2.84	5.89	-9.54	15.22
			.482	17.97	.026	2.84	5.89	-9.54	15.22
WC	.014	.906	1.13	18	.273	4.70	4.15	-4.03	13.43
			1.13	17.99	.263	4.70	4.15	-4.03	13.43
AC	2.40	.138	2.11	18	.049	2.20	1.04	0.01	4.39
			2.11	15.74	.031	2.20	1.04	-0.01	4.41
THC	3.48	.078	2.04	18	.055	5.00	2.44	-0.13	10.13
			2.04	11.85	.043	5.00	2.44	-0.32	10.32
THBC	.021	.886	.738	18	.470	1.40	1.89	-2.58	5.38
			.738	17.96	.470	1.40	1.89	-2.58	5.38
SFTAB	.378	.546	1.10	18	.285	3.90	3.54	-3.53	11.33
			1.10	17.66	.286	3.90	3.54	-3.54	11.34
SFTB	.084	.776	1.18	18	.252	3.30	2.78	-2.55	9.15
			1.18	17.96	.252	3.30	2.78	-2.55	9.15
SFTA	.157	.696	1.05	18	.304	1.90	1.79	-1.86	5.66
			1.05	17.19	.304	1.90	1.79	-1.88	5.68
SFTTH	.218	.646	.596	18	.559	2.00	3.35	-5.05	9.05
			.596	16.93	.559	2.00	3.35	-5.08	9.08
SFTTHB	.049	.827	.767	18	.453	1.30	1.69	-2.26	4.86
			.767	17.56	.453	1.30	1.69	-2.26	4.86
PBF	.279	.604	1.63	18	.120	2.52	1.54	-0.71	5.75
			1.63	17.69	.120	2.52	1.54	-0.72	5.76
MM	1.41	.250	.179	18	.860	0.28	1.56	-3.01	3.57
			.179	17.27	.860	0.28	1.56	-3.02	3.58
BMI	.164	.690	1.04	18	.311	1.62	1.55	-1.64	4.88
			1.04	17.94	.311	1.62	1.50	-1.64	4.88
AWB	2.44	.136	.048	18	.962	0.12	2.49	-5.12	5.36
			.048	16.32	.962	0.12	2.49	-5.16	5.40
VF	1.15	.298	1.85	18	.080	1.20	0.64	-0.15	2.50
			1.85	14.52	.084	1.20	0.64	-0.18	2.58

In table 5. The obtained differences between arithmetic averages at first glance show that the initial measurements differ from the one-month measurements, but the probability coefficient denies this impression in most of the variables.The values of the probability coefficient indicate that no statistically significant difference was obtained $P>0.05$, in all the variables applied.

Significant statistical difference was obtained in the variable Body Weight (BW) with a probability coefficient of 0.02 in favor of measurements after one month which achieved the group goal of weight loss.

Significant statistical difference was also obtained in the variable Arm circumference(AC) with probability coefficient 0.03 in favor of the second measurements.

Significant statistical difference was also obtained in the variable Thigh circumference (THC) with a probability coefficient.043.It is very important that training program for weight loss of females was to develop a healthy, long-term and safe lifestyle, and that their participation in physical activity would normally be as gradual as possible, so based on this situation we did not expect a significant difference as the weight loss should go as gradually as possible in the long run.

Table 6. Differences in morphological and functional variables between measurements after two months and

	F	Sig.	t-test for Equality of Means			Me Diff	Std. Error Diff	95% Conf Int Diff	
			t	df	Sig. (2-ta)			Loëer	Upper
BH	.163	.691	.239	18	.813	.400	1.67	-3.11	3.91
			.239	17.36	.814	.400	1.67	-3.11	3.91
BW	.007	.933	.512	18	.061	2.84	5.54	-8.81	14.49
			.512	17.99	.051	2.84	5.54	-8.81	14.49
WC	.000	1.00	.504	18	.620	2.00	3.96	-6.32	10.32
			.504	17.98	.620	2.00	3.96	-6.32	10.32
AC	.000	.326	.504	18	.620	.600	1.19	-1.90	3.10
			.504	17.09	.620	.600	1.19	-1.90	3.10
THC	.179	.678	.725	18	.478	1.00	1.37	-1.89	3.89
			.725	17.84	.478	1.00	1.37	-1.89	3.89
THBC	.011	.917	.053	18	.958	.100	1.88	-3.85	4.05
			.053	17.99	.958	.100	1.88	-3.85	4.05
SFTAB	.012	.915	.946	18	.357	3.80	4.01	-4.64	12.24
			.946	17.99	.357	3.80	4.01	-4.64	12.24
SFTB	.197	.662	.893	18	.384	2.90	3.24	-3.92	9.72
			.893	17.99	.384	2.90	3.24	-3.92	9.72
SFTA	.026	.873	1.23	18	.234	2.50	2.03	-1.76	6.76
			1.23	17.56	.235	2.50	2.03	-1.77	6.77
SFTTH	.000	.262	1.15	18	.265	2.60	2.26	-2.15	7.35
			1.15	17.84	.266	2.60	2.26	-2.15	7.35
SFTTHB	.014	.906	1.21	18	.241	1.40	1.15	-1.02	3.82
			1.21	17.68	.242	1.40	1.15	-1.03	3.83
PBF	.119	.734	.772	18	.450	1.36	1.76	-2.33	5.05
			.772	17.67	.450	1.36	1.76	-2.34	5.06
MM	.310	.585	.319	18	.754	.640	2.00	-3.57	4.85
			.319	17.53	.754	.640	2.00	-3.58	4.86
BMI	.004	.953	.648	18	.525	1.08	1.66	-2.42	4.58
			.648	17.99	.525	1.08	1.66	-2.42	4.58
AWB	.507	.485	-.104	18	.918	-.380	3.66	-8.07	7.31
			-.104	17.56	.919	-.380	3.66	-8.08	7.32
VF	.200	.660	.277	18	.785	.200	.723	-1.31	1.71
			.277	17.09	.785	.200	.723	-1.32	1.72

final (Weight loss- females)

After observing Table 6, we notice that a statistically significant difference was obtained in the variable of Arm circumference (AC) with a probability of coefficient 0.05 in favor of recent measurements, which is the most demanded by the female group.

For sure the differences are present if we would rely on arithmetic averages but still are small changes since we are dealing with an unselected group and as such the results are expected as such.

It has long been known that regular physical activity causes numerous adaptations within the skeletal muscle and cardio-pulmonary system, which provide positive results for the prevention and treatment of many metabolic disorders. Lack of physical exercises should rather be perceived as "anormal" and associated with numerous health risks. The goal for us as researchers is to be more innovative in finding ways to motivate people to exercise and approve healthy lifestyle choices. (Church, Thomas, Tudor-Locke, Katzmarzyk, Earnest, Rodarte, Martin, Blair, Bouchard, 2011).

Conclusion

The paper presents a brief overview on morphological, intellectual and emotional characteristics of their healthy achievements and healthy lives. The paper has attempted to accurately represent morphological and morphological-functional differences in height, body weight, waist circumference, arm circumference, thigh circumference, thigh bone circumference, subcutaneous fatty tissue of abdomen, subcutaneous fatty tissue of the back, subcutaneous fatty tissue of the arm and subcutaneous fatty tissue of the thigh bone. The group has also undergone tests to try to present morphological-functional differences with the variables Body fat percentage,

muscle mass, body mass index, amount of water in the body and visceral fats.

The results obtained from their processing show that:

- The tested females have different morphological and functional characteristics as evidenced by the asymmetry test.
- From the results obtained we see that the differences were evident (albeit small).

It is significant that the result obtained between the initial and final condition has achieved the weight loss requirements gradually, and especially the higher success has been shown in the last month. It is the utmost importance to mention that today in modern times fitness has become an integral part of the lives of many individuals of all ages and this shows a higher awareness than in previous years of living healthy in continuity.

References

- Church, TS., Thomas, DM., Tudor-Locke, C., Katzmarzyk, PT., Earnest, CP., Rodarte, RQ., Martin, CK., Blair, SN., Bouchard, C. (2011). Effects of recovery mode (active vs. passive) on performance during a short high-intensity interval training program: a longitudinal study. *European Journal of Applied Physiology and Occupational Physiology*, 113(6), 1373-1383. doi: 10.1007/s00421-012-2556-9.
- Katzmarzyk et al., (2000). Adiposity, physical fitness and incident diabetes: the physical activity longitudinal study. *Diabetologia*, 50(3), 538-544.
- Legenbauer, TM., de Zéaan, M., Mühlhans, B., Petrak, F., Herpertz, S., (2010). The effects of physical training of functional capacity in adults. Ages 46 to 90: a meta-analysis. *The Journal of sports medicine and physical fitness*, 40(1), 1-10.
- Tudor-Locke, C., Bassett D, (2004). Impact of exercise intensity on body fatness and skeletal muscle metabolism. *Metabolism: Clinical and Experimental*, 43(7), 814-818.
- Aerobics Instructor Manual (1997). *American Council of Exercise*, Ur: R.T. Cotton, R.L. Goldstein.
- Carnethon, M. R., Gidding, S. S., Nehgme, R., Sidney, S., Jacobs Jr, D. R., et al. (2003). Cardiorespiratory fitness in young adulthood and the development of cardiovascular disease risk factors. *JAMA: the journal of the American Medical Association*, 290(23), 3092-3100.
- Caspersen, C. J., Poëll, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports*, 100(2), 126.
- Church TS, Thomas DM, Tudor-Locke C, Katzmarzyk PT, Earnest CP, Rodarte RQ, Martin CK, Blair SN, Bouchard C. (2011). Trends over 5 decades in U.S. occupation-related physical activity and their associations with obesity, 189-196.
- Duggan, M., Mercier, D., & Canadian Society for Exercise, P. (2007). *Certified exercise physiologist : CSEP CEP certification guide*. Ottaëa, Ont.: Canadian Society for Exercise Physiology.
- Esotheria, Beograd Isacoëitz, R., & Clippinger, K. (2010). Pilates Anatomy. *Human Kinetics*, USA.
- Katzmarzyk, P. T., Gledhill, N., & Shephard, R. J. (2000). The economic burden of physical inactivity in Canada. *Canadian Medical Association Journal*, 163(11), 1435-1440.
- Keating, X. D., Chen, L., Dover, D., Guan, J., & Bridges, D. (2007). An examination of ninth-grade students' fitness knowledge in a metropolitan area. *Research Quarterly for Exercise and Sport*, 78(1).
- Lee, D., Sui, X., Artero, E. G., Lee, I. M., Church, T. S., et al. (2011). Long-term effects of changes in cardiorespiratory fitness and body mass index on all-cause and cardiovascular disease mortality in men: the Aerobics Center Longitudinal Study. *Circulation*, 124(23), 2483-2490.
- Legenbauer TM, de Zéaan M, Mühlhans B, Petrak F, Herpertz S. (2010). Do mental disorders and eating patterns affect long-term weight loss maintenance? *GenHospPsychiatry*, 132-40.
- Myrtaj, N., Shkodra, M. (2019). The impact of physical activities of aerobic type in body mass and volume parameters. *Journal of Education, Health and Sport*. 2019;9(9):50-57. eISSN 2391-8306
- Pedišić, Ž., Jurakić, D., Rakovac, M., Hodak, D., & Dizdar, D. (2011). Reliability of the Croatian long version of the international physical activity questionnaire. *Kinesiology*, 43(2), 185-191
- Ploëman, S. A., & Smith, D. L. (2007). *Exercise physiology for health, fitness, and performance*: Lippincott Williams & Wilkins.
- Siler, B. (2003). *Pilates tijelo*, Biovega, Zagreb,.
- Stevens J, Truesdale KP, McClain JE, Cai J. (2006). The definition of weight maintenance. *Int J Obes (Lond)*, 391-9.
- Stojiljković, S. i saradnici (2005). *Fitness*. Fakultet sporta i fizičkog vaspitanja, Beograd.
- Tudor-Locke C, Bassett DR Jr. (2004). How many steps/day are enough? Preliminary pedometer indices for public health, 1-8.
- Vignjević, R. (2001). *Step aerobik kao model rekreativnog vežbanja*. Diplomski rad, FFK, Beograd.
- Zagorc, M., Zaletel, F. i Ižanc N. (1996). *Aerobika*. Ljubljana: Fakulteta za šport.
- Костић, Р. (2009). *Базичне фитнес компоненте*. Ниш: Факултет спорта и физичког васпитања.