

Impact of Recreational Fitness Training Program on Dynamic Strength of Women

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ABSTRACT

In addition to multivariate analysis of covariance (MANCOVA) it was found that there were statistically significant differences between the experimental and control groups in three of the five motor variables in favor of the experimental group ($p=0.00$). In general, it can be concluded that the application of the experimental treatment for 10 weeks in the experimental group led to an increase, improved results in variables Push-ups, body folding 30 s and pull-ups in high jump on the shaft.

Key words: treatment, motor capacity, women

Introduction

In modern conditions of life and work one of the most popular areas of physical education is the area of recreation. Recreation stems from the need of society to investigate and scientifically study the specific connection between work and other activities, as well as the relationships that affect the psychosomatic status of man. It is a freely chosen, individual or organized social activity, which by means of physical exercise and sports recreational activities allows people an active and healthy fun and entertainment, which helps them to maintain good health, physical and work fitness, and to express their creativity they were largely denied by specialized work (Mitic, 2001). Nowadays, there are a lot of programs in the framework of recreation and it allows us to select the one that best suits us, through which we achieve the set objectives, and which is of course in positive correlation with our health condition. Selection of motion activities is left to us with a big support of qualified, professional staff that will give us the best instructions and help in monitoring the effects of physical exercise on the body (Zaciorski, 1995; Stojiljković et al., 2005).

Recreational fitness programs result primarily from the present way of life which is characterized by busy life activities, often related to stressful situations, as well as hypokinesia as a disease of modern man. Hypokinesia (lack of bodily movement) carries a variety of ailments and diseases of modern man, which are primarily reflected in reduced functioning of the locomotor system, the decline of motor capacity, and therefore to a great extent the decline of functional characteristics. These circumstances (and some others), has led modern men to seriously tackle their health, persistence, their life, and especially the quality of life, and with the help of experts, seek advice and opportunities to preserve and improve their health, and thereby live more qualitative and easier life. Recreational fitness programs are physical activities that primarily affect the improvement of human health, increasing their motor capacity, function-

nal characteristics, the necessary fitness for life and work, and thus prosperity, good mood and easier coping with all life difficulties (Nićin, 2003).

In the context of research Cvetković (2003), Kloubec (2005), Čokorilo (2005), Sekendiz, Altun, Korkusuz, and Akin (2007), Obradović et al. (2008), Borer (2008), Babayiğit et al. (2009) dealt with similar topics. The aim of their research was to investigate the effects of fitness exercise (Pilates, tae-bo, aerobics) on the strength of the abdomen and lower back, abdominal muscle endurance and flexibility of the lower back of adult women. The authors concluded the positive effect of modern Pilates programs, fitness programs, aerobics on the abdomen and lower back, muscular strength, muscular endurance and flexibility of adult women, regardless of the fact that the body weight and fat percentages were not statistically significantly different. Also, it was concluded that the applied experimental exercise program three times a week caused the transformation processes of motor capacity of the subjects, i.e. that the changes in the results of motor manifestations were higher than in the application of some other treatment.

Research problem is to analyze the effects of fitness training program on the dynamic strength of women. The subject of the study is the dynamic strength. The aim of the study is indicating the possibility of increasing the dynamic strength in women who perform recreational exercise for just 10 weeks. The study started with the assumption (H_1): There are statistically significant differences in the effect of the model of the group guided recreational program on the dynamic strength of women in the experimental group of subjects.

Methods

The sample was made up of female subjects, aged 22-40 years, all from Belgrade, who practiced in the fitness club "Hercules" (experimental group), and women who did not do

any sports, employed in service organizations on the territory of Belgrade. The total sample in the study consisted of 60 subjects, of which N=30 of the experimental group, who implement recreational exercise program, and N=29 of the control group, who did not implement recreational exercise program. The subjects from both groups were tested before starting an exercise program and after the exercise program.

The assessment of motor capacity was carried out in June 2015 and September 2015, which included measurements at two time points.

The assessment of motor capacity used the standard motor tests (Bala, 2010; Obradovic, 1999; Kukolj, 2006):

- 1) Push-ups,
- 2) Pull-ups in high jump on the shaft,
- 3) Body lift 30 s,
- 4) Leg folding 30 s,
- 5) Squats on both feet 30 s.

The survey was conducted on a sample of recreational trainees from Belgrade. The assessment of motor capacity was carried out in early June 2015 when it the initial condition was established. The experimental group was tested in the fitness club "Hercules" in Belgrade, while the control group was tested in the gym of the primary school "Petar Kocic" in Belgrade, where the testing of motor capacity was conducted in the school's gym. In addition, after 10 weeks of training, a second measurement was performed which was realized in the same places with the same groups of women, using the same tests and the fact that testing was carried out by the same person (the author of the paper).

Description of the experimental treatment

The experimental program was led by the author of the study and was implemented, conducted in Belgrade in the fitness center "Hercules". It was only applied to the experimental group subjects. The control group was not practicing under such circumstances but only certain subjects indicated that they had, along with some fixed training mode in with dumbbells and small weights in the gym, used only a treadmill or bicycle, but once a week.

The experimental program consisted of the training which included the replacement of load in the form of anaerobic and aerobic mode, in the 2 to 1 ratio in favor of aerobic mode. Aerobic training was conducted in the experimental group of subjects. Trainings included 5-10 minutes of skip warm-up, aerobic-anaerobic part of the training in the duration of 35-40 minutes (the main part of the training). It consisted of different exercises. Strength exercises were performed at the end of each training for 10-minutes. Certain exercises on the parterre were followed by stretching exercises for 10 minutes.

Each training was designed to prepare the body for the exercise through the warm-up program, which gradually grew into a cardiac stage for a period of thirty minutes, in the form of varied choreography, which included all parts of the body. Breaks between the movements lasted only a few seconds. There were also squats, lunges, and sometimes weights to enrich the exercise so it would not be monotonous. The second part of the training included the exercises on the mat, which shaped leg muscles, inner thighs (inner lodge of the thigh), abdominal muscles, gluteal muscles, arms and shoulders with a focus on increasing muscle strength (muscle hypertrophy). The very end of the training was dedicated to stretching and relaxation exercises. The key to a successful exercise lies in concentrating on each movement and breathing, with full awareness of the body, while the experimental group subjects performed each exercise correctly and powerfully under the constant su-

pervision of a fitness instructor.

Abdominal muscles, which are particularly demanding area in women, were treated with the following exercises on the floor:

- 1) classic abdominal muscles in the intervals of 30 s or 60 s,
- 2) "bicycle"
- 3) "scissors"
- 4) "squat" and
- 5) all kinds of exercises to stimulate abdominal muscle region;

raising to the sitting position with squatting legs, lifting the legs to the vertical position with the assistance co-trainees, and lifting the hull from the surface 60 s.

Arm muscles were treated with the following exercises:

- 1) forearm bending with small weights (0.5 and 1 kg)
- 2) lifting dumbbells overhead, but all with imitating certain movements of individual martial arts that are a part of tae-bo workout.

Shoulder muscles were treated with the following:

- 1) lateral raise,
- 2) front lateral raise,
- 3) overhead press with weights of 0.5 to 1 kg.

Back muscles were treated with the following exercises:

- 1) rowing in a sitting position,
- 2) "deadlift" (single-handed)
- 3) "dead" lift (both hands).

Each exercise for a specific muscle region was performed in 4 series, in each training, all muscle regions in 8-10 with repetitions in 4 series. Exercises for the abdominal region were done by two series in each training. Exercises and intensity of work were performed in the zone of submaximal loads in order to obtain the best effect and for the exercises to have the maximum effect on women's health, and to achieve the goal, the increase of muscle strength.

Statistical analysis of the data contained calculating descriptive characteristics: arithmetic mean (AM) and standard deviation (S), minimum (MIN) and maximum (MAX) values of the measurement results and the coefficient of variation (CV). In order to determine statistically significant differences between the groups of subjects, the initial and final measurement applied multivariate variance analysis (MANOVA). In order to determine the effect of the training program between the two tests (determining statistically significant difference between the initial and final measurement) multivariate covariance analysis (MANCOVA) was applied.

Results

Based on the descriptive statistics value, one can see a remarkable variability of the results in the experimental and control groups in all the analyzed motor variables at the initial and final measurement. This is due to the large age range of the subjects and their initial level of strength.

It should be noted that the groups included women who had previously been engaged in sports, which can be indicated by the maximum values of the measurement results at the initial and final measurement (eg. 27 body foldings for 30 s in the experimental group, or 25 squats on both legs for 30 s). The subjects were of different social status.

Some subjects had never been subjected to any process of training (0 pull-ups on the shaft, 0 leg foldings for 30 s), and some had been engaged in some sport before. Due to this fact there are big differences between the recorded minimum and maximum values of the measurement results.

Table 1. Descriptive Variable Statistics

Measurement	Variable	Group	AM	S	MIN	MAX	CV (%)
Initial	Push-ups (frec.)	Experimental	2.07	3.35	0	13	161.84
		Control	3.22	3.92	0	13	121.74
	Body fold 30s (frec.)	Experimental	15.81	5.00	0	27	31.63
		Control	16.83	3.54	13	23	21.03
	Pull-ups on the shaft (frec.)	Experimental	2.04	1.72	0	6	84.31
		Control	1.94	1.77	0	5	91.24
	Leg fold 30s (frec.)	Experimental	11.30	5.07	0	22	44.87
		Control	13.33	3.34	9	21	25.06
	Squats on both legs 30s (frec.)	Experimental	16.07	6.42	5	28	39.95
		Control	15.17	5.59	5	24	36.85
Final	Push-ups (frec.)	Experimental	4.56	5.12	0	19	112.58
		Control	3.28	3.64	0	13	110.98
	Body fold 30s (frec.)	Experimental	18.54	4.09	10	28	26.32
		Control	16.72	3.01	12	22	18.00
	Pull-ups on the shaft (frec.)	Experimental	3.48	1.72	1	7	49.42
		Control	2.44	1.79	0	5	73.66
	Leg fold 30s (frec.)	Experimental	12.15	5.23	2	23	43.05
		Control	13.83	3.03	3	19	21.91
	Squats on both legs 30s (frec.)	Experimental	17.15	5.77	7	27	33.64
		Control	16.11	5.94	6	25	36.87

Legend: MIN – minimum recorded values, MAX – maximum recorded values, AM – arithmetic mean, S – standard deviation; CV – coefficient of variation

Values of the multivariate Wilk's F-test indicated that there was no statistically significant difference ($p=0.57$) between the different groups of subjects (experimental and control) with respect to the dynamic strength in the value of $F=0.79$ at the initial measurement. The individual analysis of each motor variable led to a conclusion that these differences do not exist

in any of the tested variables ($p>0.05$). It can be concluded that the groups were approximately equal (comparable situation of dynamic strength) before the application of the experimental treatment in the form of initial and advanced group fitness exercise program.

Table 2. Results of Multivariate Analysis of Variance at the Initial Measurement

Group	Variable	f	p	F	P
Experimental Control	Push-ups	1,11	0,30	0,79	0,57
	Body fold 30 s	0,56	0,46		
	Pull-ups on the shaft	0,03	0,86		
	Leg fold 30 s	2,25	0,14		
	Squats on both legs 30 s	0,24	0,63		

Legend: f – univariate f-test; p – level of statistical significance of the f-test; F – multivariate Wilk's F-test; P – statistical significance of multivariate F-test

As suggested, in order to determine the actual effects of the application of the experimental treatment multivariate covariance analysis (MANCOVA) was performed, and the results are shown in Table 3.

Analysis of the results in Table 3 can lead to a conclusion that there are statistically significant differences ($p=0.00$) between the experimental and control group subjects in the dynamic strength in the value Wilk's test $F=5.29$. By equalizing the subjects before the application of the treatment and individual observation, it can be concluded that these differences existed in 3 of 5 examined variables. Statistically significant differences were observed in the evaluation variables for the repetitive strength of arms and shoulders, and the strength of the torso:

- 1) Push-ups ($p=0.00$),
- 2) Body fold 30 s ($p=0.00$) and
- 3) Pull-ups on the shaft ($p=0.01$) in favor of the subjects in the experimental group.

Considering the variables for the assessment of dynamic strength of the body, using other variables leg folds 30 s and dynamic leg strength, squats on both legs 30 s, statistically

significant differences were not found ($p>0.05$).

Neutralizing the difference of the initial measurement, the subjects in the experimental group achieved better and statistically significant results can be seen by comparing the adjusted means in all variables. In the Push-ups variable, the ratio was 5.22 in the experimental group by 2.28 push-ups than in those from the control group. In the Body fold 30 s variable ratio was 18.85 by 16.26 in favour of the subjects in the experimental group, while the ratio of arithmetic means in the third tested variable, Pull-up on the shaft, amounted to 3.45 by 2.50 in the control group subjects.

Discussion

The study was conducted in order to determine the effects of group fitness program of exercise on the dynamic strength in women aged 22-40 years. The applied experimental exercise program twice a week for 10 weeks, caused a change in the results of the repetitive strength of arms and shoulders, as well as in a variable for assessing the dynamic body strength in the

experimental group subjects. The application of initial and advanced level of exercises (exercises listed in the parts of the experimental program), caused the changes in terms of repeti-

tive strength of arms and shoulders, and repetitive strength of the torso.

Table 3. Multivariate Analysis of Covariance for the Assessed Variables (MANCOVA)

Factor	Variable	f	p	Group	AM*	F	P
Group	Push-ups	13.74	0.00	Experimental	5.22	5.29	0.00
				Control	2.28		
	Body fold 30 s	12.36	0.00	Experimental	18.85		
				Control	16.26		
	Pull-ups on the shaft	8.62	0.01	Experimental	3.45		
				Control	2.50		
	Leg fold 30 s	0.02	0.88	Experimental	12.86		
				Control	12.77		
	Squats on both legs 30 s	0.01	0.99	Experimental	16.74		
				Control	16.73		

Legend: f – univariate f test; p – level of statistical significance of f test; F – multivariate Wilk's F test; p – statistical significance of multivariate F test; AM* - adjusted arithmetic mean

The results show positive changes in the dynamic strength as the motor capacity of women involved in the group fitness exercise program. The subjects who applied this method, achieved better results in the final measurement in 3 out of 5 motor tests included in this research. Fitness method is a system of physical exercises primarily aimed at increasing the body strength. Such method included the work on muscle tone, influenced the improvement of motor capacity in the experimental group, because it activated the movements of the spine and allowed the body to relax. The very performing of repetitive contractions in trainings, using certain exercises such as the "Hundred, Roll - up", "Single leg circles", "Scissors", "Shoulder bridge" and many other, contributed to the increased strength of the torso muscles, which resulted in the improved outcome after the treatment for a period of 2 months in the experimental group subjects. This confirmed the research hypothesis and the treatment can be considered successful.

Recreation with its means, content and methods has an impact on the correction of negative side effects, which affect the reduction of the working capacity function, impair health and lead to the emergence of early disability. This means that recreation represents an integral part of preventive action when it comes to health and becomes an integral part of modern medicine. The aim was to, by permanent and systematic involvement in recreation, create a positive habit for conceived, organized, meaningful and useful way of spending leisure time. Exercises for the development of repetitive strength of arms and shoulders, applied in an experimental program of exercise, contributed to the growing strength of arms and shoulders in the experimental group subjects.

It was found that the program significantly affected the repetitive muscle strength of the torso, and arms and shoulders. It primarily referred to the muscles m. rectus abdominus, m. obliquus internus et externus abdominus, mm. deltoidei, mm. pectorali, m. latisimuss dorsi, m. triceps brachi and m. biceps brachi which increased their strength. During the implementation of the experimental program, not only was the improvement of

motor capacity being in the focus, but also the state of the development of the mind and body. Possibly the crucial role belonged to the development of the system for the transport of oxygen which was impacted in the introductory parts of the fitness program and the main parts of the program using the movement exercises, breathing exercises, which are again an integral part of every workout. It was worked on proper breathing, the relationship between inhalation (inspiration) and exhalation (expiration), which could affect such obtained results.

It can also be assumed that the tests, in addition to sensitivity to pain, also involved some connotative characteristics responsible for pregnancy of the motivational structure (self-dominance, superego, and probably superego formation), which could be developed in the experimental group subjects during the implementation of the group fitness training. If we consider that the repetitive strength was under the mechanism of regulators of excitation duration, we get that it was distinguished by repeating certain movements to failure. A general feature of this mechanism is the duration of the activity itself the performance of which requires significantly less strength than the maximum possible, hence the selected tests.

The obtained research results confirm the expected transformation possibilities provided by an organized physical exercise and confirm previous results of Obradović et al. (2008). By observing the work so far and expectations for future experimental exercise programs of a similar type for women who want to succeed in their objective and the result of each training, it is possible to expect the improvement of their physical and mental health, as well as further progress in terms of strength, which will provide a better and more qualitative life.

Further research of this type should include more variables for assessing repetitive strength of certain parts of the body, the treatment should last longer, at least 6 months, and the sample of subjects should be more homogeneous in terms of age groups in order to avoid greater variability of results.

REFERENCES

- Babayigit, I., G., Evin, R., Ozdemir, R., A., Irez, S., G., & Kor-kusuz, F. (2009). The effects of 12 weeks pilates on balance, flexibility, muscle strength in elderly women. U (ed. Lolland, S., Bo, K., Fastang, K., Hallen, J., Ommundsen, Y., Roberts, G., & Tsoiakidis, E. B.). *Book of Abstracts of the 14th Annual Congress of the European College of Sport Science (625-626)*. Oslo: Gamlebyen Grafiske As.
- Bala, G. (2010). *Methodology kinesiometric research with*

- special emphasis on motor measurements*. Novi Sad: Faculty of Sport and Physical Education.
- Borer, K. (2008). How much is the body exercise effective in influencing the loss of body fat. *Kinesiology*, 40(2), 127-138.
- Cvetković, M. (2003). Effects of different models of circular training on strength development In Anthology of the *XXXVIII Congress of Anthropological Society of Yugoslavia with international participation (191-204)*. Belgrade: Anthropological Society of Yugoslavia.
- Čokorilo, N. (2005). *The effects of the application of the exercise model with progressive load on adipose tissue and muscle mass in female students*. Master's thesis. Novi Sad: Faculty of Physical Education.
- Kloubec, A. (2005). *Pilates exercises for improvement of muscle endurance, flexibility, balance and posture*. University of Minnesota.
- Kukolj, M. (2006). *Anthropometry*. Belgrade: Faculty of Sport and Physical Education.
- Mitić, D. (2001). *Recreation*. Belgrade.
- Obradović, J., Cvetković, M., & Kalajdžić, J. (2008). Effects of pilates on motor capacity of female students at the Faculty of Physical Education. *Gazette of Anthropological Society of Serbia*, 43, 598-604.
- Stojiljković, S., Mitić, D., Mandarić, S., & Nešić, D. (2005). *Fitness*. Belgrade: Faculty of Sport and Physical Education.
- Zaciorski, V. M. (1995). *Science and practice of Strength Training*. Human Kinetics. Champaign, IL.

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