EFFECTS OF FITNESS PROGRAMS ON FUNCTIONAL CAPABILITIES

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ORIGINAL SCIENTIFIC ARTICLE

Summary: Group fitness programs are organized trainings that are conducted in a group environment under the guidance of an instructor, and are designed to cover different levels of physical fitness. The research included 52 respondents, divided into experimental and control groups. Bruce's treadmill test with seven output variables was used to assess functional abilities. The experimental program lasted 12 weeks with a combination of different programs and intensity between 40-85%. The results indicate positive effects of group fitness programs on cardiac work, speed improvement, effects on absolute and relative oxygen consumption. No differences were recorded in the forced vital capacity variable suggesting the need for additional research to optimize the effects on all aspects of physical fitness. It is recommended that future research include larger samples and longer time periods to further examine effects on functional abilities.

Keywords: zumba, pilates, aerobics, women, VO2max, treadmill

INTRODUCTION

Fitness programs have a significant impact on improving functional abilities, which is reflected in the improvement of cardiovascular endurance, strength, flexibility and overall fitness. Research conducted by (Smouter et al., 2019) showed that a six-month program of combined strength and endurance training significantly improved aerobic capacity and muscle strength in adult participants. Similarly, the group of authors Martinez et al. (2020) investigated the effects of high-intensity interval training (HIIT) on functional capacity and showed a decrease in body mass with an increase in aerobic efficiency in obese individuals. Fitness programs are key to the development and improvement of functional abilities, which refer to an individual's ability to perform daily activities with minimal effort and optimal performance. Functional ability is based on components such as strength, endurance, flexibility, balance and coordination, and properly designed fitness programs can significantly affect all of these aspects. Different types of training, such as aerobic exercises, strength training, flexibility and balance exercises, contribute to better cardiovascular function, muscle strength and endurance, as well as better movement control and balance.

One of the key reasons for researching the effects of fitness programs on functional abilities is the need to provide a scientific basis for the design of effective

training programs. For example, a study by Fritz et al. (2018) showed that the application of functional training significantly reduces the risk of injuries and improves recovery in athletes, while a study by Parker et al. (2019) indicated the positive effects of high-intensity interval training on the functional abilities of people.

Researching these effects also has a wider societal benefit, as it provides insight into how physical activity can improve quality of life, reduce the risk of chronic disease, and facilitate rehabilitation after injury. Given the growing interest in personalized approaches in fitness, further study of functional abilities will enable better adaptation of programs to the specific needs of individuals, which will contribute to more effective results in training. This study is rational because it examines the specific effects of different training on functional abilities, providing useful guidelines for application in the broader context of health fitness. The aim of this paper is to examine the impact of different fitness programs on functional abilities, providing a basis for improving fitness training in order to optimize physical form.

The aim of the research was to determine the effects of group exercise on women's functional abilities.

RESEARCH METHOD

Sample of participants

The total sample included 52 subjects aged 35 to 42 years. The sample was divided into two subsamples. The first group (experimental) consisted of female subjects, physically active (N=32). The second group (control) consisted of a subsample of (N=20) female respondents who were not involved in any content of systematic exercise, i.e. were not active. Subjects of the experimental group exercised twice a week for 60 minutes.

A sample of measuring instruments

1. Bruce's treadmill test, Using the test, the following variables were obtained:

- HRmax (bpm) – maximum heart rate,
- Vmax (km/min) - Maximum speed achieved while running on the treadmill
- (min) T - Total duration of treadmill load test
- VO2max (ml/min/kg) – relative oxygen consumption,
- VO2max, (l) – maximum oxygen consumption,
- VE (l/min) – maximum minute ventilation
- FVC, forced vital capacity

This test is used to evaluate patients with suspected heart disease and involves gradually increasing the speed and incline of the treadmill every three minutes. The test has 7 load levels, each of which lasts 3 minutes. The initial slope is 10% and increases to 22%, while the speed starts from 2.73 km/h and increases to 9.6 km/h. The test is stopped if the set load, heart rate is reached, or symptoms such

as anginal pain or high blood pressure appear. Along with this test, monitoring of oxygen consumption by spirometry is used. The spiroergometric test uses the Quark b 9.0 system and software package for continuous monitoring of parameters such as oxygen consumption (VO2), heart rate (HR), respiratory minute volume (VE), and respiratory quotient (RQ). The test is performed under controlled conditions of temperature and humidity, with patients breathing through a mask connected to gas analyzers. The test begins with walking at a speed of 2.7 km/h, and every three minutes the speed and incline of the treadmill increases.

Experimental program

Before the start of the experimental program, during the first week, subjects from the experimental and control groups had their body height measured using an anthropometer and body weight using a digital scale. Based on these measurements, the body mass index (BMI) was calculated. The parameters are not shown statistically, but the values are listed in the results.

The experimental program lasted 12 weeks and aimed to determine improvements in the functional abilities of the subjects in the experimental group. During the month there were eight trainings, and a total of 32 trainings in continuity throughout the program, without interruption. Out of the total number of trainings, 16 trainings were Pilates, 16 trainings were step aerobics.

Each week, one workout was Pilates at an intensity of 40-60% maximum heart rate, while the second workout included a combination of aerobics-step aerobics at an intensity of 65-85% maximum heart rate. Heart rate was monitored by the simple method of feeling the pulse and counting the beats for 10 seconds, then multiplied by six. Heart rate monitoring was performed at least five times during one hour of training.

Statistical data processing

The SPSS v20 program was used for data processing. To determine the differences in functional abilities between the experimental and control groups at the initial and final measurement, a multivariate analysis of variance (MANOVA) was used, while a univariate analysis of variance (ANOVA) was used to determine the differences between the groups for each variable. The testing of differences was done with the F-test, and the level of significance of the differences was expressed as p. To determine the differences between the initial and final measurement of the functional abilities of the subjects within the experimental and control groups, a t-test for dependent samples was applied.

RESULTS

Table 1. Differences between experimental and control groups in functional abilities at initial measurement

Var.	EG n=32		CG n=20		F	Sig.
	AS	S	AS	S		
HRmax (bpm)	173,08	12,19	168,79	12,26	1,95	0,17
Vmax (km/min)	5,62	0,86	5,23	0,70	3,84	0,06
(min) T	7,18	1,70	6,70	1,16	1,66	0,20
VO2max (ml/min/kg)	27,53	4,11	28,26	4,86	0,42	0,52
VO2max, (l)	1,81	0,29	1,84	0,29	0,18	0,67
VE	63,04	10,95	59,98	12,10	1,12	0,29
FVC	3,70	0,64	3,62	0,58	0,27	0,61

Legend: AS – arithmetic mean, S – standard deviation, f – univariate f-test, Sig. – statistical significance

By analyzing table no. 1, based on the statistical significance of the multivariate F-test, it can be observed (Sig.>0.05) that there is no statistically significant difference in the entire system of analyzed variables between the groups (experimental and control) at the initial measurement. Analyzing each variable individually, it can also be observed that there is no statistically significant difference between the groups (experimental and control) at the initial measurement, which is a good prerequisite for conducting the experimental treatment.

Table 2. Differences between the experimental and control groups in functional abilities at the final measurement

Var.	EG n=32		CG n=20		F	Sig.
	AS	S	AS	S		
HRmax (bpm)	174,42	11,57	168,75	11,03	3,93	**0,05**
Vmax (km/min)	5,93	0,71	5,18	0,63	19,41	**0,00**
(min) T	8,06	1,51	6,33	1,14	25,63	**0,00**
VO2max (ml/min/kg)	30,04	4,15	27,52	5,01	4,85	**0,03**
VO2max, (l)	1,98	0,29	1,75	0,25	11,32	**0,00**
VE	71,27	13,88	59,61	12,21	12,32	**0,00**
FVC	3,85	0,72	3,54	0,64	3,06	0,09

Legend: AS – arithmetic mean, S – standard deviation, f – univariate f-test, Sig. – statistical significance

By interpreting table 2, it can be seen that in the entire system of analyzed variables (functional abilities) there are statistically significant differences between the experimental and control groups at the final measurement. Code variables:

HRmax (bpm) (Sig.=0.05), maximum speed (Sig.=0.00), total test time (Sig.=0.00), VO2max (Sig.=0.03), VO2max (I)-(Sig.=0.00) and VE (p=0.00) it is observed that there is a statistically significant difference between the experimental and control groups at the final measurement. Analyzing the AS for the Hrmax (bpm) variable, it can be seen that the subjects from the experimental group (AS=174.42) had higher values on the final measurement than the subjects from the control group (AS=168.75). In the case of the variable maximum speed by analyzing the AS, it is observed that the subjects of the experimental group (AS=5.93) achieved better results on the final measurement than the control group (AS=5.18). The total duration of the test increased in the experimental group (AS=8.06) compared to the control group (AS=6.33). With the variable VO2max - relative, the maximum oxygen consumption increased in the experimental group (AS=30.04) compared to the control group (AS=27.52), which fully justifies the statistical significance stated in the table. VO2max-absolute oxygen consumption increased in the experimental group (AS=1.98) compared to the control group (AS=1.75). The arithmetic mean in the VE variable in the experimental group is AS=71.27, and the control AS=59.61. For the FVC variable, there is a statistically significant difference between the experimental and control groups at the final measurement.

Table 3. Differences between the initial and final measurements in the functional abilities of the experimental and control groups

Var.	**EG n=32**		**CG n=20**	
	AS	**Sig.**	**AS**	**Sig.**
HRmax (bpm)	173,08 174,42	0,06	168,79 168,75	0,95
Vmax (kg/min)	5,62 5,93	**0,00**	5,23 5,18	0,33
(min) T	7,18 8,06	**0,00**	6,70 6,33	**0,00**
VO2max (ml/min/kg)	27,53 30,04	**0,00**	28,26 27,52	**0,01**
VO2max, (1)	1,81 1,98	**0,00**	1,84 1,75	**0,00**
VE	63,04 71,27	**0,00**	59,98 59,61	0,60
FVC	3,70 3,85	**0,01**	3,62 3,54	**0,02**

By analyzing table 3 based on statistical significance, it can be observed that in the experimental group there are statistically significant differences in functional abilities between the initial and final measurements. Based on t-test values for variables: maximum speed (-3.15), total duration time (-5.67), VO2max-relative (-3.83), VO2max-absolute (-4.21), VE (-4.25) and FVC (-2.91), it was observed that the subjects achieved better values in the second measurement (final). In the variables

HRmax, HR on VO2max, there is no statistically significant difference between the initial and final measurements of the experimental group.

On the other hand, in the control group, total time, VO2max-relative, VO2max-absolute, FVC. For the variables of the same name, total time (5.35), VO2max-relative (2.70), VO2max-absolute (4.48) and FVC (2.56). The positive value of the statistics tells us that the respondents achieved better values at the initial measurement. There is no statistically significant difference between the initial and final measurements of the control group for the variables HRmax, maximum speed during the test, VO2 and VE.

DISCUSSION

Functional or aerobic capacity refers to the ability of the organism to maintain aerobic metabolic processes, which constitutes the majority of the total energy capacity of a person. Maximum oxygen consumption (VO2max) represents the body's capacity to absorb the largest possible amount of oxygen at a given moment and is considered the best indicator of aerobic capacity and physical fitness (Jones & Carter, 2020). It depends on the ability of muscle tissue to use oxygen for energy production, as well as on the efficiency of the cardio-vascular and respiratory systems in transporting oxygen to working muscles (Bassett & Howley, 2022).

With aging comes a gradual decline in aerobic capacity, which is associated with physiological changes, especially in the cardio-vascular system and skeletal muscles. Inherited genetic factors play a significant role in determining aerobic capacity, both in active and inactive individuals (Tucker et al., 2021). According to the World Health Organization, regular physical exercise can significantly reduce the risk of chronic diseases such as obesity and stress (WHO, 2023). Physiological age, compared to chronological age, is determined by the organism's ability to adapt to everyday life conditions and workloads. VO2max is a key indicator for assessing physiological age, as well as the overall efficiency of the organism in mature and older age. Research shows that a significant part of the changes attributed to aging is a consequence of insufficient physical activity, which leads to muscle atrophy (Santos et al., 2022).

Directed and planned physical activity lasting four months has been shown to improve certain aspects of functional (aerobic) abilities. The effects of group exercise on women's functional abilities were determined on a sample of 52 respondents. The experimental group consisted of 32 subjects who were actively involved in recreational group exercise for 4 months, twice a week for 60 minutes (120 minutes per week in total). The control group consisted of 20 subjects who were not involved in any content of systematic recreational exercise. The aim of the research was to determine the effects of group exercise on women's functional abilities. The obtained results show that there are statistically significant differences in the aerobic abilities of women in the experimental and control groups.

Statistical significance indicates differences between the initial and final measurements in the following variables: maximum speed, total test time, relative oxygen consumption (VO2max (ml/min/kg)), absolute oxygen consumption (VO2max (1), pulmonary ventilation (VE) and forced vital capacity (FVC) Similar results were obtained by Eskurza et al. (2002), Gillet & Eisenman (1987) that there

was a difference between the experimental and control groups in the relative maximal oxygen consumption (VO2max (ml/min/kg)). Eskurza et al. (2002) show that maximum oxygen consumption is higher in physically active women than in sedentary women. no statistically significant difference was found.These results can be attributed to the fact that the maximum heart rate is individual at a certain effort of the individual, as well as to the fact that the maximum heart rate is affected by external and internal factors (gender, medications, temperature, emotional state). Based on the value of the statistical test, it can be seen that the test subjects in the experimental group achieved better results in all variables of functional abilities in the second measurement (final). The obtained values are expected, because aerobic group recreational exercise has a positive effect on the functional abilities of the test subjects.

The control subjects achieved better results on the initial measurement. There are various facts that explain this claim. One of them is motivation for physical activity and quality of life, i.e. commitment to a sedentary lifestyle. Fitzgerald et al. (1997) state that aerobic capacity increases with age (women who regularly exercise recreationally), in contrast to inactive women whose aerobic capacity decreases over the years. During the performance of the spiroergometric load test on the treadmill, some shortcomings were observed that could be attributed to the lower results. The respondents had less experience of running on a treadmill, due to their age. As a result, there is a lack of a certain routine during running.

CONCLUSION

The results of the research indicate positive effects of group fitness programs on the functional abilities of the subjects, especially in terms of improving heart rate, speed and oxygen consumption. Although no improvement in forced vital capacity was noted, these findings confirm the effectiveness of a variable-intensity program for improving fitness. Group trainings allow comprehensive development of physical abilities and can be useful in different populations, adapted to their level of physical fitness.

It is recommended that future research include larger samples and longer time periods to further examine effects on functional abilities, especially those variables that did not show significant changes. Also, a more detailed analysis of individual differences and the effects of different types of group programs could provide deeper insights into training optimization for specific target groups.

REFERENCES

Bassett, D. R., & Howley, E. T. (2022). Limiting factors for maximum oxygen uptake and determinants of endurance performance. *Medicine and Science in Sports and Exercise*, *54*(4), 669-677.

Eskurza, I., Donato, A. J., Moreau, K.L., Seals, D. R., & Tanaka, H. (2002). Changes in maximal aerobic capacity with age in endurance-trained women: 7-yr follow-up. *Journal of Applied Physiology*, *92*(6), 2303-2308.

Fitzgerald, M., Tanaka H., Tran Z., & Seals, D., (1997). Age-related declines in maximal aerobic capacity in regularly exercising vs. sedentary women: a meta- analysis. *Journal of Applied Physiology*, *83*(1), 160–165

Fritz, C., Heeren, A., & Keller, M. (2018). Functional training reduces injury risk and improves recovery in athletes: A randomized controlled trial. *Journal of Strength and Conditioning Research, 32*(7), 1905-1913.

Gillett, P., & Eisenman, A. (1987). The effect of intensity controlled aerobic dance exercise on aerobic capacity of middle-aged, overweight women. *Research in Nursing & Health*, *10*(6), 383-90.

Jones, A. M., & Carter, H. (2020). The effect of age and training on VO2 max and exercise performance. *Journal of Physiology*, *598*(7), 1215-1230.

Martinez, L., Gonzalez, P., & Ramirez, F. (2020). High-intensity interval training improves functional capacity and reduces body weight in obese individuals. *European Journal of Applied Physiology, 120*(4), 789-797.

Parker, J., Thompson, L., & Evans, K. (2019). High-intensity interval training improves functional capacity in older adults: A systematic review. *Journal of Aging and Physical Activity, 27*(3), 409-420.

Santos, L. M., Oliveira, J. C., & Lima, A. M. (2022). The role of physical activity in the prevention of muscle atrophy in older adults. *Journal of Geriatric Physical Therapy, 45*(3), 215-224.

Smouter, L., Smolarek, A. C., Souza, W. C., Lima, V. A., & Mascarenhas, L. P. G. (2019). Cardiorespiratory fitness associated to teenagers' fat: VO2max cutoff point. *Revista paulista de pediatria: orgao oficial da Sociedade de Pediatria de Sao Paulo*, *37*(1), 73–81. https://doi.org/10.1590/1984-0462/;2019;37;1;00017

Tucker, R., Marais, D., & Lambert, M. I. (2021). The genetic basis of endurance performance and trainability. *Sports Medicine*, *51*(5), 843-856.

World Health Organization (WHO). (2023). *Global recommendations on physical activity for health*. Geneva: WHO Press.

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