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EFFECTS OF THE HEALTH AND PREVENTION NORDIC WALKING PROGRAM ON THE FUNCTIONAL STATUS OF WOMEN AGED 30-40

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Abstract: In mitigating the negative effects of technological development and modern lifestyle, it is necessary to apply proper models of physical activity programs oriented towards health and prevention. The application of such models enables an efficient optimization of functional capacities, the preservation and enhancement of health, as well as an elimination and mitigation of health issues. Lately, Nordic walking is being used as a sports-recreational activity and a health and prevention technique. In this research, the sample of respondents consisted of women aged 30-40. The total number of respondents comprised 28 individuals (N=28). The applied Nordic walking experimental program lasting three times a week over three months resulted in a change in the results of the functional capacities. Testing differences between the initial and final measuring of the effects of functional capacities of the applied program show a significant statistical difference corresponding to a significant level of $p<0.05$ in all examined variables (vital capacity - FVITKP, heart rate in state of inactivity - FFSRCM, pulse in state of activity - FFSRCR, systolic blood pressure - FTASI, diastolic blood pressure - FTADI, relative oxygen consumption - VO2 max, Stange test - PŠ, Romberg test - PR). The aim of this research is to evaluate the effects of the three-month long Nordic walking program on the functional capacities of women aged 30-40.

Keywords: *Nordic walking, functional capacity, female body*

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INTRODUCTION

In addition to a positive effect on the development of society, the era of technological progress of contemporary civilization has a number of negative impacts, which are primarily manifested on psychosomatic health and the reduction of the functional capabilities of the population. Women are a particularly vulnerable category of the population. The anthropological characteristics of women (functional, morphological, motor, etc.) are biologically conditioned and transformed under the influence of the environment and life style. Among various influences, sports-recreational activities appear as a significant factor in the life of a modern woman. These activities should be organized so as to have a beneficial effect on the health status of women, and above all, future mothers should enjoy its positive effect.

The female body is a sensitive, complex bio-psycho-physical circuit. Physical exercises and the sports activity of women must be based on the knowledge of differences and specificities - anatomical, physiological, and psychological (Juhas, 2011, 42).

Changes in the functional conditions of women depend on the different phases of the menstrual cycle. During the menstrual cycle, activities related to the cooling of the female body are not recommended (Solodkov, 2001, 263).

Human functional capabilities include the functional structures of the organ systems and their operation (Čolakhodžić, Rađo, 2011, 48).

Research on the functional state of women shows that, due to a lack of physical activity of the organism, there are disorders of nerve-reflex connections (Beljavskaja et al., 1964, 43; Volkov, 1990, 56; Novakov, 1996, 10; Gravskaja, 1997, 3).

Appropriate models of sports and recreational programs have a complex effect on the female organism and contribute to the development of a general adaptation mechanism. The systematic application of adequate sports and recreational programs improves the functional possibilities and regulatory mechanisms of certain organs and the system of the female organism.

Lately, Nordic walking as a sports-recreational activity is being used as a health-preventive technology for the elimination and alleviation of nervous-psychiatric conditions. This sports-recreational activity is an innovative aerobic model that is used as a recreational activity, as a means of recovery in kinesitherapy, but also as a means of preparing athletes – Nordic skiers during the summer. This activity is extremely popular among older recreationalists as a means of prophylaxis and active rest (http://kineterapy.ru/nw-rules.html, downloaded on November 29, 2016).

American researcher Knox compared the load of Nordic walking and regular walking in women aged 17-35 years using comparative analysis. When activating the arm in Nordic walking compared to normal walking, the pulse is increased, as well as ventilation and oxygen and energy consumption. The pulse

increases from 17-33 beats, and energy consumption increases by 14% (Kantanova, 2014, 21).

Porcari, Hondrickson, Walter, Tery, Wasko (1997) conducted a survey involving 31 individuals - 16 women and 15 men aged 19 to 32. They explored the consumption of oxygen and energy during Nordic walking and walking without poles. The research showed that in Nordic walking in relation to walking without poles, the consumption of oxygen was 23% higher, and energy consumption was increased by 22%. The results of the study also indicated an increase in pulse by 16% (18 beats per minute) in Nordic walking compared to normal walking.

Atila, Holopainen and Jokinen (1999) investigated the effect of Nordic walking and running on the neck and shoulder belt. Through muscle research, the EMG method has established that Nordic walking is an effective means of alleviating pain in the neck and shoulders.

Osowski et al. (2010) investigated the effect of Nordic walking on the development of upper and lower extremities in women aged 60 to 69.

The *research problem* concerns the consideration of whether and to what extent the three-month program of Nordic walking influences the functional status of women aged 30 to 40.

The *subject of the research* are the changes in the functional status of women aged 30-40 who lead a sedentary lifestyle under the influence of programmed physical activity-Nordic walking.

The *aim of the research* is to evaluate the effect of the three-month program of targeted programmed sports and recreational activities of Nordic walking on the functional abilities of women aged 30-40.

In order to achieve the set research goal, it is necessary to carry out the following *research tasks*:

- To examine the appropriate literature that addresses the problem of functional changes in the application of the programmed physical activity - Nordic walking;
- To determine whether the application of the programmed physical activity - Nordic walking, can lead to some positive effects of the functional abilities of the respondents;
- To determine the medium level and variability of the functional characteristics of the initial and final measurements in the applied program;
- To determine the level of homogeneity in the group in which the Nordic walking program was applied;
- To determine the level of change - the difference between the initial and final measurement of a functional status using the student's t-criterion.

METHOD

Based on the goal and subject of the research, we applied the following methods:

- The experimental method with one experimental group (Nordic walking group). The experimental factor was realized within the three-month program (3 x per week);
- Methods for assessing general functional abilities and methods for assessing the function of the cardiovascular system;
- The theoretical method: content analysis method;
- Statistical methods.

The sample of respondents (N=28) consisted of women aged 30-40. At the beginning of the experimental program, the age of the respondents was 35.57 years. They had to meet the following criteria: no health problems; the willingness to participate regularly in the program; and volunteering to participate in the program;

For the purposes of this research, and for the purpose of testing the functional abilities, we used a sample of variables for the assessment of functional abilities: vital capacity (FVITKP); heart rate in a state of inactivity (FFSRCM); working pulse (FFSRCR); systolic arterial blood pressure (FTASI); diastolic arterial blood pressure (FTADI); relative consumption of oxygen (VO2max); Stange test (PS); and the Romberg test (PR).

Functional capability checks were performed prior to the beginning of program implementation (initial measurement) and at the end of the program (final measurement). The obtained results at initial and final measurements were processed with adequate methods by which we obtained appropriate information concerning the research problem. The basic statistical parameters for all tested variables were calculated. To determine the significant statistical difference between the initial and final measurement experimental treatment, we applied the student's t-test.

RESEARCH RESULTS

When presenting the results, the descriptive statistical variable results shall be presented first, followed by the differences between the initial and final measurements of the functional abilities of women aged 30-40.

Table 1 shows the results of descriptive statistical variables related to women's functional abilities with the applied Nordic walking program at initial measurement, indicating that there are no significant deviations from normal distribution.

Table 1. *Basic statistical indicators of functional abilities of respondents at initial and final measurement*

	Variable	N	M	min	max	R	SD	S^2	V%
Initial measurement	FVITKP	28	3439.43	3297.00	3590.00	293.00	77.87	6064.25	2.26
	FFSRCM	28	74.71	67.00	84.00	17.00	4.06	16.51	5.43
	FFRCR	28	165.29	155.00	173.00	18.00	4.09	16.73	2.47
	FTASI	28	129.21	115.00	152.00	37.00	10.48	109.73	8.11
	FTADI	28	81.00	65.00	91.00	26.00	5.36	28.74	6.62
	VO2max	28	31.84	13.25	46.34	33.09	8.56	73.32	26.88
	PŠ	28	43.13	37.24	47.29	10.05	2.50	6.24	5.80
	PR	28	10.24	5.28	13.25	7.97	2.14	4.57	20.90
Final measurement	FVITKP	28	3880.64	3749.00	4001.00	252.00	72.40	5241.20	1.87
	FFSRCM	28	72.32	64.00	81.00	17.00	4.00	16.00	5.53
	FFRCR	28	156.43	150.00	167.00	17.00	4.26	18.18	2.72
	FTASI	28	127.14	115.00	146.00	31.00	9.39	88.13	7.39
	FTADI	28	78.82	62.00	87.00	25.00	5.10	26.00	6.47
	VO2max	28	39.72	20.37	55.10	34.73	8.25	68.08	20.77
	PŠ	28	52.62	47.24	57.28	10.04	2.55	6.52	4.85
	PR	28	13.55	9.28	17.01	7.73	2.11	4.47	15.57

Legend: FVITKP - vital capacity; FFSRCM - resting heart rate; FFRCR - working pulse; FTASI - systolic blood pressure; FTADI - diastolic blood pressure; VO2max - relative oxygen consumption; PŠ – Stange test; PR – Romberg test; N - number of respondents; M - arithmetic mean; min - minimum; max - maximum; R - range of statistical series; SD - standard deviation; S2 - variance; V% - coefficient of variation.

By inspecting the mean value of the vital capacity (FVITKP) in the initial measurement, a value of 3439.43cm^3 was recorded and 3880.64cm^3 at the final. The coefficient of variation (V%) describes the group as highly homogeneous, as it was 2.26% at the initial measurement, and 1.87% at the final measurement.

The average measured heart rate in a state of inactivity at initial measurement was 74.71 points, and 72.32 beats at the final. The coefficient of variation (V%) at the initial measurement was 5.43%, and the final 5.53%, describing the group as extremely homogeneous. The range of the statistical series at the initial and the final measurement was 17 beats.

The obtained mean pulse results (FFSRCR) at the initial measurement were 165.29 beats per minute, and 156.43 beats per minute at the final. The values of the coefficient of variation (V%) at the initial measurement in the variable working pulse (FFSRCR) was 2.47%, and 2.72% in the final, describing the group as an extremely homogenous set. The range of the statistical series at the initial measurement was 18 beats per minute and 17 beats per minute at the final.

The mean measured systolic blood pressure (FTASI) at the initial measurement was 129.21mmHg, and 127.14mmHg at the final. The coefficient of variation (V%) at the initial measurement was 8.11%, and 7.39% at the final, describing the group as extremely homogeneous.

The average measured diastolic blood pressure (FTADI) at initial measurement was 81.00mmHg, and 78.82mmHg at the final measurement. The

coefficient of variation (V%) at the initial measurement was 6.62%, and 6.47% in the final, describing the group as an extremely homogenous set.

As regards the respondents, the average value of the maximum oxygen consumption (VO2 max) at initial measurement was 31.84ml/kg/min, and the final 39.72ml/kg/min, and the statistical series range was 33.09ml/kg/min at the initial measurement and 33.73ml/kg/min at the final measurement. The coefficient of variation (V%) at the initial measurement was 26.88%, and 20.77% in the final, describing the group as belonging to a homogeneous set.

In the experimental group, in the Stange test (PŠ) (assessment of the organism according to hypoxia), the median result was 43.13 seconds at the initial measurement, and the final measurement was 52.62 seconds. The coefficient of variation (V%) at the initial measurement was 5.80%, and 4.85% in the final, describing the group as highly homogeneous. The range of statistical series, i.e. the initial width of the initial measurement was 10.05 seconds, and the final measurement was 10.04 seconds.

The mean values on the Romberg test (a test for assessing the static coordination of the functional state of the vestibular apparatus) showed that the coordination-functional abilities at the initial measurement were not at a satisfactory level - 10.24 seconds (according to Egorova, 2013). Following the Nordic walking treatment program, there was an improvement in the Romberg test from 10.24 to 13.55 seconds. The coefficient of variation (V%) at the initial measurement was 20.90%, and 15.57% at the final, describing the group as belonging to a homogeneous set.

Table 2 shows the results of the t-test for dependent variables - arithmetic mean (M), standard deviation (S), 95% standard error of arithmetic mean (Std. Error), confidence interval (95% Confidence Interval of Difference) , t-values, df-degree of freedom, p-level of significance.

Table 2. *Difference between initial and final measurements of functional variable variables in the applied program (Nordic walking)*

Variable (init.- fin.)	Paired differences					t	df	p
	M	SD	Std. Error Mean	α=95% Lower	α=95% Upper			
FVITKP	-441.214	10.429	1.970	-445.258	-437.170	-223.862	27	0.000
FTASI	2.071	1.923	0.363	1.325	2.817	5.700	27	0.000
FTADI	2.178	1.492	0.281	1.600	2.757	7.726	27	0.000
FFSRCM	2.392	0.566	0.107	2.173	2.612	22.333	27	0.000
FFRCR	8.857	3.319	0.627	7.570	10.144	14.121	27	0.000
PR	-3.308	0.540	0.102	-3.518	-3.098	-223.862	27	0.000
PŠ	-9.481	1.272	0.240	-9.974	-8.987	-39.425	27	0.000
VO2max	-7.883	2.602	0.491	-8.892	-6.874	-16.031	27	0.000

Legend: FVITKP - vital capacity; FFSRCM - resting heart rate; FFRCR - working pulse; FTASI - systolic blood pressure; FTADI - diastolic blood pressure; VO2max - relative oxygen consumption; PŠ – Stange test; PR – Romberg test.

Testing the differences between the initial and final measurements of the effects of the applied program (Nordic walking) of the tested variables, there was a statistically significant difference with a significance level of $p<0.05$ in all variables. The results of functional indicators show improvement - an optimization of functional abilities.

DISCUSSION

Changes after experimental treatment were recorded in all variables for assessing the functions of the cardio-vascular system and functional abilities. The results of our research, in terms of functional abilities, can be compared with the studies carried out by Staugthon (1992), and Larkin and Karvonen (1992) from the University of Oregon, who investigated the effects of Nordic walking. If we compare the results of the functional capabilities of respondents between the initial and final measurement, we can note an improvement of the functional status. The analysed differences between initial and final vital capacity testing (FVITKP) show a statistically significant difference (improvement of -441.214cm^3; t=233.862; p=0.00). The obtained results of the vital capacity are approximate to the results obtained by Staugthon (1992).

There was an improvement in VO2max results in the final testing (an increase of VO2max of 7.833ml/kg/min; t=16.031; p=0.00). If we compare the results obtained with the recommended VO2max values for women aged 30-39, we can see that the respondents from one mid-level VO2 max passed to a high level (34-44ml/kg/min, according to WHO).

In regards to the results of the Romberg test (PR), we can see an improvement in the final test results. The results are on the verge of recommended values, according to Egorova (2013).

The results of the functional conditions of the respiratory system in the test-sample Stange (PŠ) range were within the values recommended by Egorova (2013).

By inspecting the t-test results in sleeping heart rate variables (FFSRCRM) and the heart rate during work (FFSRCR), a significant statistical difference was observed in the final test. The standstill pulse decreased from 74.71 beats per minute at initial measurement to 72.32 beats at final testing - a difference of 2.392 beats per minute; t=22.333; p=0.000. Many factors affect the frequency of the heart: age, gender, body position, level of training, etc. By checking the results of work-testing (FFSRCR) we can conclude that after experimental treatment there were statistically significant changes. There was a decrease of 10.144 beats per minute (from 165.29 beats per minute at initial measurement to 156.43 beats per minute at the final measurement, t=14.121; p=0.00). The working pulse can be influenced by the following factors: work intensity, i.e. consumption of O_2 during operation, muscle mass, volume of work, body position, digestion, body temperature, level of training, and work pace.

The dynamics of the systolic arterial pressure (FTASI) and diastolic pressure (FTADI) indicators show a decrease in the value at final testing. In the systolic arterial pressure (FTASI), there is a significant statistical difference of 2.071mmHg (from 129.21mmHg at the initial to 127.14mmHg at the final measurement, t=7.726; p=0.000).

By inspecting the results, we notice a significant statistical difference between the initial and final measurement of diastolic blood pressure (FTADI); (from 81.00mmHg at the initial to 78.82mmHg at the final measurement; t=7.726; p=0.000). Arterial blood pressure can be influenced by the following factors: age, gender, body position, emotion, time of day, and digestion.

The obtained results of functional abilities are the result of a targeted training process, resulting in the optimization of the functional capacities of women aged 30-40.

CONCLUSION

The applied Nordic walking program was a good instrument for optimizing the functional skills of the respondents;

The average values of the results of the statistical indicators of the respondents' functional abilities showed an improvement in all investigated functional characteristics;

The analysed results of the coefficient of variation (V%) in all variables at initial and final testing describe the group as extremely homogeneous;

Testing the differences between the initial and final measurement of the effects of the applied program's functional indicators show a significant statistical difference at the $p<0.05$ level of significance in all tested variables;

The obtained results of the respondents' functional abilities were examined on the basis of previous studies that dealt with the problems of the functional abilities of Nordic walking.

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