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Research Article

Effects of Waterobics Programs on Body Mass, Body Composition, and Coronary Risk Profile of Sedentary Obese Middle-aged Women

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Abstract

Background: Waterobics is a physical exercise with very few effects on the joints, hence its attractiveness for weight loss in obese middle-aged people.
Objectives: This study was intended to evaluate the body mass, body composition, and coronary risk profile in sedentary obese middle-aged women in response to exercise-related time (continuous and at intervals) in waterobics programs.
Methods: This prospective experimental research was conducted in 2018. Forty women with sedentary lifestyles (mean age 50.7±4.7 years) were selected and distributed randomly into two groups: high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT). Both programs consisted of waterobics exercises with similar energy expenditures (1500 kcal per week), implemented over three 60-minute sessions per week for three months. Before and after the study, anthropometry, body composition, and coronary risk profile were assessed. Non-parametric Wilcoxon test was used for group comparison (before and after).
Results: Before-after comparison of the parameters showed a significant decrease in body mass (-0.8 kg, P=0.04), BMI (-0.4 kg/m^2, P=0.02), fatty mass (-0.6 kg, P=0.03), and hip circumference (-4.2 cm, P=0.04) of the MICT, and a significant reduction in fat mass (-0.7 kg, P=0.03) in the HIIT. No significant differences were observed concerning the T-C, LDL-C, and HDL-C between the MICT (respectively, P=0.23; P=0.1; P=0.08) and HIIT (respectively, P=0.1; P= 0.06; P=0.14) groups.
Conclusion: Waterobics programs without nutritional monitoring showed moderate effects on the body mass and body composition of sedentary obese middle-aged women. The HIIT group exhibited better, yet insignificant, results with regards to the coronary risk profile.

Keywords: Body weight, Middle-aged women, Obesity, Weight loss

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1. Introduction

According to the World Health Organization (WHO), the obesity epidemic among Iranian adult women and men in 2010, amounted to 56% and 46%, respectively (1, 2). In 2015, this estimate was 74% and 54% for women and men, respectively (2, 3). Obesity rates have increased worldwide over the past decades (2, 4). Increasing the energy expenditure through physical exercise and reduction of energy consumption via dietary restrictions should be considered in a weight loss program (5). Evidence suggests that physical activity can continuously increase energy costs and cause weight loss (6).

Waterobics is a physical exercise that is highly practiced by both adults and elderly people because it improves the health-related aspects of fitness (7), neuromuscular performance (8), and physical fitness (9), and favors adhesion to exercise programs since body weight is not a limiting factor for the exercises (10). Compared with dry land sports, water sports have fewer impacts on joints because the body loses about 90% of its weight when immersed in water up to a shoulder level. Therefore, such sports are particularly suitable for obese people who are susceptible to increased risks of orthopedic injuries caused by exercise, or require a workout intensity below the recommended level to ensure more cardiorespiratory resistance (11). Water pressure relieves swelling and joint pain and increases body flexibility and mobility, which is an important factor in obese people as excess weight can ensue discomfort during exercises on the ground (11, 12).

Since exercise prescription has a direct effect on the body structure, attention to its properties is of high importance. Anaerobic exercises increase muscle mass and reduce fat mass, but do not significantly impact the overall weight loss; aerobic exercises, on the other hand, promote weight and body fat reduction without significant changes in muscle mass (13, 14). That said, the influence of aerobic and anaerobic workouts on fat and muscle compartments is still a matter of controversy (15). There have been a few reports on the effect of waterobics programs on the health and weight loss of obese adult women.

This study seeks to evaluate the body mass, body composition, and coronary risk profile in sedentary obese middle-aged women in response to exercise-related time (high-intensity intermittent training [HIIT] and at traditional moderate-intensity continuous training [MICT]) in waterobics exercise.

2. Methods

2.1. Participants

This prospective experimental research was conducted in the Ukrainian Sports Medicine Center (Kyiv, 2018) for three months. The available statistical population was 45 sedentary obese middle-aged women (aged 45 to 65) who had participated in a weight-loss counseling program. The sample size was calculated using the following equation for 0.05 (error of 5%):

$$n = \frac{c^2 N \ (1-p)}{(A^2 N) + (c^2 p[1-p])} = \frac{1.96^2 \times 45 \times 0.5 \times (1-0.5)}{(0.05^2 \times 45) + (1.96^2 \times 0.5 \times [1-0.5])} \simeq 40$$

The objective was to implement two protocols separately.

Therefore, forty participants were selected and randomly assigned into two exercise programs, namely moderate-intensity continuous training program (MICT) and high-intensity intermittent training program (HIIT), each including 20 participants. Random allocation was carried out using a manual lottery in which subjects drew their own lot. Inclusion criteria were over three-month weight stability (±2 kg), non-smokers, blood pressures less than 140/85 mm Hg, body mass index (BMI) of more than 30 kg/m^2 and no medical contraindications for waterobics (2, 16-18). The exclusion criteria were heart disease, diabetes, psychiatric disorders, infectious-contagious diseases, orthopedic limitations, history of drug use (especially statins, fibrates, and hormonal replacement therapy) or consumption of food supplements for weight control (2, 16-18).

2.2. Waterobics Programs

Waterobics program in the MICT group was performed without intervals and with continuous movements of the upper (UL) and lower (LL) limbs. Each session was comprised of three phases: an initial 10-minute warm-up by stretching exercises, 40 minutes of waterobics with plastic dumb bells and foam spaghetti involving the large muscle groups of UL and LL, and a final 10-minute relaxation (cool-down). The exercises were performed at 70-85% of maximum heart rate (HRmax), characterizing moderate to vigorous intensity according ACSM (19). Waterobics program of the HIT group was performed with intermittent movements of UL and LL. Each exercise session also consisted of three phases: ten initial minutes of warming up by stretching movements, 40 minutes of exercises in series (five two-minute standardized exercises repeated 3 times with two-minute intervals), and final ten minutes of relaxation (cool-down). The HIIT group performed a circuit program comprising five waterobics exercises at 90-95% HRmax, characterizing a vigorous-intensity according ACSM (19). For the rest of the intervals, subjects took a light walk to the next station (to continue the exercise) and while waiting, they walked inside the pool (back and forth) for active recovery.

Heart rate was measured by HRmax=220–age (years). Heart rate was measured three times during and after the session in the MICT group and immediately after each exercise session in the HIIT group. Both programs lasted three months and included three weekly sessions of 60 minutes. Energy expenditure in both groups was the same (1500 kcal per week) and it was converted into minutes per week and the duration of the weekly exercises was adjusted accordingly.

2.3. Measurements

Body height and weight were measured in the participants who were wearing light clothes and no shoes, with an accuracy of 0.1 cm (with a stadiometer) and 0.1 kg (with a Scale-Tronix model 5002, Wheaton, IL, USA), respectively (16, 17). After calculating BMI (kg/m^2), the subjects were classified according to cut-off points recommended by the WHO (20). Waist circumference (WC) was determined at the end of a normal exhalation at the midpoint between the iliac crest and the last rib in the horizontal plane; similarly, the hip circumference (HC) was obtained in the horizontal plane but at the maximum point (21).

Body composition analysis (total body water [W], fat-free mass [FFM] and fat mass [FM]) was evaluated using tetrapolar bioelectrical impedance analyzer (BIA 310A, Biodynamics, USA) according to standardized manner. FFM (kg) was estimated using the tetrapolar resistance and reactance. The equation suggested by Segal and other colleagues (22) was used to calculate FFM and FM for obese women: FFM (woman)=0.00091186 (height)^2−0.01466×(resistance at 50 Hz)+0.29990 (body mass)−0.07012 (age)+9.37938; FM (kg)=W−FFM.

FFM mass in kg; height in cm; resistance in ohms; body mass in Kg; age in full years.

Before and after the study, sample of fasting blood was obtained in the morning after a 12-hour overnight fast. Plasma levels of total cholesterol (T-C),low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) were measured through the use of an enzymatic method (using COBAS, Roche Diagnostics, Germany).

2.4. Method Management

During the study, participants took part in weekly meetings (including the assessment of exercise, diet, and weight loss trajectories). All participants were informed about the research, and after obtaining the medical certificate verifying that the intervention was not contraindicated, written informed consent was provided prior to enrollment. The research complies with all relevant national statutes, institutional policies, and the principles of the Helsinki Declaration. The Institutional Research Ethics Committee approved the informed consent forms and the application of human ethics. All participants were instructed to maintain their leisure-time physical activity and nutrition habits throughout the study period. They were further asked to complete the dietary records for four days (3-day a week and a weekend day) prior to the commencement of the study. The same procedure was performed just after the intervention to report the unaltered nutrition habits throughout the study course (16, 17).

2.5. Statistical analysis

All analyses were performed with SPSS software version 21.0 (for Windows). Normality distribution of the data was not confirmed by Kolmogorov-Smirnov test. Since the distribution of variables is tested, data are presented as mean and standard deviations (±SD) with median and interquartile range (IQR). The Wilcoxon test was used for group and time point (before and after) comparisons. The P<0.05 was set as a significance level.

3. Results

Throughout the study, three participants (two in MICT and one in HIIT) dropped out, and 37 participants (MICT group: 18 and HIIT group: 19) completed the study. The reasons for drop out were loss of motivation and dissatisfaction with the randomization. At baseline, there were no differences between the groups regarding the studied variables (P>0.05). As shown in Table 1, evaluation of the results in each group in terms of time (before and after) revealed modest, but significant, reductions in body mass (P=0.04), BMI (P=0.02), fat mass (P=0.03), and HC in the MICT group (P=0.04).

In the HIIT group, there was a significant reduction only in FM (P=0.03). There were no significant differences concerning the evaluation of coronary risk profile, which included T-C, LDL-C, and HDL-C in the MICT (P=0.23; P=0.1; P=0.08, respectively) and HIIT (P=0.1; P=0.06; P=0.14, respectively) groups. After the study, no significant difference was observed between the groups regarding the investigated variables (mass, P=0.23; BMI, P= 0.31; FM, P=0.13; FFM, P=0.1; WC, P=0.38; HC, P=0.45; WHR, P=0.57; T-C, P=0.61;

Table 1: Mean Comparison of the Studied Variables in Groups of Continuous and Intermittent Waterobics Programs Before and After the Study

Variables	MICT group (n =18)			HIIT group (n=19)		
	Mean±SD/median (IQR)	Mean variation	P value*	Mean±SD/median (IQR)	Mean variation	P value*
Mass, kg	95.4±16.5, 88.9 (26.0)	-0.8	0.04	93.6±18.4, 88.1 (24.0)	-0.2	0.12
BMI, kg/m^2	38.8±4.9, 38.1 (4.1)	-0.4	0.02	35.7±5.4, 35.2 (3.8)	-0.1	0.07
FM, kg	44.5±12.4, 45.4 (8.0)	-0.6	0.03	42.6±28.7, 43.3 (7.6)	-0.7	0.03
FFM, kg	50.6±7.2, 51.4 (9.3)	-0.1	0.09	50.8±6.5, 51.7 (10.0)	+0.4	0.16
WC, cm	106.8±15.3, 108.1 (19.0)	-0.7	0.13	108.3±12.6, 109.9 (20.0)	-0.7	0.1
HC, cm	126.7±14.4, 127.8 (24.0)	-4.2	0.04	120.5±13.6, 124.7 (22.0)	+0.4	0.22
WHR, cm	0.84±0.07, 0.86 (0.04)	+0.02	0.11	0.89±0.07, 0.9 (0.06)	-0.01	0.09
Total-C, mg/dl	194.3±22.9, 198.5 (45.0)	+1.2	0.23	195.9±27.2, 199.4 (59.0)	-1.5	0.1
LDL-C, mg/dl	136.3±31.4, 138.8(32.0)	-0.1	0.1	137.1±23.6, 139.7 (43.0)	-0.8	0.06
HDL-C, mg/dl	49.3±7.7, 50.4 (11.0)	-1.3	0.08	52.4±6.4, 52.9 (13.0)	+0.2	0.14

*P<0.05 is statistically significant, MICT: Moderate-intensity continuous training, HIIT: High-intensity intermittent training, IQR: Interquartile range, FM: Fat mass, FFM: Fat-free mass, WC: Waist circumference, HC: Hip circumference, WHR: Waist-to-hip ratio

LDL-C, P=0.75; HDL-C, P=0.48).

4. Discussion

According to different studies, weight loss assessment and variations in the coronary risk profile under sports conditions require at least three months (2, 16-18). Therefore, the present study ended after three months. The present results showed a certain inefficiency in the waterobics programs carried out continuously or at intervals regarding mass reduction, body composition changes and coronary risk profile of sedentary obese middle-aged women. The modest, but significant, weight loss observed only in MICT group suggests that in this particular case, continuous waterobics was more efficient in regard to weight loss compared with intermittent waterobics. However, both interventions achieved similar and significant fat mass loss.

The triglyceride levels of blood depend on food intake, hence its omission from the research (2, 16-18). In our previous studies on dry land exercises, more positive outcomes in terms of body mass, body composition, and coronary risk panel were achieved after evaluating overweightness or obesity in middle-aged men or women before and after 12 weeks of continuous and intermittent training; however, these studies were associated with included a link to an energy-restricted diet (2, 18). Conversely, Louzada and co-workers (2007) measured the body composition in obese women performing longer exercises compared with the present study (four months) and 30-minute walking and weight training twice a week; similar to our research, they did not identify any significant differences in weight (23).

Waterobics benefits are connected with the physical properties of water and resistance to progress, which is directly related to the speed of movement (8). Therefore, waterobics, which uses the buoyancy of water as an impact reducer, can be selected as an alternative form of physical conditioning (12). It is to be borne in mind that even when doing exercises in water, obese individuals have restrictions on mobility and difficulty in overcoming the resistance of water. Therefore, the intensity and speed of activities may not guarantee a greater impact on the body mass and other studied variables because both are directly linked with the exercise results.

Regarding the changes in body circumferences, the results were positive for the MICT group, which presented a significant reduction in HC. Other studies conducted on adult and elderly women also observed more reduction in body circumferences such as WC and HC (23, 24) with predominant aerobic physical exercises. The resistance of water against the speed of leg movement leads to the overload of legs, possibly the reason for HC reduction.

The program duration (three months) and isolated use of physical exercises for weight loss, without food control not connected with food control, were among other factors possibly leading to the very few anthropometrical and coronary risk profile changes observed in the current study. Both factors may have limited the effectiveness of the waterobics programs, which was the same for total-C, LDL-C, and HDL-C. The lack of significant differences between the studied groups regarding three-month weight loss may be indicative of the fact that water exercises do not have the effectiveness of dry land exercises or exercises without dietary monitoring do not prevent the occurrence or development of cardiovascular disorders. These findings are inconsistent with the studies conducted by Rezaeipour (2018) and Rezaeipour and co-workers (2018) (2, 18).

As far as study limitations are concerned, the selection of obese middle-aged women prevented the generalization of the study outcomes. There were no other legal limitations such as potential bias and multiple analyses, except for the non-commitment of some individuals who were excluded from the study. It is recommended that the impact of the time models of waterobics program be further investigated on men.

5. Conclusion

The outcomes of this study showed that waterobics programs without nutritional monitoring had a modest impact on body mass and composition, and the MICT group produced better results. The study of the changes in the coronary risk profile showed no obvious advantages between the studied groups. The outcomes of this study can be clinically conducive and provide information on how to prescribe waterobics program in sedentary obese middle-aged women.

Conflict of Interest: None declared.

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