



The influence of Aqua Power aerobics on body mass reduction in middle-aged, overweight women

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ABSTRACT

Objectives: This study aims to evaluate the effects of Aqua Power exercises on the body composition and cardiovascular response in middle-aged, overweight women after a six-month intervention.

Patients and methods: Between November 2013 and May 2014, a total of 37 middle-aged, overweight women (mean age 42.6 years, range 36 to 57 years) participated in the Aqua Power aerobic sessions twice per week for six months. The body composition was evaluated using the near-infrared method. The heart rate was self-controlled by the participant during the exercise.

Results: The majority of the body composition elements decreased after six months of the Aqua Power aerobic training. The heart rate values decreased in the females after the intervention period.

Conclusion: Aqua Power aerobics can be recommended for middle-aged females for the treatment of overweight and in the process of cardiopulmonary fitness improvement.

Keywords: Body Mass Index; cardiopulmonary fitness; excess weight; heart rate.

Excess weight and obesity are among the most common health-related risk factors in developed countries. According to the Ogden's study,^[1] more than one-third of adult United States (US) citizens and almost 17% of youth were diagnosed with obesity in 2009-2010. According to the Finkelstein's^[2] calculations, 51% of the US population would suffer from obesity by 2030. In Europe, obesity prevalence in adults varies from 7.9% in Romania to 24.5% in the United Kingdom (UK).^[3] Self-reported information obtained from 15,000 European adults revealed that 34.8% of respondents suffered from excess weight and that 12.8% of respondents suffered from obesity.^[4] Among common health issues associated with excess weight are cardiovascular diseases, type 2 diabetes, hypertension, and certain types of cancer.^[5] Weight loss equivalent to 5 to 10% of the body mass in

overweight or obese individuals is recommended to decrease the risk of cardiovascular disease.^[6] Wessel et al.^[7] reported that cardiopulmonary fitness as a result of regular physical activity had a greater preventive role in coronary artery disease than the Body Mass Index (BMI) value. The recommended amount of daily moderate-intensity physical activity is 30 min to achieve proper weight control.^[8] A higher amount of daily physical activity (up to 60 min) may be crucial in maintaining long-term effects of weight loss.^[9] Exercises in the aquatic environment show significant benefits in treating obesity and excess weight.^[10,11] Hydrodynamic properties of water such as density, buoyancy, and resistance make these exercises less exhausting than land-based physical activities, while simultaneously giving similar physiological effects.^[12] As shown by Nagle et al.,^[13] the cardiopulmonary fitness

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effects of combined water-based exercises and walking were comparable to those of walking alone. The results of a study by Nikolai et al.^[14] also indicated that water aerobics sessions could be an alternative to land-based exercises, particularly for middle-aged and older adults. Recent studies concerning the impact of water aerobics exercises on physiological and anthropometrical changes are focused on circuit or resistance training conducted in shallow water.^[15-18] A few studies present positive effects of water exercise on body composition in middle-aged and elderly women.^[19,20] According to our study, no study has been carried out to evaluate the health-related effects of Aqua Power aerobics. It is a fast-paced class designed to combine aerobic conditioning with strength training, muscular endurance, and flexibility. The exercises consist of simultaneous arm and leg movement accompanied by music with a high cadence (up to 135 beats per min). This class uses buoyant and resistant equipment to provide a cardiovascular workout with minimal stress. The workouts are performed mainly in deep water. Swimming skills are not necessary due to utilization of buoyant bells.

In the present study, we aimed to assess the effects of Aqua Power aerobics sessions on body composition and cardiovascular response in middle-aged overweight women after a six-month intervention.

PATIENTS AND METHODS

This is quasi-experimental one group design. Non-random sampling method was used in our study. The inclusion criteria for the study were as follows: (i) stable health condition, i.e., free from infectious or skin diseases;^[21] (ii) middle age, i.e., 35 to 65 years of age;^[22] (iii) excess weight as indicated by BMI of 25.0 to 29.9 kg/m²; and (iv) precedent experience in water exercises. A total of 42 women who met the inclusion criteria volunteered to participate in the study. The participants were accustomed to the aquatic environment prior to participation (ability to swim or precedent participation in other water exercises classes). Before the study, the participants were asked to visit a physician to obtain clearance to take part in vigorous water workouts. At this stage, two women were excluded from the study due to health issues. Participants were asked not to attend any other land-based or water aerobics classes during the study. Prior to the examination, the participants were asked to avoid strenuous physical activity as well as to refrain from consuming any caffeine and alcohol. Participants were informed about the purpose of the study and

a written informed consent was obtained from each participant. The study protocol was accepted by the Institutional Review Board of the University, School of Physical Education, in Wroclaw. The study was conducted in accordance with the principles of the Declaration of Helsinki. Due to the fact that three participants did not attend the classes regularly (class attendance of less than 80%), the final study group consisted of 37 women (mean age 42.6 years, range 36 to 57 years) (Table 1). No dietary restrictions were imposed on the participants.

Intervention

Aqua Power aerobics classes were held two times per week in the afternoon between November 2013 and May 2014 for a total of 46 sessions. The sessions were performed in an indoor 25-meter swimming pool with water and air temperatures of 29 to 30°C and 27 to 28°C, respectively. An instructor with 10 years of experience conducted all the classes. Each session consisted of 5 to 8 min of warming up, 25 to 27 min of Aqua Power exercises (e.g., swinging the arms to the sides, pushing and pulling the arms against the water's resistance with various leg movements), and 5-8 min of cooling down. Approximately 60 to 70% of each session took place in deep (below 1.5 m) water. All participants wore Aqua Jogging Belts (Beco, Germany) and utilized neoprene gloves in some sessions. The exercises were performed with high-cadence music (up to 135 beats per min) and involved whole-body muscle groups. During Aqua Power exercises, the participants were advised to maintain a heart rate (HR) level of 70-75% of their predicted maximum HR (HRmax).

Anthropometric parameters and body composition were evaluated directly before the first and last Aqua Power sessions. Body mass and height were measured with a calibrated standard scale (Seca 711, Seca GmbH, & Co. KG, Hamburg, Germany) and a stadiometer (Seca 214, Seca GmbH, & Co. KG, Hamburg, Germany). During the measurement procedures, the participants were barefoot and wore light clothing. Body composition was evaluated by a FUTREX-6100A/ZL device (Futrex Inc., Gaithersburg, Maryland, USA). This apparatus applies a NIR (near-infrared) method

Table 1. Anthropometric data of participants (n=37)

	Mean±SD	Range
Age (year)	42.6±6.1	36-57
Body height (m)	1.66±0.05	1.57-1.79
Body mass (kg)	72.9±4.9	62.3-84.1
Body Mass Index (kg/m ²)	26.2±0.7	25.0-27.6

SD: Standard deviation.

Table 2. Changes in body composition after six months of Aqua Power aerobics training in the female participants (n=37)

Parameter	Preoperative	Postoperative	T-test value	P value	Mean difference	Standard error for mean difference
Body mass (kg)	72.9±5.0	69.5±4.6	6.68	0.0000	3.40	1.39
Body fat (%)	35.3±6.3	33.7±5.8	6.62	0.0000	1.60	2.61
Essential fat (kg)	25.2±8.2	24.0±7.6	6.10	0.0000	1.19	3.74
Total lean mass (kg)	45.9±10.3	42.4±4.2	2.39	0.022	3.50	6.58
Body water (%)	50.0±4.1	51.9±4.4	-4.19	0.0001	1.93	1.63
Body mass index (kg/m ²)	26.2±0.7	24.9±0.6	6.64	0.0000	1.26	0.44

of body components percentage assessment.^[24,25] A Futrex Light Wand (Futrex Inc., Gaithersburg, Maryland, USA) was applied to the midpoint of the biceps of the participant's dominant hand. To calculate coefficient of variation (CV), the evaluation process was performed twice. The CV was calculated from each pair of measurement results. The range of CV values was from 2.3 to 3.4. The measurements were completed by an experienced assistant employed in the school of physical education of a local university. The HR was assessed with a Polar RS300X device (Polar Electro, Kempele, Finland). Each of the participants was instructed on how to control the HR level by using the Polar Wrist Unit display. The predicted HR_{max} was calculated according to the following formula:

$$\text{HR}_{\text{max}} = 208 - 0.7 \times \text{age}^{[26]}$$

Statistical analysis

Statistical analysis was performed using the Statistica® software version 10.0 (StatSoft Inc., Tulsa, OK, USA). The sample size was calculated according to the recommendations reported in the study of Haijan-Telaki.^[27] An effect size of 0.8 was accepted, which demands at least six participants to estimate mean values and at least 33 participants to achieve 90% of statistical power. We assumed type I error (α) as 0.05 and type II error (β) as 0.10. The distribution of parameters was normal according to the Shapiro-Wilk test. The paired t-test was applied to compare changes in body composition and HR variations before and after the study. Power of the test was assessed as 1.0. Descriptive statistics were expressed in mean ± standard deviation (SD), standard error, mean difference, and standard error for mean difference.

A *p* value of less than 0.05 was considered statistically significant.

RESULTS

As presented in Table 2, the values of body mass, body fat, essential fat and total lean mass decreased in woman after a six-month intervention of Aqua Power aerobics. Body Mass Index also decreased essentially. A statistically significant increase was observed in the body water content. The mean post-training values of HR at rest and during exercise significantly decreased, compared to the pre-training values. In addition, we found this decline in the maximal HR values (Table 3).

DISCUSSION

In the present study, we investigated whether intense deep water-based exercise, namely Aqua Power, had an impact on the body composition and cardiorespiratory response of middle-age overweight women. We found that three main factors were determinants for beneficial influence of these exercises. The first is the exercise scheme, which involves a wide range of lower and upper limbs movement with utilization of proper equipment. The results of a study by Costa et al.^[28] suggested that simultaneous movements of the legs and arms with buoyancy equipment increased the physiological response to the water-based exercise. Pinto et al.^[29] also reported that utilizing water-drag and floating equipment during water gymnastics increased cardiorespiratory response in healthy young women. The second factor is water depth. The results of several studies showed that immersion to the sternum or shoulder level caused a decrease in the HR due to

Table 3. Changes in heart rate after six-month of Aqua Power aerobics training in the female participants (n=37)

Parameter	Preoperative	Postoperative	T-test value	P value	Mean difference±SE
Heart rate rest (beat/min)	79.9±5.1	74.7±5.6	11.09	0.0000	5.81±3.22
Heart rate exercise (beat/min)	118.3±5.7	114.6±6.9	9.31	0.0000	3.75±2.47
Heart rate max (beat/min)	150.8±6.9	146.8±7.0	12.12	0.0000	3.97±1.96

SE: Standard error.

the thermoregulatory reaction of the body.^[30] In a study conducted by Nuttamonwarakul et al.,^[31] aqua aerobics exercises performed in deep water caused a significant decrease in the body mass, percentage of body fat, and BMI in diabetic elderly patients. Jones^[32] also observed a decreasing tendency in the body composition parameters of elderly women after deep-water training sessions. These changes, however, were not statistically significant. Of note, the aforementioned experiments had similar study protocols, such as 12-week training durations, three sessions per week, and exercise intensities of 70% HRmax. Kantyka et al.^[33] observed a significant reduction of the body mass and non-significant decrease in the body fat mass and BMI in a group of middle-aged, overweight women who attended aqua aerobics classes three times per week for 14 weeks. On the other hand, an eight-week resistance aqua aerobic training program in deep water did not cause any changes in the body fat and BMI of postmenopausal women.^[34]

The third component of a beneficial water aerobics session would be an appropriate musical cadence. Barbosa et al.^[35] reported that an increase in the musical cadence was strongly correlated with increased physiological response in young, healthy women participating in aquatic exercises. In the aforementioned study, the participants were immersed to the sternum level. The increase of physiological demand caused by increased movement frequency among healthy women was also shown in another study.^[36] Pinto et al.^[29] reported that the maximal cadence of the exercises (over 100 bpm) resulted in greater responses in the HR and oxygen consumption (VO_2), as well as higher activation of the muscles. Alberton et al.,^[37] however, suggested that musical cadence was of less importance in prescribing aqua aerobics sessions, as the percentage of maximal oxygen consumption (VO_2 max) and HR should be considered main factors for determining the intensity of effort in the aquatic environment.

The results of our study correspond to those of Piotrowska-Calka's^[38] study. In the aforementioned study, middle-aged, overweight women participated twice a week in 24 weeks of aqua aerobics training conducted in deep water. Drag force equipment (i.e., hand bars and hand paddles) was utilized in the study. Significant decreases in the HR rest values and HR peak values were noted as a result of the aqua aerobics program. By contrast, Jones et al.^[32] reported an increase in the HR peak values after 12 weeks of water-based exercises. It is worth noting that participants in our study did not maintain the targeted

HR limits during the exercises. The actual intensity of effort reached 65% of the predicted HRmax. Benelli et al.^[39] reported an even lower percentage of HRmax value (58.5%) reached by young normal-weight women during deep water aerobics at a fast pace.

Furthermore, the duration of an aqua aerobics intervention also plays an important role in the weight management. Barbosa et al.^[40] reviewed a number of studies in the literature concerning physiological effects of water aerobics exercises. The authors concluded that positive changes in the body composition could be seen after at least eight-week-long programs.

Nonetheless, there are some limitations to this study. The lack of a control group is the main limitation. Plans to create such a group were set aside due to inconclusive data concerning changes in the body composition of middle-aged women living in the Central European countries. According to the aforementioned data, the reduction of body mass caused by a reductive diet is accompanied by a disadvantageous decrease of muscle mass, whereas a reductive diet combined with aerobics exercises causes a reduction of body mass at the expense of fat tissue loss.^[41,42] Another study even revealed growth of fat tissue in conjunction with a reductive diet.^[43]

On the other hand, our strength is the presentation of the popular aquatic activity as an accessible method of physical therapy. To the best of our knowledge, no specific water aerobics training mode was described in terms of its health benefits. Although there is a number of water aerobics types performed worldwide (e.g. aqua dance, aqua kick boxing, aqua cycling), none has been reported in the literature.

In conclusion, our study results suggest that three characteristics of Aqua Power aerobics factor into the improvement of health-related parameters are as follows: submersion to the neck level, involvement of numerous muscle groups, and high intensity of the movements with simultaneous utilization of flotation devices. Based on these results, Aqua Power aerobics training can be recommended for middle-aged women due to observable changes in the body composition and decrease in the HR values.

Declaration of conflicting interests

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