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Original Article

The Effect of WATERinMOTION (WiM) Aquatic Exercise on Weight Loss and Metabolic Profiles in Sedentary Obese Elderly Men

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Abstract

Background: The effect of water exercise on weight-loss parameters is still controversial. We aimed to explore the effect of WATERinMOTION (WiM) aquatic exercise on weight loss and metabolic profiles in sedentary obese elderly men.

Methods: Sixty-one sedentary older men, who came to the Ukrainian Sports Medicine Center for a weight-loss consultation, voluntarily took part in this cross-sectional study (Kyiv, summer 2019). The participants were selected using convenient sampling and allocated randomly to two groups: WiM (n=31) or a control group (n=30). Meanwhile, the WiM group performed the WiM exercise plan with two weekly sessions of 55 minutes each. The control subjects did not participate in any physical exercise. They were asked to perform their routine activities during the study. This study lasted for one month. Anthropometric indices (height, weight, and waist circumference) and metabolic profile assessment (glycemia and lipid profiles) were obtained at baseline and after the study.

Results: No significant differences were found in any of the analyzed parameters. Pre- and post-study comparison showed a significant reduction in weight (-1.8, P = 0.003) and mean BMI (-0.7, P = 0.004) in the WiM group. Furthermore, a significant difference was found only in weight after the study (P = 0.002).

Conclusion: The WiM plan, without dietetic intervention, had a positive influence on weight, waist circumference, and metabolic profiles in sedentary obese elderly men.

Keywords: Blood glucose; Lipid metabolism; Resistance training; Waist circumference; Obesity; Weight loss

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Background

The increasing emergence of obesity in old age (1) creates new challenges for health services, and is becoming a serious problem worldwide (2). Besides genetics and diet, physical exercise is especially authoritative when attempting to cut weight or preserve a healthy weight (3). However, some people have restrictions that limit their ability to take part in the land-based exercise module, such as sedentary obese older people who have low levels of fitness or difficulties with mobility because of old age, neuro-skeletal dysfunctions, and pulmonary disorders (4).

Meanwhile, some review articles have supported the use of an aquatics exercise plan to encourage weight management (5-7). However, other researchers have not confirmed the water exercises' impacts on these issues (8-10), and so there is still disagreement in this regard. Besides, no study has specifically assessed the consequences of the WATERinMOTION (WiM) plan on weight loss and metabolic profiles.

The WiM plan is a standardized aquatic exercise plan with music, in which people of any age can take part and the choreography fits the music (11). Findings of studies have shown that the body loses 90% of its heaviness during immersion in water up to the shoulder (7, 12). For this reason, the WiM as a water exercise is especially favorable for obese people, who are at increased risk of orthopedic traumas secondary to exercise. Moreover, while studies on other modalities of water exercise have been conducted for at least six weeks (13) or longer (4, 7, 12, 14), this study investigated whether two weekly sessions per month would be enough to enjoy the significant health benefits.

Objectives

The purpose of the present study was to define whether one-month of WiM aquatic exercise is effective in reducing the participants' body weight waist circumference (WC), and improving their metabolic profiles such as glycemia and lipid profiles.

Material and Methods

Sample and Study design

Thirty-five sedentary older men who came to the Ukrainian Sports Medicine Center for a weight-loss consultation voluntarily took part in this cross-sectional study (Kyiv, summer 2019). With the probability of a population of 72 people, a 95% confidence level, and a five-confidence interval, a sample size of at least 61 by creative research systems would have been desirable (15). Participants were selected using the convenient sampling method and allocated randomly to two groups: WiM (n = 31) or a control group (n = 30). Meanwhile, the WiM group performed the WiM exercise plan with two weekly sessions of 55 minutes each. The participants in the control group did not participate in any physical exercise and performed their daily activities during the study. The study lasted for one month.

The research team, which included two physicians and two trainers, explained the study to the participants. A medical examination was done and participants presented a physician's permit, which revealed that the study was not prohibited for the participants. The participants voluntarily assigned the consent form and participated based on the following inclusion criteria: sedentary lifestyle as physical exercise frequency from 1 to 2 times a month or less (14, 16), men aged 65 years and over, BMI of ≥30 kg.m^{-2} (7, 12), living self-sufficiently and classified with the level of the functional status of 3, 4 or 5 concerning the activities of daily living (the average status was three in this study) (17). A score of more than 18 on the Mini-Mental State Examination was another inclusion criterion (18).

We excluded any participant who missed three serial sessions or greater than one-third of the sessions or had any strong family history of cardiovascular diseases and dyslipidemia, volunteers with diabetes, high blood pressure, cardiovascular illness, tobacco user (acute and chronic), transmittable sicknesses, orthopaedic limits, taking drugs that affect lipid metabolisms, products such as thyroxine, progestin and estrogen, vitamin E, beta-blockers, history of weight control supplements or medication such as hormone replacement therapy (19). The Institutional Research Ethics Committee approved this study and informed consent forms were completed. The protocol of the study with all relevant strategies and institutional policies was designed consistent with the Helsinki Declaration.

In addition, to control eating habits, a diary was used, which had previously been approved by household measures (7, 12). Participants were instructed to fill in dietary records on four-days (three days per week and the weekend), and the same procedure was done right after the study to report altered eating habits during the study period (7, 12). This information was processed by the application of EVIDENT II (20), which was validated to calculate the amount of energy consumed (Kcal/day). More information on nutritional consumption in this study is shown in Table 1.

All participants were asked to maintain their dietary habits and leisure-time physical activities during the study. Each participants was followed every two weeks.

The WiM plan

The typical WiM plan comprised of warming up (five minutes), main exercise (45 minutes), and cool down (five minutes) (11). Figure 1 provides a schematic diagram with more details about the WiM plan.

Additionally, the music used for the WiM is specifically tuned so that people of any age can take part in it and the choreography fits the music (11). The conditioning of intensity was considered moderate to vigorous or 70–85% of the maximal heart rate (12, 21). Participants' heart rates were checked with a waterproof device (Polar Electro Oy, Kempele, Finland) in all the training sessions. The sessions of the WiM plan were held in an indoor pool.

Body measurements

Anthropometric measures of weight in kilogram (kg) (by a Scale-Tronix model 5002, Wheaton, IL, USA, accuracy of 0.1 kg), height in centimeter (cm) (by a stadiometer, accuracy of 0.1 cm), and WC (cm) were obtained before the first aquatic exercise session by the research teams

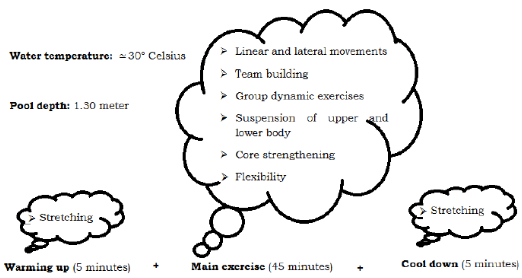

Figure 1. Schematic Diagram of the WiM Plan

Table 1. Changes in nutritional consumption

Parameters/Group	WiM Group			Control Group		
	Baseline	Post-Study	*P*	Baseline	Post-Study	*P*
Energy (Kcal/day)	2216 (±276)	2241 (±254)	0.7	2286 (±264)	2293 (±249)	0.8

Data are reported as mean (±SD), WiM = WATERinMOTION, $P<0.05$ was statistically significant compared to baseline.

and their BMI's were computed (7, 12). These measures were taken by participants clothed with a light dressing and without footwear. Body composition was studied via BMI and WC (14, 22). The BMI formula is "the weight of a person in kilogram, which is divided into the height squares in meter" (23). Obesity is defined as a BMI of 30 or higher (23). The WC measurement was done in the horizontal plane at the middle point of the crest of the ilium and the last rib at the end of a normal exhalation (14).

Biochemical evaluation

Biochemical evaluations were performed in the morning (9 to 10 a.m.), after an hour of rest in the semi-recumbent position (14), and after a 12 hour overnight fast at baseline and after the study (7, 16). Fasting glycemia was examined via a Wiener® liquid AA enzymatic glycemia kit with the sensitivity of 0.54 mg/dl (Wiener laboratories®, Rosario, Argentina). Total cholesterol (TC, with the sensitivity of 3.86 mg/dl), high-density lipoprotein cholesterol (HDL-C, with the sensitivity of 3.09 mg/dl), and triglyceride (TG, with the sensitivity of 8.85 mg/dl) were analyzed via the enzymatic method utilizing COBAS, Roche Diagnostics, Germany. Low-density lipoprotein cholesterol (LDL-C, with the sensitivity of 3.87 mg/dl) was computed utilizing the Friedewald formula: LDL-C = TC – (HDL-C + TG/5). This formula can exclusively be used when the TG results were < 400mg/dl (24).

Statistical analysis

Statistical analysis was done using IBM SPSS 21.0 (SPSS Inc.; USA) for Windows. Normally distributed data were assessed via the Shapiro-Wilk test and expressed in the form of mean values (±SD). Paired samples *t* test was used to compare pre- and post-study data. Comparisons between groups were carried out using analysis of covariance (ANCOVA). Differences in the distribution of categorical parameters from one another were analyzed using Pearson's Chi-squared (χ^2) test. The mean differences were statistically significant if the values of *P* were less than 0.05.

Results

Throughout the study, one man was excluded because of current tobacco smoking. Therefore, sixty participants, who met the study criteria completed the study. The preliminary demographic and anthropometric characteristics of the participants in both groups are demonstrated in Table 2.

No side effects were reported during the study. Rates of completion between the study groups were assessed by χ^2 and did not reveal a significant difference ($P = 0.43$). At baseline, no significant differences were detected between the groups regarding the studied anthropometric and biochemical parameters (*P*>0. 05). Tables 3 show the parameters evaluated in the study groups pre- and post-study.

Assessment of the outcomes within each group regarding time (pre/post) revealed a modest, but significant reduction of weight ($P = 0.003$) and a significant decline in their BMI ($P = 0.004$) for the WiM group. The WiM group demonstrated an average weight reduction of -1.8 kg and a BMI of -0.7 kg.m^{-2}. No significant differences were detected in the biochemical parameters (TC, $P = 0.11$; LDL-C, $P = 0.08$; HDL-C, $P = 0.14$; FBS, $P = 0.18$) or WC ($P = 0.1$). Furthermore, as shown in Figure 2, comparing the two groups after the study showed a significant difference only in weight.

The WiM group exhibited better, yet insignificant results concerning other anthropometric or biochemical parameters Table 3 and Figure 2).

Discussion

Our data indicate the effectiveness of the one-month WiM plan on weight loss and metabolic profiles in sedentary obese older men. In addition to the genetic (25, 26) and nutritional (27, 28) components previously recognized in some studies, the WiM aquatic exercise plan had a positive effect on age-related physiological changes. The effect of water exercise on weight-loss parameters is still controversial. Penaforte and colleagues (5) performed an aquatic exercise plan that lasted two months with three weekly sessions in obese older men. They noticed significant reductions in weight and BMI. Rezaeipour and co-workers (14) performed a 12-week aquatic exercise (three sessions per week) in postmenopausal women. They reported significant reductions in weight loss parameters. However, Charmas and co-workers (8) conducted swimming training, which lasted 12 weeks three times a week in young people, but no changes in weight were found.

The modest weight loss experienced in this study was most likely caused by maintaining a calorie deficit during the WiM plan. The WiM plan provides calorie-burning by the built-in resistance from the viscosity of the water that is evident in any movement made. The lack of compensatory increases in calorie intake in line with

Table 2. Baseline demographic and anthropometric characteristics of the participants in both groups

Parameters/Group	WiM Group (men, n = 30)	Control Group (men, n = 30)	P value
Age, year	70.4 (± 4.3)	69.2 (± 4.1)	0.127
Height, cm	168.5 (± 5.2)	169.6 (± 4.9)	0.134
SBP, mm Hg	126.7 (± 13.2)	127.1 (± 12.6)	0.124
DBP, mm Hg	82.4 (± 4.1)	81.9 (± 3.7)	0.145

Data are reported as mean (±SD), WiM = WATERinMOTION, DBP = diastolic blood pressure, SBP = systolic blood pressure, P < 0.05 was statistically significant.

Table 3. Describing the studied parameters in both groups at baseline and post-study

Parameters	WiM Group (n = 30)		Control Group (n = 30)	
	Baseline	Post-Study	Baseline	Post-Study
Weight, kg	95.5 (±15.6)	93.7 (±14.7) * §	96.2 (±16.8)	96.3 (±16.4)
BMI, kg.m^{-2}	33.2 (±3.1)	32.5 (±2.4) *	32.3 (±2.2)	32.3 (±2.1)
TC, mg/dl	220.8 (±22.7)	216.2 (±23.4)	222.3 (±24.7)	222.8 (±25.1)
LDL-C, mg/dl	139.4 (±21.8)	136.5 (±23.1)	140.4 (±24.8)	139.9 (±23.9)
HDL-C, mg/dl	46.7 (±4.3)	45.9 (±3.9)	47.1 (±7.6)	47.1 (±7.3)
FBS, mg/dl	94.9 (±15.8)	93.2 (±14.3)	95.6 (±14.5)	95.4 (±14.9)
WC, cm	102.9 (±5.8)	102.6 (±5.1)	103.2 (±7.1)	103.3 (±7.8)

Data are reported as mean (±SD). WiM = WATERinMOTION, BMI = body mass index, TC = total cholesterol, LDL-C = low-density lipoprotein cholesterol, HDL-C = high-density lipoprotein cholesterol, FBS = fasting blood sugar, WC = waist circumference. *, P<0.05 in comparison with pre-study. §, *P*<0.05 in comparison with the control group.

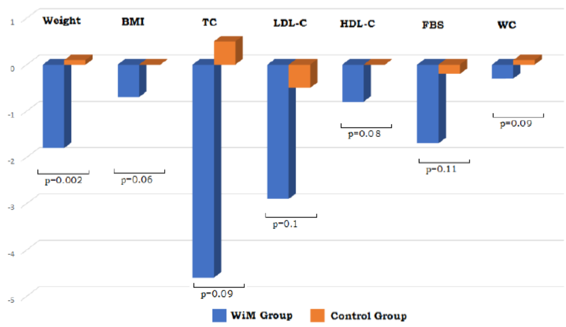

Figure 2. Between-Group Comparison of Changes in Parameters Assessed During the Study

energy expenditure suggests that this aquatic exercise had a positive effect on body weight for a month (two sessions per week). Whereas, exercise with a restricted diet showed more positive weight loss results in another study (29) on obese men at the 8th week. Similar results were found in meta-analytic studies, which showed that in spite of the advantages, the effect of physical exercise on weight loss is modest, particularly when not accompanied by nutritional control (19, 30).

Increased WC because of visceral fat can expose a person to illness (31). The result of WC was positive, but insignificant for the WiM group. Another study conducted on older people showed a greater reduction of the WC when water-walking and also of longer duration (24 to 48 weeks) was performed (32), which can explain its better result than the current one.

The serum level of TG is related to diet and was therefore omitted from the study (19, 24). Our outcomes also confirmed that changes in the metabolic profiles such as glycemia and lipid profiles, while positive, were not significant. These findings contradict those of Karo and colleagues (33) and Nakhaei and co-workers (34) who studied regular moderate-intensity exercise.

Although the significant associations of this study with weight reduction, BMI, and an insignificant decline in metabolic profiles suggest that a one-month WiM exercise can be a good option for stimulating positive changes in weight and metabolic profile of sedentary older men with obesity, the short-run WiM aquatic exercise (one- onth) is not good for individuals that are at risk because of elevated metabolic profiles.

In the control group, an insignificant rise in weight was found. Though this change is not statistically significant, the continuation of this trend may over time lead to a significant rise in body weight that is linked to a high risk of many chronic disorders (35). By analyzing the direction of changes in glycemia, such a trend can also be observed.

Limitations and future research

The generalizations of these findings are limited and may not be seen outside elderly men because of sex- and age-related metabolic differences. Moreover, this study was unable to compare ground exercises or other water exercise plans. Suggestions for future research include the use of a randomized controlled trial design and sampling in such a way that the population under study had the chance to be selected. It is also recommended to explore other age and sex groups.

Conclusion

The short-run WiM plan, which is not associated with nutritional monitoring had significant benefits for losing weight. Its inclusion in lifestyle plans of sedentary obese elderly men provides positive results in terms of WC and metabolic profiles. The results of this study will enable health professionals, such as physicians and trainers, to recommend the WiM aquatic exercise plan to their patients who cannot easily exercise on the ground to help them achieve their physical fitness and health goals.

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Authors' Contribution

The authors of Rezaeipour M and Nychyporuk VI have made substantial contributions to conception, design, and data collection. Rezaeipour M was involved in the analysis and interpretation of the data, the compilation of the manuscript, the critical reworking of it for important intellectual content, and all the authors read and approved the final manuscript.

Conflict of Interests

None.

Ethical Approval

This investigation complies with all relevant national statutes, institutional policies, and Helsinki Declaration Principles. Samples were obtained after informed consent and with the approval of the Institutional Research Ethics Committee [NMAPE, (2019) No.04112-06]. Participants presented physician permission that offered intervention was not contraindicated for them.

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None.

Informed Consent

Participants were informed about the research study, and after getting a medical certificate to note that the study was not contraindicated, provided written informed consent before participation.

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