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**Submission date:** 07-Jul-2023 08:53AM (UTC+0700)
**Submission ID:** 2127489745
**File name:** effects_of_aquafit_running.pdf (224.76K)
**Word count:** 5770
**Character count:** 32938

*Journal of Physical Education and Sport* ® (JPES), Vol. 23 (issue 4), Art 104, pp. 824 - 830, April 2023
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

**Original Article**

# Effects of Aquafit-running exercise and fit bar consumption on adiponectin levels in obese women

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Published online: April 30, 2023
(Accepted for publication April 15, 2023)
**DOI:10.7752/jpes.2023.04104**

**Abstract**.
Adiponectin is a type of protein that has anti-inflammatory effects downregulated in adipose tissue. The consequences of adiponectin on exercise-induced weight loss and caloric restriction levels are not well understood. The purpose of this research was to determine whether the dose of Aquafit-Running (AR) exercise at an intensity of 75% HRmax for a duration of 45 minutes, a frequency of 3–4 times per week, and calorie restriction consumption of Fit-Bar (FB) 1 pack before and after treatment can have an effect on adiponectin levels in obese women. A randomized pretest-posttest control group design was used experimentally on 48 obese women (BMI > 31 kg/m2) aged 50–60 years and divided into four groups. Aquafit-Running group (AR) 75% HRmax, twice a day, for 6 weeks (n = 12). Fit-Bar group (FB) 1 pack of Fit-Bar before and after treatment, for 6 weeks (n = 12), Aquafit-Running and Fit-Bar group (AR+FB) (n = 12), as well as the (n = 12) control group. Body fat percentage, body weight, height, BMI, and adiponectin levels were examined before and after treatment. Hypothesis The (One-Way Anova and Kruskal-Wallis) tests were used, Mann-Whitney and Tukey HSD tests for average difference. The findings of this study showed a the (AR+FB) group had a greater decrease in body fat percentage. compared to the (AR), (FB), and control groups (6.21±0.40; 04.20±0.32; 2.45±0.93; 0.62± 1.22, p = 0.000). The growth in the AR had higher adiponectin levels group in comparison to the FB, AR+FB, and control groups, amounting to (10.28+1.02 ; 3.36+0.36; 5.61+0.70; 0.58+ 0.64; p = 0.000). The conclusions of this study showed positive changes in decreasing body fat percentage and increasing the levels of adiponectin in obese women; in the (AR+FB) group, body fat percentage decreased by 6.21%, while the adiponectin levels increased by 10.28 µg/mL. Aquafit-Running exercises with an intensity of 75% HRMax, duration of 45 minutes, frequency of 3–4 times a week, and consuming 1 pack of Fitbar before and after Aquafit-Running is one of the non-pharmacological preventions in obesity.
**Key Words. waterfitness, physical fitness, overweight.**

## Introduction

Obesity can be caused by an excessive energy intake combined with insufficient exercise and an accumulation of subcutaneous fat in the body (Fischer-Posovszky, 2007). Obesity is the result of a number of influencing factors, including unhealthy lifestyles, unhealthy eating habits, and genetic factors, among others. Belly fat accumulation is an appealing research topic because it is linked to a greater likelihood of cardiovascular disease, diabetes, and cancer (Jensen et al., 2013). Adipose tissue is a hormone-secreting endocrine organ, adiponectin is a protein involved in energy metabolism, is one of these factors that has anti-inflammatory properties, as well as may aid in the prevention of atherosclerosis (Hocking et al., 2013). As a result, higher adiponectin levels may be linked to a lower risk of cardiometabolic disease. Despite the fact that adiponectin is primarily produced by adipose tissue, obese people have lower circulating levels than lean people individuals (Arita et al. 1999). For the treatment of obesity, it is generally recommended to establish lifestyle patterns that include active exercise and proper eating habits (Jensen et al., 2013) Adipose tissue in the abdomen hypertrophies and infiltrates macrophages, resulting in low-grade chronic inflammation and impaired insulin function. Furthermore, under normal conditions, fat acts as a hormonal organ, making adipokines like leptin, resistin, and adiponectin. These adipokines regulate the metabolism and immune system of the body. Excess accumulation, on the other hand, impairs adipokine function (Ambeba et al., 2013).


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Nowadays, people are getting more and more physically active and exercising (Mesias, 2022), especially in big cities; this means that our society truly recognizes the health and fitness benefits of exercise according to the principles of frequency, intensity, time, and type (FITT)( Geidl et al., 2020). Individuals with normal weight should exercise for at least 30 minutes every day to keep the body fit and healthy, while to maintain body weight, the dose for moderate intensity exercise is 150 minutes per week, and the dose for vigorous exercise is 75 minutes per week (Esposito et al., 2003). Sports training can be done on land or in water, water fitness is an exercise that uses the upper and lower extremities in water to train the entire body, one of which is aquarobics (Mukarromah, 2014). Aquarobics exercise is a form of aerobic exercise performed in water accompanied by music (Mukarromah et al., 2022). The benefits of exercising in water include the fact that the body relaxes more and water's physical properties, buoyancy, resistance, pressure, water temperature, and thermoregulation are some examples are followed, as well as the underwater effect of high gravitational pressure, which gives you more endurance. Exercise in water is thought to increase muscle strength due to the resistance exerted on the body by varying upper and lower limb magnitude and speed movement, as well as water resistance in various ways, aquarobic movement choreography includes aquafit kick-butt cardio, aquafit aching body, aquafit running, aquafit shallow, aquafit deep, and aquafit water (Sanders et al., 2013; Nagle et al., 2016; Nagle et al., 2019).

Long-term aquafitness has been shown to help adults in their forties and fifties improve their physical condition and the reduction of musculoskeletal disorders, prevent falls and reduce stress (Takeshima et al., 2002). The effects of water-based exercise versus land-based exercise on physical fitness in older women International Journal of Gerontology (Heywood et al., 2017; Katsura et al., 2010; Kaneda et al., 2008). As a result, Waterfitness exercise has been recommended as a safe and effective form of exercise way to increase muscle strength and health in middle-aged and elderly people (ACSM, 2013). Previous study found that combining exercise training with caloric restriction had inconclusive results on adiponectin levels; however, adiponectin levels were found to increase after weight loss (Bruun et al., 2003; Summer et al., 2011; Bouchonville et al., 2014). Other studies shown that adiponectin levels are rising not accompanied by a loss of body weight, states that an adiponectin elevation is not associated with weight loss (Arvidsson et al., 2004; Kovacova et al., 2009; Ryan et al., 2003), so there is still a lack of proper data and research results to use as the foundation for determining measured and regular exercise doses for managing body weight and adiponectin. Because of adiponectin's potential role as a cause of obesity and cardiometabolic disease (Calton et al., 2013; Chandran et al., 2003), only a few studies have compared caloric restriction and exercise.

It is exciting to conduct research and clarification to determine the appropriate dose of exercise and food intake in the management of obesity using adiponectin level indicators. Previous research has shown that the size and number of adipocytes in the abdomen (central obesity) change in response to overeating (You et al., 2006), as well as weight loss. However, there have been few studies have looked into whether weight loss The effects on adiponectin production by adipose tissue were inconclusive. The goal of this research was to find out whether the dose of Aquafit-Running (AR) exercise with an intensity of 75% HRmax, duration of 45 minutes, frequency of 3-4 times per week, and calorie restriction [consumption of Fit-Bar (FB) 1 pack before and after treatment could affect adiponectin levels in obese women.

## Methods

### Participants and Study Design

The study excluded participants who had serious injuries or illnesses that prevented them from participating in sports. No prior water sports training is required, and all participants have no prior water sports experience. Forty-eight obese women, we used a randomized pretest-posttest control group design (BMI > 31 kg/m$^2$) aged 50–60 years, who were divided into four groups. Aquafit-Running (AR) Group Fit-Bar (FB) group were given 1 pack of Fit-bar before and after treatment for 6 weeks (n = 12), the Aquafit-Running and Fit-Bar group (AR+FB) (n = 12), as well as the control group (n = 12). Before and after treatment (after 6 weeks), body fat percentage, body weight, height, BMI, and adiponectin levels were measured.

### Study Approval

Before signing the informed consent form, All participants were informed of the potential risks and were given a copy of the study procedures to read. The Indonesian Research Ethics Committee, Kariadi Hospital, Diponegoro University, Semarang (No.781/EC/FK/RSDK/2022) approved this study.

### Aquafit-Running (AR) Training Program

The participants performed 12 sessions of aquatic exercise instruction over the course of 6 weeks, twice a week and this training technique has already been described (Mukarromah et al., 2017; Mukarromah et al., 2023). Our aquafit-running class regimen included warm-up activities like jogging and moderately intense water aerobics for five minutes, for twenty minutes during this phase, the sample receives jogging, aquafit-running, with the goal of raising the heart rate to 65-70% of the maximum heart rate, resistance training with for ten minutes, and cool-down activities like stretching ten minutes. Each activity was followed by a 2 to 3 minute rest period. Three to four cycles of 25-meter jogging made up an aquafit running. The program was made to be finished in 45 minutes. Previous studies have validated the training program's safety, which incorporates low

intensity to moderate intensity exercise (Sanders et al., 2013; Nagle et al. 2016; Nagle, 2019; Mukarromah et al., 2023). The exercises were carried out in the college's outdoor pool (depth: 1.2-1.5 m, temperature of the water: 28.0°C-29.0°C) under the guidance of a fitness coach. The participants' was held on the same day as this instruction. In this study, the participants' heart rates [HR] were periodically checked while exercising in the water using a heart rate monitor (Polar H10 bluetooth Heart Rate Monitor ANT+ - Forest Camo, Germany).

**Fitbar Nutrition Fact**

Energy bars are supplements manufactured with cereals, vitamins, and flavorings designed to provide quick energy. Energy bars provide the body with essential carbohydrates to fuel exercise. Given that they frequently contain extra protein, carbs, dietary fiber, and other nutrients, fitbar may be advertised as a functional food, Fitbar, made from organic ingredients and flavored with oats, peanut butter, honey almond, and coffee. Glucose Syrup, Whole Wheat Flour (5.6%), Soy Puff, High Fructose Syrup, Margarine, Sucrose, Natural Sweetener Isomalt, Vegetable Humectant Glycerine, Natural Sweetener Maltitol, and Quinoa Powder (1%). White Chocolate Compound Coating (Sugar, Vegetable Fat) Allergens: Gluten, Milk, and Soybeans: Gluten Traces. Fitbar MultiGrain Choco delight, 22 gram, KALBE Nutritionals].

**Anthropometry Measurements**

At least two hours were spent fasting before anthropometric measurements were taken. The heights and weights of the participants were measured., as well as their BMI values are defined as relationship between body weight (kg) and square of height—were computed ($m^2$), BMI is considered underweight if it is less than 18.5 $kg/m^2$, BMI is between 18.5-25 $kg/m^2$, which is considered a healthy weight level, if BMI is between 25 and 30, are considered overweight, 25.0-30 kg/m2 and obesity is defined as a BMI of 30 or higher (WHO., 2000). The bioelectrical impedance method was used to determine body fat and lean body mass (TANITA Inc., Tokyo, Japan (MC-780A-N).

**Statistical Analyses**

The collected data is electronically cleaned, coded, and tabulated, Hypothesis testing and descriptive analysis are also part of data analysis. Standard deviation and mean are displayed in graphs and tables frequency distributions are displayed for interval and ratio data, but not for nominal and ordinal data. The Levene Statistics Test of Variance was used to examine the data for variance homogeneity. The Shapiro-Wilk test is used to determine homogeneity and normality before putting the theory to the test. The Tukey's HSD post hoc test was used to examine data with a normal distribution and homogeneous data variance after a parametric one-way ANOVA (open significant difference). Regardless of whether the When the data were not normally distributed or the variance was not homogeneous, the Kruskal-Wallis and Mann-Whitney differential tests were used to perform a non-parametric analysis. To test the results of measurements and calculations, the SPSS system for Windows version 21 was used (Agus, 2009; Hartono, 2011). 95% confidence level was used throughout the analysis.

**Blood Serum for Adiponectin Levels**

Adiponectin measurement is a blood test that detects Adiponectin is a circulating hormone. Adiponectin is a hormone that regulates glucose metabolism as well as fatty acid catabolism. Low levels of adiponectin levels in the blood (hypoadiponectinemia; 4 µg/mL) have been linked to atherosclerosis (coronary artery disease, stroke, peripheral artery disease), sleep apnea, non-alcoholic fatty liver disease, gastritis, and gastro-intestinal disorders Endometrial cancer, postmenopausal breast cancer, leukemia, colon cancer, gastric cancer, and prostate cancer are all examples of cancers that can occur in women and hyperadiponectinemia has been linked to heart, kidney, and lung disease.

After a 12-hour fast (both before and after 6 weeks of exercise), antecubital vein blood samples were collected into vacutainer tubes with EDTA under the same conditions and time periods. The concentration of adiponectin in plasma was determined using an Quantikine kits and enzyme-linked immunosorbent assays (R&D System, Minneapolis, MN). This test had a sensitivity of 0.2 ng/ml. In our laboratory, the variation coefficients between assays were 5.7% and 3.4%, respectively and the blood was centrifuged at 3000 rpm for 10 minutes before being stored in a deep freezer at 70 °C.

**Results**

The subjects' average age, height, energy, protein, and fat intake in any of the groups, the differences between before and after treatment were not statistically significant.

However, after treatment, body weight and body fat percentage were significantly different from the control group. (p=0.000). According to the regulation of the Minister of Health of the Republic of Indonesia No. 28 of 2019, the recommended nutritional adequacy rate for Indonesians is female aged 50-64 years with a body weight of 56 kg, 158 cm, calorie needs of 1800-2150 kcal, protein of 60 gr, and fat 50 gr, food intake was measured using a 24-hour food recall in this study and there were no statistically significant differences in the four groups' baseline characteristics, including baseline The characteristics of participants in the training and control groups were similar. Table 1 shows the baseline participants in the training and control groups shared similar characteristics.

Table 1. The characteristics of training and control group participants.

| Variabel | P1(AR) Mean ± SD (n-12) | P2 (FB) Mean ± SD (n-12) | P3 (AR+FB) Mean ± SD (n-12) | Control group Mean ± SD (n-12) | p |
|---|---|---|---|---|---|
| Age (year) | 52.49±1.41 | 50.74±1.30 | 51.79±1.35 | 52.79±1.35 | 0.125[(1)] |
| Intake energi (ccal) | 3157± 119.97 | 3125± 165.81 | 3134± 116.01 | 3224± 121.18 | 0.212[(1)] |
| Intake protein (g) | 58.38±1.57 | 54.91±1.36 | 55.38±1.48 | 53.18±1.14 | 0.413[(1)] |
| Intake fat (g) | 59.17±2.13 | 58.13±2.12 | 55.23±1.84 | 55.16±2.34 | 0.251[(1)] |
| Height (m) | 1.55 ± 0.03 | 1.53 ± 0.05 | 1.54 ± 0.02 | 1.53 ± 0.01 | 0.173[(1)] |
| Weight (kg) *pre* | 66.11±3.41 | 65.16±4.24 | 65.41 ±5.31 | 65.41 ±4.11 | 0.282[(1)] |
| Weight (kg) *post* | 58.25±2.49 | 63.45±4.10 | 53.11 ± 4.61 | 65.01 ± 3.16 | 0.001[(1)] |
| BMI (kg/m$^2$) *pre* | 32.78±1.13 | 32.97±1.05 | 32.29±0.98 | 33.27±1.95 | 0.315[(1)] |
| BMI (kg/m$^2$) *post* | 30.56±0.93 | 32.46±1.54 | 29.19±1.16 | 33.01±1.14 | 0.000[(1)] |
| Fat percentage (%) *pre* | 37.64±1.58 | 36.48±3.14 | 36.82 ± 1.65 | 33.93 ± 1.95 | 0.076[(1)] |
| Fat Percentage (%) *post* | 33.44±1.26 | 34.03±2.21 | 30.61 ± 1.24 | 33.31 ± 0.73 | 0.000[(1)] |

[(1)] Uji Anova

Aquafit-Running decreased lose BMI including body weight including by increasing energy expenditure, improving body composition, increasing mobilization capacity and fat oxidation, controlling food intake, and improving lipid profile. Body weight loss in the treatment vs. control groups, each group experienced a decrease. AF of 7.86 ± 0.92; FB 1.71 ± 0.14; AF±FB 12.30 ± 0.70 and control group 0.40±0.95, body fat percentage each group AF of 4.20 ± 0.32; FB 2.45 ± 0.93; AF±FB 6.21 ± 0.40 and control group 0.62±1.22. Table 2 shows the data for measuring adiponectin levels before and after treatment in each group.

Table 2. Levels of adiponectin in the training and control groups before and after a 6-week intervention.

| Variabel | P1(AR) Mean ± SD (n-12) | P2 (FB) Mean ± SD (n-12) | P3 (AR+FB) Mean ± SD (n-12) | Control group Mean ± SD (n-12) | p |
|---|---|---|---|---|---|
| Adiponectin (µg/ml) | 5.69±1.68 | 4.92±1.45 | 5.11±1.65 | 4.24±0.76 | 0.472[(1)] |
| Adiponectin (µg/ml) | 15.97±2.70 | 8.28 ± 1.81 | 10.72± 2.35 | 4.82±1.40 | 0.001[(1)] |
| Delta Adiponectin (µg/ml) | 10.28±1.02 | 3.36±0.36 | 5.61±0.70 | 0.58±0.64 | 0.000[(1)] |

[1] Uji Anova

Adiponectin levels in each group before treatment (pretest) 5.69±1.68; 4.92±1.45; 5.11±1.65; 4.24± 0.76 (p = 0.472). Posttest 15.97±2.70; 8.28±1.81; 10.72±2.35; and 4.82±1.40 (p=0.001) in comparison to the control group. There was a significant difference in adiponectin levels between groups after treatment 10.28±1.02 in the AF group, FB 3.36 ± 0.36; FB±AF 5.61±0.70; and 0.58±0.64 (p=0.000) in comparison to the control group. After 6 weeks of treatment with AF±FB (5.61 g/ml), the concentration in the AF group has increased by 34% (10.28 g/ml), but not in the FB or control groups. Furthermore, plasma adiponectin concentrations in people who lost body weight were higher and lower than the average percent weight loss in the AF (7.86 kg) and AF+FB (12.30 kg) groups, respectively (Table 1). Adiponectin concentrations (5.61 µg/mL) (p=0.001) in the AF+FB group who lost 12.7% or more, and adiponectin concentrations tended to increase in the AF group who lost less than 12.7% (p=0.001) (0.28 µg/mL) (p=0.000) concentration increased significantly. Adiponectin levels remained unchanged in both the FB and control groups in women who lost less than 12.7% of their body weight (p=0.007).

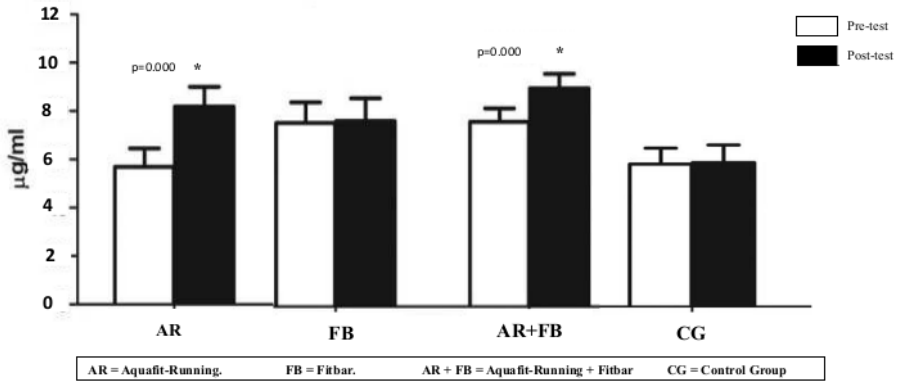


Figure 1. Adiponectin levels before and after treatment.

**Discussions**

The current study looked at the impact of 6 weeks of aquafit running and fit bar consumption on adiponectin in obese females. The combined approach significantly increased Adiponectin levels in the two groups (Aquafit-running and Aquafit-running Fitbar), while the control group's Adiponectin amounts remained low. Furthermore, the study discovered a statistically significant difference in adiponectin levels between groups, which were reduced in the aquafit-running, fitbar, aquafit running fitbar, and control groups. Some studies supported the study's findings, which revealed a significant increase in adiponectin concentrations following moderate to severe resistance exercise (Garekani et al., 2011). As a result, the effects of six months of resistance exercise intensity (various low and moderate intensities ranging from 50% to 80% RM 65%) on adiponectin in elderly people were investigated, It was eventually discovered that adiponectin levels significantly increased after moderate to severe exercise and low intensity does not change (Jürimäe et al., 2005).

According to these findings, healthy subjects' circulating adiponectin levels are in the range of 5 and 20 µg/mL (Matsuzawa, 2005). Obesity has been found to be the primary factor that is human adiponectin concentration is closely related. In obese people, other adipokines are secreted at higher than normal levels (Arita et al., 1999). However, Adiponectin levels in the blood drop significantly in both animal and human research when obesity is present., possibly due to decreased protein secretion. BMI and adiponectin have been shown to have an inverse relationship (Kumada, 2003). Adiponectin levels in obese subjects are consistently reported to be 6 µg/mL (Esposito et al., 2003; Faraj et al., 2003).

Circulating adiponectin concentrations in postmenopausal women with comparable weight loss (12%) caloric restriction alone had no effect. However, when the caloric restriction intervention was combined with exercise training, the effect was significantly increased. This is supported by changes in adiponectin release from subcutaneous adipose tissue with abdominal fat releasing significantly more and the AR+FB group had an increase in gluteal fat, while the AR group had an increase in the release of adiponectin from both abdominal and gluteal fat. Despite due to the fact that no the relationship between adiponectin levels and adipose tissue release, the changes after AR+FB intervention were in the same direction. As a result, differences in the release of adiponectin from subcutaneous fat in response to AR and AR+FB interventions could explain some of the circulating data concentration variations. Women who lost more than 12.7% of their body weight of their body weight had higher levels of adiponectin, those who lost less than 12.7% of their body weight experienced no change. According to the findings of this study, caloric restriction may require an even greater weight loss in women to alter the concentration of circulating adiponectin. We believe this is because women have a higher percentage of body fat than men; as a result, similar total weight loss in women is frequently associated with a lower percentage of fat mass loss, and adiponectin is primarily produced by adipose tissue.

Exercise alone has inconsistent effects on the level of adiponectin, The majority of studies show that exercise has no effect on adiponectin levels (Bouchonville et al., 2014). Other studies, on the other hand, found that despite the fact that exercise training increased adiponectin, maintaining or losing only a small amount of weight (Moghadasi et al., 2012). These two studies, like caloric restriction-induced weight loss, were only in men, and those with no change in adiponectin concentration included both men and women or women only (Polak et al., 2006; Abbenhardt et al., 2013). In a few of these studies, adiponectin was measured at least 24 hours following the most recent exercise session, but not in others (Christiansen et al., 2010). As a result, we cannot rule out the possibility that the timing inconsistency with respect the previous exercise also contributed to the inconsistency of the results. Our results indicate that exercise increases adiponectin's sensitivity to a weight-loss program. Furthermore, there are no studies that we are aware of that have used caloric restriction or exercise interventions, our findings suggest that variations there were differences in adiponectin release from gluteal fat observed similar to changes in abdominal fat but of a lesser magnitude. Exercise and caloric restriction-induced weight loss may influence adiponectin concentration levels through different mechanisms.

**Conclusions**

In conclusion, According to our findings, the concentration of the amount of circulating adiponectin did not change with fitbar consumption only, but increased when aquafit running was added. Changes in circulating adiponectin concentration correlated with changes in adiponectin release from the subcutaneous fat abdominal as well as gluteal adipose tissue. Our findings and those of others suggest that a greater percentage of weight loss is required in women to increase adiponectin levels, and that exercise enhances the effects of weight loss on adiponectin levels. Aquafit-running allows you to exercise in the water, aquafit-running choreography combined with measured and consistent doses of exercise (intensity 75% HRMax, duration 45 minutes, frequency 3-4 times per week), accompanied by fitbar consumption for six weeks, can reduce body weight and increase adiponectin levels in obese women. This demonstrates that doing aquafit-running exercises becomes a modulator in obesity prevention and an alternative to non-pharmacological obesity prevention.

**Acknowledgment**

Falcon Scientific Editing (https://falconediting.com) proofread the English in this paper, and the authors are grateful.

**References**


Abbenhardt, C., McTiernan, A., Alfano, C. M., Wener, M. H., Campbell, K. L., Duggan, C., & Ulrich, C. M. (2013). Effects of individual and combined dietary weight loss and exercise interventions in postmenopausal women on adiponectin and leptin levels. *Journal of internal medicine*, *274*(2), 163-175.

American College of Sports Medicine. (2013). *ACSM's guidelines for exercise testing and prescription*. Lippincott williams & wilkins.

Ambeba, E. J., Styn, M. A., Kuller, L. H., Brooks, M. M., Evans, R. W., & Burke, L. E. (2013). Longitudinal effects of weight loss and regain on cytokine concentration of obese adults. *Metabolism*, *62*(9), 1218-1222.

Arita, Y., Kihara, S., Ouchi, N., Takahashi, M., Maeda, K., Miyagawa, J. I., & Matsuzawa, Y. (1999). Paradoxical decrease of an adipose-specific protein, adiponectin, in obesity. *Biochemical and biophysical research communications*, *257*(1), 79-83.

Arvidsson, E., Viguerie, N., Andersson, I., Verdich, C., Langin, D., & Arner, P. (2004). Effects of different hypocaloric diets on protein secretion from adipose tissue of obese women. *Diabetes*, *53*(8), 1966-1971.

Bento, P. C. B., Pereira, G., Ugrinowitsch, C., & Rodacki, A. L. (2012). The effects of a water-based exercise program on strength and functionality of older adults. *Journal of aging and physical activity*, *20*(4), 469-470.

Bocalini, D. S., Serra, A. J., Murad, N., & Levy, R. F. (2008). Water-versus land-based exercise effects on physical fitness in older women. *Geriatrics & gerontology international*, *8*(4), 265-271.

Bouchonville, M., Armamento-Villareal, R., Shah, K., Napoli, N., Sinacore, D. R., Qualls, C., & Villareal, D. T. (2014). Weight loss, exercise or both and cardiometabolic risk factors in obese older adults: results of a randomized controlled trial. *International journal of obesity*, *38*(3), 423-431.

Bruun, J. M., Lihn, A. S., Verdich, C., Pedersen, S. B., Toubro, S., Astrup, A., & Richelsen, B. (2003). Regulation of adiponectin by adipose tissue-derived cytokines: in vivo and in vitro investigations in humans. *American journal of physiology-Endocrinology and metabolism*, *285*(3), E527-E533.

Calton, E. K., Miller, V. S., & Soares, M. J. (2013). Factors determining the risk of the metabolic syndrome: is there a central role for adiponectin?. *European journal of clinical nutrition*, *67*(5), 485-491.

Chandran, M., Phillips, S. A., Ciaraldi, T., & Henry, R. R. (2003). Adiponectin: more than just another fat cell hormone?. *Diabetes care*, *26*(8), 2442-2450.

Christiansen, T., Paulsen, S. K., Bruun, J. M., Pedersen, S. B., & Richelsen, B. (2010). Exercise training versus diet-induced weight-loss on metabolic risk factors and inflammatory markers in obese subjects: a 12-week randomized intervention study. *American Journal of Physiology-Endocrinology and Metabolism*.

Esposito, K., Pontillo, A., Di Palo, C., Giugliano, G., Masella, M., Marfella, R., & Giugliano, D. (2003). Effect of weight loss and lifestyle changes on vascular inflammatory markers in obese women: a randomized trial. *Jama*, *289*(14), 1799-1804.

Fischer-Posovszky, P., Wabitsch, M., & Hochberg, Z. (2007). Endocrinology of adipose tissue-an update. *Hormone and Metabolic Research*, *39*(05), 314-321.

Garekani, E. T., Mohebbi, H., Kraemer, R. R., & Fathi, R. (2011). Exercise training intensity/volume affects plasma and tissue adiponectin concentrations in the male rat. *Peptides*, *32*(5), 1008-1012.

Geidl, W., Schlesinger, S., Mino, E., Miranda, L., & Pfeifer, K. (2020). Dose–response relationship between physical activity and mortality in adults with noncommunicable diseases: a systematic review and meta-analysis of prospective observational studies. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 1-18.

Heywood, S., McClelland, J., Mentiplay, B., Geigle, P., Rahmann, A., & Clark, R. (2017). Effectiveness of aquatic exercise in improving lower limb strength in musculoskeletal conditions: a systematic review and meta-analysis. *Archives of physical medicine and rehabilitation*, *98*(1), 173-186.

Hocking, S., Samocha-Bonet, D., Milner, K. L., Greenfield, J. R., & Chisholm, D. J. (2013). Adiposity and insulin resistance in humans: the role of the different tissue and cellular lipid depots. *Endocrine reviews*, *34*(4), 463-500.

Jensen, M. D., Ryan, D. H., Apovian, C. M., Ard, J. D., Comuzzie, A. G., Donato, K. A., & Yanovski, S. Z. (2013). AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. Circulation, 129 (suppl. 2), S102–S138.

Jürimäe, J., Purge, P., & Jürimäe, T. (2005). Adiponectin is altered after maximal exercise in highly trained male rowers. *European journal of applied physiology*, *93*, 502-505.

Kaneda, K., Sato, D., Wakabayashi, H., Hanai, A., & Nomura, T. (2008). A comparison of the effects of different water exercise programs on balance ability in elderly people. *Journal of Aging and physical activity*, *16*(4), 381-392.

Katsura, Y., Yoshikawa, T., Ueda, S. Y., Usui, T., Sotobayashi, D., Nakao, H., & Fujimoto, S. (2010). Effects of aquatic exercise training using water-resistance equipment in elderly. *European journal of applied physiology*, *108*, 957-964.

Kovacova, Z., Vitkova, M., Kovacikova, M., Klimcakova, E., Bajzova, M., Hnevkovska, Z., & Polak, J. (2009). Secretion of adiponectin multimeric complexes from adipose tissue explants is not modified by very low calorie diet. *European journal of endocrinology*, *160*(4), 585-592.

Matsuzawa, Y. (2005). White adipose tissue and cardiovascular disease. *Best practice & research Clinical endocrinology & metabolism*, *19*(4), 637-647.

Mesias, J. C. M. (2022). Out-of-Field Public Senior High School Teachers: Competencies in Teaching Physical Education. *Physical Education and Sports: Studies and Research*, *1*(2), 123-135. https://doi.org/10.56003/pessr.v1i2.137

Michishita, R., Hide, T., Kawakami, S., Kanegawa, Y., Takayanagi, K., Inui, M., & Higaki, Y. (2022). Effects of Aquatic Exercise Training on Physical Performance and Mood States in Male Collegiate Soccer Players. *Translational Journal of the American College of Sports Medicine*, *8*(1), e000218.

Moghadasi, M., Mohebbi, H., Rahmani-Nia, F., Hassan-Nia, S., Noroozi, H., & Pirooznia, N. (2012). High-intensity endurance training improves adiponectin mRNA and plasma concentrations. *European journal of applied physiology*, *112*, 1207-1214.

Mukarromah, S, B. (2014). Development of Aquajogger as a Prospective Business Opportunity in the Field of Sports Fitness. *Media Ilmu Keolahragaan Indonesia*, *4*(2), 105–13.

Mukarromah, S, B., Hardhono Susanto., Wara Kushartanti., Soegiyanto., Setya Rahayu. (2017). Beneficial Health Effect of Aquarobics (Role of Adiponectin on Women with Obesity).1st Annual Applied Science and Engineering Conference IOP PublishingIOP Conf. Series: Materials Science and Engineering.

Mukarromah, S. B., Hidayah, T., Sumartiningsih, S., Ali, M. A., Hakim, A. A., Lesmana, R., & Giang, N. T. (2021). Serum Dehydroepiandrosterone (DHEA) concentration after aquarobic training in premenopausal women with obesity. *Journal of Physical Education and Sport*, *21*, 2402-2407.

Mukarromah, S. B. T., Ali, M. A., Anggita, G. M., Lesmana, R., Rosdianto, A. M., Hanief, Y. N., & Park, S. H. (2022). The effect of aquarobics high intensity interval training in on interleukin-6 (IL-6) serum changes for over 8 weeks. *Journal of Physical Education and Sport*, *22*(12), 3114-3121.

Nagle, E. F., Sanders, M. E., & Franklin, B. A. (2017). Aquatic high intensity interval training for cardiometabolic health: benefits and training design. *American journal of lifestyle medicine*, *11*(1), 64-76.

Nagle, E. F., Sanders, M. E., & Becker, B. E. (2019). Aquatic exercise for health: probing the depths of HIIT for cardiometabolic training. *ACSM's Health & Fitness Journal*, *23*(4), 14-26.

Polak, J., Klimcakova, E., Moro, C., Viguerie, N., Berlan, M., Hejnova, J., & Stich, V. (2006). Effect of aerobic training on plasma levels and subcutaneous abdominal adipose tissue gene expression of adiponectin, leptin, interleukin 6, and tumor necrosis factor α in obese women. *Metabolism*, *55*(10), 1375-1381.

Ryan, A. S., Nicklas, B. J., Berman, D. M., & Elahi, D. (2003). Adiponectin levels do not change with moderate dietary induced weight loss and exercise in obese postmenopausal women. *International journal of obesity*, *27*(9), 1066-1071.

Sanders, M. E., Takeshima, N., Rogers, M. E., Colado, J. C., & Borreani, S. (2013). Impact of the SWEAT™ water-exercise method on activities of daily living for older women. *Journal of Sports Science & Medicine*, *12*(4), 707.

Summer, S. S., Brehm, B. J., Benoit, S. C., & D'alessio, D. A. (2011). Adiponectin changes in relation to the macronutrient composition of a weight-loss diet. *Obesity*, *19*(11), 2198-2204.

Takeshima, N., Rogers, M. E., Watanabe, E., Brechue, W. F., Okada, A., Yamada, T., & Hayano, J. (2002). Water-based exercise improves health-related aspects of fitness in older women. *Medicine & Science in Sports & Exercise*, *34*(3), 544-551.

Tchoukalova, Y. D., Votruba, S. B., Tchkonia, T., Giorgadze, N., Kirkland, J. L., & Jensen, M. D. (2010). Regional differences in cellular mechanisms of adipose tissue gain with overfeeding. *Proceedings of the national academy of sciences*, *107*(42), 18226-18231.

World Health Organization. (2000). Obesity; Preventing and Managing the global endemic. WHO Technical Report Series No 894. WHO, Geneva.

You, T., Murphy, K. M., Lyles, M. F., Demons, J. L., Lenchik, L., & Nicklas, B. J. (2006). Addition of aerobic exercise to dietary weight loss preferentially reduces abdominal adipocyte size. *International journal of obesity*, *30*(8), 1211-1216.

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