Impact of Nutritional Modifications and Sports on Metabolic Indicators and the Physique in Women with Obesity

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ABSTRACT

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These days, obesity is a major concern since it is rising significantly along with the frequency of co-occurring diseases like type 2 diabetes and hypertension. The purpose of the current research is to evaluate how diet and Zumba exercise affect obese women's physiques and some biochemical indicators. From December 2023 to May 2024, a randomized experiment was held at the Faculty of Physical Education GYM in Alexandria. Participants were one hundred adult obese women without any other medical conditions and 30 to 34.9 kg/m2 is an acceptable average for a BMI (Class I obesity). Four groups of participants were formed; the first group was the control group, which received no assistance. The interventions for the other three groups were limited to nutrition and physical exercise. The other three groups received equivalent nutritional and physical activity interventions or treatments that included diet and exercise exclusively. Changes in body weight and composition were the primary outcome measure, while other biochemical indicators indicating the risk of chronic illness were the secondary ones. The results examined metabolic indicators and demonstrated that it is not reasonable to expect significant weight loss from training or diet adjustment for obese persons. The fourth group had the strongest effect, and there were notable disparities between it and the other groups. So, it should combine a modified diet with physical activity. Despite the reduction effects of diet exercise improves body weight, BMI, lipid profile, liver enzymes, and hematology indices which may have important benefits on several diseases later in life

Keywords: *Obesity; physical activity; diet; biochemical parameters*

INTRODUCTION

Because obesity is linked to higher risks of several diseases, including diabetes, hypertension, cardiovascular disease, and some types of cancer, it has become a major global health concern. Global health, social, and economic costs have increased significantly as a result of the growth in obesity rates in recent decades **(Mehrabani & Khazraei, 2018; Talen & Mann, 2009; Dobbs et al., 2014).** Notably, mental health, decreased productivity, and financial burdens on individuals, households, and healthcare systems are all health issues associated with obesity. Obesity was once thought to be an issue only in high-income nations, but it is increasingly common in places like the Eastern Mediterranean due to a combination of dietary changes, sedentary lifestyles, urbanization, and cultural norms **(Heslehurst et al., 2019).** Non-communicable diseases are largely caused by lifestyle factors, such as poor food choices and insufficient physical activity **(Lee et al., 2019).** Improving eating habits and upping physical activity are two key lifestyle changes that are frequently the first steps toward effective obesity treatment. To support intentional weight loss, interventions usually involve dietary changes including switching to low-carb and low-glycemic diets **(Lee et al., 2019).**

To investigate obesity further, researchers tried a variety of workout regimens, ultimately settling on Zumba (aerobic dancing). Beto Perez developed the Zumba fitness program in Colombia in the 1990s. It combines aerobic exercises with simple Latin music with a variety of Latin dances, including Samba, Salsa, Reggaeton, Cumbia, Merengue, and Belly Dance **(Domene et al., 2015).** In just one hour, Zumba training can burn 400–800 calories. The method involves a gentle warm-up to calm music before progressively increasing the intensity of the routines. Zumba fitness is also a lot of fun because it's a group exercise that helps achieve fitness objectives and offers a lot of advantages, like helping people lose weight and combat obesity; building muscles; enhancing mood and mental clarity; boosting self-esteem;

enhancing cardiovascular efficiency; facilitating mental and physical synchronization; and bringing about pleasure and happiness **(Sridevi et al., 2015).** According to **İmamoğlu and Özdenk (2019),** regular physical activities like Zumba seem to be one of the most popular and successful ways to prevent obesity, weight loss, and body tightening among women with nutrition.

Therefore, the main aim of this research is to investigate the impact of physical exercise, such as Zumba, in conjunction with dietary changes, on reducing body mass index, body fat percentage, and selected signals from metabolism in women with obesity **(World Health Organization, 2021).**

SUBJECTS AND METHODS

Subjects

For the study; one hundred females, their mean age was about 35 y. participated in the study, who had a BMI ranging between (30-34.9) kg/ht^2 (Class I obesity) and body fat about 36.83 %. Participants have no physical, or neurological diseases and no sports activity. The sample was taken from women who participated in a commercial weight loss program in nutritional clinical at Menoufia University, Egypt.

Research design

This research is a comparison design study. All the parameters were calculated for four categories; a control set, a physical activity (Zumba) group, the diet modification group, and the group that did physical activity (Zumba) with diet modification. The experimental program used in the research was conducted daily modified diet of caloric food or physical activity three times per week for six months **(Andersen *et al.*, 1999).** The study was conducted in the Nutritional Clinic at Menoufia University, from March 2023 to the end of September 2023. The participant underwent weekly interviews and a six-month follow-up with a nutritionist at the Nutrition Clinic.

Ethics approval

The Scientific Research Ethics Committee of Alexandria University Faculty of Physical Education for Girls approved the study.

Assessment of anthropometric measurement

Using a Beurer BG42 scale with the bioelectric impedance approach, anthropometric measu-rements were made on subjects who were bare-chested and shoeless. Readings were recorded to the nearest 0.5 kg (Tai et al., 2010). The formula for calculating body mass index (BMI) is weight in kilograms divided by height in meters squared (kg/m2). Underweight (BMI < 18.5 kg/m²), normal weight (BMI 18.5-24.9 kg/m²), overweight (BMI 25-29.9 kg/m²), obese class 1 (BMI 30-34.9 kg/m²), obese class 2 (BMI 35-39.9 kg/m²), and severely obese (BMI ≥ 40 kg/m²) were the BMI classifications that were used (Smith, 2016). Furthermore, body fat, body water, and body muscle percentages were determined using bioelectric impedance measurement using In Body 170 equipment (Bering et al., 2018).

Some metabolic biomarker determination

Blood sample were taken ten ml of blood samples were taken and immediately transported to the analysis laboratory. Blood glucose, Serum triglycerides (TG), total cholesterols (TC), high-density lipoprotein (HDL) cholesterols, and low-density lipoprotein (LDL)-cholesterols were estimated using the methods of **Trinder (1969); McGowan et al., (1983); Schettler and Nussle (1975); Warnick and workmate (1983) and Demacker *and Others* (1984)** respectively. By the following guidelines of **Bergmeyer and coworkers (1978) and King (1965),** alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) were evaluated**.**

Hematological analysis including serum iron, total iron binding capacity (TIBC), transferrin saturation, red blood cells (RBC), hemoglobin (Hb), white blood cells (WBC) stuff, lymphocytes stuff and platelet count was estimated by following the method of **Buttarello (2016); Brancaleoni *and* Colleagues (2016); Kawabata (2016); Fazal *and* Co-workers (2017); Herklotz and Else (2006).** Thyroid-stimulating hormone (TSH), leptin, and insulin hormones are carried out according to **Uotila and Partners (1981); Considine and Associates (1996); Defronzo and researchers (1979)** respectively**.**

Analytical statistics:

The obtained information was analyzed using the statistical program for social sciences (SPSS version 17.0). The arithmetic mean and standard deviation (SD) were used to express the results. The significance level between the four groups was assessed by an independent sample t-test;

differences were deemed significant at P<0.05 or less **(Snedecor and Cochran, 1980).**

FINDINGS AND DISCUSSIONS

Dietary modifications for obese women advised for six months, were organized according to Table (1). Before modification, the diet's protein, carbohydrate, fat, and total calorie content were 97.45, 400.04, 101.98 g, and 2907.78 kcal, respectively. The adjusted diets drastically reduced the intake of these nutrients. Carbohydrates, protein, fat, and total calories were measured as follows: 244.77g, 75.01g, and 25.002g, or 65, 20, and 15% of the total calories, or 1500.13kcal. The percentages of total calories consumed, protein, fat, and carbs that were modified were 38.8, 23.03, 75.48, and 48.41%, respectively. In this investigation, the protein proportion was set at 10–20% of the energy in the diet type; **Kalra (2012)** made note of the diet's protein content. It was highlighted that eating enough protein might preserve muscle mass and give rise to a satisfied feeling, both of which could help regulate body weight. According to **Rush et al. (2019),** daily fat consumption should be 10-15% of total calories for individuals with obesity, and the diet should be supplemented with omega 3. The daily fat intake was approximately fifteen.

One hundred women in all, with an average age of roughly thirty-five, took part. **Table 2** displays the average height, weight, and BMI of obese women as they relate to changing one's diet, increasing physical activity, or doing both. Age and height do not significantly differ between the groups. Although the body weight and body mass index of the analyzed groups were lower than those of the control sample with substantial variations, there were no substantial modifications found between the Zumba team and the modified diet category. The weight and BMI decrease percentages from the control values were 7.37, 13.22, and 25.80%, respectively. **Romieu and Colleagues (2017)** claim that the main factor causing excessive weight gain that results in obesity is an increase in energy consumption. According to **Barter and Genest (2019),** weight reduction is believed to be partially attributed to metabolic adaptation in a low-energy diet. A modified diet has been implemented to reduce body mass and attenuate additional weight loss by altering calorie-dense meals, decreasing mitochondrial efficiency, and circulating hormone conce-ntrations. Compared to conve-ntional exercise, Zumba emphasizes fat burning and uses it as a source of energy, which lowers the percentage of body weight. This is consistent with other research showing that six weeks of moderate-intensity dancing to music could reduce body fat in females who are overweight and obese **(Wiklund and collaborators 2014).** It shows a decrease in overall body fat, a rise in muscle mass, and a change in total fat lump depending on how long the intervention is conducted. because it affects more energy that has been used. According to a different study **(Micallef, 2014; Guerendiain et al., 2018),** dancing exercises release energy at a rate of 369 Kcal in approximately 39 minutes. Depending on the type of dance style, a longer time would result in greater energy wasted.

Zumba's advantages over traditional fitness. Following the six-month treatment, the body composition of various groups of obese women was disclosed in **Table 3**. Their body composition was observed to be much lower than a control woman, despite a notable rise in bone, water, and muscle amount due to a lowering in fat quantity, an improvement in physique rating, and a basal metabolic rate. The fourth group, which participated in programs for physical activity and food modification, had the most notable outcomes. The findings demonstrated that lowering the metabolic age from roughly 48 to approximately 37 increased the pace at which physical activity and dietary modifications burnt calories. The terms "body composition" refer to the proportions of muscle, bone, and fat in human bodies. Because it can be highly useful in monitoring health, the body fat percentage is of the most interest **(Andersson et al., 2011).** management of obesity strategically based on obesity class. Dietary modifications, particularly in obese people, lead to a reduction in fat and a healthier body composition. Without a doubt, because low-calorie diets reduce body fat, they may alter body composition metrics. A negative energy value diet causes a person's body mass to decrease, which not only results in the anticipated loss of body fat but also negatively impacts muscle mass. In terms of comparing the diets' efficacy in terms of body mass decrease and body fat index, it is important to highlight that both diets emphasize increasing or maintaining muscle mass within a healthy range **(Noakes, 2013; Mark and Others 2016).** Here, BMI determines the degree of obesity, and BMI is typically regarded as a proxy indicator of the rise in adiposity to overweight and obesity **(Wang and Else 2010).** Participants' ability to respond to the Zumba motions in a cohesive and integrated way determines how well the proportion of body fat is reduced. According to **Pantelic (2013)**, young women's body composition and subcutaneous fatty tissue diminish as a result of the Zumba program. The Zumba model was applied for 12 weeks, and the results showed that muscle mass increased by 2.4% and body mass decreased by 3.7%. Furthermore, a decrease in skinfolds and fat mass percentage was observed, suggesting that the Zumba strategy benefited in modifying the patients' changes in their physiques. When it comes to lowering visceral fat, regular exercise may have a greater impact than dieting. Studies have indicated that visceral fat can be reduced more efficiently by regular exercise than subcutaneous fat, and this effect can be achieved without a substantial reduction in physique **(Sasai and colleagues, 2009).**

A few biochemical biomarkers of obese women as impacted by tried-and-true protocol programs are displayed in **Table (4).** After applying the tested programs for six months, there was a substantial reduction in the levels of TG, TC, and low and very low lipoproteins when compared to the control woman. The group that followed a program, that included changing their diet and increasing their physical activity, had the biggest results. The second and third groups, which adhere to dietary modifications or physical activity, exhibited notable progress in comparison to the control group;

nonetheless, their levels remained lower than those of the fourth group. The fourth group was the best; yet, following the intervention of the various programs, the high-density lipoprotein was much higher. The outcomes matched those of Barter and Genest (2019), who showed a comparable advantage of low-carbohydrate eating on weight loss, HDL-c, and TG after adjusting for the detrimental effects of increasing LDL-c and TC levels. According to **Sasai et al. (2009),** Zumba exercise was superior in terms of raising HDL-c, lowering LDL-c, and increasing red blood cells. Research has indicated that engaging in ballroom dancing daily can help lower stress levels, lower the risk of heart disease and strokes, burn calories and lose excess weight, and naturally lower cholesterol levels by increasing heart rate and breathing **(Myers, 2015; Luo and Zheng, 2020).**

Using the three programs under investigation led to a statistically significant reduction in liver enzymes when compared to the control group in terms of liver functions (see the same table). When compared to the control group, the women who performed physical activity or dietary modification reported significant reductions, and the fourth group's reduction values were higher than those of the other groups. Overindulge in high-calorie foods, may hinder the liver's capacity to operate and cause inflammation, all of which can lead to the liver's scarring condition, cirrhosis. By reducing elevated liver enzymes, a balanced diet decreases the risk of liver ailment **(Eckard et al., 2013; Srour and Partners 2019).** According to **Barter and Genest (2019)**, diet change is anticipated to have several positive, associated impacts, including decreased adipose tissue inflammation, enhanced insulin sensitivity, and decreased hepatic free fatty acid supply. After six weeks, aerobic exercise has been shown to help lower ALT, AST, and ALP enzyme levels in men with fatty liver disease **(Hong, 2022). El-Kader and Others (2014); Mohammad et al. (2022)** discovered that there were negligible changes in liver enzymes that could have been brought on by changes in body weight, increased lymph flow, and return muscle pumping, but there were significant changes in AST, ALT, and alkaline phosphatase levels between pre- and post-training programs.

According to **Table (5),** the fourth group had the largest influence on blood glucose, followed by the third group, and the second group, which had a considerable decrease in comparison to the control sample, had the lowest effect. In comparison to the control category, the fourth group significantly changed the mean value of the insulin hormone and had a crucial role in lowering the levels of leptin and TSH hormones. Eating a diet heavy in calories might slow down digestion and complicate the way insulin functions. To boost hepatic glucose synthesis, it raises fasting glucose levels. During weight loss, a low-calorie diet raises energy expenditure and decreases ghrelin and leptin **(Srour et al., 2019)**. Furthermore, **Barter and Genest (2019)** discovered that to fully understand the variations between low-carb and low-fat diets, it is crucial to take into account additional mechanisms such as energy expenditure, hormone release, adipogenesis, and fatty acid metabolism. **Gordon et al. (2018)** provided support for the current study's conclusions. Researchers discovered that exercise may lower blood glucose levels because it raises the hormone insulin. This means that when muscles are less resistant to insulin, glucose can be used by the working muscles to produce energy. Another study by **Amita et al. (2009)** found that Zumba, or gymnastic dancing, can help control blood sugar levels, increase insulin sensitivity, and enhance fitness. It can even help slim down while building metabolism-boosting muscle mass**.**

The mean values of hematological analysis of obese women who applied to the tested programs were displayed **in Table (6)** in comparison to a control group. Considerable differences were observed in the hematological analysis when compared to the control group's values. The fourth group's mean serum iron, transferrin saturation, and hemoglobin readings are noticeably greater than those of the other groups. These parameters mean and standard deviations were raised. Regarding red blood cells, a non-significant trend was noted. Following the treatment to enhance the immune system and the blood component, the other parameter levels were lowered. Obesity is linked to elevated platelet counts, a higher risk of venous thromboembolism (VTE), and a correlation between iron deficiency (ID), red blood cell counts, and obesity. According to **Stoffel and Else (2020),** there may be a connection between iron deficiency and obesity that is caused by elevated hepcidin levels brought on by persistent inflammation, which in turn raises lymphocyte and total leucocytic count percentages. In people who are overweight or obese, weight loss brought on by an energy-modification diet and/or exercise may help to ameliorate hypoferremia associated with obesity and support the restoration of iron homeostasis. Furthermore, a decrease in adipose tissue is linked to changes in pro-inflammatory cytokine levels, which may enhance iron status and reduce the production of hepcidin in individuals who are overweight or obese **(Teng and co-workers 2020).** Exercise raises hemoglobin levels in the blood, which raises red cell mass and total hemoglobin, which raises the hematocrit and oxygen-carrying capacity **(Barter and Genest, 2019).**

CONCLUSION

Excessive fat accumulation that poses a health concern is referred to as obesity. Obese people have a BMI of 30 or higher. It is brought on by consuming large amounts of energy and not expelling it entirely through physical exercise, especially from foods heavy in fat and sugar. Therefore, the purpose of this study was to examine the effects of diet modification, physical exercise (Zumba), or both on the body composition and a few biochemical indicators of 35-year-old obese women. It was determined that combining a modified diet with regular exercise can lower blood sugar, liver function, body fat, BMI, body weight, fat storage, and certain hormones like TSH and leptin. It can also improve insulin hormones, body water balance, and muscle mass, all of which help to maintain optimal health and a strong immune system.

REFERENCES

Afshin A; Forouzanfar MH; Reitsma MB; Sur P; Estep K; Lee A; Marczak L; Mokdad AH; Moradi-Lakeh M; Naghavi M, Salama JS, Vos T, Abate KH, Abbafati C, Ahmed MB, Al-Aly Z, Alkerwi A, Al-Raddadi R, Amare AT, Amberbir A, Amegah AK, Amini E, Amrock SM, Anjana RM, Ärnlöv J, Asayesh H, Banerjee A, Barac A, Baye E, Bennett DA, Beyene AS, Biadgilign S, Biryukov S, Bjertness E, Boneya DJ, Campos-Nonato I, Carrero JJ, Cecilio P, Cercy K, Ciobanu LG, Cornaby L, Damtew SA, Dandona L, Dandona R, Dharmaratne SD, Duncan BB, Eshrati B, Esteghamati A,

Feigin VL, Fernandes JC, Fürst T, Gebrehiwot TT, Gold A, Gona PN, Goto A, Habtewold TD, Hadush KT, Hafezi-Nejad N, Hay SI, Horino M, Islami F, Kamal R, Kasaeian A, Katikireddi SV, Kengne AP, Kesavachandran CN, Khader YS, Khang YH, Khubchandani J, Kim D, Kim YJ, Kinfu Y, Kosen S, Ku T, Defo BK, Kumar GA, Larson HJ, Leinsalu M, Liang X, Lim SS, Liu P, Lopez AD, Lozano R, Majeed A, Malekzadeh R, Malta DC, Mazidi M, McAlinden C, McGarvey ST, Mengistu DT, Mensah GA, Mensink GBM, Mezgebe HB, Mirrakhimov EM, Mueller UO, Noubiap JJ, Obermeyer CM, Ogbo FA, Owolabi MO, Patton GC, Pourmalek F, Qorbani M, Rafay A, Rai RK, Ranabhat CL, Reinig N, Safiri S, Salomon JA, Sanabria JR, Santos IS, Sartorius B, Sawhney M, Schmidhuber J, Schutte AE, Schmidt MI, Sepanlou SG, Shamsizadeh M, Sheikhbahaei S, Shin MJ, Shiri R, Shiue I, Roba HS, Silva DAS, Silverberg JI, Singh JA, Stranges S, Swaminathan S, Tabarés-Seisdedos R, Tadese F, Tedla BA, Tegegne BS, Terkawi AS, Thakur JS, Tonelli M, Topor-Madry R, Tyrovolas S, Ukwaja KN, Uthman OA, Vaezghasemi M, Vasankari T, Vlassov VV, Vollset SE, Weiderpass E, Werdecker A, Wesana J, Westerman R, Yano Y, Yonemoto N, Yonga G, Zaidi Z, Zenebe ZM, Zipkin B, Murray CJL (2017): Health Effects of Overweight and Obesity in 195 Countries over 25 Years. N Engl J Med. 2017 Jul 6;377(1):13-27. doi: 10.1056/ NEJM oa1614362.

Andersen RE; Wadden TA; Bartlett SJ; Zemel B; Verde TJ and Franckowiak SC (1999): Effects of lifestyle activity vs structured aerobic exercise in obese women. The Journal of the American Medical Association, 281 (4): 335 – 40. doi: 10.1001 /jama. 281.4.335.

Andersson DP; Löfgren P; Thorell A; Arner P and Hoffstedt J (2011): Visceral fat cell lipolysis and cardiovascular risk factors in obesity. Horm. Metab. Res., 43: 809-815. doi: 10.1055/s-0031-1287767.

Barter P and Genest J (2019):

HDL cholesterol and ASCVD risk stratification: A debate. *Atherosclerosis*,283: 7-12.doi: 10. 1016/ j. atherosclerosis.2019.01.001

Bergmeyer HU; Schreiber P and Wahlefeld AW (1978): Optimization of methods for aspartate aminotransferase and alanine aminotransferase. *C fin. Chem.*, 24, 58-61.

Bering T; Diniz KG; Coelho MPP; de Souza ACM; de Melo LF; Vieira DA; Soares MMS; Kakehasi AM; Correia MIT; Teixeira R; Queiroz DMM; Rocha GA and Silva LD (2018): Bioelectrical Impedance Analysis–Derived Measurements in Chronic Hepatitis C: Clinical Relevance of Fat-Free Mass and Phase Angle Evaluation. *Nutrition in Clinical Practice*, 33(2):238-246. doi: 10. 11 77/0884533 6177 28487.

Brancaleoni V; Di Pierro E; Motta I and Cappellini MD (2016): Laboratory diagnosis of thalas-semia. Int. *J. Lab. Hematol.*, 38 (1): 32-40. doi: 10.1111/ ijlh. 12527.

Buttarello M (2016): Laboratory diagnosis of anemia: Are the old and new red cell parameters useful in classification and treatment, and how? *Int. J. Lab. Hematol.*,38 (1):123-32. doi:10.1111/ijlh.12500

Considine RV; Sinha MK; Heiman ML and Kriunas A (1996): Serum immunoreactive-leptin concentration in normal weight and obese humans. *N. Engl. j. Med.*, 334(5):292-295. doi: 10. 1056/NEJM199602013340 503.

Defronzo RA; Tobin JD and Andres R (1979): Glucose clamp technique: A method for quantifying insulin secretion and resistance. *Am. J. Physiol.*, 237: 214-223. doi: 10.1152 /ajpendo.1979.237.3. E214

Demacker PN; Brenninkmeijer BJ; Jansen AP and Laar A (1984): Five methods for determining LDL-cholesterol. Compared Clin. Chem., 30: 1797-1800. Clin Chem.; 30

(11):1797-800. PMID: 6593139.

Dogbe W; Salazar-Ordonez M and Gil JM (2021): Disentangling the Drivers of Obesity: An Analytical Framework Based on Socioeconomic and Intrapersonal Factors. *Frontiers in Nutrition*, www. Frontiersin.org., 8: 1-14. doi: 10.3389/fnut.2021.585318.

Domene PA; Moir HJ; Pummell E; Knox A and Easton C (2015): The health-enhancing efficacy of Zumba fitness: An 8-week randomized controlled study The health-enhancing efficacy of Zumba® fitness: An 8-week randomized controlled study. Journal of Sports Sciences. doi: 10.1080/02640414.2015.1112022.

Dobbs R; Sawers C; Thompson F; Manyika J; Woetzel JR; Child P; McKenna S and Spatharou A (2014): Overcoming obesity: *An Initial Economic Analysis. McKinsey Global Institute;* Jakarta, Indonesia: 2014.

Eckard C; Cole R and Lockwood J (2013): Prospective histopathological evaluation of lifestyle modification in non-alcoholic fatty liver disease: a randomized trial. *Therapy. Adv. Gastroenterol*.,6:249–59. doi:10.1177/1756283X13484078.

El-Kader S; Al-Jiffri OH and Al-Shreef FM (2014): Liver enzymes and psychological well-being response to aerobic exercise training in patients with chronic hepatitis C. Afr. Health Sci. **14**(2): 414–419. doi:10.4314/ahs.v14i2.18.

Fazal MW; Andrews JM; Thomas J and Saffouri E (2017): Inpatient iron deficiency detection and management: How do general physicians and gastroenterologists perform in a tertiary care hospital? *Intern. Med. J.*,47 (8):928-932. doi:10.1111/imj.13486.

Gordon LA; Morrison EY; Zamora EM; Alexander-Lindo RL and Irving RR (2018): Effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes mellitus. *BMC Complement Alternative Medicine,* 8: 21. doi. 10.1186/1472-6882-8-21

Guerendiain M; Villa-Gonzalez E and Barranco-Ruiz Y (2018): Body composition and dairy intake in sedentary employees who participated in a healthy program based on nutrition education and Zumba. *Clinical Nutrition*, 1-10. doi: 10.1016 /j.clnu.2018.09.032. Epub 2018 Oct 5.

Heslehurst N; Vieira R; Akhter Z; Bailey H; Slack E Ngongalah L; Pemu A and Rankin J (2019): The association between maternal body mass index and child obesity: a systematic review and meta-analysis. *PLoS Med.*;16(6): e1002817. doi: 10.1371/ journal. pmed.1002817.

Herklotz R; Risch L and Huber AR (2017): Hemoglobinopathies--clinical symptoms and diagnosis of thalassemia and abnormal hemoglobin. *Ther. Umsch.*, 63 (1): 35 - 46. DOI: 10. 1024/0040-5930.63.1.35

Hong F (2022): Effect of exercise training on serum transaminases in patients with nonalcoholic fatty liver disease: A systematic review and meta-analysis. Front. Physiol. doi.org/10.3389 / fphys. 2022. 894044.

İmamoğlu M and Özdenk S (2019): The Effect of 12-week Regular Pilates, Step and Zumba Training Program on Muscle and Fat Weight. *JETS*, 7:33. DOI:10. 11114 / jets.v7i11.4421

Kalra S and Unnikrishnan- A G (2012): Obesity in India: The weight of the nation. Journal of Medical Nutrition and Nutraceuticals. 1(1): 37-

41. Doi: 10.4103/2278-019X.94634

Kawabata H (2016):
Iron-refractory iron deficiency anemia. *Rinsho Ketsueki*., 57 (2): 104-9. doi:10.11406/ rink-etsu. 57.104.

King J (1965):
The hydrolases are acid and alkaline phosphatase. "Practical Clinical Enzymology", London, Nostrand Company, 191-208.

Lee JH; Kim JY; Paik JK; Kim OY; Park HW; Jang Y and Lee JH (2019):
Effects of lycopene supplementation on oxidative stress and markers of endothelial function in healthy men. *Atherosclerosis*,2151: 189-195. doi: 10.1016 / j. atherosclerosis.2010.11.036.

Luo J and Zheng B (2020):
Effect of yoga combined with aerobic exercise intervention on morphological and blood lipid indicators in female college students. J. Sports Med. Phys. Fitness, 60(3):442–448. doi: 10.23736/S0022-4707.19.10147-8.

Mark S; Du Toit S; Noakes TD; Nordli K; Coetzee D; Makin M; Van der Spuy S; Frey J and Wortman J (2016):
A successful lifestyle intervention model replicated in diverse clinical settings. *South African Medical Journal*, 106: 763–766. doi.org/10.7196/samj.2016. v106i8.10136

McGowan MW; Artiss JD; Strandbergh D and, Zak B (1983):
A peroxidase-coupled method for the colorimetric determination of serum triglycerides. Clin Chem. 1983 Mar;29(3):538-42. PMID: 6825269.

Micallef C (2014):
The effectiveness of an 8-week Zumba program for weight reduction in a group of Maltese overweight and obese women. Sport Sciences for Health,10: 211-217. DOI:10.1007/s11332-014-0195-8

Mohammad GR and Attarzadeh SR (2022): Effect of aerobic exercise alone or in conjunction with diet on liver function, insulin resistance, and lipids in non-alcoholic fatty liver disease. Biol. Res. Nurs., **24** (2): 259–276. doi: 10.1177/ 10998 004211068026.

Mehrabani J and Khazraei, ZG (2018): Overweight and Obesity: A Brief Challenge on Prevalence, Complications and Physical Activity among Men and Women. *MOJ Women's Heal*.,7 (1): 161– 6. DOI:10.15 406/mojwh.2018.06.00161

Myers, J. (2015): Physical activity and cardiorespiratory fitness as major markers of cardiovascular risk: their independent and interwoven importance to health status. *Prog. Cardiovasc*. Dis., 31: 259-266. doi: 10. 1016/ j. pcad.2014.09.011.

Musaiger AO (2004): Overweight and obesity in the Eastern Mediterranean Region): can we control it? *EMHJ - Eastern Mediterranean Health Journal, 10 (6), 789-793,* https://iris.who.int/handle/10665/119480

Nadolsky K; Addison B; Agarwal M; Almandoz JP; BirdMichelle MD; De Chaplin G; Garvey WT and Kyle TK (2023): American Association of Clinical Endocrinology Consensus Statement: Addressing Stigma and Bias in the Diagnosis and Management of Patients with Obesity/Adiposity-Based Chronic Disease and Assessing Bias and Stigmatization as Determinants of Disease Severity. *Endocrine Practice* 29 417 e427.doi. org/10.1016/j.eprac.2023. 03.272.

Niyaz Ö (2020): Eating habits in terms of gender among Turkish agricultural engineering students: a cross-sectional study. Progress in Nutrition,22(2):568-76. DOI: 10.23751 /pn.v 22i2.8917.

Noakes TD (2013):

Low-carbohydrate and high-fat intake can manage obesity and associated conditions: Occasional survey. *South African Medical Journal*, 103: 826–830. DOI:10.7196/ SAMJ. 7302

Romieu I; Dossus L; Barquera S; Blottière HM; Franks PW; Gunter M and Willett WC (2017):
Energy balance and obesity: what are the main drivers? Cancer Causes and Control, 28 (3): 247-258. doi: 10. 1007/s10552-017-0869-z.

Rush EC; Freitas I and Plank LD (2009):
Body size, body composition, and fat distribution: a compar-ative analysis of European, Maori, Pacific Island and Asian Indian adults. *Br J Nutr*.; 102 (4):632-41. doi: 10.1017/ S0007 114508 207221.

Sasai H; Katayama Y; Nakata Y; Ohkubo H and Tanakra K (2009):
Obesity phenotype and intra-abdominal fat responses to regular aerobic exercise. *Diabetes Research and Clinical Practice*, 84(3): 230 – 8. doi: 10.1016 /j.diabres.2009.03.011.

Sibai AM; Nasreddine L; Mokdad AH; Adra N; Tabet M and Hwalla N (2010):
Nutrition transition and cardiovascular disease risk factors in Middle East and North Africa countries: reviewing the evidence. *Annals of Nutrition and Metabolism*.57(3–4):193–203. doi: 10. 1159/ 000321527.

Sridevi K; Kent G and Christina E (2015):
Zumba Dance Improves Health in Overweight /Obese or Type 2 Diabetic Women. *American journal of health behavior*, 39 (1): 109-120. doi: 10.5993 /AJHB.39.1.12.

Smith D (2016):
Waist-to-hip ratio vs. Body Mass Index as a Predictor of Total Mortality for People with Normal Weight and Central Obesity. doi: 10.1055/s-0035-1569986.

Snedecor GW and Cochran WG (1980): "Statistical Methods", 7th Ed., Iowa State University Press, Ames, USA, Page 90. 7th Edition, Iowa State University Press, Ames.

Srour B; Fezeu LK; Kesse-Guyot E; Allès B; Méjean C; Andrianasolo RM; Chazelas E; Deschasaux M; Hercberg S and Galan P (2019): Ultra-processed food intake and risk of cardiovascular disease: Prospective cohort study (Nutri Net Santé). *BMJ*, 365: l1451. DOI: 10.1136/bmj. l1451

Stoffel NU; El-Mallah C; Herter-Aeberli I; Bissani N; Wehbe N; Obeid, O and Zimmermann MB (2020): The effect of central obesity on inflammation, hepcidin, and iron metabolism in young women. *Int. J. Obes*.,44:1291–1300. DOI: 10. 1038/s41366-020-0522-x

Swinburn BA; Sacks G; Hall KD; McPherson K; Finegood DT; Moodie ML and Gortmaker SL (2011): The global obesity pandemic: shaped by global drivers and local environments. *Lancet.* 27;378(9793):804-14. doi: 10.1016/S0140-6736 (11) 60813-1.

Tai MLS; Goh KL; Mohd-Taib SH; Rampal S and Mahadeva S (2010): Anthropometric, biochemical and clinical assessment of malnutrition in Malaysian patients with advanced cirrhosis. *Nutrition journal*, 9 (1):27. doi: 10.1186/1475-2891-9-27.

Talen MR and Mann MM (2009): Obesity and mental health. Prim Care: *Clin Office Pract*.;36(2):287–305. doi: 10.1016/ j.pop. 2009.01.012.

Teng IC; Tseng SH; Aulia B; Shih CK; Bai CH and Chang JS (2020): Can diet-induced weight loss improve iron homeostasis in patients with obesity: A systematic review and meta-analysis. *Obes Rev.*,21(e13080). doi: 10. 1111/obr.13080.

Trinder P (1969):
Glucose. Ann. Clin. Biochem., (62): 24-33. Enzymatic determination of glucose in blood serum. *Annals of Clinical Biochemistry*, 6, 24.

Uotila M; Ruoslahti E and Engvall E (1981):
Two-site sandwich enzyme immunoassay with monoclonal antibodies to human alpha-fetoprotein. J. Immunol.Methods,42:11 -15. doi: 10.1016/0022-1759(81)90219-2.

Wang C; Hou X; Hong Z; Liang B; Qian Z; Hua Z; Hong Xi and San J (2010):
Comparison of body mass index with body fat percentage in the evaluation of obesity in Chinese. *Biomedical and Environmental Sciences*, 23:173-179. doi:10.10 16 /S0895-3988(10) 60049-9.

Warnick GR; Benderson V and Albers N (1983):
Selected methods. Clin. Chem., 10: 91-99.

Wiklund P; Alen M; Munukka E; Cheng SM; Yu B; Pekkala S and Cheng S (2014):
Metabolic response to 6-week aerobic exercise training and dieting in previously sedentary overweight and obese premenopausal women: A randomized trial. Journal of Sport and Health Science,3: 217-224.DOI:10.1016/j.jshs.2014.03.013

World Data Atlas (2021):
Available from: (https:// knoema.com/atlas/Egyp. (Accessed on September 03, 2021).

World Health Organization (2021):
Regional Office for the Eastern Mediterranean. Available from: (http:// www.emro.who.int/egy/ programmes/noncommunicable-diseases. html). Accessed on September 02, 2021).

WHO (2019):
Obesity Rates. Updated 2019; cited 2019 Nov 93. Available from: http www.who.int/news-room/fact-sheets/detail/obesity-and overweight

Table (1): Composition of modified diet

Nutrients	Regular diet	Modified diet
Protein (g)	97.45± 6.03 [a]	**75.01 ± 3.99 [b]**
Carbohydrates(g)	400.04± 9.66 [a]	**244.77± 11.98 [b]**
Fat (g)	101.98 ± 10.32 [a]	**25.002± 7.65 [b]**
Calories (kcal)	2907.78± 21.55 [a]	**1636.072± 15.76 [b]**

Values are means ± SD. Values that were superscripted at the same row are significantly different at $p \leq 0.05$.

Table (2): Height, weight, and BMI of obese women as affected by diet modification and physical activity (zumba)

Variables	Control group	Zumba group	Diet modification group	Zumba and diet modification group
Age (y)	35.45± 0.46 [a]	35.50± 1.05 [a]	35.48± 1.76 [a]	35.51± 0.75 [a]
Height(cm)	1.60± 0.18 [a]	1.61± 0.58 [a]	1.60± 1.42 [a]	1.61± 1.88 [a]
Weight(kg)	102.54± 3.55 [a]	94.98± 3.95 [b]	88.98± 5.05 [b]	76.08± 7.11 [d]
BMI (kg/cm^2)	40.20± 8.34 [a]	36.67± 6.06 [b]	34.76± 8.11 [b]	29.37± 4.83 [c]

Values are means ± SD. Values that were superscripted at the same row are significantly different at $p \leq 0.05$.

Table (3): Anthropometric measurements and body composition of obese women as affected by diet modification and physical activity (zumba) program

Variables	Control group	Zumba group	Diet modification group	Zumba and diet modification group
Waist circumference(cm)	101.77±6.33 [a]	93.87±8.65[b]	88.99±9.77[b]	77.98± 10.54[c]
Circumference of the right thigh (cm)	85.02± 5.91[a]	81.12± 9.32[b]	78.76± 5.81[b]	70.19± 8.03[c]
Circumference of the left thigh(cm)	85.19± 4.77 [a]	81.17± 6.03 [b]	78.80± 5.44 [b]	70.22± 9.14[c]
Right mid-arm circumference (cm)	40.01± 4.99[a]	38.33± 3.11[b]	36.89± 6.33[b]	31.08± 3.05[c]
Left mid-arm circumference (cm)	40.07± 8.54[a]	38.76± 4.81[b]	36.91± 3.44[b]	31.93± 1.52[c]
Fat Range (%)	38.11± 3.11[a]	36.33± 1.92[b]	33.01± 2.65[c]	30.95± 4.11[d]
Fat Mass (Kg)	43.22± 9.10[a]	40.08± 8.75[b]	37.99± 2.42[c]	34.04± 2.05[d]
Visceral Fat (Level)	13.57± 0.99[a]	13.07± 2.44[a]	12.12± 0.59[b]	10.01± 0.03[c]
Metabolic Age (years)	48.94± 7.34[a]	45.11± 7.03[b]	42.04± 4.88[c]	37.08± 9.22[d]
Fat-Free Mass / (Kg)	39.98± 4.88[a]	37.46± 6.29[b]	34.08± 4.76[c]	30.18± 2.07[d]
Body Water / TBW (Kg)	30.08± 8.06[c]	32.67± 3.06[b]	34.01± 3.22[b]	37.07± 0.11[a]
Muscle Mass /PMM (Kg)	29.97± 4.91[d]	33.06± 0.93[b]	31.73± 0.93[c]	36.11± 0.48[a]
Bone Mass	3.85± 0.09[c]	4.25± 0.01[b]	4.85± 0.43[b]	5.19± 0.66[a]
Rate Physique Rating %	16.02± 1.06[d]	18.62± 0.36[b]	17.11± 1.45[c]	22.19± 4.04[a]
Basal Metabolic Rate (KJ)	4306.08± 10.77[d]	4667.44± 14.55[c]	5167.98± 14.06[b]	5920.06± 9.76[a]

Values are means ± SD. Values that were superscripted at the same row are significantly different at $p \leq 0.05$.

Table (4): Some serum biochemical biomarkers as affected by diet modification and physical activity (Zumba) program

Variables	Control group	Zumba group	Diet modification group	Zumba and diet modification group
Total cholesterol (mg/dl)	280.78± 8.9[a]	252.44± 6.1[b]	242.43± 9.6[c]	202.44± 11.8[d]
Total triglycerides(mg/dl)	292.54± 7.2[a]	273.03± 13.9[b]	259.56± 18.9[c]	210.56± 8.98[d]
High-density lipoprotein (HDL-c) (mg/dl)	31.22± 5.1[d]	34.87± 0.9[c]	36.33± 1.1[b]	43.93± 5.9[a]
Low-density lipoprotein (LDL-c) (mg/dl)	191.05± 6.5[a]	162.96± 10.1[b]	154.19± 2.9[c]	116.4± 8.7[d]
Very low-density lipoprotein (VLDL-c) (mg/dl)	58.51± 0.5[a]	54.61± 1.9[b]	51.91± 3.6[c]	42.11± 0.5[d]
Aspartate transferase (AST) (U/L)	54.25± 3.0[a]	50.05± 0.9[b]	47.04± 2.7[c]	41.05± 0.3[d]
Alanine transferase (ALT) (U/L)	57.64± 0.0[a]	53.07± 1.2[b]	49.77± 3.8[c]	42.87± 0.5[d]
Alkaline Phosphatase (ALP) (U/L)	101.76± 8.9[a]	94.04± 1.1[b]	88.032± 5.5[c]	74.04± 1.1[d]

Values are means ± SD. Values that were superscripted at the same row are significantly different at $p \leq 0.05$.

Table (5): Blood glucose, leptin, TSH, and insulin hormones of obese women as affected by diet modification and physical activity (Zumba) program

Variables	Control group	Zumba group	Diet modification group	Zumba and diet modification group
Blood glucose (mg/dl)	215.12±6.01[a]	199.23±2.37 [b]	184.08±5.07 [c]	**120.55[d]±4.37**
TSH (mIU/L)	3.64±6.01[a]	3.02±0.51[c]	3.11±0.45[b]	**2.01±0.06[d]**
Insulin hormones (IU/ml)	7.23 ±1.52 [d]	10.08 ±0.11 [c]	11.21 ±0.73 [b]	**14.34 ±1.66 [a]**
Leptin hormones (ng/mL)	**26.43±6.49 [a]**	**23.33±3.91 [b]**	**20.29±2.06 [c]**	**16.28±1.62 [d]**

Values are means ± SD. Values that were superscripted at the same row are significantly different at $p \leq 0.05$.

Table (6): Hematologic indices of obese women as affected by diet modification and physical activity (Zumba) program

Variables	Control group	Zumba group	Diet modification group	Zumba and diet modification group
Serum Iron (mcg/dL)	80.11± 4.71 [c]	80.42± 5.08 [c]	86.09± 5.08 [b]	91.54± 5.21 [a]
Total Iron Binding Capacity (TIBC) (mcg/dL)	291.11± 10.28 [a]	287.08± 7.54 [b]	280.76± 9.98 [c]	276.76± 3.95[d]
Transferrin Saturation%	20.82± 0.08 [a]	22.02± 2.08 [b]	24.98± 3.45 [c]	27.07± 2.93 [d]
Hemoglobin (g/dl)	10.01± 0.98 [d]	10.92± 0.87 [c]	11.21± 3.98 [b]	11.99± 2.02 [a]
Red cell count (cells/mcL)	4.45± 0.03 [a]	4.46± 0.08 [a]	4.49± 0.44 [b]	4.53± 0.03 [c]
Lymphocytes %	39.94± 2.56[a]	36.94± 0.16[b]	37.07± 0.87[b]	30.54± 4.08 [c]
Total leucocytic count (WBC/mm$^{3)}$	6.82± 1.28[a]	6.01± 1.28[b]	6.06± 0.20[b]	5.37± 0.01 [c]
Platelets count/ microliter	290.83± 10.76 [a]	282.03± 8.22 [b]	271.76± 5.72 [c]	242.07± 8.07 [d]

Values are means ± SD. Values that were superscripted at the same row are significantly different at $p \leq 0.05$.

تأثير التعديلات الغذائية والرياضة على المؤشرات الأيضية واللياقة البدنية لدى النساء المصابات بالسمنة

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الملخص العربي

أصبحت السمنة الآن مشكلة متنامية، وهي تتزايد بشكل ملحوظ، كما هو الحال مع انتشار الحالات المرضية المصاحبة مثل ارتفاع ضغط الدم والسكري من النوع الثاني. ولذلك فإن الهدف من هذه الدراسة هو تقييم تأثير تعديل النظام الغذائي والنشاط البدني (الزومبا) على تكوين الجسم وبعض المعايير البيوكيميائية لدى النساء البدينات. تجربة عشوائية أجريت في الفترة من ديسمبر 2023 إلى مايو 2024 في الصاله الرياضيه GYM لكلية التربية الرياضيه بنات جامعه الاسكندريه تمت مشاركة 100 من النساء البالغات البدينات يتراوح لديهم مؤشر كتلة الجسم بين (30-34.9) كجم/م2 (سمنة من الدرجة الأولى) دون أمراض أخرى. تم تقسيم المشاركين إلى 4 مجموعات، المجموعة الأولى كانت المجموعة الضابطة دون تدخل. كان للمجموعات الثلاث الأخرى تدخل يتكون من النظام الغذائي فقط والنشاط البدني فقط وكان لها التدخل الغذائي المتطابق مع النشاط البدني على التوالي. وكان قياس النتيجة الرئيسية التغيرات في وزن الجسم وتكوين الجسم؛ والثاني هو المؤشرات الحيوية البيوكيميائية الإضافية التي تشمل مخاطر الأمراض المزمنة. أظهرت النتائج أن علاج الأفراد الذين يعانون من السمنة المفرطة بالتدريب أو تعديل النظام الغذائي لا يمكن أن يتوقع أن يؤدي إلى أي خسارة كبيرة في الوزن واختبار المعايير البيوكيميائية. تم اكتشاف التأثير الأفضل في المجموعة الرابعة وكانت الفروق بين المجموعة الرابعة والآخرين كبيرة. لذلك، ينبغي الجمع بين النظام الغذائي المعدل والنشاط البدني. على الرغم من انخفاض آثار النظام الغذائي مع ممارسة الرياضة، إلا أن ممارسة الرياضة تحسن وزن الجسم ومؤشر كتلة الجسم ومستوى الدهون وإنزيمات الكبد ومؤشرات أمراض الدم، مما قد يكون له فوائد مهمة على العديد من الأمراض في وقت لاحق من الحياة.

الكلمات المفتاحية: السمنة. النشاط البدني نظام عذائي؛ المعلمات البيوكيميائية.