

The Role of Diet and Exercise in Fighting Obesity

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ABSTRACT

Purpose: This study aimed to evaluate the effectiveness of the diet and exercise program for overweight and obese women.

Material and Method: A questionnaire was applied to the participants, and anthropometric measurements were made. Then, they were given a diet list and an aerobic exercise program for eight weeks. After eight weeks, the questionnaire and anthropometric measurements were repeated. In the study, the cases were divided into groups. The 1st group consisted of diet, the 2nd group with exercise, the 3rd group with diet and exercise, and the control group with no diet and no exercise.

Results: 32.6% of women were overweight, and 67.4% were obese. Group 1 was 29.2%, group 2 was 13.5%, and group 3 was 38.2%. The control group was 19.1%. A statistical decrease was observed in the participants' BMI, waist circumference, and hip circumference parameters between the groups ($p<0.05$). Weight and BMI differences in group 3 were significantly higher than weight and BMI differences in groups 1 and 2 ($p<0.001$).

Conclusion: Diet and exercise influenced weight control by lowering anthropometric measures. In the fight against obesity, the combination of diet and exercise proved to be more effective than the separate implementation of these measures.

Keywords: Body weights and measures, diet therapy, exercise therapy, preventive health

ÖZET

Amaç: Fazla kilolu ve obez kadınlara verilen diyet ve egzersiz programının etkinliğinin değerlendirilmesi amaçlanmıştır.

Materyal ve Metot: Katılımcılara anket uygulanmış ve antropometrik ölçümleri yapılmıştır. Ardından 8 hafta boyunca uygulayacakları bir diyet listesi ve bir aerobik egzersiz programıyla eğitim verilmiştir. 8 hafta sonra anket ve antropometrik ölçümler tekrarlanmıştır. Çalışmada vakalar gruplara ayrıldı. 1. grup diyet yapan, 2. grup egzersiz yapan, 3. grup diyet ve egzersiz yapan ve kontrol grubu ise diyet ve egzersiz yapmayanlardan oluştu.

Bulgular: Kadınların %32,6'sı fazla kilolu, %67,4'ü obez idi. Katılımcıların %29,2'si grup 1, %13,5'i grup 2, %38,2'si grup 3'teydi. Kontrol grubu %19,1 idi. Katılımcıların VKİ, bel çevresi ve kalça çevresi parametrelerinde gruplar arasında istatistiksel bir azalma görülmüştür ($p<0,05$). Grup 3'teki ağırlık ve VKİ farkları, grup 1 ve 2'deki ağırlık ve VKİ farklarından anlamlı olarak yüksek çıkmıştır ($p<0,001$).

Sonuç: Diyet ve egzersiz antropometrik ölçüm değerlerinde düşüş sağlayarak, kilo kontrolüne etki etmiştir. Obezite mücadelesinde diyet ve egzersizin birlikte yapılması ayrı ayrı yapılmalarından daha etkili bulunmuştur.

Anahtar Kelimeler: Antropometrik ölçüm, diyet, egzersiz, koruyucu sağlık

Obesity is a significant public health problem in many countries worldwide, characterized by excessive increases in body fat (1). The fact that high-fat – high-energy foods become more accessible and cheaper, the decrease in physical activity, and the time spent with technological equipment reach severe levels lead to the prevalence of obesity (2).

The World Health Organization (WHO) uses Body Mass Index (BMI) to determine obesity generally. BMI is calculated by dividing weight in kilograms and length in square meters. BMI values are classified as < 18.50 low weight, 18.50-24.99 normal, 25-29.99 overweight, and ≥ 30.00 obese (3).

According to the World Obesity Atlas 2023 report, 14% of men and 18% of women are in the obese group in the population over the age of 20 worldwide (4). According to the WHO European Region Obesity Report 2022, 59% of adults (63% men, 54% women) in the European Region are overweight or obese. In the same report, Türkiye has the highest obesity prevalence in the WHO European Region. It has been reported that 66.8% of the adult population in Türkiye is overweight (64.0% male, 69.3% female), and 32.1% is obese (24.4% male, 39.2% female) (5).

The following methods are used in treating obesity: Diet-nutrition therapy, exercise and physical activity, behavioral therapies, pharmacological applications, and surgical applications. Among these methods, it is possible to control obesity when caloric intake is restricted and physical activity is increased (6).

Diet and exercise are the most critical factors influencing weight control and loss. Diet programs and exercise applications are used together or alone for weight loss. However, combined dietary energy restriction and exercise are more effective than diet and exercise programs in increasing cardiovascular conditioning, muscle strength, and fat mass loss (7, 8). In a study conducted with overweight/obese adults aged 55-75 years in Spain, it was stated that an energy-restricted diet and physical activity-promoted lifestyle change were effective in reducing adiposity (9). Kaikkonen et al. (10) also reported that an intensified diet program alone and in combination with exercise resulted in clinically significant weight loss and long-term weight maintenance.

This study was designed to determine whether women who exercise and receive nutritional support to combat obesity comply with diet and exercise practices and to reveal the program's effect on anthropometric values.

Material and Methods

Ethical Approval: The Noninvasive Clinical Research Ethics Committee of the Dicle University School of Medicine (Date:25/01/2018, decision no:29) approved the conduct of the study. Permission was obtained from Diyarbakır Gazi Yaşargil Training and Research Hospital Chief Physician to conduct the study. All participants were informed about the study and signed a written informed consent form stating they agreed to participate.

Design of the Study: The research design is a non-randomized controlled trial with an 8-week follow-up. The study population consisted of women with BMI ≥ 25 who came to the Polyclinic of Nutrition and Dietetics of Health Sciences University Diyarbakır Gazi Yaşargil Training and Research Hospital. The study was conducted with 89 volunteer women who enrolled in the outpatient clinic between February, March, and April 2019 in 3 months. No sampling method was used. The criteria for inclusion and exclusion in the study were as follows.

Inclusion criteria: Volunteers who want to participate must be women between the ages of 15-65, have a BMI ≥ 25 , have a psychosocial fitness status, and not have any chronic disease (hypertension, COPD, etc.) that may prevent them from implementing the prescribed diet and exercise program.

Exclusion Criteria: Women who cannot participate voluntarily, women who are pregnant, and people who do not meet the specified age range and BMI value.

Diet Training: The dietitians gave a diet list suitable for the individual's total energy expenditure calories using the Harris-Benedict formula. This calorie level is the coefficient of the individual's basal metabolic rate (ideal weight + (own weight - ideal weight) x 25%) of the individual's physical activity level (very light:1.3, light:1.5, medium:1.6, heavy:1.9, very heavy: calculated by multiplying by 2.2) (11). After finding the total energy of the weight loss diet, the energy coverage percentages of macronutrients are

planned to be 55-60% carbohydrates, 15-20% protein, and 25-30% fat (12). Meal times of individuals are planned as three main meals and 2-3 snacks to suit their lifestyles. In the first interview, individuals were given training on the portion amount of foods, food groups, and changes. During the program, the energy and macronutrient ratios of the diets of the individuals were not changed, but the change tables were explained to the individuals and how their diets would be enriched.

Exercise Training: Training was via a physiotherapist-designed aerobic exercise program (fast walking or light jogging) that a person could perform alone for 45 minutes three days per week (warm-up; 10 minutes, aerobic exercise; 30 minutes, cool-down; 5 minutes). During the warm-up and cool-down periods, stretching and breathing exercises were performed to stretch all body parts and protect against possible injuries. As an aerobic exercise, a personalized fast-paced walking or light-paced jogging program was given at 50-60% of the target heart rate (13).

Participants were asked to use these programs for eight weeks. After eight weeks, the women were called back to the dietary polyclinic and asked if they were adhering to the diet and exercise program. At the beginning of the study, participants were not divided into groups and all participants were given a diet and exercise program. Those who implemented the given program and those who did not implement it constituted the groups within the scope of the study. At the end of the study, the cases were divided into groups. The 1st group consisted of diet, the 2nd group with exercise, the 3rd group with diet and exercise, and the control group with no diet and no exercise.

Data Collection Instruments of Study and Application:

Participants were presented with a questionnaire consisting of 2 parts based on the relevant literature, and anthropometric measurements were performed before and after the program.

In the first part of the questionnaire, participants were asked 34 questions before the program regarding sociodemographic information, weight gain, dietary habits, and physical activity status. The second part was conducted at the end of the program. The participants were asked whether the program was implemented, and a form questioning the reasons was directed to those who did not.

Anthropometric measurements consisted of height, weight, waist, and hip circumferences measured with a non-stretchable tape and scale routinely used by dietitians before and after the program.

Anthropometric measurements:

Measurement of Body Length: It was measured with heels together, back, shoulders, and head in an upright position.

Measurement of Waist Circumference: A measured tape was placed at the level of the umbilicus.

Measurement of the Hip Circumference: The tape measure was placed through the widest part of the hip.

Body Mass Index: It was calculated from the measurement values using the formula $\text{body weight (kg)} / [\text{height (m)}]^2$. BMI values are < 18.50 underweight, 18.50-24.99 normal, 25-29.99 overweight, and ≥ 30.00 obese.

Waist/Hip Ratio (WHR) is calculated using the waist circumference/hip circumference formula (14).

Statistical Analysis: Statistical analysis of the data was performed using the SPSS 21.0 package program. Data are reported with mean, standard deviation, and percentages. The Chi-Square test was used as a significant test to compare the data, and the t-test was used to compare the measured values. The significance of the difference between the pre-and post-measurements of each group was determined using the Wilcoxon signed-rank test, the Kruskal-Wallis analysis of variance for group comparisons, and the post hoc Games-Howell test to determine from which group the difference originated. All statistical tests are based on $p < 0.05$ for significance.

Results

It was found that 32.6% of participants were overweight, and 67.4% were obese. It was observed that obese people are more common in the age group of 36 years and older, in married people, in people with low educational level, in homemakers with the same weight for more than ten years, and in people who were obese in childhood ($p < 0.05$) (Table 1).

Table 1. Socio-demographic characteristics of the participants

		Overweight (n=29) n (%)	Obese (n=60) n (%)	p
Age	15-25 age	6 (31.6)	13 (68.4)	0.032
	26-35 age	15 (40.5)	22 (59.5)	
	36 age and above	8 (24.2)	25 (75.8)	
Marital status	Single	8 (38.1)	13 (61.9)	0.014
	Married	21 (30.9)	47 (69.1)	
Education	Illiterate	2 (20.0)	8 (80.0)	0.022
	Primary school**	9 (25.0)	27 (75.0)	
	High school and above	18 (41.9)	25 (58.1)	
Labor status	Housewife	22 (31.9)	47 (68.1)	0.040
	Student/non-employee	3 (33.3)	6 (66.7)	
	Working	4 (36.4)	7 (63.6)	
How many years have you had this weight?	1-4 years	19 (48.7)	20 (51.3)	0.001
	5-9 years	8 (44.4)	10 (55.6)	
	10 years and above	2 (6.3)	30 (93.8)	
Were you obese in your childhood?	Yes	4 (12.9)	27 (87.1)	0.004
	No	25 (43.1)	33 (56.9)	
Have you ever been on a diet?	Yes	14 (28.6)	35 (71.4)	0.371
	No	15 (37.5)	25 (62.5)	

*, Row Percentage; **, The women who had education for eight years or below; n: number of participants; %: percent; $p < 0.05$.

48.3% of participants had a normal appetite, 57.3% ate snacks, 66.3% skipped meals, the daily activity rate of 51.7% was considered normal, and 84.3% did not exercise regularly (Table 2).

Table 2. Nutritional Habits and Physical Activity Status of Participants

		n (%)
Appetite	Stomachless	5 (5.6)
	Normal	43 (48.3)
	Very appetite	41 (46.1)
Consume snacks	Yes	51 (57.3)
	No	38 (42.7)
Meal skipping status	Yes	59 (66.3)
	No	30 (33.7)
Physical activity status	Slow	26 (29.2)
	Normal	46 (51.7)
	Very quick and intense	17 (19.1)
To exercise regularly	Yes	14 (15.7)
	No	75 (84.3)

n: number of participants; %: percent

29.2% of participants did diet only (group 1), 13.5% did exercise only (group 2), 38.2% did both diet and exercise (group 3), and 19.1% did neither (control group) (Figure 1).

It was found that diet (group 1) statistically affected the participants' weight, BMI, waist circumference, and hip circumference using the groups' first and last anthropometric measurements ($p<0.001$). The exercise

(group 2) was effective on BMI, waist circumference, and hip circumference ($p<0.05$). The combination of diet and exercise (group 3) also significantly decreased the parameters of weight, BMI, waist circumference, and hip circumference ($p<0.001$). In the control group, there was no difference in the parameters of weight, BMI, waist circumference, hip circumference, and WHR ($p>0.05$) (Table 3).

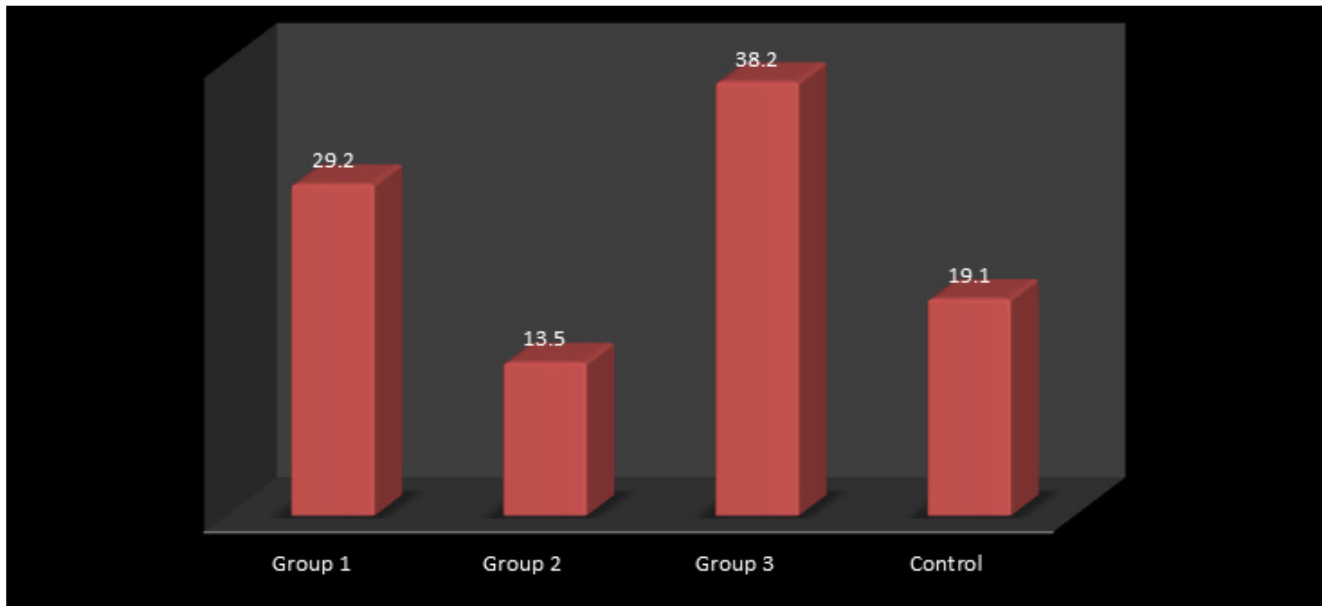


Figure 1: Distribution of study groups

Table 3. Comparison of the first measurement and the last measurement anthropometric measurements of all groups

		Group 1	Group 2	Group 3	Control
Weight	FM	88.03±14.81	85.40±16.66	88.68±16.04	81.80±10.36
	LM	83.49±14.93	82.86±16.12	81.99±13.80	82.51±10.62
	Test value	Z=-4.459	Z=-1.961	t=9.588	Z=-1.609
	p	0.001	0.050	0.001	0.108
BMI	FM	35.12±5.54	32.95±5.87	35.41±7.06	32.55±4.62
	LM	33.31±5.63	31.96±5.65	32.75±6.19	32.82±4.62
	Test value	Z=-4.458	Z=-2.040	t=9.340	Z=-1.569
	p	0.001	0.041	0.001	0.117
Waist circumference	FM	102.61±11.44	97.16±8.16	100.67±11.31	102.35±11.40
	LM	99.13±11.48	94.08±8.40	96.94±10.48	102.47±11.26
	Test value	Z=-4.414	Z=-2.825	t=6.058	Z=-0.583
	p	0.001	0.005	0.001	0.560
Hip circumference	FM	121.84±12.63	120.08±11.56	122.05±12.14	114.70±6.61
	LM	117.80±11.01	115.00±11.70	117.02±11.69	114.76±6.60
	Test value	Z=-4.389	Z=-3.076	t=8.351	Z=-0.447
	p	0.001	0.002	0.001	0.655
WHR	FM	0.84±0.06	0.81±0.06	0.82±0.05	0.89±0.06
	LM	0.84±0.05	0.82±0.05	0.82±0.05	0.89±0.06
	Test value	Z=-1.359	Z=-0.314	t=-0.832	Z=-0.764
	p	0.174	0.754	0.411	0.445

FM: First Measurement; LM: Last Measurement; z: Mann Whitney U Test; t: t test; $p<0.05$

The differences between the two measurement averages resulted in a statistically significant decrease in the parameters of weight, BMI, waist circumference, and hip circumference in the study groups ($p < 0.001$). When differentiating between all groups, the anthropometric measurements decrease was significantly higher in the group 1, group 2, and group 3 than in the control group. The average weight difference (6.68 ± 4.06) and average BMI difference (2.65 ± 1.65) of the group 3 were significantly higher than both the average weight difference (2.54 ± 3.64) and average BMI difference of the group 2 (0.98 ± 1.34) and the average weight difference (4.53 ± 1.81) and average BMI difference (1.81 ± 0.70) of the group 1 (Table 4).

Table 4. Comparison of anthropometric variation between groups between two measurements.

	Group 1	Group 2	Group 3	Control	p
Weight	4.53±1.81	2.54±3.64	6.68±4.06	0.71±1.57	0.001
BMI	1.81±0.70	0.98±1.34	2.65±1.65	0.27±0.62	0.001
Waist circumference	3.48±3.41	3.08±2.64	3.73±3.59	0.11±1.21	0.001
Hip circumference	4.03±5.98	5.08±5.31	5.02±3.51	0.05±0.89	0.001
WHR	0.00±0.04	0.00±0.04	0.00±0.02	0.00±0.00	0.516
z: Mann Whitney U Test; t: t test; $p < 0.05$					

Discussion

Studies suggest that among Turkish women, low physical activity, the high number of births, long breastfeeding periods and short intervals between births, concomitant diabetes and diseases such as HT, psychological problems, low income, and low education level have a significant impact on obesity (15). It has been reported that the incidence of obesity increases after the age of 30 years and is highest in the age group of 40 to 44 years (16). Tzotzas et al. (17) reported that married, divorced, and widowed individuals were more likely to be overweight and obese than single individuals. Studies conducted in our country and worldwide found an inverse relationship between educational level and BMI (18, 19). Our study found that obese women were more often in the age group of 36 years and older, married, with a low education level, and homemakers. Psychological depression caused

by low socioeconomic conditions, limited range of motion at home, and weight that cannot be lost with ageing can be counted as the most crucial obesity risk factors. Questioning the exercise history of women, identifying the points they have difficulty maintaining the program, and the father's support to women in domestic responsibilities may increase individual exercise and diet compliance.

It was found that 66.3% of the participants skipped meals, 51.7% had normal daily activities, and 84.3% had not exercised regularly before. Meal skipping has been reported to be common in obese individuals (20). A review examining the long-term effects of physical activity found a negative association between physical activity and weight gain and obesity (21). Irregular feeding intervals and an inactive lifestyle can trigger further weight gain.

Our study found that diet statistically affects participants' weight, BMI, waist circumference, and hip circumference, according to the groups' first and last anthropometric measurements. Reducing caloric intake is one of the most essential steps in treatment (22). Significant weight loss was observed with low-carbohydrate or low-fat diets (23). A meta-analysis showed that low-carbohydrate diets effectively lost weight and improved HDL and TG lipid profiles (24). In particular, avoiding high-calorie food such as fast food, chips, etc., restricting access to unhealthy foods, maintaining a daily carbohydrate-fat-protein intake balance, and controlling excessive eating can prevent weight gain.

In our study, exercise was shown to affect BMI, waist circumference, and hip circumference only in the exercise-only group. Shaw et al. (25) emphasized that exercise is effective in weight loss in obese people and improves cardiovascular risk factors, even when weight loss is impossible. There are few studies on the effectiveness of exercise in obesity. Studies have shown that aerobic exercise decreases adipose tissue and that the combination of aerobic and resistance exercise is more effective in increasing regional and whole-body lean mass. It reduces total body weight and visceral fat mass slightly and prevents a decrease in lean mass (26, 27). Kaikkonen et al. (10) stated that adding exercise right at the beginning of the weight loss period reduced waist circumference. Indeed, there are health benefits, such as improved cardiovascular risk factors and reduced adiposity, after exercise training, with or without weight loss.

The combination of diet and exercise also significantly reduced weight, BMI, waist circumference, and hip circumference parameters. It is also known from some studies in the literature that exercise with energy restriction protects lean tissue and prevents the resting metabolic rate from decreasing (28). In studies using energy restriction and/or additional exercise to treat obesity, body weight, fat percentage, and abdominal fat loss were effectively observed. Studies in the literature also support these findings (9, 29). Calorie restriction and exercise training cause a decrease in body weight by providing a negative energy balance in which energy expenditure exceeds calorie intake.

Limitation of Study

The fact that only overweight and obese women were included in the study resulted in the absence of male gender data and the inability to conduct possible gender analyses. Failure to distribute groups using appropriate randomization methods when designing the study and determining the group according to the program applied by the participant caused the group numbers to be not distributed homogeneously.

Conclusion

In conclusion, it was observed that women do not have regular eating habits and are physically inactive. It has been noted that there is not enough sensitivity to follow a diet and exercise regularly. Diet and exercise have an impact on weight control by lowering anthropometric measurements. In controlling obesity, the combination of diet and exercise proved to be more effective than doing them separately. To prevent excessive weight gain, it would be beneficial to provide more comprehensive training on topics that increase women's awareness of diet and exercise. As for the sustainability of diet and exercise programs, people can be supported psychologically and socially. The study's limitations are that it only works with the female gender, and it does not give an idea about the effect of the given program on men or the comparison of the two genders. In the literature, many studies separately reveal the effect of diet or exercise on weight loss in the fight against obesity. This study shows that a combination of exercise and diet is having a significant impact even in as little as eight weeks. In addition, the fact that the study was conducted not only with obese but also with overweight individuals reveals the importance of prevention programs in terms of public health.

Declarations

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This research did not receive financial support from any institution or project.

Conflict of Interest

The authors declared no potential conflicts of interest related to the research, authorship, or publication of this article.

Ethics Approval

The Noninvasive Clinical Research Ethics Committee of the Dicle University School of Medicine (Date:25/01/2018, decision no:29) approved the conduct of the study. Permission was obtained from Diyarbakır Gazi Yaşargil Training and Research Hospital Chief Physician to conduct the study.

Availability of data and material

All data and material are available on request from the authors.

Authors' Contributions

Concept – MA, EDD; Supervision – MA, HK, NY; Materials – MA, HK, NY; Data Collection and/or Processing – HK, NY; Analysis and/or Interpretation – MA, HK, EDD; Writing – MA, EDD.

Other information

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