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The Role of Obesity Centers in the Fight against Obesity: The Case of Antalya Province

Obezite ile Mücadelede Obezite Merkezleri; Antalya İli Örneği

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ABSTRACT

Aim: This study aimed to share data regarding the results obtained at the Obesity Center of Antalya Training and Research Hospital at the University of Health Sciences. **Methods:** This retrospective, descriptive and cross-sectional study included 281 obese patients who were followed up at the Obesity Center of Antalya Training and Research Hospital, the University of Health Sciences, between November 1st, 2018 and March 20th, 2020.First admission and last control anthropometric measurements of 281 patients and first follow-up and 6th or 12th months control blood tests of 106 patients (the last test and concurrent measurements were evaluated), during which fasting blood glucose, glycosylated hemoglobin, fasting insulin, insulin resistance, total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol and triglyceride levels were compared. **Results:** Of all the patients included in the study, 260 (92.5%) were female and 21 were male (7.5%). The mean age was 52.05 ± 9.52 (21-73) years. The mean follow-up period was estimated to be 161.1 ± 82.97 (11-365) days. Median weight and body mass index of all patients (281 patients) were found to have decreased from 93.4 (68.5-152.6) kg to 83.7 (59.3-138) kg, and from 36.9 (30-65.2) kg/m^2 to 32.6 (24.68-58.9) kg/m^2 ($p<0.001$), respectively. Similarly, a statistically significant decrease was observed in the waist and hip circumference of the patients ($p <0.001$). Apart from this, fasting blood glucose, glycosylated hemoglobin, fasting insulin, insulin resistance ($p<0.001$), systolic blood pressure ($p=0.014$), and triglyceride ($p=0.007$) levels of 106 patients who had control blood tests also showed a significant decrease, as opposed to a significant increase in high density lipoprotein cholesterol levels ($p<0.001$). Another statistical significance was the decrease in the body mass index ($p<0.001$), waist circumference ($p <0.001$), hip circumference ($p <0.001$), waist/hip ratio ($p<0.001$) as well as in the glycosylated hemoglobin ($p=0.043$) according to the weight loss ratio of the patients. **Conclusion:** Achieved only through adopting the right lifestyle, the positive effect of weight loss is observed on endocrine and metabolic markers such as blood pressure, blood sugar and lipid parameters. Obesity centers provide patients a healthy, reliable, cost-effective and sustainable treatment opportunity, especially for those who can fully comply with the program.

Key Words: Obesity, obesity center, weight loss

ÖZET

Amaç: Bu araştırmada Sağlık Bilimleri Üniversitesi Antalya Eğitim ve Araştırma Hastanesi bünyesinde yer alan obezite merkezimizde aldığımız sonuçlarla ilgili verilerimizi paylaşmayı hedefledik. **Yöntem:** Retrospektif, tanımlayıcı, kesitsel araştırmaya 1 Kasım 2018 ve 20 Mart 2020 tarihleri arasında Sağlık Bilimleri Üniversitesi Antalya Eğitim ve Araştırma Hastanesi Obezite Merkezinde takipli 281 obez hasta dahil edildi. Sağlıklı beslenme ve düzenli fiziksel aktiviteyi yaşam tarzı haline getirmenin hedeflendiği merkezimizden hizmet alan 281 hastanın ilk başvuru ve son kontrol antropometrik ölçümleri ile kontrol kan tetkikleri yapılan 106 hastanın başlangıç ve 6 veya 12. ay kontrollerinde (en son yapılan test ve eş zamanlı bakılan ölçümleri değerlendirmeye alınmıştır) bakılan açlık kan şekeri, glikozillenmiş hemoglobin, açlık insülini, insülin direnci, total kolesterol, düşük dansiteli lipoprotein kolesterol, yüksek dansiteli lipoprotein kolesterol ve trigliserit düzeyleri karşılaştırıldı. **Bulgular:** Çalışmaya dahil edilen hastaların 260'ı (%92,5) kadın, 21'i erkekti (%7,5); yaş ortalaması 52,05±9,52 (21-73) yıl idi. Ortalama takip süresi 161,1±82,97 (11-365) gün olarak hesaplandı. Çalışmaya dahil edilen tüm hastaların kilo ve vücut kitle indeksi ortancalarının sırasıyla 93,4 (68,5-152,6) kg'dan 83,7 (59,3-138) kg'a ve 36,9 (30-65,2) kg/m2'den 32,6 (24,68-58,9) kg/m2'ye düştüğü gözlendi ($p<0,001$). Benzer şekilde, hastaların bel ve kalça çevrelerinde de istatistiksel olarak anlamlı bir düşüş tespit edildi ($p<0,001$). Kontrol kan tetkikleri yapılmış olan 106 hastanın açlık kan şekeri, glikozillenmiş hemoglobin, açlık insülini, insulin direnci ($p<0,001$), sistolik kan basıncı ($p=0,014$) ve trigliserit ($p=0,007$) düzeylerinde anlamlı düşüş, yüksek dansiteli lipoprotein kolesterol düzeyinde ise anlamlı yükselme görüldü ($p<0,001$). Hastaların verdikleri kilo oranına göre vücut kitle indeksi ($p<0,001$), bel çevresi ($p<0,001$), kalça çevresi ($p<0,001$), bel/kalça oranının ($p<0,001$) yanısıra glikozillenmiş hemoglobin ($p=0,043$) düşüşünde de istatistiksel olarak anlamlı bir değişiklik olduğu gözlendi. **Sonuç:** Sadece doğru yaşam tarzı değişikliği ile sağlanan kilo kaybının kan basıncı, kan şekeri ve lipid parametreleri gibi endokrin ve metabolik belirteçler üzerine olumlu etkisi gözlenmektedir. Özellikle programa tam uyum sağlayabilen hastalarda obezite merkezleri sağlıklı, güvenilir, maliyet etkin ve sürdürülebilir bir tedavi olanağı sağlamaktadır.

Anahtar kelimeler: Obezite, obezite merkezi, kilo kaybı

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INTRODUCTION

Obesity, which is regarded as a chronic and non-contagious disease, is abnormal or excessive fat accumulation at a level that poses a risk to health, as defined by the World Health Organization (WHO)[1,2]. Obesity is seen as a major risk factor for a number of chronic diseases such as hypertension, type 2 diabetes, cardiovascular disease (CVD), and cancer[3-6].

In 2016, WHO reported that more than 1.9 billion of adults aged 18 and over in the world were overweight, and more than 650 million were obese, and the figures had tripled since 1975[2]. It was also reported that there were 16.092.644 obese adults in Turkey in 2016 and that Turkey ranked first in Europe with the prevalence rate of 29.5%[7]. The Ministry of Health has accelerated its efforts to combat obesity with 34 Obesity Centers in 21 provinces as of November 1st, 2018 in order to prevent obesity, which has become an increasingly important public health problem across Turkey, and to provide obesity treatment.

One of the obesity centers in Turkey is at University of Health Sciences, Antalya Training and Research Hospital, where the research was conducted. The program, which is entirely based on lifestyle modification and carried out by the healthcare staff consisting of doctors, dieticians, psychologists, physiotherapists and nurses, lasted about 1 year in 6 modules. In Module 1, the patients who had applied to the program were informed about the center, the anthropometric measurements were recorded, and those with a body mass index (BMI) greater than 30 were considered as obese patients and included in the program. The patients were consulted by doctors, dieticians, psychologists and physiotherapists, and given personalized recommendations on general healthy nourishment principles and to do physical activities. In Module 2, the patients were consulted by specialists in the fields of Internal Medicine, Cardiology, Physical Therapy and Rehabilitation, Psychiatry and General Surgery for health screening. In the event that any obesity-related or unrelated disease was detected in a patient, the consultant physician informed the patient and the center about the suitability of participating in the program during or after the treatment of the disease. A group of 12-20 people was formed with the patients who had completed the second module, and the trainings after that stage continued as group trainings. In Module 3 of two weeks, the patients were included in 10 group trainings. Through the trainings, it was aimed to initiate a modification of consciousness in patients with the purpose of instilling a habit of healthy living and nourishment as a vital behavior. Module 4 lasted for 2 months, with 3 group meetings held once a week. In that module, it was ensured that the nourishment and activity habits of the patients changed as a result of the practical demonstrations and repetitions of all the subjects that were previously considered as consciousness change. In Module 5, which lasted for five months, 3 group meetings were held every 15 days in order to change the patient's behavior permanently and to ensure that they reached the target weight. In Module 6, where 3 group meetings were held once a month and lasted for 4 months, the aim was to maintain the target weight and to create an environmental change and awareness by spreading the information that the patient had gathered[8].

In this study, we aimed to share our data regarding the results obtained in our Obesity Center at the University of Health Sciences, Antalya Training and Research Hospital, which provides health care in line with the program mentioned above.

METHODS

Study Population:

This study includes the evaluation of the weight loss and its impacts on blood pressure, blood sugar and lipid profile of the patients who received health care from the Obesity Center at the University of Health Sciences, Antalya Training and Research Hospital between November 1st, 2018 and March 20th, 2020. The study continued with 281 obese patients after 92 patients in Modules 1 and 2, and 31 patients with incomplete anthropometric and laboratory measurements were all excluded from the study. The anthropometric measurements of 281 patients, and not only anthropometric but also blood parameters of 106 patients (excluding 79 patients whose antihypertensive, anti-diabetic and/or anti-hyperlipidemic treatment was changed/arranged by the consulting physicians in Module 2 in order to observe the effects of only weight loss on endocrine and metabolic parameters, and 96 patients who did not yet have any follow-up blood tests) were associated with their weight loss. The algorithm of the research is presented below.

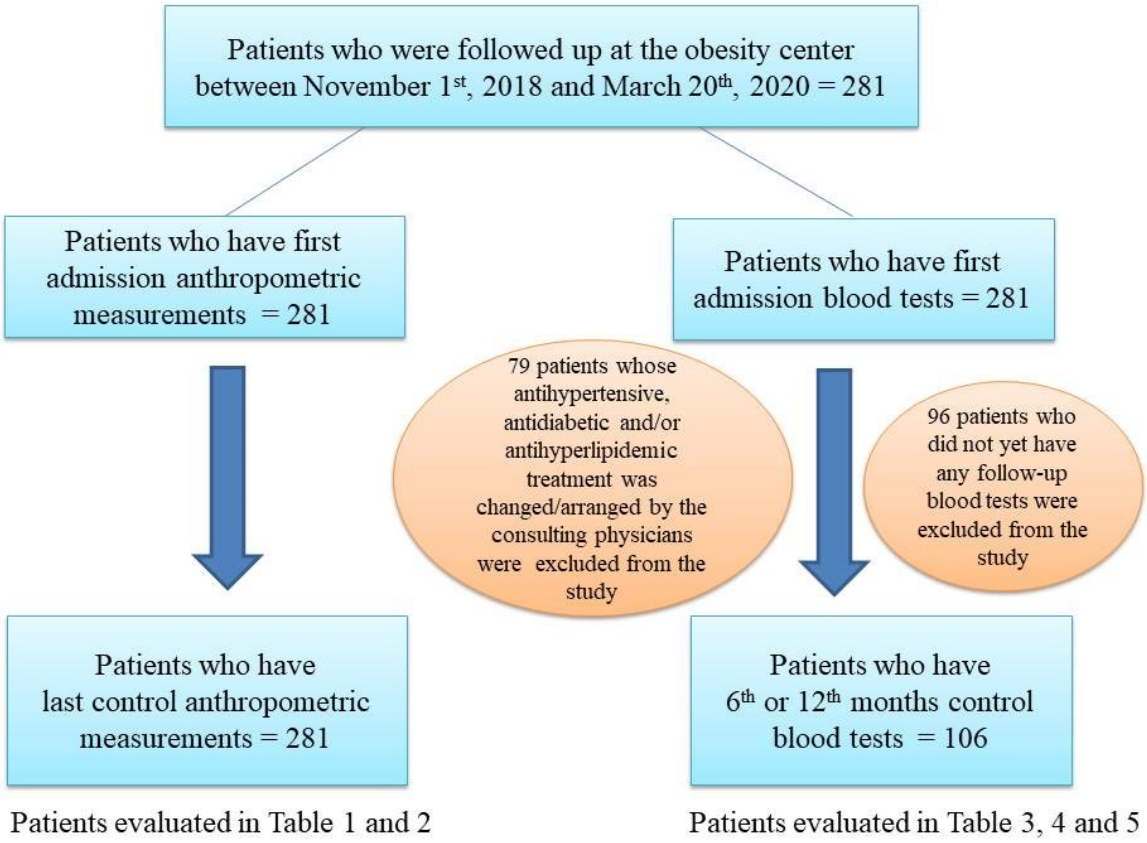

Figure 1. The algorithm of the research

Data Collection:

Within the scope of this retrospective, descriptive and cross-sectional study, the data collection forms were completed by the baseline and control anthropometric measurements of 281 patients as well as the parameters of 106 patients with control blood tests, whose fasting blood glucose (FBG), glycosylated hemoglobin (HbA1c), fasting insulin, insulin resistance (HOMA-IR), total cholesterol (total-C), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C) and triglyceride levels were checked after 12-hour fasting in the 6th or 12th months (the last test and concurrent measurements were evaluated). In addition, weight (with Tanita MC 580 device) and BMI were measured once a week, once every 15 days or once a month, with the formula of weight (kg)/height-square meter (m^2), in accordance with the modules of all patients[9]. Consequently, the relationship between weight loss and changes in blood parameters was compared.

FBG, total-C, TG and HDL-C levels were evaluated by the spectrophotometric method using Beckman coulter commercial kits in Beckman Coulter AU5800 (Beckman Coulter Inc., CA, USA) autoanalyzer.HbA1c levels were identified using commercially available and high-performance liquid chromatography (Tosoh HLC 723 G8; Tosoh Bioscience, Japan). The HOMA-IR levels were calculated according to the FBG (mg / dL) x fasting insulin (μU/mL)/405 formula as suggested by Mathews et al.[10], while the LDL-C levels according to the formula developed by Friedewald et al.[11].

Ethical Consent of the Study:

The protocol of the study was approved by the Clinical Research Ethics Committee of Antalya Training and Research Hospital of the University of Health Sciences. The study was conducted in accordance with the Helsinki Declaration. Since the study was performed as a retrospective file scan, no specific approval was obtained from the participants. However, a general contract was signed with the patients before starting the obesity follow-up and treatment program.

Statistical Analysis:

The data were analyzed with IBM SPSS 23.0 package program (IBM Corp., Armonk, NY) and presented with descriptive statistics as n (%), mean ± standard deviation (min-max) and median (min-max) values. Shapiro Wilks test was used in the analysis of normality assumption. The difference between the first and last measurements was

analyzed using Wilcoxon Signed Rank test when the value did not comply with the normal distribution, and Paired Sample T test when it was compatible with the normal distribution. The Jonckheere-Terpstra's test was used for non-parametric comparison of the trend of changes in measurements according to the weight loss ratio of the patients. Bonferroni-Dunn test was used as a post-hoc test for significant situations. The relationship between the amount of decrease in the BMI and the change in other measurements was examined with the Spearman correlation test. The p values less than 0.05 were considered statistically significant.

RESULTS

Of the patients included in the study, 260 (92.5%) were female and 21 were male (7.5%). The mean age was 52.05 ± 9.52 (21-73) years. The patients were in 18 different groups; 17 patients in Module 3, 47 in Module 4, 99 in Module 5, and 82 in Module 6. The number of the patients who completed the program composed of 6 modules, was 36, and the number of groups was 5. Mean follow-up period of the patients whose mean weight and BMI at the first admission was 95.4 ± 15.63 (68.5-152.6) kg and 37.91 ± 6.06 (30-65.2) kg / m^2, respectively, was calculated as 161.1 ± 82.97 (11-365) days. The baseline demographic, clinical and laboratory characteristics of all patients (281 patients) are presented in detail in Table 1.

When compared, the baseline and final control anthropometric measurements of all patients (n=281) showed that the patients lost approximately 3 tons (2974.8 kg), and their weight and the BMI median values fell from 93.4 (68.5-152.6) kg to 83.7 (59,3-138) kg and from 36.9 (30-65.2) kg/m^2 to 32.6 (24.68-58.9) kg/m^2 (p<0.001), respectively. Similarly, a statistically significant decrease was found in the waist and hip circumference of the patients (p<0.001). The BMI values of 6 patients were below 25 kg/m^2, and those of 80 patients were below 30 kg/m^2. The baseline and control data of the patients are presented in detail in Table 2

Table 1. The baseline demographic, clinical and laboratory characteristics of the patients (n=281

Variables	Patients (n=281)
Age (year)	52.05±9.52 (21-73)
Gender	
Female	260 (92.5)
Male	21 (7.5)
Height	158.68±7.02 (138-182)
Weight	95.4±15.63(68.5-152.6)
BMI	37.91±6.06 (30-65.2)
Waist circumference	112.77±16.01 (85-189)
Hip circumference	120.37±12.46 (97-182)
Waist/hip ratio	0.94±0.08 (0.74-1.6)
SBP	122.53±13.28 (80-180)
DBP	79.25±9.05 (60-130)
FBG	105.69±23.39 (70-231)
HbA1c	6.07±0.9 (4.4-11.7)
Fasting insulin	10.02±6.61 (0.93-43.53)
HOMA-IR	2.73±2.13 (0.23-15.35)
Total-C	218.17±45.33 (125-366)
LDL-C	135.74±38.43 (55-285)
HDL-C	56.46±12.61 (31-105)
Triglyceride	129.64±55.21 (37-382)
Follow-up period (days)	161.1±82.97 (11-365)
Follow-up period (months)	4.82±2.75 (0-12)

The results are presented as mean ± SD (min-max) or n (%) values.
BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; FBG: Fasting blood glucose; HbA1c: glycosylated hemoglobin; HOMA-IR: Homeostasis model assessment of insulin resistance;Total-C: Total cholesterol; LDL-C: Low density lipoprotein cholesterol; HDL-C: High density lipoprotein cholesterol

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Table 2. The comparison of baseline and control anthropometric measurements of the patients (n=281)

Variables	Baseline measurements (n=281)	Final measurements (n=281)	p values
Weight	93.4 (68.5-152.6)	83.7 (59.3-138)	**<0.001**
BMI	36.9 (30-65.2)	32.6 (24.68-58.9)	**<0.001**
Waist circumference	111 (85-189)	100 (74-166)	**<0.001**
Hip circumference	118 (97-182)	108 (86-176)	**<0.001**
Waist/hip ratio	0.93 (0.74-1.6)	0.89 (0.67-117.78)	**<0.001**

The results are presented as median (min-max) or n (%) values. Wilcoxon Signed Rank test.
BMI: Body mass index

Of the 106 patients who had their control blood tests checked, 89.6% were female and 10.4% were male. The mean age of the patients was 53.99 ± 8.47 years, and the mean follow-up and treatment period was 211.59 ± 58.84 days. There was a statistically significant decrease in weight, BMI, waist circumference, hip circumference, FBG, HbA1c, fasting insulin, HOMA-IR (all p <0.001), systolic BP (p = 0.014), and triglyceride (p = 0.007) levels, while there was a significant rise in the HDL-C levels (p<0.001) (Table 3).

Table 3.The comparison of anthropometric measurements and laboratory data of the patients who have control blood tests (n=106)			
Variables	**Baseline measurements (n=106)**	**Control measurements (n=106)**	**p value**
Weight	93.6 (74-149)	82.95 (59.3-116.2)	**<0.001**
BMI	37.15 (30.1-58.6)	31.65 (24.68-52.52)	**<0.001**
Waist circumference	111.81±12.75 (92-149)	100.03±13.33 (74-134)	**<0.001**
Hip circumference	118.5 (101-150)	111.5 (96-176)	**<0.001**
Waist/hip ratio	0.93±0.06 (0.76-1.14)	0.89±0.07 (0.67-1.06)	**<0.001**
SBP	121.65±13.99 (90-150)	119.25±8.36 (90-140)	**0.014**
DBP	79.01±8.77 (60-100)	79.48±5.73 (70-90)	0.464
FBG	101.5 (77-222)	95 (68-204)	**<0.001**
HbA1c	6 (4.9-11.7)	5.8 (4.5-8.5)	**<0.001**
Fasting insulin	8.44 (3.06-40.83)	5.45 (1.94-30.35)	**<0.001**
HOMA-IR	2.12 (0.71-11.39)	1.26 (0.39-13.34)	**<0.001**
Total-C	204.5 (148-351)	212.5 (136-338)	0.061
LDL-C	123.5 (64-257)	129 (57-245)	0.166
HDL-C	54.36±11.39 (31-89)	59.78±12.08 (36-104)	**<0.001**
Triglyceride	117 (43-382)	102.5 (47-346)	**0.007**

The results are presented as mean ± SD (min-max) or median (min-max) values. Paired Sample T test, Wilcoxon Signed Rank test
BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; FBG: Fasting blood glucose; HbA1c: glycosylated hemoglobin; HOMA-IR: Homeostasis model assessment of insulin resistance; Total-C: Total cholesterol; LDL-C: Low density lipoprotein cholesterol; HDL-C: High density lipoprotein cholesterol

A statistically significant change was observed in the decline in the BMI ($p<0.001$), waist circumference ($p<0.001$), hip circumference ($p<0.001$), waist/hip ratio ($p<0.001$), and HbA1c ($p = 0.043$) values according to the weight loss ratio of the patients. The amount of decrease in HbA1c in the group who lost more than 20% weight was significantly higher than those who lost less than 5% weight.

Table 4 presents the information, in detail, on the change in anthropometric and laboratory measurements according to the weight loss ratio of the patients.

Table 4. The comparison of differences in anthropometric and laboratory measurements (last measurement-first measurement) according to the weight loss ratio of the patients who have control blood tests (n=106)						
Variables	**<%5 (n=8)**	**%5-9.9 (n=24)**	**%10-14.9 (n=34)**	**%15-20 (n=34)**	**>%20 (n=40)**	**p values**
Weight	-2.55(-3.8-(-1))[a]	-7.55(-8.6-(-5.4))[b]	-11.4(-18.6-(-8.2))[c]	-15(-20.8-(-11.8))[d]	-23.9(-51.3-(-15.1))[e]	**<0.001**
BMI	-1.13(-1.6-(-0.46))[a]	-2.9(-3.73-(-2.07))[b]	-4.56(-7.27-(-3.44))[c]	-6.36(-8.2-(-4.84))[d]	-9.66(-17.76-(-6.32))[e]	**<0.001**
Waist circ.	-5(-8-0)[a]	-5.5(-23-9915)[a]	-9.5(-23-0)[b]	-15(-27-(-2))[b,c]	-18(-40-0)[c]	**<0.001**
Hip circ.	-2(-16-1)[a]	-5.5(-21-5)[a]	-7(-17-2)[a]	-10(-19-3)[b]	-12(-21-51)[b]	**<0.001**
Waist/hip ratio	-0.01 (-0.08-0.08)[a]	0(-0.19-0.12)[a]	-0.03 (-0.18-0.08)[a,b]	-0.04 (-0.16-0.08)[a,b]	-0.07 (-0.27-0)[b]	**<0.001**
SBP	-10(-10-10)	0(-30-10)	0(-20-30)	0(-15-20)	0(-20-10)	0.670
DBP	0(-10-10)	0(-10-10)	0(-15-20)	0(-10-15)	0(-10-10)	0.722
FBG	-7 (-76-5)	-3 (-28-84)	-3.5 (-135-8)	-13 (-59-14)	-2 (-54-10)	0.265
HbA1c	-0.1 (-1.2-0.5)[a]	-0.2 (-1.2-0.9)[a,b]	-0.25 (-5.6-0.7)[a,b]	-0.4 (-1.8-0.4)[a,b]	-0.5 (-1.4-0.2)[b]	**0.043**
Fasting insulin	-1.6 (-7.31-1.12)	-2.03 (-11.82-11.21)	-2.55 (-11.29-1.72)	-3,26 (-23,42-1.11)	-3,28 (-20.71-1.85)	0.095
HOMA-IR	-0.52 (-3,46-0.23)	-0.72 (-3,09-4.79)	-0.65 (-7-0.31)	-0.75 (-7.68-0.18)	-0.88 (-5.53-0.09)	0.132
Total-C	11(-10-72)	14.5(-33-45)	-0.5(-106-76)	10(-38-98)	1(-119-33)	0.332
LDL-C	0(-21-61)	10(-34-33)	-0.5(-106-65)	4(-30-49)	0(-113-24)	0.765
HDL-C	5.5(-4-16)	5(-9-17)	4(-7-27)	7(-7-21)	3(-5-17)	0.773
Triglyceride	14.5(-52-113)	-2(-98-118)	-3(-88-74)	-14(-256-47)	-5(-151-20)	0.064

The results are presented with median (min-max) values. Jonckheere - Terpstra's test. The statistical significance between groups are shown in different small exponential letters.

BMI: Body mass index; Waist circ.: Waist circumference; Hip circ: Hip circumference; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; FBG: Fasting blood glucose; HbA1c: glycosylated hemoglobin; HOMA-IR: Homeostasis model assessment of insulin resistance; Total-C: Total cholesterol; LDL-C: Low density lipoprotein cholesterol; HDL-C: High density lipoprotein cholesterol

A statistically significant positive moderate correlation was found between the decline in the BMI and the decrease in waist circumference (r = 0.513; p <0.001), while there was a weak positive correlation among the decrease in hip circumference (r = 0.470; p <0.001), waist/hip ratio (r = 0.278 ; p = 0.004), HbA1c (r = 0.259; p = 0.007), fasting insulin (r = 0.220; p = 0.023), HOMA-IR (r = 0.222; p = 0.022) and triglyceride (r = 0.214; p = 0.027) (Table 5).

Table 5. The correlation between the changes in the BMI and anthropometric and laboratory measurement (last measurement-first measurement) of patients who have control blood tests (n=106)

	BMI difference	
Variables	**r**	**p**
Weight	0.981	**<0.001**
Waist circumference	0.513	**<0.001**
Hip circumference	0.470	**<0.001**
Waist/hip ratio	0.278	**0.004**
SBP	-0.004	0.966
DBP	0.060	0.544
FBG	0.134	0.172
HbA1c	0.259	**0.007**
Fasting insulin	0.220	**0.023**
HOMA-IR	0.222	**0.022**
Total-C	0.096	0.327
LDL-C	0.007	0.944
HDL-C	0.024	0.807
Triglyceride	0.214	**0.027**

Spearman Correlation Test

BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; FBG: Fasting blood glucose; HbA1c: glycosylated hemoglobin; HOMA-IR: Homeostasis model assessment of insulin resistance; Total-C: Total cholesterol; LDL-C: Low density lipoprotein cholesterol; HDL-C: High density lipoprotein cholesterol

DISCUSSION

The findings revealed that the participants, regularly followed up in our Obesity Center, showed significant weight loss, and that there was a significant decrease in SBP, FBG, HbA1c, fasting insulin, HOMA-IR and triglyceride levels in addition to the anthropometric measurements, as opposed to a significant increase in HDL-cholesterol levels in patients who lost weight (even though most of the patients had not completed the 1-year follow-up period).In the literature, the number of studies conducted in obesity centers is quite limited. This part of our study, therefore, included studies investigating the effects of weight loss after bariatric surgery on biochemical and hormonal parameters.

In a study conducted at an obesity center in Konya, the BMI values of the patients, who regularly attended the trainings at the center, were reported to have decreased in the 3rd month controls from 39.45 ± 5.90 to 36.85 ± 5.68, waist circumference from 110.10 ± 11.30 cm to 102.83 ± 10.66 cm, and the hip circumference from 128.94 ± 11.60 cm to 122.29 ± 11.05 cm (12).We found out that the participants, who all met the requirement of regular participation in our trainings mentioned in the Yıldırım's study, had an average of 161.1 ± 82.97 (11-365) days of daily follow-up, during which the BMI fell from 36.9 (30-65.2) kg/m^2 to 32.6 (24.68- 58.9) kg/m^2, waist circumference from 111 (85-189) cm to 100 (74-166) cm, and the hip circumference from 118 (97-182) cm to 108 (86-176) cm. The same study also examined the changes in blood parameters in line with the weight loss in the 3rd month and revealed that there was a significant decrease in HbA1c, LDL-C and triglyceride levels, and a minimal decrease in HDL-C level, although not significant[12]. Our results came to a similar conclusion with that of Yıldırım. What is different is the statistically significant increase in HDL cholesterol level observed in our study.

In the literature, there are studies supporting the positive independent effect of sustained moderate weight loss on health in parameters such as blood pressure, blood sugar, and blood lipids regulation[13,14]. The study by Wing et al. conducted with overweight and obese patients with Type 2 DM showed that even 5-10% weight loss contributes significantly to the improvement of cardiovascular disease (CVD) risk factors. In the same study, weight loss was shown to be strongly associated with blood glucose, blood pressure, triglyceride and HDL-C levels at 1-year follow-up, yet no relation was found with LDL-C[14]. Similarly, this study revealed a significant decrease in blood sugar, systolic blood pressure and triglyceride levels, while a significant increase in HDL-C level in conformity with weight loss, yet no relationship was found between weight loss and total cholesterol or LDL-C.

In a review which evaluates 52 studies and 16,867 patients, the change in the cardiovascular risk profile of the patients after bariatric surgery was investigated during a mean follow-up of 34 months, and most studies reported significant reduction in the prevalence of HT (mean improvement of 68%), diabetes (mean improvement of 75%). and dyslipidemia (mean 71% improvement)[15]. In a study with 70 patients followed up after bariatric surgery, Kocaöz et al. found that the patients developed a significant decrease in systolic BP, diastolic BP, FBG, HbA1c, fasting insulin, HOMA-IR, total-C, LDL-C and triglyceride levels, while a significant increase in

HDL-C levels[16]. In a study by Son et al., 40 patients undergoing sleeve gastrectomy were divided into 3 groups (the group with HT, the group with type 2 DM and the group without a chronic disease), and revealed a significant decrease in systolic BP, diastolic BP, FBG, HbA1c, total-C, LDL-C and triglyceride levels, while a significant increase in HDL-C levels were detected in the postoperative controls of the patients[17]. In the study by Karlowicz et al. evaluating the atherosclerosis markers before and after bariatric surgery, 40 patients were followed up prospectively and a significant decrease was observed in fasting insulin, HOMA-IR, total-C and triglyceride levels in the 6th month, while the decrease in FBG was not statistically significant. In the same study, the decrease in LDL-C and the increase in HDL-C could not be evaluated[18]. In a study conducted by Ertuğrul and Kuzu with 71 patients who underwent Roux-en-Y gastric by-pass and sleeve gastrectomy, the impact of bariatric surgery on hematological inflammatory parameters was investigated, and FBG, total cholesterol, LDL-C, triglyceride levels were found to have decreased in the follow-up examination in the 6th and 12th months[19].

In studies conducted with patients undergoing bariatric surgery, significant improvement is generally observed in blood pressure, blood sugar and lipid regulation in the postoperative follow-up of the patients. However, there are also studies showing that there is no decrease or significant increase in HDL-C[20-22] levels, whose low levels are known to increase the risk of CVD or be a marker of increased risk[18,19]. One of the most important results we have achieved in our patients, in whom we were able to instill lifestyle modification is the increase in HDL-C levels, while another result is the positive change in mental health brought about by regular physical activity, adequate/balanced nutrition, and awareness on healthy living.

The strength of our study is that the patients, whose anti-hypertensive, anti-diabetic and/or anti-hyperlipidemic treatments were administered and/or changed at the beginning of the program- in Module 2-, were excluded from the study in order to observe the effect of mere weight loss on endocrine and metabolic parameters. The fact that not all patients completed the 1-year program nor reached their target weight can be considered as a limitation of our study.

CONCLUSIONS

A positive effect of weight loss achieved through right lifestyle modification is observed on endocrine and metabolic markers such as blood pressure, blood sugar and lipid parameters. Obesity centers provide patients a healthy, reliable, cost-effective and sustainable treatment opportunity, especially for those who can fully comply with the program. The data obtained from this study or to be obtained from similar studies may contribute to strengthen such centers in terms of quality and quantity.

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