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The effect of physical activity on body composition and blood lipids after sleeve gastrectomy surgery in adult obese women – A one year longitudinal study

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Abstract

Obesity is a global health problem that is increasing in prevalence and poses significant risks to the health of individuals. In recent years, bariatric surgery, especially sleeve gastrectomy, has become a widely adopted approach in the treatment of obesity. However, the role of post-operative physical activity, especially in women, has not been adequately studied. The aim of this study is to compare the body composition and blood lipid levels of adult obese women who do physical activity and those who do not for a year after bariatric surgery. Twenty-one women (PA group / non-PA group) participants with a sedentary lifestyle and a body mass index above 35 were included in the study. The PA group performed regular aerobic exercises, while the non-PA group maintained a sedentary lifestyle. Measurements were made in both groups preoperatively, at 1, 3, 6 and 12 months. The results showed that physical activity has a significant effect on body composition. Regarding blood lipid levels, physical activity contributed to significantly improvements in cholesterol, low-density lipoprotein and triglyceride levels over the 12-month period. However, no significant relationship was found between physical activity and high-density lipoprotein levels. In summary, this study highlights the beneficial effects of physical activity on body composition and some blood lipid parameters in women after sleeve gastrectomy.

Keywords: Body composition, blood lipids, obesity, physical activity, sedentary lifestyle

Yetişkin obez kadınlarda tüp mide ameliyatı sonrası fiziksel aktivitenin vücut kompozisyonu ve kan lipitleri üzerine etkisi – 1 yıllık boylamsal çalışma

Öz

Obezite, yaygınlığı giderek artan ve bireylerin sağlığı için önemli riskler oluşturan küresel bir sağlık sorunudur. Son yıllarda bariatrik cerrahi, özellikle de tüp mide operasyonu, obezitenin tedavisinde yaygın olarak benimsenen bir yaklaşım haline gelmiştir. Ancak özellikle kadınlarda operasyon sonrası fiziksel aktivitenin rolü yeterince araştırılmamıştır. Bu çalışmanın amacı, yetişkin obez kadınlarda bariatrik cerrahi sonrası 1 yıl boyunca fiziksel aktivite yapan (PA) ve yapmayan (non-PA) bireylerin vücut kompozisyonu ve kan lipit düzeylerini karşılaştırmaktır. Çalışmaya sedanter yaşam tarzına sahip, vücut kitle indeksi 35'in üzerinde olan 21 kadın (PA grup / non-PA grup) katılımcı dahil edildi. PA grubu düzenli aerobik egzersizler yaparken, non-PA grup sedanter yaşam tarzını sürdürdü. Her iki gruba ameliyat öncesi, 1, 3, 6 ve 12 aylık zaman dilimlerinde ölçümler yapıldı. Sonuçlar, fiziksel aktivitenin vücut kompozisyonu üzerinde önemli bir etkiye sahip olduğunu gösterdi. Kan lipit düzeylerine ilişkin olarak, fiziksel aktivite, 12 aylık dönemde tatol kolesterol, düşük yoğunluklu lipoprotein ve trigliserit düzeylerinde önemli iyileşmelere katkıda bulundu. Ancak fiziksel aktivite ile yüksek yoğunluklu lipoprotein düzeylerinde anlamlı bir ilişki bulunamadı. Özetle, bu çalışma, tüp mide operasyonu sonrası kadınlarda fiziksel aktivitenin vücut kompozisyonu ve kan lipit parametreleri üzerindeki yararlı etkilerini vurgulamaktadır.

Anahtar Kelimeler: *Vücut kompozisyonu, kan lipitleri, obezite, fiziksel aktivite, sedanter yaşam tarzı*

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Genişletilmiş Türkçe Özet makalenin sonunda yer almaktadır.

INTRODUCTION

Obesity is defined as abnormal or excessive fat accumulation that poses a health risk. It contributes to a wide variety of disease states, including diabetes mellitus, coronary artery disease, dyslipidemia (Wändell et al., 2009). According to the data of 2016, there are approximately 650 million (13%) obese individuals in the world and this number is increasing every year (Obesity and overweight, 2020). In contemporary times, advancements in technology and surgical procedures have increased the utilization of surgical methods for rapid weight loss.

Bariatric surgery is thought to be an effective treatment to provide long-term weight loss and improve the quality of life with the developing surgical techniques and the low risk of post-operative (Sjöström et al., 2004; Arterburn et al., 2020). Historically, six predominant procedures in bariatric surgery have existed, namely jejunoileal by-pass, Roux-en-Y gastric bypass, vertical banded gastroplasty, biliopancreatic diversion, adjustable gastric banding, and sleeve gastrectomy (SG) (Buchwald, 2014). Sleeve gastrectomy is a restrictive bariatric surgery technique and the most common bariatric surgery procedure in the world. Furthermore, long-term data have demonstrated its similar effectiveness in weight loss and the decreased mortality and morbidity rates, in relation to other procedures (the acknowledged gold standard) (Shoar & Saber, 2017). Sleeve gastrectomy is a technique consisting of subtotal vertical gastrectomy with preservation of the pylorus, including longitudinal resection of fundus, corpus and antrum, to create a tubular duct along the lesser curvature. This excision corresponds to approximately 80% of the stomach's volume. (Shabbir & Teh, 2014). The effect of physical activity on weight loss after bariatric surgery has aroused curiosity in recent years.

Physical activity (PA) has an important role in non-surgical weight loss, weight control, treatment of dyslipidemia and reducing postoperative complications (Laukkanen et al., 2016; Saavedra et al., 2019; Volaklis et al., 2015). It also contributes to achieving healthy and maximum weight loss after Sleeve gastrectomy, preventing recurrent weight gain and improving blood parameters (Jacobi et al., 2011; Arterburn et al., 2020). It's taken required energy expenditure about 7400 calories to loss 1 kilogram of the body weight (Health, 1998). So a negative energy balance of 1100 calories per day approximately results in a weight loss of 1 kilogram per week. (Noël & Pugh, 2002). This evidence emphasizes the importance of incorporating both dietary control and physical activity for effective weight management. A walking-based exercise regimen is highly beneficial for overweight individuals as a method of initiating a physical activity program. A monthly step count ranging from 280,000 to 400,000

has been found to significantly support weight loss endeavors (Livhits et al., 2010). In a study by Colles et al. in which a total of 129 patients found that physical activity for 12 months after bariatric surgery had a positive effect on weight loss (Colles et al., 2008). Moreover, research indicates that individuals aged 18-65 years, previously inactive prior to bariatric surgery, who engaged in physical activity within one-year post-surgery, demonstrated superior weight loss outcomes compared to those who remained inactive following the procedure (Bond et al., 2009). When the literature is examined, many studies have found a positive relationship between physical activity and weight loss after bariatric surgery (Arterburn et al., 2020; Chevallier et al., 2007; Dixon et al., 2008; Latner et al., 2004; Wolfe & Terry, 2006). Larsen et al., on the other hand, did not find a positive relationship in their study between PA and weight loss (Larsen et al., 2006). The authors noted that although the BAQ is a valid questionnaire for assessing physical exercise, this conclusion is affected by the limitation that its validity has not been established in obese samples after gastric banding for morbid obesity

While physical activity is acknowledged as a highly effective method in non-surgical obesity management for weight reduction and sustaining weight loss (Jacobi et al., 2011), the association between physical activity and blood lipid levels post-surgery, as well as weight loss post-surgery, remains unclear. Moreover, no specific studies for women exist in the current literature. This research aims to examine and compare the body composition and blood lipid levels of adult obese women who engaged in physical activity versus those who did not for one year following bariatric surgery.

METHOD

Research group

This study was a longitudinal trial that compared outcomes of body compositions and blood lipids of PA and non-PA groups over the initial 12 postoperative months. 113 potential participants were screened, and 21 volunteer women participants (11 physical activity group, 10 non-physical activity group) with a BMI over 35 and a sedentary lifestyle who had undergone gastric sleeve surgery were included in the study. Before surgery values is mean age 33.90 years, height 163.95 cm, body weight 115.78 kg, body mass index (BMI) 43.24, basal metabolic rate (BMR) 1903.57 kcal, total cholesterol 193.90 mg/dl, HDL (High Density lipoprotein) 48.90 mg/dl, LDL (Low Density Lipoprotein) 115.90 mg/dl, triglyceride 147.14 mg/dl. While selecting the participant group, it was taken into consideration that the BMI should not be below 30, not younger than 18 or older than 58 years old, not having an untreated eating

disorder, not consuming alcohol, not being pregnant (In et al., 2021). Sample size has been analyzed with G*power analysis.

Study design

Participants were divided into 2 groups as physical activity group (PA) and non-physical activity group control group (non-PA). While PA group participated in aerobic regularly physical activity, non-PA continued a sedentary lifestyle. Daily calorie and macronutrient intakes of all participants were standardized for 12 months after the operation. Diet and exercise process were monitored weekly. Lipid profiles parameters (total cholesterol, HDL, LDL triglyceride) and body composition (weight, body fat and muscle mass, BMI, BMR) measurements were taken from the patients before the operation and considering a time interval of 1, 3, 6 and 12 months after the operation.

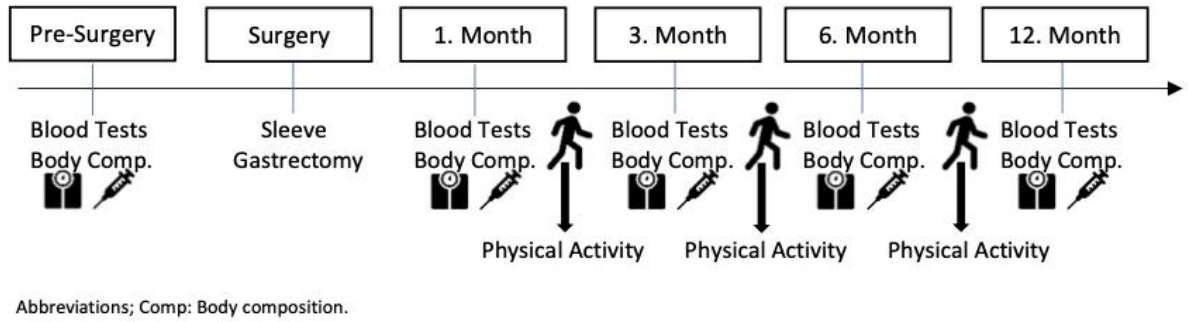


Figure 1. Study process

Diet

A diet determined according to the guidelines of the American Society of Metabolic and Bariatric Surgery was applied to the patients for 11 months from the 1st month of the operation.

Physical activity

The patients spent the first month of the operation without physical activity to wait for recovery. After the first month was completed, the patients were instructed to walk at 40-60% of the heart rate. Heart rates were monitored with a polar watch. Physical activities were limited to 150 min*wk-1. According to the performance and BMI data of the patients, the type of physical activity was diversified with exercise like swimming. In addition, the time of the physical activity to 250-300 min*wk-1, intense of the exercise ≥ 60 of the HR was increased. The frequency, intensity, duration, and type (FITT) of the physical activity protocol was created taking into account the American College of Sports Medicine guidelines for exercise testing and prescription of FITT recommendations for individuals with overweight and obesity

(ACSM, 2013). In contrast, the alternative group was directed to continue their normal daily activities.

Data collection method

Anthropometric measurements: A bioelectrical impedance analyzer (Tanita SC 330ST, Japan) was used to measure the body composition before and at 1st, 3rd, 6th, and 12th months after bariatric surgery. To ensure standardization, all data were taken between 08 a.m. - 09 a.m. in the morning on an empty stomach. Body composition test is consisting of body weight, body fat, muscle rate and BMI parameters.

Blood samples: Before the blood samples were carried out, the participants were informed that they should not eat anything after midnight. The blood samples were taken from the forearm (vena mediana cubiti or vena cephalica) between 08:00-09:00 in the morning. Total cholesterol, HDL, LDL, triglyceride parameters were analyzed in laboratory. These measurements were taken before bariatric surgery and repeated 1,3,6 and 12 months after the operation.

Data analysis

Two-way repeated measures analysis of variance (to examine the interaction between time and P.A. condition) was used in this study. The assumption of normal distribution was examined using the Shapiro-Wilk test and it was observed that the data was normally distributed. Mauchly's sphericity test was performed for the sphericity assumption. A Greenhouse-Geisser correction for sphericity was used when necessary. Two conditions (P.A. and Non-P.A.) were considered as between-subject factors (group) and five measures (pre-surgery, 1st, 3rd, 6th, and 12th) were considered within-subject factors. Results are given using the mean value with standard deviation. Partial eta squared η_p^2 was calculated for the effect size. The η_p^2 was classified as: 0.00–0.059 (small effect), 0.06–0.14 (medium effect), and ≥ 0.15 (large effect) (Cohen, 2013). The *p*-value of < 0.05 was considered as statistically significant. IBM SPSS Statistics for Windows version 28.0 was used in the analysis process (New York, NY, USA).

FINDINGS

All body compositions parameters (Weight, Fat, Muscle, and BMI) had a time × condition interaction effect as well as the main effect of time. Post-hoc analysis revealed significant difference in all pairwise comparisons, and particularly at 12th Month, Weight, Fat,

Muscle, and BMI results were significantly lower compared to other times. The P.A. main effect was significant only in BMI and the BMI improved in P.A. (Table 1 and Figure 2).

Table 1. Body compositions parameters over time

Parameters	Fac.	Pre-Surgery	1. Month	3. Month	6. Month	12. Month	Between Measurements	Between Conditions	Interaction
Weight (kg)	P.A.	114.54± (9.70)	104.15± (11.73)	92.85± (7.67)	78.60± (6.81)	68.10± (8.27)	F = 203.01 **$p < 0.001$** $\eta_p^2 = 0.91$ **Post-hoc** pre>1>3>6>12	F = 1.21 $p = 0.28$ $\eta_p^2 = 0.06$	F = 5.77 **$p < 0.001$** $\eta_p^2 = 0.23$
	Non-P.A.	116.90± (17.97)	106.13± (16.58)	95.37± (16.39)	87.98± (15.82)	82.33± (15.87)			
Fat (kg)	P.A.	54.32± (6.34)	47.90± (7.72)	39.22± (6.66)	27.43± (6.46)	19.90± (7.91)	F = 195.88 **$p < 0.001$** $\eta_p^2 = 0.91$ **Post-hoc** pre>1>3>6>12	F = 1.49 $p = 0.24$ $\eta_p^2 = 0.07$	F = 4.39 **$p = 0.003$** $\eta_p^2 = 0.19$
	Non-P.A.	57.78± (13.12)	50.52± (12.85)	40.71± (12.50)	34.80± (12.03)	30.51± (11.80)			
Muscle (kg)	P.A.	55.98± (5.51)	52.79± (4.06)	51.90± (4.92)	50.47± (4.81)	49.19± (5.09)	F= 35.11 **$p < 0.001$** $\eta_p^2 = 0.65$ **Post-hoc** pre>1>3>6>12	F = 0.52 $p = 0.48$ $\eta_p^2 = 0.03$	F = 3.01 **$p = 0.02$** $\eta_p^2 = 0.14$
	Non-P.A.	57.17±(4.59)	53.40± (4.65)	49.14± (6.03)	48.59± (2.18)	45.75± (3.49)			
BMI (kg/m²)	P.A.	41.10± (4.71)	37.33± (4.93)	33.28± (3.45)	28.18± (3.00)	24.39± (3.06)	F = 199.95 **$p < 0.001$** $\eta_p^2 = 0.91$ **Post-hoc** pre>1>3>6>12	F = 5.46 **$p = 0.03$** $\eta_p^2 = 0.22$	F = 3.70 **$p = 0.008$** $\eta_p^2 = 0.16$
	Non-P.A.	45.19± (6.45)	41.34± (5.54)	36.99± (5.90)	34.06± (6.29)	31.95± (6.73)			

Abbreviations: Factors (Fac); Body Mass Index (BMI); Physical Activity (P.A.); Non-Physical Activity (Non-P.A.); Kilogram (kg); Square Meters (m²); Partial eta squared (η_p^2); Bold values denote statistical significance at the $p < 0.05$ level; * Parameters were summarized with mean and standard deviation.

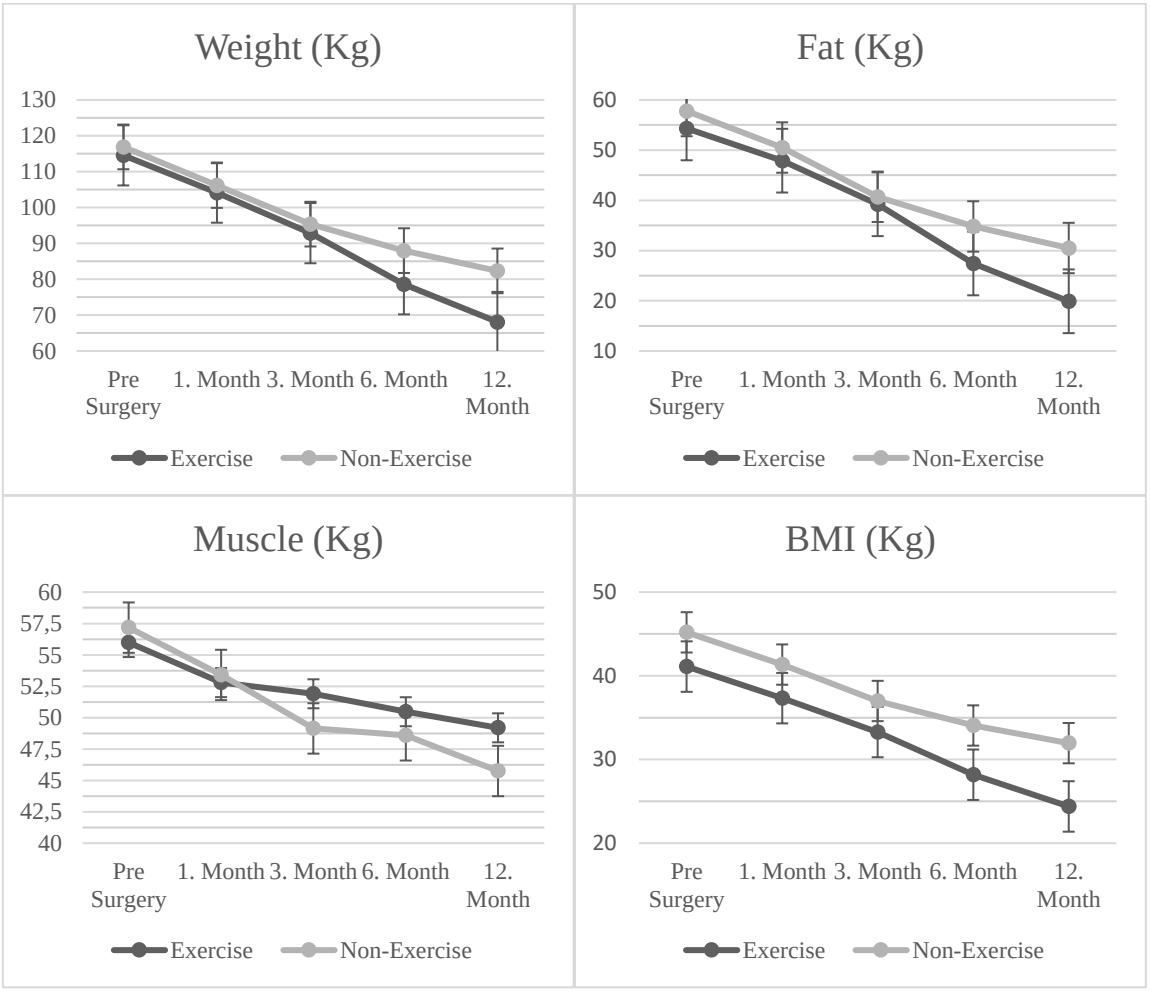


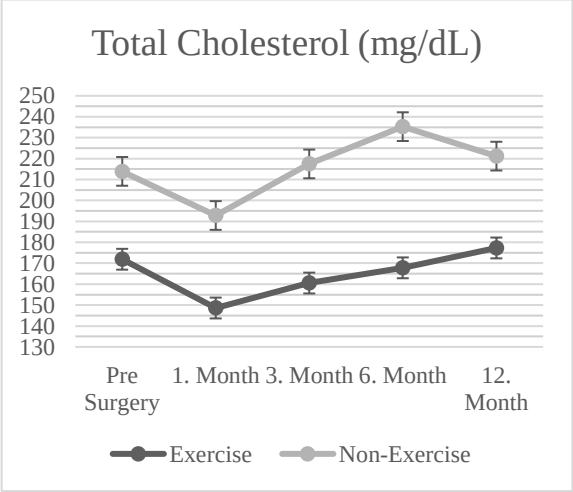
Figure 2. Body composition parameters

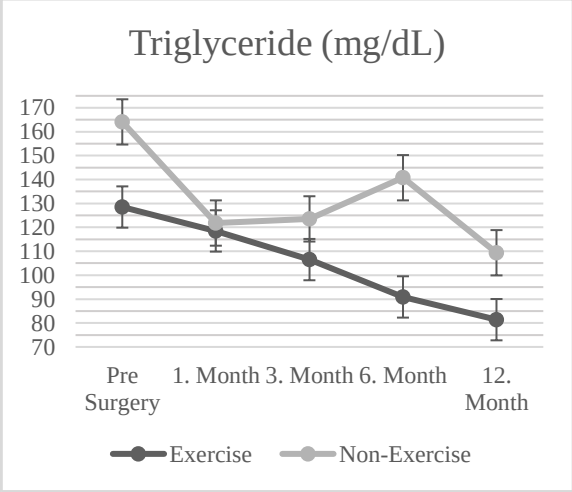
There was no time × condition interaction in any of the blood lipid parameters (total cholesterol, HDL, LDL, and triglyceride). Although there was no interaction effect, the condition had a main effect for total cholesterol (F = 8.56; p = 0.009; η_p^2 = 0.31), LDL (F = 7.72; p = 0.01; η_p^2= 0.29), and triglyceride (F = 3.98; p = 0.06; η_p^2= 0.17). Total cholesterol, LDL, and triglyceride results decreased significantly in P.A. However, HDL (F = 1.49; p = 0.24; η_p^2 = 0.07) results did not change with P.A. Moreover, all of the blood lipid parameters (total cholesterol, HDL, LDL, and triglyceride) had a time main effect. Total cholesterol (F = 5.70; p < 0.001; η_p^2 = 0.23), and LDL (F = 2.72; p = 0.03; η_p^2 = 0.12) results were significantly lower in 1st month compared to other months, however, there was no difference in total cholesterol and LDL results at between pre, 3rd, 6th, and 12th months. HDL (F = 18.94; p < 0.001; η_p^2 = 0.50), and triglyceride (F = 7.33; p < 0.001; η_p^2 = 0.28) results improved significantly at 12th month compared to other months (Table 2 and Figure 3).

Table 2. Blood lipids parameters over time

Parameters	Fac.	Pre Surgery	1. Month	3. Month	6. Month	12. Month	Between Measurements	Between conditions	Interaction
Total C. (mg/dL)	P.A.	171.90± 30.32	148.60± 40.55	160.53± 26.52	167.80± 36.44	177.30± 45.78	F = 5.70 ***p* < 0.001** η_p^2 = 0.23 **Post-hoc** pre=3=6=12>1	F = 8.56 ***p* = 0.009** η_p^2 = 0.31	F = 1.15 *p* = 0.34 η_p^2 = 0.06
	Non-P.A.	213.90± 38.77	192.81± 42.04	217.45± 51.62	235.27± 64.01	221.19± 56.31			
HDL (mg/dL)	P.A.	48.14±14.98	38.65±6.57	41.10±6.71	47.96±9.28	58.29±13.48	F = 18.94 ***p* < 0.001** η_p^2 = 0.50 **Post-hoc** 12>pre=6>1=3	F = 1.49 *p* = 0.24 η_p^2 = 0.07	F = 0.93 *p* = 0.45 η_p^2 = 0.05
	Non-P.A.	49.60±13.90	46.71±11.43	48.50±12.22	54.74±13.92	61.17±15.33			
LDL (mg/dL)	P.A.	102.56± 23.81	86.23±30.84	96.88±24.59	98.91±34.75	96.35±35.72	F = 2.72 ***p* = 0.03** η_p^2 = 0.12 **Post-hoc** pre=3=6=12>1	F = 7.72 ***p* = 0.01** η_p^2 = 0.29	F =1.45 *p* = 0.22 η_p^2 = 0.07
	Non-P.A.	128.04± 33.43	125.50± 39.48	138.47± 45.89	155.41± 56.02	141.02± 49.46			
Trig. (mg/dL)	P.A.	128.50± 46.76	118.50± 44.63	106.52± 37.56	90.90±30.42	81.40±18.78	F = 7.33 ***p* < 0.001** η_p^2 = 0.28 **Post-hoc** pre>1=3=6>12	F = 3.98 ***p* = 0.06** η_p^2 = 0.17	F = 1.73 *p* = 0.15 η_p^2 = 0.08
	Non-P.A.	164.09± 56.41	121.81± 39.47	123.54± 34.32	140.75± 40.96	109.38± 48.82			

Abbreviations: Factors (Fac); Total Cholesterol (Total C); Triglyceride (Trig); High Density Lipoprotein (HDL); Low Density Lipoprotein (LDL); Physical Activity (P.A.); Non-Physical Activity (Non-P.A.); Milligram/Deciliter (mg/dL); Partial eta squared (η_p^2); Bold values denote statistical significance at the $p < 0.05$ level; * Parameters were summarized with mean and standard deviation.





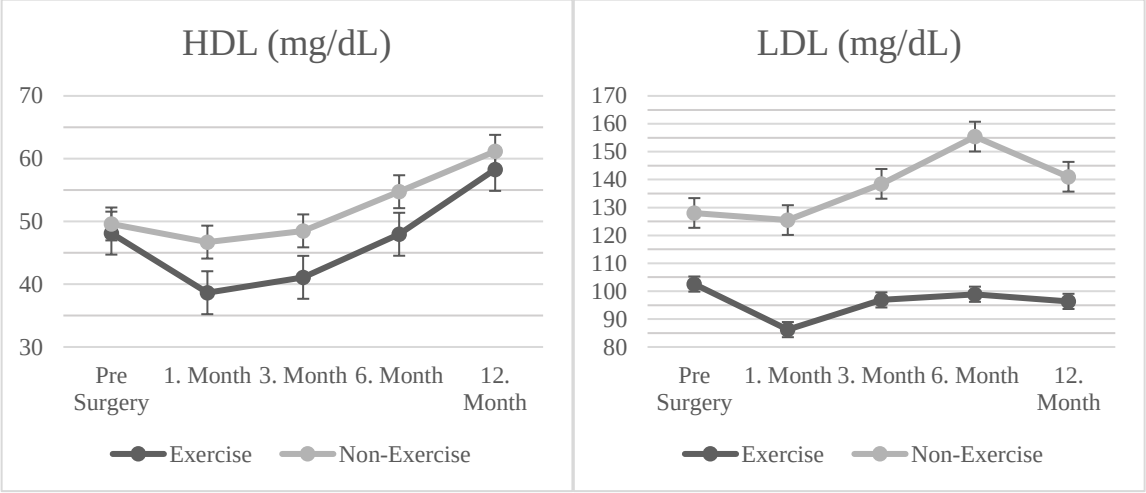


Figure 3. Blood lipid parameters

DISCUSSION AND CONCLUSION

The aim of this study is to compare the body composition and blood lipids levels of individuals engaged in physical activity and those who did not for 1 year after bariatric surgery in adult women with obesity. As a result, time x condition interaction effect was found on weight loss, fat and muscle mass and BMI parameters, and it was determined that P.A, which lasted longer, improved the body composition of the patients after sleeve gastrectomy. It turned out that P.A significantly reduced Total Cholesterol, LDL and Triglyceride results. However, HDL results did not change in the P.A group. The effect of the duration of P.A. after sleeve gastrectomy was significant in all blood lipid parameters. Total Cholesterol and LDL results decreased significantly at 1st month. HDL and Triglyceride results showed the best improvement at 12th months.

Bariatric surgery has been proven to be a successful intervention for obesity and its related comorbidities, as it facilitates weight reduction, encourages regular physical exercise, and improves patients' functional capacity (Aguilar-Cordero., 2022). Nonetheless, individuals undergoing bariatric surgery tend to experience weight gain in subsequent years post-operation. This highlights the potential value of exploring alternative methods to augment the advantages associated with this surgical intervention (Coleman., 2017). In addition, individualized counseling that is focused on physical activity can assist bariatric patients in increasing their level of physical activity after surgery, according to the findings of a study that was published in 2013 (King et al., 2013). In our study, weights regain was not observed, and more weight loss was detected in the exercise group compare to the control group. Body weight, fat and muscle mass was significantly decreased after 6th and 12th month in physical activity group

($p<0.05$). Same benefits could not be detected after 1st and 3rd month of physical activity. Moreover, a significant improvement in the BMI parameter was detected, similar to the study of Aguilar-Cordero et al. (2022). After six months of moderate intensity aerobic exercise (30 min.), it was found that BMI was BMI significantly decreased compared to control group (Aguilar-Cordero., 2022). On the other hand, Ren et al. (2021) found that 12 weeks transtheoretical model-based exercise training did not have an impact on body composition or weight lost according to the control group. It can be concluded that more time (than 12 weeks) can be needed to further lose weight or improve body composition parameters. Our findings are also parallel with a meta-analysis by Bellicha et al., (2021) which found that postoperative exercise training led to higher weight and fat loss. Conversely, they (Bellicha., 2021) did not report any significant effect in lean body mass which is in contrast to our finding. Extended investigation is warranted to examine the impact of prolonged physical exercise participation (exceeding one year) on weight loss/regain and BMI parameters. Current evidence from post-bariatric surgery research indicates that the risk of weight re-gain and elevated body fat composition persists in obese individuals beyond the one-year mark. On the other hand, it should be highlighted that weight regain did not observed in our control group which contrast to the current literature (Bellicha et al. 2021). Robust adherence to the high protein diet which determined according to the guidelines of American Society of Metabolic and Bariatric Surgery may hinder the weight regain. This inference can be supported by Vilela's meta-analysis (2023) in which high-protein diet was suggested to increase 50% weight loss and maintenance success. Conversely, inconclusive evidence for lean body mass preservation due to high protein diet in post bariatric patients was shown in a systematic review (Romeijn et al., 2021) in which only 5 studies was included. Furthermore, high protein diet may affect the motivation of participants to adhere physical activity instructions that can improve body composition parameters.

Surprisingly, no significant differences were found in blood lipid parameters measured at different time points between physical activity and control groups. It can be concluded that training principle set in this study does not substantially elicited any changes in HDL, LDL, triglyceride, and total cholesterol parameters among individuals who have undergone bariatric surgery. This observation is consistent with previous research that also reported no significant effects (Mundbjerg et al., 2018; Marchesi et al. 2015; Marc-Hernandez et al. 2019; Marcon et al., 2017). Body weight and cardiovascular risk markers (LDL, HDL, and triglyceride) was found to be significantly improved with Roux-en-Y gastric bypass surgery (Mundbjerg et al., 2018). Authors stated that 26 weeks of supervised physical exercise training significantly

decreased body mass (-4.2 kg) compared to sedentary style of after gastric bypass surgery period. Further, the HDL concentration was significantly higher in physical exercise training group than in control group at the termination of the intervention and this was not maintained at the 24-months examination (Mundbjerg et al., 2018). In addition, Marchesi et al. (2015) investigated the effects of aerobic physical activity (road running) in enhancing the metabolic effects of bariatric surgery. Finally, they found that running seems to have an important supporting role in boosting bariatric surgery results (Marchesi et al., 2015). Further, physical exercise training can be implemented not only postoperatively but also prior to bariatric surgery. A 12-week exercise regimen encompassing both endurance and resistance training prior to bariatric surgery has been demonstrated to decrease fat mass and central obesity, while concurrently enhancing cardiometabolic risk factors (Marc-Hernandez et al. 2019). HDL, LDL, and triglyceride levels play a crucial role in maintaining metabolic health in obese individuals, particularly following bariatric surgery. Ensuring these parameters remain within acceptable ranges can minimize the risk of postoperative metabolic complications often observed in obese patients (Bond et al., 2009). In research conducted by Marcon et al. (2017), the optimal preoperative strategy for bariatric surgery was investigated. The study highlighted that a supervised program, consisting of low-intensity physical activity twice a week for four months, significantly impacted weight loss and enhanced functional capacity and cardiometabolic parameters in individuals with morbid obesity. Another study by Stegen et al. (2011) carried out on people with bariatric surgery who had undergone surgery and were participating in an exercise program four months following the procedure. The results demonstrated an increase in walking distance for both the intervention and control groups, with the exercise group exhibiting a more substantial improvement in walking distance compared to the control group. The enhanced physical condition increased aerobic capacity, and reduced heart rate and diastolic pressure in the exercise group can be attributed to cardiac modulation.

This study has several limitations that need to be addressed. Firstly, exclusively recruiting female participants precludes the ability to extrapolate findings to male counterparts. Furthermore, our analyses involving patients undergoing sleeve gastrectomy surgery necessitates caution when drawing comparisons with alternative bariatric procedures. Secondly, a reduced sample size was utilized for per-protocol and sensitivity analyses, potentially compromising the statistical power needed to discern differences between groups.

Recommendations

To our best knowledge, this is the first intervention in sleeve gastrectomy patients after surgery in which they conducted aerobic exercise for 12 months and it was investigated that blood lipids and body composition parameters. Physical exercise training did significantly affect body mass and composition parameters. However, no significant differences was found in blood lipids parameters. Future research should replicate this study's design both with larger sample sizes and longer time of physical activity.

GENİŞLETİLMİŞ ÖZET

GİRİŞ

Obezite, sağlık riski oluşturacak şekilde anormal veya aşırı yağ birikimi olarak tanımlanmaktadır. Diyabet, koroner arter hastalığı, dislipidemi gibi çok çeşitli hastalık durumlarına katkıda bulunur (Wändell ve ark., 2009). Günümüzde teknoloji ve cerrahi işlemlerdeki ilerlemeler, hızlı kilo verme amaçlı cerrahi yöntemlerin kullanımını arttırmıştır. Bariatrik cerrahinin, gelişen cerrahi teknikler ve ameliyat sonrası düşük risk ile uzun süreli kilo kaybı sağlamak ve yaşam kalitesini artırmak için etkili bir tedavi olduğu düşünülmektedir (Sjöström ve ark., 2004). T operasyonları kısıtlayıcı bir bariatrik cerrahi tekniğidir ve dünyada en yaygın kullanılan bariatrik cerrahi prosedürdür. Ayrıca uzun vadeli kanıtlar, diğer prosedürlere nazaran kilo vermede benzer sonuçların bu prosedirde de sağlandığını, ilaveten diğer prosedürlere göre daha az mortalite ve morbidite oranlarına sahip olduğunu ortaya koymaktadır (Shoar & Sabre, 2017). Fiziksel aktivite (FA), tüp mide ameliyatı sonrası sağlıklı ve maksimum kilo kaybına ulaşılmasına, yeniden kilo alımının önlenmesine ve kan parametrelerinin iyileştirilmesine katkıda bulunmaktadır (Jacobi ve ark. 2011). Colles ve arkadaşları Bariatrik cerrahi sonrası 12 ay boyunca devam eden düzenli fiziksel aktivitenin kilo kaybı üzerinde olumlu bir etkisi olduğu sonucunu ortaya koymuştur (Colles ve ark., 2008). Literatür incelendiğinde pek çok çalışma bariatrik cerrahi sonrası fiziksel aktivite ile kilo kaybı arasında pozitif ilişki bulmuştur (Chevallier ve ark., 2007; Dixon ve ark., 2008; Latner ve ark., 2004; Wolfe & Terry, 2006). Bu araştırmada, tüp mide operasyonunu takip eden 12 ay boyunca fiziksel aktivite yapan ile yapmayan yetişkin obez kadınların kilo ve kan lipit düzeylerini incelemeyi ve karşılaştırmayı amaçlamaktadır.

YÖNTEM

Araştırmaya sedanter yaşam tarzına sahip, vücut kitle indeksi 35'in üzerinde olan ve tüp mide operasyonu geçiren toplam 21 gönüllü kadın katılmıştır. Katılımcılar fiziksel aktivite grubu (FA) ve fiziksel aktivite dışı grup (non-FA) olmak üzere 2 gruba ayrıldı. PA grubu operasyonun birinci ayı itibari ile düzenli olarak aerobik fiziksel aktiviteye katılırken, non-PA grubu sedanter yaşam tarzını sürdürdü. Tüm katılımcıların günlük kalori ve makro besin alımları operasyondan sonraki 12 ay boyunca standartlaştırıldı. Hastalardan operasyon öncesi kan lipitleri ve vücut kompozisyonu değerleri kaydedildi. Bu ölçümler operasyon sonrası 1, 3, 6 ve 12. Ayda tekrarlandı. Verilerin analizi için iki

yönlü tekrarlanan ölçümlü varyans analizi kullanıldı. Etki büyüklüğü için kısmi eta kare (η_p^2) hesaplandı. P değerinin <0,05 olması istatistiksel olarak anlamlı kabul edildi. Analizler için IBM SPSS İstatistik programı (sürüm 28.0) kullanıldı.

BULGULAR

Sonuçlar, P.A. grubunun operasyon sonrası dönemde vücut kompozisyonunda önemli bir iyileşme gösterdiğini ve özellikle 12. Ayda ağırlık, yağ, kas ve BMI değerlerinin diğer dönemlere göre önemli ölçüde düştüğünü göstermektedir. Ayrıca, P.A. grubunda sadece BMI değerlerinde anlamlı bir iyileşme olduğu bulunmuştur.

Kan lipid değerleri analizi, P.A. grubunda toplam kolesterol, LDL ve trigliserit düzeylerinin önemli ölçüde azaldığını göstermiştir. HDL düzeyleri ise P.A. ile değişmemiştir. Her iki grup için de kan lipid parametreleri üzerinde zaman etkisi bulunmuş, ancak zaman ve grup arasında etkileşim gözlenmemiştir.

TARTIŞMA VE SONUÇ

Bu çalışma, tüp mide operasyonu sonrası 1 yıl boyunca aerobik egzersiz yapan bireyler ile egzersiz yapmayan bireylerin kilo kaybı, vücut kompozisyonu ve kan lipit seviyelerini karşılaştırmıştır. Sonuçlar, egzersiz grubunun kilo kaybında ve vücut kompozisyonu parametrelerinde önemli iyileşmeler yaşadığını göstermiştir. Bununla birlikte, kan lipit parametrelerinde gelişmeler olsa da anlamlı ve istikrarlı farklar bulunmamıştır. Bu bulgular, tüp mide operasyonu sonrası uzun süreli fiziksel aktivitenin kilo kaybı ve vücut kompozisyonu üzerinde olumlu etkileri olduğunu göstermektedir. Ancak kan lipit seviyelerini etkilemeyebilir. Gelecekteki araştırmaların daha büyük örneklemler ve daha uzun egzersiz süreleri ile bu çalışmanın sonuçlarını doğrulaması gerekebilir.

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