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Electromyostimulation Exercise with Diet Program is More Effective on Body Composition than its Exercise without Diet

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Abstract

Electromyostimulation (EMS) exercise attracts and receives great attention with many studies showings that it has positive effects on body composition. However, the number of studies showing the effects of this exercise when combined with diet is limited. In this context, the aim of this study is to compare the effects of EMS exercise with diet program and EMS exercise without diet program. A total of 104 men and women with an average of age 33.4±0.62 years participated in the study voluntarily. The participants were randomly divided into two groups as dieting EMS group and non-dieting EMS group. Both groups were subjected to the EMS exercise consisting of exercises twice a week, 20 minutes/session a day, for 4 weeks. Body composition measurements of the participants were performed with the InBody 120 Professional Body analysis at the beginning and end of the study. The circumference measurements of the participants were recorded with a tape measure as (cm). In the intra-group change evaluation, significant differences were found between the pre-test and post-test in both groups ($p<0.05$). When the comparisons between the groups were examined, it was determined that the dieting EMS group had better results in terms of waist and hip circumference than the non-dieting group. It can be said that EMS exercise with diet is more effective than EMS exercise without diet in terms of body composition.

Keywords: EMS, Exercise, Diet

Diyet Programı ile Yapılan Elektromyostimülasyon Uygulaması Diyetsiz Yapılana Göre Vücut Kompozisyonu Üzerinde Daha Etkilidir

Öz

Elektromyostimülasyon (EMS) uygulaması son dönemlerde vücut kompozisyonu üzerinde olumlu etkilerinin olduğunu gösteren birçok çalışma ile büyük ilgi ve alaka bulmuştur. Ancak bu uygulamanın diyetle birlikte yapıldığında etkilerini gösteren çalışma sayısı sınırlıdır. Bu bağlamda bu çalışmanın amacı diyet programı ile gerçekleştirilen EMS uygulamasının etkilerinin diyet programı olmadan gerçekleştirilen EMS uygulaması ile karşılaştırılmasının yapılmasıdır. Çalışmaya yaş ortalamaları 33.4±0.62 yıl olan toplam 104 kadın ve erkek gönüllü olarak katılmıştır. Katılımcılar rastgele diyet yapan EMS grubu (n:55) ve diyet yapmayan EMS grubu (n:49) olmak üzere iki gruba ayrılmıştır. Her iki grupta 4 hafta boyunca, günde 20 dakika/seans olmak üzere haftada iki kez high knees, jumping jack, plank, squat, lunge, crunch ve push up gibi egzersizlerden oluşan EMS uygulamasına tabi tutulmuştur. Çalışmanın başlangıcında ve sonunda katılımcıların vücut kompozisyon ölçümleri InBody 120 Profesyonel Vücut analizi ile ölçülmüştür. Katılımcıların çevre ölçümleri ise mezura ile ölçülmüş ve cm olarak kaydedilmiştir. Gruplar arası karşılaştırmalara bakıldığında diyet yapan EMS grubunda yapmayan gruba göre bel ve kalça çevresi özelinde daha iyi sonuçların elde edildiği tespit edilmiştir. ($p<0.05$). Sonuç olarak diyet ile birlikte uygulanan EMS uygulamasının, diyetsiz yapılana göre vücut kompozisyonu özelinde daha etkili olduğu söylenebilir.

Anahtar kelimeler: EMS, Egzersiz, Diyet

Introduction

Nowadays, the fact that technological developments make the lifestyle sedentary, gradually reduces individuals' physical activity and exercise levels (Serin, 2020). This decrease in the exercise levels is associated with an increase in body weight, body fat percentage, waist-hip ratio and body mass index (Yavuz, 2020). The whole of components such as fat, muscle and bone tissue that make up the human body is called body composition. High amounts of adipose tissue or body fat is harmful to health and can increase the risk of disease, therefore body composition can be regarded as a vital part of an individual's health and physical fitness (Lin, 2002; Aasen et al., 2009; Nattiv et al., 2007). It is a very important factor for individuals to maintain active life with exercise for the protection and development of health and physical fitness (Rejeski, 2001). Regular exercise is recommended for individuals to be more active in their daily lives (Kaya et al., 2018). ACSM (American College of Sports Medicine) and DHHS (The US Department of Health and Human Services) recommend 150 minutes of moderate-intensity aerobic and resistance exercises per week for weight loss and weight control (Gooding, et al., 2020; Bushman, 2019).

Along with the existence of various exercises (Aerobic exercises; walking, running, cycling, etc. Anaerobic exercises: weightlifting, sprinting and jumping, etc.) for individuals, today new exercise methods providing more positive effects in a short time are also used in order to reduce inactivity and bring about positive changes in the perspective of health and performance (Jirathananuwat et al., 2017; Çetin et al., 2017). Electromyostimulation (EMS) applications that have emerged recently are electrical muscle stimulation that can be applied locally and throughout the body, increasing muscle strength and performance (Sánchez et al.,2005; Berger et al., 2020., Silva et al.,2018., 2017; Schink et al., 2018). While local EMS is performed by applying the current to the motor point of one or two muscle groups, the whole-body EMS which is used in sports is performed by stimulating the whole body by applying the same thing to all major muscle groups in a wide area (Borenstein et al., 2010; Mosole et al.,2018). It is an economical method in terms of time for those who want to do intense exercise in a short time (Bauer et al., 2013).

Studies on EMS exercises indicate positive effects on body composition (Özdal et al., 2016; Kemmler et al., 2010; Çirkin, 2016; Kirişçioğlu, 2019). Moreover, it is frequently reported that regular exercise and diet program have more positive effects on body composition than only diet or only exercise program (Saçaklı, 2017; Yaman, 2009). Despite this, most people think that only exercise practices will be sufficient, so they may not see the benefits they expect from the exercises they do without diet for a long time. This may cause people to tend to drop out of exercise programs.

When the studies conducted in this context are evaluated, the number of studies comparing EMS with diet and without diet is very limited. Therefore, the aim of this study is to examine the results of EMS exercise with diet and without diet in terms of body composition.

Materials and Methods

After the participants were given general information about the study, their statements that they accepted to participate in the study on a voluntary basis were obtained with the "Informed Consent Form for Study for Research Purposes".

Participants

A total of 104 men and women, whose age average was 33.4±0.62 years, and who did not have any health problems participated in the study voluntarily. The participants were randomly divided into two groups as dieting EMS group and non-dieting EMS group. Both groups were subjected to 4 weeks of whole-body EMS (WB-EMS) exercise. In addition to the EMS exercises, a personalized diet program was applied to the dieting EMS group.

Exercise Program

The exercise program was carried out twice a week, 20 minutes/session per day for 4 weeks. Electrical muscle stimulation was applied with bipolar impulses with a frequency of 85 Hz and a pulse width of 350 μs. A 30 second stimulation was followed by a 10 second stimulation rest. Exercises: high knees, jumping jack, plank, squat, lunge, crunch, push up, which are suitable for each participant and easy to apply, were applied in order to stimulate upper leg, upper arm, lower abdomen, chest, lower back, upper back and latissimus dorsi muscles. (Kemmler et al., 2010; Kemmler and Stengel, 2013; Schink et al., 2018).

Diet Program

A dietitian prepared personalized diet programs for the participants receiving nutritional therapy according to the individual's body analysis results (body fat, muscle mass, body water ratios), complete blood count results, lifestyle and nutritional habits, taking into account daily energy consumption and these programs were not below the basal metabolic rate (BMR) of the individuals. The content of the diet program was planned to be 45-55% carbohydrate, 15-20% protein (or 1.5 g/kg/day), fat ratio 25-35%, daily water consumption 30-35 ml per kg. The participants were interviewed face to face on a weekly basis, measurements were made with a body analyzer every week, and changes were made in the diet program within the planned standards, as deemed appropriate by the dietitian.

Data Collection Method

Body Analysis

The body composition values of the participants in the study were made with the bio impedance analyzer (InBody 120, Biospace, California, USA). with a sensitivity of 0.01 kg. Body composition analysis measures the bone ratio, body water and muscle mass with great precision, as well as measuring fat for each part of the body separately by sending a slight electrical current to the body with electrodes that touch the hands and feet (Czartoryski et al., 2020).

Body Circumference Measurement: The body circumference measurements of the participants (chest circumference, waist circumference, hip circumference, right thigh circumference, left thigh circumference, right upper arm circumference, left upper arm circumference, waist-hip ratio) were taken with an inflexible tape measure.

Statistical Analysis

Data analysis was performed with SPSS 23.0 package program. The Paired Sample T test was applied to determine whether there was a difference between the pre-test and post-tests within the group. While the ANOVA test was used for the comparison between the groups, the TUKEY test was used to determine which group the difference originated from. The statistical significance level was accepted as $p<0.05$.

Results

Table 1

Comparison of body composition values on performing EMS exercises with diet and without diet

Parameters	**Groups**	**Pre-Test**	**Post-Test**	**t**	***p***	***p***
		Mean±SD	**Mean±SD**			
Body Weight (kg)	EMS Without Diet (n:49)	75.8±2.11	73.5±2.11	9.12	*0.00**	*0.00**
	EMS With Diet (n:55)	75.1±1.67	70.4±1.73	10.4	*0.00**	
BMI(kg/m^2)	EMS Without Diet (n:49)	27.1±0.53	26.3±0.54	8.53	*0.00**	*0.01**
	EMS With Diet (n:55)	27.2±0.41	26.2±0.42	13.02	*0.00**	
Percent Body Fat (%)	EMS Without Diet (n:49)	33.4±0.85	31.9±0.86	7.49	*0.00**	*0.00**
	EMS With Diet (n:55)	33.4±0.82	30.9±0.84	14.7	*0.00**	
Lean Body Mass (kg)	EMS Without Diet (n:49)	27.5±0.86	27.8±0.87	-3.34	*0.00**	*0.78*
	EMS With Diet (n:55)	27.5±0.83	27.8±0.81	-3.57	*0.00**	

p<0.05

Significant difference was observed in the pre-test post-test values of all parameters of the dieting EMS group and the non-dieting EMS group ($p<0.05$). When the groups were compared, there was significant difference in BW, BMI, PBF parameters in favor of the dieting EMS group between the dieting EMS group and the non-dieting EMS group ($p<0.05$).

Table 2

Comparison of Body Circumference Measures on Performing EMS Exercises with Diet and without Diet

Parameters	**Groups**	**Pre Test**	**Post Test**	***t***	***p***	***p***
		Mean±SD	**Mean±SD**			
Chest Circumference (cm)	EMS Without Diet (n:49)	100.2±1.15	*98.01*±1.16	*7.19*	*0.00**	*0.66*
	EMS With Diet (n:55)	97.8±1.04	*95.7*±1.0	*7.89*	*0.00**	
Waist Circumference (cm)	EMS Without Diet (n:49)	96.7±1.58	*93.7*±1.65	*5.29*	*0.00**	*0.58*
	EMS With Diet (n:55)	93.7±1.55	*90.1*±.1.65	*9.12*	*0.00**	
Hip Circumference (cm)	EMS Without Diet (n:49)	109±1.03	*106.6*±0.98	*8.6*	*0.00**	*0.32*
	EMS With Diet (n:55)	107.7±0.91	*104.5*±0.86	*11.5*	*0.00**	
Right Thigh Circumference (cm)	EMS Without Diet (n:49)	58±0.60	*55.4*±0.59	*8.13*	*0.00**	*0.98*
	EMS With Diet (n:55)	58.6±0.53	*55.7*±0.54	*9.87*	*0.00**	
Left Thigh Circumference (cm)	EMS Without Diet (n:49)	57.9±0.61	*55.5*±0.63	*7.61*	*0.00**	*0.67*
	EMS With Diet (n:55)	58.4±0.51	*55.6*±0.54	*9.39*	*0.00**	
Right Biceps Circumference (cm)	EMS Without Diet (n:49)	32.3±0.52	*30.9*±0.52	*7.41*	*0.00**	*0.87*
	EMS With Diet (n:55)	31.3±0.43	*29.8*±0.38	*7.88*	*0.00**	
Left Biceps Circumference (cm)	EMS Without Diet (n:49)	32.2±0.51	*30.7*±0.51	*7.42*	*0.00**	*0.52*
	EMS With Diet (n:55)	31.2±0.44	29.6±0.39	*8.98*	*0.00**	
Hip-Waist Ratio (%)	EMS Without Diet (n:49)	0.89±0.01	*0.87*±0.01	*2.03*	*0.04**	*0.00**
	EMS With Diet (n:55)	0.87±0.01	*0.86*±0.01	*2.11*	*0.04**	

p<0.05

Significant difference was observed in the pre-test post-test values of all parameters of the dieting EMS group and the non-dieting EMS group ($p<0.05$). Between the groups, there was a statistically significant difference only in waist-hip ratio between the dieting EMS group and the non-dieting EMS group ($p<0.05$).

Discussion

When the results of the study were evaluated between the groups, a significant difference was observed in favor of the dieting EMS group in body weight, body mass index, and body fat percentage values. While a significant difference was detected in the pre-test-post-test values of the body circumference measurement values in both groups, no significance was found in the evaluation

between the groups (p>0.05). In addition, better body fat loss was observed in the dieting EMS group, while lean body mass was not affected. When the relevant literature is examined, it is seen that in a study conducted, significant changes were reported in the body composition values of 41 participants with an age average of 34.05 ± 8.94 years with 8-week EMS exercise (Kirişçioğlu et al., 2019). In another study, the effect of EMS training on the physical fitness parameters of 18 female participants aged 31-41 was examined and it was stated that a significant decrease was observed in the body fat percentage and body mass index values of the participants as a result of the 8-week EMS exercise (Çirkin, 2016). When the effects of EMS exercises on various age groups were examined, it was stated that EMS exercises applied for 8 weeks, 2 days a week and for 25 minutes were effective on the body fat parameters of the participants, consisting of 3 groups between the ages of 23-41 (Çetin et al., 2017). When the effect of EMS exercises on different genders was examined, it was stated that significant changes were observed in body weight, body mass index, body fat percentage and lean body mass values in sedentary male and female participants in EMS exercises performed 3 days a week for 6 weeks (Kılıç and Ugurlu, 2018). All these studies support our study findings and they show that the exercise of EMS exercises on different durations, different ages and genders is effective on body composition. However, Porcari et al., (2002) applied the same exercise program to two groups, EMS and placebo, male and female participants with an average age of 20 years in their study and at the end of the study, it was stated that there was no significant change in body composition values in both groups. In another study, 41 participants between the ages of 25-50 years were examined in two groups as exercise and control, the exercise group participated in abdominal EMS exercises for 8 weeks, while the control group did not participate in any exercise program. Despite this, there was improvement in body composition values for both groups at the end of 8 weeks, the change was not significant (Porcari et al., 2005). In addition to this, Özdal and Bostancı (2016) divided 40 sedentary female participants into two groups as EMS and placebo and applied the same exercise protocol to both groups. As a result of the 8-week study, it was stated that while there were significant changes in the body composition of the group exercising with EMS, no significant change was observed in the placebo group. When we examine the effectiveness of exercises, which is one of the hypotheses of our study, on body composition parameters by combining them with the diet program; In the literature, it has been seen that the studies in which the combination of EMS and diet program have been applied are limited. However, Öztürk et al., (2016) stated in their study that the implementation of a diet program with trekking, treadmill, and resistance exercises for 12 weeks in sedentary women and men provided significant changes in body composition values. Finally, when they compared the results of their study with the exercise studies performed without diet in the literature, they stated that the exercise study with diet provided a greater percentage change than those without diet. In another study, 439 postmenopausal sedentary participants were divided into 4 groups:

diet (calorie restriction), exercise (5 days a week of moderate intensity aerobic exercise), dieting exercise (calorie restriction and aerobic exercise) and control (continuing their normal life). As a result of the 12-week period, positive changes were observed in body weight, body mass index, waist circumference, body fat percentage and body fat mass values. While no significant change could be observed in the control group, it showed a proportional increase in the exercise, diet and dieting exercise group, respectively. In addition, the findings showed that exercise with diet is more effective on body fat percentage without losing muscle. As a result, it was reported that the dieting exercise group showed much more improvement than the only exercise or only diet group. (Foster-Schubert et al., 2012). The literature and our study findings show that exercise will be more effective when applied with a diet program. It should be noted that these results were observed in sedentary adults. Therefore, our study results may not generalize to participants of different performance levels and age groups.

Conclusion

It can be said that while exercise and diet programs alone have a limited effect on body composition, exercise combined with diet programs is more effective on body composition.

Ethics Committee Permission Information

In the method of the article, during the current research, "Higher Education Institutions Scientific Research and Publication Ethics Directive" has been acted upon.

Statement of Researchers' Contribution Rates

The authors contributed equally at all stages of the research.

Conflict Statement

The authors don’t have a conflict statement regarding the research.

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