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Comparison of the Effects of Electrostimulation and Zumba Exercise on Some Physical and Physiological Parameters of Sedentary Women

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Abstract

The aim of this study is to compare the effects of Electrostimulation (EMS) exercise, which is a popular research topic recently, whose effectiveness and benefits are frequently stated in the literature, and zumba exercise, which is also a popular type of exercise, on some physical and physiological parameters in healthy sedentary women. A total of 30 women (35.8 ± 1.4 years) volunteered for this study. The participants were randomly divided into EMS (n:15) and Zumba (n:15) groups. Then, for a total of 6 weeks, the EMS group performed EMS exercise two days a week, and the Zumba group performed Zumba exercise two days a week. The body composition, blood pressure, maximal oxygen consumption (VO_{2max}), strength performance and determined blood parameters of the participants were evaluated at the beginning and end of the study. Each exercise session was followed by heart rate monitoring system in order to evaluate the participants' maximal, average heart rate and total calories burned. Moreover, rate of perceived exertion was recorded at the end of each exercise with the Borg scale. When intergroup comparison performed, a statistically significant difference was found in favor of the Zumba group in the values of body weight, body mass index (BMI), body fat percentage and. VO_{2max} There was no statistically significant difference between the groups in strength and blood lipid parameters. It can be said that both EMS and zumba practices have positive effects on body composition, strength and blood lipid levels when the duration of each session and the total duration of the exercises as well as intra-group changes are evaluated.
Keywords: Electrostimulation, Zumba, Sedentary

Elektrostimülasyon ve Zumba Egzersizinin Sedanter Kadınlarda Bazı Fiziksel ve Fizyolojik Parametreleri Üzerine Etkilerinin Karşılaştırılması

Öz

Bu çalışmanın amacı, son dönemlerde popüler bir araştırma konusu olmakla beraber etkinliği ve faydaları literatürde sıklıkla bildirilen elektrostimülasyon (EMS) uygulaması ile yine popüler bir egzersiz türü olan zumba egzersizinin sağlıklı sedanter kadınların bazı fiziksel ve fizyolojik parametreleri üzerinde etkilerinin karşılaştırılmasıdır. Çalışmaya yaş ortalamaları 35.8±1.4 yıl olan toplam 30 kadın gönüllü olarak katılmıştır. Katılımcılar rastgele EMS (n:15) ve Zumba (n:15) grubu olarak ikiye ayrılmıştır. Daha sonra toplamda 6 hafta olmak üzere, EMS grubuna haftada iki gün EMS uygulaması, zumba grubuna ise yine haftada iki gün olmak üzere zumba egzersizleri yaptırılmıştır. Çalışmanın başında ve sonunda katılımcıların vücut kompozisyonu, kan basıncı, maksimal oksijen tüketimi (VO_{2maks}), kuvvet performansları ve belirlenen kan parametreleri değerlendirilmiştir. Her bir egzersiz seansı katılımcıların maksimal, ortalama kalp atım hızları ve toplam harcanan kalorininin değerlendirilebilmesi için Realtrack Seego marka nabız monitörleme sistemi ile takip edilmiştir. Ayrıca BORG skalası ile her bir egzersiz sonunda algıladıkları zorluk dereceleri kaydedilmiştir. Gruplar arası karşılaştırma yapıldığında, vücut ağırlığı, beden kütle indeksi (BKI), vücut yağ yüzdesi ve maxVO_2, değerlerinde zumba grubu lehine istatiksel olarak anlamlı fark tespit edilmiştir. Kuvvet ve kan lipit parametrelerinde ise gruplar arası istatistiksel olarak anlamlı fark tespit edilememiştir. Uygulamaların her bir seans süresi ve toplam süreleri ayrıca grup içi değişimler değerlendirildiğinde hem EMS hem de zumba uygulamasının vücut kompozisyonu, kuvvet ve kan lipit düzeyleri üzerinde olumlu etkileri olduğu söylenebilir.
Anahtar kelimeler: Elektromyostimülasyon, Zumba, Sedanter

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INTRODUCTION

As a result of technological developments and developments in industrialization in recent years, physical inactivity increased, so serious health problems increased in the world and in Turkey, and the quality of life was adversely affected (Atan et al., 2012; Keskin and Tokat, 2023). The World Health Organization (WHO) recognized physical inactivity as a global public health problem and reported it among the global risk factors for death, along with hypertension and obesity (Benjamin et al., 2017). It was reported that high inactivity levels (43.7%) were reached between 2001-2016 in Europe and many world countries, and therefore there is a great increase in participation in sports and physical activity in the last few years, especially by women, after reports of increased health problems were published (Guthold et al., 2018; Stamatakis and Chaudhury, 2008; Vendramin et al., 2016). Again, the American College of Sports Medicine (ACSM) recommends 75 to 150 minutes of moderate-intensity exercise per week in order to eliminate these negativities and to lead a healthy life. In addition to this, ACSM recommends adding strengthening activities that appeal to whole body muscle groups for at least two days (Garber et al., 2011). In line with the recommendations, new exercise methods are now used to reduce inactivity and to bring about positive changes in the perspective of health and performance (Jirathananuwat and Pongpirul, 2017; Lassen et al., 2018; Tokat and Keskin, 2023). Exercises such as zumba, EMS, and pilates are now most preferred training routines, especially for women (Aukštuolytė et al., 2018).

EMS is one of the exercise methods coming to the fore with the development of technology. EMS is an electrical muscle simulation that increases muscle strength and performance and enables simultaneous contraction of all fibers that make up the muscle especially by improving the intramuscular coordination of major muscle groups (Duchateau, 2007; Stojanovic et al., 2017; Vanderthommen and). EMS is performed in two ways, local and whole-body (Tiggemann et al., 2010). While the local EMS exercise is based on the exercise of current to the motor point of one or two muscle groups, the whole-body EMS exercise is based on the exercise of the same current over a large area and across several major muscle groups (Maffiuletti et al., 2009; Wirtz, Zinner et al., 2016). The EMS system, which has a powerful battery as a wireless electrical stimulator, allows muscle activation in the posterior thigh, arm, hip, abdomen, and chest muscles with the help of channels. These devices are managed by a software with the help of available parameters and channels that allow the intensity of each individual to be changed. EMS exercises lasting 20-25 minutes provide a concentrated effect by working all major muscle groups (Kemmler et al., 2012; Kemmler et al., 2018). For these reasons, EMS is an exercise method that positively affects muscle mass, fat mass and functional capacity, provides high adaptation in those who do not exercise, saves time and is also less physically tiring.

Zumba is a new fitness version that emerged in Colombia in the 1990s and is hugely popular around the world, inspired by dance-based Latin American music, basic aerobic steps, and other dances such as Indian, African dance (Perez and Greenwood-Robinson, 2009). It is a combination of exercises that increase calorie consumption, improve the cardiovascular system, increase the endurance of the whole body, and are based on aerobic training (Ljubojević et al., 2014). A standard zumba exercise lasts about an hour and includes many dance styles and many fitness movements such as forward lunges and squats, and a person burns an average of 500-1000 calories during the exercise (Laskowski, 2013). It was determined by some studies that Zumba, a cardio-dance program that gained popularity in fitness programs, increases the motivation to be physically active, is effective in the development of body composition and muscle strength, and can be effective in the development of balance, quality of life, aerobic capacity, and cardiovascular system (Donath et al., 2014; Vendramin et al., 2016). According to a study conducted by the American Council on Exercise in 2012, apart from the fun factor, zumba program burns more calories than cardio, kickboxing, yoga, jogging, hula hoop, and step aerobics (Luettgen et al., 2012).

Although there are studies that discuss that EMS and zumba exercises have positive results on parameters such as body composition and muscle strength (Barene et al., 2014; Brocheri et al. 2005; Cugusi et al. 2015; Donath et al., 2014; Herrero et al. 2006; Krishnan et al., 2015; Micallef, 2014), people have a question point about which one will be more beneficial and there are limited studies in the literature to eliminate this question point. In this context, in this study, it is aimed to compare the effects of these two exercise practices, the effectiveness and benefits of which are frequently reported, on healthy sedentary women.

METHODS

Research Model

The research was designed with an experimental model, one of the quantitative research methods. In the study, the pretest-posttest control group design was preferred. In this design, measurements related to the dependent variable were applied to the participants before and after the experimental protocol (Büyüköztürk et al., 2012).

Research Group

A total of 30 women whose age average is 28±2.3 years and who have no health problems participated in the study voluntarily. The participants were randomly divided into two groups as performing EMS (n:15) and performing zumba (n:15) exercises. Both groups were subjected to whole body EMS (WB-EMS) exercise and Zumba exercise twice a week for 6 weeks. The personalized diet programs of the participants were prepared by a specialist dietitian for 6 weeks and were controlled according to the body composition and hematological and biochemical parameters of each person. All measurements were taken twice, before and after exercise.

EMS Exercise Program

The exercise program was carried out twice a week, 20 minutes/session per day for 6 weeks. EMS 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). The values of the participants in each exercise (beats/min) for 6 weeks were determined by Realtrack Seego brand heart rate monitoring system (Spain), and the mean heart rate for the EMS exercise was determined as 151±5.6 beats/min. Rate of perceived exertion (Borg, CR-20 scala) was saved immediately after each EMS exercise.

Zumba Exercise Program

Zumba exercise program was carried out twice a week, 45 minutes/session per day for 6 weeks. Each zumba training includes 60 minutes of zumba® basic1 principles (warm-up, the main part of the workout is zumba dances, cool-down and stretching) (Perez and Greenwood-Robinson, 2009). The exercise intensity is determined by the tempo of the music that changes during the exercise segments. The warm-up lasted 8-10 minutes (tempo 100-120 bpm) with basic dance steps (starter, step, sidesteps, etc.) with gradually accelerating music tempo. The main phase of the Zumba exercise was performed with original zumba fitness songs for 8-10 minutes. With the change of music, dance choreographies and movement intensity were also changed (tempo between 140-160 beats/min). In the main phase of Basic1 zumba exercises, generally Latin American dance choreographies such as merengue, salsa, samba, belly dance, cha cha cha, tango, etc. are used. The intensity and density of the exercise are determined by the differences between the character and dynamics of the movement (Lukić, 2006). Each dance choreography lasts 3-5 minutes, with 15-30 seconds of passive rest. At the end of the exercise, slower cooling movements were performed accompanied by slow music for mental and physical relaxation (musical tempo -90 beats/min). The intensity of the exercise was adjusted using cadence sticks (zumba cadence program) and by changing the character of the dance movements in the presented choreographies. The values of the participants in each exercise (beats/min) for 4 weeks were determined by the Realtrack Seego brand heart rate monitoring system (Spain), and the mean heart rate for the EMS exercise was determined as 120±4.3 beats/min. Rate of perceived exertion (Borg, CR-10 scala) was saved immediately after each zumba exercise.

Data Collection Tools

Body Composition: While the height (cm) of the participants was measured with a stadiometer, Inbody 270 body analysis measuring device was used for the body weight (kg), Body mass index (BMI) (kg/m^2), body fat percentage (%), body fat mass (kg) and body muscle percentage (%).

Isometric Contraction Power: Takei brand dynamometer was used to determine isometric leg and back strength. The dynamometer was adjusted according to the participant's foot length, then the participant applied as much force as possible to the device. The best result obtained by the participant as a result of two trials was accepted as the highest value.

Grasping strength: Holtin brand hand dynamometer was used for grasping strength. The best result obtained by the participant as a result of two trials was accepted as the highest value.

Blood Pressure: Systolic and diastolic blood pressures were measured with the “Omron” brand digital blood pressure device.

Rockport 1-mile Walk Test (VO_{2max}*):* The participants were asked to walk 1 mile (1609 m) as fast as possible with the start of the stopwatch. The mean number of heart beats per minute of the participant who completed 1 mile and completion time were recorded in the measurement chart. The participants' VO_{2max} values were estimated using the values recorded later and the VO_{2max} formula.

Blood laboratory tests: The participants’ Glucose, Hemoglobin (HGB), HDL, LDL and total Cholesterol and Triglyceride levels were examined in the health center before and after exercise under doctor control.

Determination of Exercise Load and Intensity: Realtrack Seego brand heart rate monitoring system (Spain), which instantly records the maximum heart rate (HRmax) (beats/min), mean heart rate (beats/min), total calories burned (kcal) values, was used to determine and follow the load and intensity of each exercise for 6 weeks, and the values were recorded by the researcher following the monitor.

Rate of perceived exertion (RPE): Rate of perceived exertion was collected within 30 minutes after each workout using a modified Borg scale of 10. Each participant was asked the question of "What is your perceived exertion in the exercise?" to calculate the exercise load (Borg, 1998; Impellizzeri et al., 2004).

Regulation of Nutrition Programs: Each participant was interviewed face-to-face by a specialist dietitian. A personalized nutrition program was arranged according to the laboratory test results, body analysis values (body fat, muscle mass, body water ratios), lifestyle and nutritional habits of the participant. The daily calorie intake was determined to be above the Basal Metabolic Rate (BMR) and the protein value to be at least 1.5 g/kg.

Ethical Approval

All participants signed an “Informed Consent Form” stating that they voluntarily participated in the study. The study procedures followed the principles outlined in the Declaration of Helsinki and were approved by Karabuk University, Non-interventional Clinical Ethics Committee (2021/573).

Analysis of Data

For the analysis of the data the SPSS 23.0 package program was used. In order to determine whether the numeric variables were normally distributed or not, the Shapiro-Wilk test was used. In order to determine whether there was a difference between the groups or not, the "Paired Samples T test" was used. While the pre- and post-exercise values of the groups were compared with the Wilcoxon Test, the comparison of the two groups was performed using the One-way Anova-Tukey test. All analyses were processed at the significance level of 0.05.

RESULTS

Table 1. Comparison of the body composition values of the groups

Parameters	Group	Pre-Test Mean±SD	Post-Test Mean±SD	t	p	p
Body Weight (kg)	EMS Group	65.2±2.52	64.9±2.47	7.79	0.45	0.00*
	Zumba Group	70±3.05	67.6±2.88	6.03	0.00*	
BMI (kg/m^2)	EMS Group	25±0.76	24.8±0.76	1.08	0.3	0.01*
	Zumba Group	26.2±0.99	25.1±0.96	4.69	0.00*	
Body Fat Percentage (%)	EMS Group	32.5±1.49	31.5±1.83	1.96	0.08	0.15
	Zumba Group	33.4±1.65	31.5±1.82	4.39	0.00*	
Body Fat Mass (kg)	EMS Group	21.4±1.48	20.9±1.74	1.33	0.21	0.04*
	Zumba Group	23.7±1.95	21.9±1.98	5.35	0.00*	
Body Muscle Mass (kg)	EMS Group	23.9±0.94	24.3±0.89	-2.52	0.03*	0.91
	Zumba Group	25.5±1.1	25.9±0.99	-1.08	0.29	

Data presented as mean ± SD. * p ≤ 0.05.

When the in-group evaluation was examined, while there was significance in body weight (kg), BMI (kg/m2), body fat percentage (%), body fat mass (kg) values in the Zumba group, there was statistical significance in the body muscle mass (kg) in the EMS group ($p< 0.05$). When the difference between the groups was examined, significance was found in body weight (kg), BMI (kg/m^2) and body fat mass (kg) values ($p<0.05$).

Table 2. Comparison of the strength values of the groups

Parameters	Group	Pre-Test Mean±SD	Post-Test Mean±SD	t	p	p
Right Hand Grasping Strength (kg)	EMS Group	25.7±1.1	27.1±0.89	-2.36	0.04*	0.16
	Zumba Group	27.1±1.53	29.9±1.51	-5.12	0.00*	
Left Hand Grasping Strength (kg)	EMS Group	22.7±0.96	23.4±0.83	-1.41	0.19	0.32
	Zumba Group	26±1.39	28.2±1.22	-2.5	0.03*	
Leg Strength (kg)	EMS Group	70.5±4.34	73.3±4.04	-0.56	0.59	0.53
	Zumba Group	71.9±3.81	80.3±4.56	-2.43	0.03*	
Back Strength (kg)	EMS Group	60.9±3.08	65.6±3.92	-1.29	0.23	0.37
	Zumba Group	75.2±3.18	77.3±3.37	-1.33	0.21	

Data presented as mean ± SD. *p≤0.05.

When the in-group evaluation was examined, while significance was found in right hand grasping strength (kg) in both groups, significance was found in left hand grasping strength (kg), leg strength (kg) and back strength (kg) in the Zumba group ($p<0.05$). When the difference between the groups was examined, no significance was found in all parameters.

Table 3. Comparison of the blood pressure and VO_{2max} values of the groups

Parameters	Group	Pre-Test Mean±SD	Post-Test Mean±SD	t	p	p
Systolic Blood Pressure (mmHg)	EMS Group	116±3.74	119±3.87	-0.83	0.23	0.23
	Zumba Group	123.8±3.37	117.4±3.56	1.23	0.00*	
Diastolic Blood Pressure (mmHg)	EMS Group	77.9±2.28	75.5±2.69	0.96	1.00	1.00
	Zumba Group	75.8±2.19	73.9±3.06	0.49	0.03*	
VO_{2max}(ml/kg/dk)	EMS Group	38.9±1.34	38.8±1.5	0.29	0.01*	0.01*
	Zumba Group	39.1±1.37	41.9±1.47	-3.81	0.03*	

Data presented as mean ± SD. * $p \leq 0.05$.

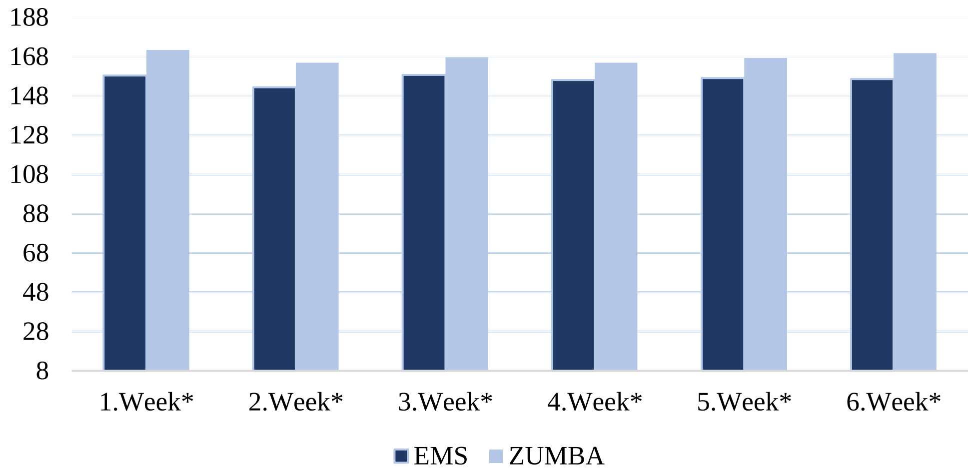
When the in-group evaluation was examined, statistically significant values were found in diastolic (mmHg) and systolic (mmHg) blood pressure and VO_{2max} values in the Zumba group. There was a significant difference in VO_{2max} (ml/kg/min) value in both groups. ($p<0.05$).

Table 3. Comparison of the blood values of the groups

Parameters	Group	Pre-Test Mean±SD	Post-Test Mean±SD	t	p	p
HGB (g/dl)	EMS Group	12.8±0.35	12.9±0.32	-0.26	0.79	0.35
	Zumba Group	12.1±0.46	12.4±0.26	-1.26	0.23	
Glucose (mg/dl)	EMS Group	86.9±2.18	85.1±2.15	1.15	0.28	0.53
	Zumba Group	91.8±2.17	89.6±2.1	0.96	0.35	
HDL Cholesterol (mg/dl)	EMS Group	65.7±4.55	67.4±3.53	-0.95	0.37	0.66
	Zumba Group	61.7±3.43	62.1±2.97	-0.36	0.72	
LDL Cholesterol (mg/dl)	EMS Group	108.2±6.85	103.3±5.86	2.23	0.04*	0.37
	Zumba Group	106.2±6.83	98.6±4.65	2.19	0.04*	
Total Cholesterol (mg/dl)	EMS Group	189.7±7.07	184.6±6.88	2.35	0.04*	0.66
	Zumba Group	181.9±8.75	174.6±8.72	0.57	0.14	
Triglyceride (mg/dl)	EMS Group	181.7±7.31	79.6±7.02	0.72	0.49	0.19
	Zumba Group	85.4±10.6	71.6±8.98	27.8	0.02*	

Data presented as mean ± SD. * $p \leq 0.05$.

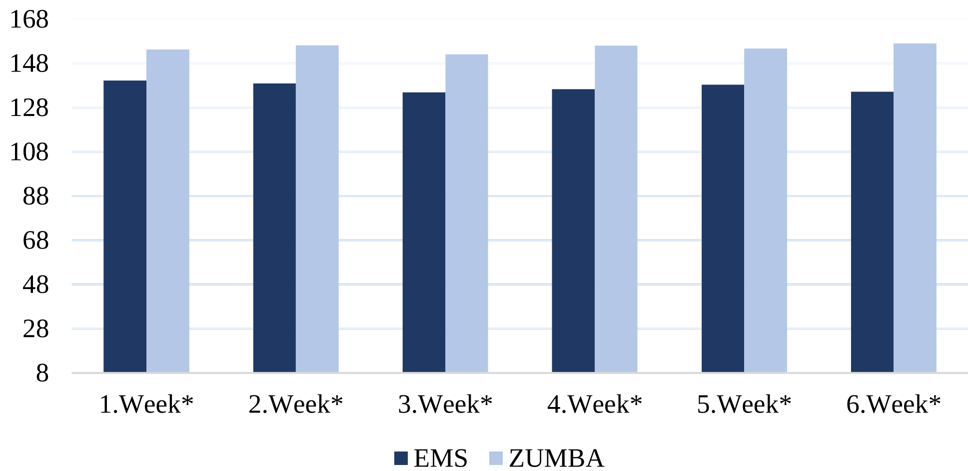
When the in-group evaluation was examined, the decrease in LDL cholesterol and total cholesterol values in the EMS group, and LDL cholesterol and Triglyceride values in the Zumba group were found to be statistically significant ($p<0.05$). When the difference between the groups was examined, no significant difference was found in all parameters.



***p<0.05**

Figure 1. Comparison of maximum heart rates (beat/min) of the groups during the exercise

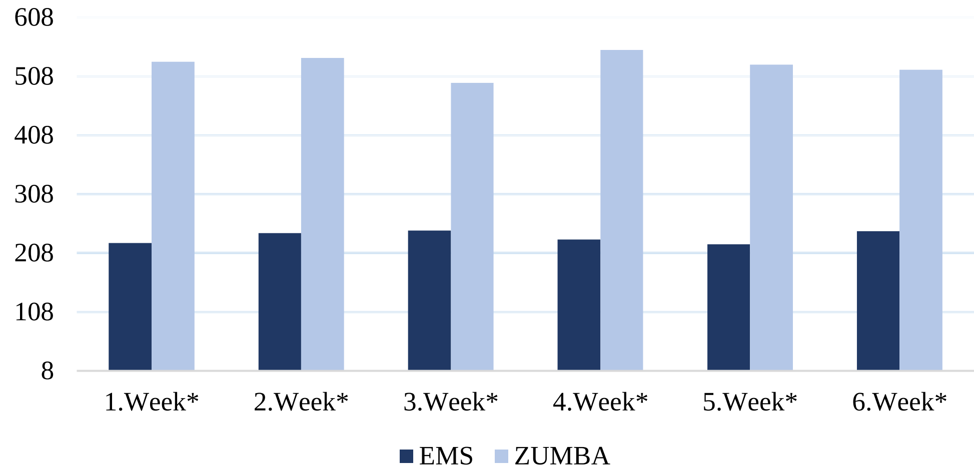
When the difference between the groups in the maximum heart rate recorded during zumba and EMS exercise for 6 weeks was examined, a significant difference was found at all weeks ($p<0.05$).



***p<0.05**

Figure 2. Comparison of average heart rates (beat/min) of the groups during the exercise

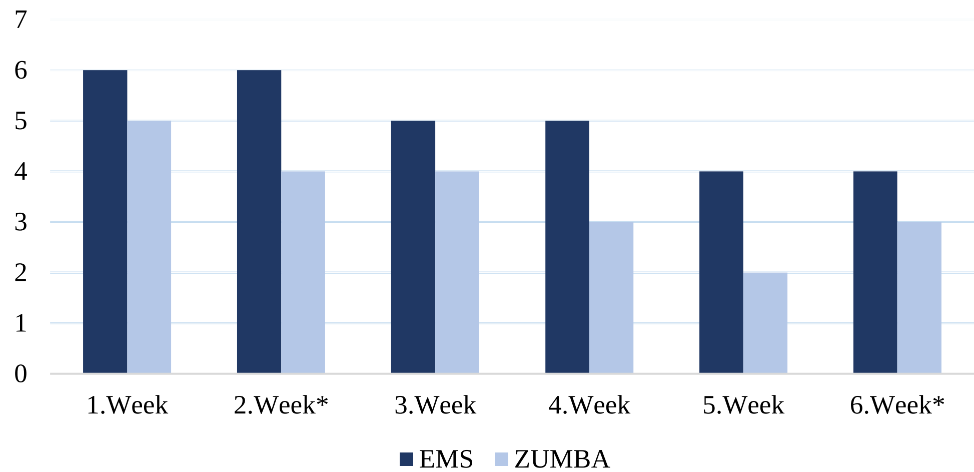
When the difference between the groups in the average heart rate recorded during zumba and EMS exercise for 6 weeks was examined, a significant difference was found at the all weeks ($p<0.05$).



$*p<0.05$

Figure 3. Comparison of the groups' total calories burned during the exercise (kcal)

When the difference between the groups in the total calories burned recorded during zumba and EMS exercise for 6 weeks was examined, a significant difference was found at all weeks ($p<0.05$).



$*p<0.05$

Figure 4. Perceived difficulty level immediately after 6 weeks of EMS exercise and zumba exercise

When the difference between the groups in the perceived difficulty level recorded immediately after the exercise for 6 weeks was examined, a significant difference was found at the 2nd and 5th weeks ($p<0.05$).

DISCUSSION AND CONCLUSION

The main funding of this study showed that Zumba exercises were more effective than EMS exercises on body weight, BMI (kg/m^2), body fat percentage (%), body fat mass, leg strength, diastolic and systolic blood pressure, and triglyceride. Moreover, positive improvement was detected regarding VO_{2max} in favor of zumba and regarding LDL in both methods. Furthermore, although it was not significant, in both groups improvement in glucose values was detected. No change was detected in HGB values. However, some results in favor of the EMS group were obtained on total cholesterol and body fat mass.

Most studies examining the effects of Zumba exercise showed a mild to moderate reduction in body weight ranging from 1% to 3.6% of total body mass (Barene et al., 2014; Cugusi et al., 2015; Krishnan et al., 2015; Micallef, 2014). Similarly, 5 different studies showed a decrease in BMI values (Barene et al., 2014; Donath et al., 2014; Krishnan et al., 2015; Micallef, 2014). After 12 weeks of zumba exercise, BMI decreased by 3.7% (Cugusi et al., 2015), after 8 weeks of zumba exercise, it decreased by 2.5% (Micallef, 2014) and 1.8% (Donath et al., 2014). They reported that body fat mass decreased by 2% (Krishnan et al., 2015) after 16 weeks of zumba exercise and 3.5% (Ljubojević et al., 2014) after 8 weeks of zumba exercise. In the study by Bayrakdar et al. (2020), in which they investigated the effects of regular zumba exercises on anthropometric characteristics, they stated that 20 women with an average age of 38.25±4.22 year performed zumba exercises for 12 weeks and there were significant differences in body weight, BMI, and body fat percentage. The findings of studies investigating the effects of Zumba exercise on body composition are in line with the findings of our study. When the studies examining the effects of Zumba exercise on maximal oxygen consumption (VO_{2max}) were examined, Krishnan et al., (2015) reported an improvement of 7.1% after 16 weeks of Zumba exercise. Donath et al. (2014), stated that there was a significant 21% increase in VO_{2max} in the 6-minute walking test, which is a field test after zumba exercise. In our study, in parallel with the results in the literature, a significant increase in VO_{2max} was found in the Zumba group. In studies examining systolic blood pressure (SBP), while only two studies found decreases in both SBP and diastolic blood pressure (Araneta and Tanori, 2015; Cugusi et al., 2015), other studies found no change (Barene et al., 2014; Krishnan et al., 2015). In our study, there was a decrease in both systolic and diastolic blood pressure. While Krishnan et al., (2015) stated that 16-week Zumba exercise led to a significant increase in lower extremity strength (16.4%), Cugusi et al., (2015) reported no difference in hand grasping strength. Moreover, Donath et al., (2014) stated that muscle strength did not change after 8 weeks of zumba exercise. In a study similar to the findings of our study (Araneta and Tanori, 2015), a significant decrease of 11.3% was found in triglyceride values after 12 weeks of regular Zumba exercise. In studies examining the effects on blood parameters after Zumba exercise, no changes were found in cholesterol values (Araneta and Tanori, 2015; Barene et al., 2014; Cugusi et al., 2015; Krishnan et al., 2015), glucose values (Araneta and Tanori, 2015; Barene et al., 2014; Cugusi et al., 2015; Krishnan et al., 2015) insulin Krishnan et al., 2015), and hemoglobin values (Barene et al., 2014; Krishnan et al., 2015). Similarly, it was revealed that there was no change in triglyceride levels (Barene et al., 2014; Cugusi et al., 2015; Krishnan et al., 2015).

When the studies discussing the effects of EMS exercise are examined, in parallel with the findings of our study, in their study. Herrero et al., (2006) found a significant increase in strength (9.1% $p<0.05$) after 53 contractions (3 seconds of stimulation-30 seconds of rest, 120 Hz) applied following 5 Hz warming with EMS 4 days a week for 4 weeks as a result of their study they performed on 40 healthy individuals. Brocheri et al. (2005) found a significant increase in isokinetic strength ($p<0.05$) in the study they conducted on 17 ice hockey players, who applied 30 contractions (4 seconds, 85 Hz) with EMS 3 days a week for 3 weeks. In the study conducted on basketball players, a significant increase was observed in isometric strength parameter ($p <0.01$) and squat jump performance ($p <0.01$) in athletes who applied 48 contractions (3 seconds of stimulation-17 seconds of rest, 100 Hz) with EMS 3 days a week for 4 weeks (Maffiuletti et al., 2000).

Overall, our results show that Zumba and EMS can improve body composition, strength, and blood lipids. We observed that Zumba groups significantly improved aerobic fitness (VO_{2max}), It is seen that the zumba group works with more heart rate average and burn more calories during exercise. However, rate of perceived exertion in zumba exercise is also lower.

This study revealed that a 6-week EMS and Zumba exercise positively affects body composition, strength and blood lipids. Although limitations of the small sample the data revealed that Zumba is more effective than EMS for the restoration of aerobic fitness to baseline levels after training period. Considering that Zumba is also practicable in terms of RPE compared to EMS, Zumba can be an alternative method to improve the desired physical condition. In the light of this information, Zumba methods applied in different forms can be preferred as a more effective training strategy to improve aerobic fitness and general health conditions for trainers and recreational exercisers.

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REFERENCES

Araneta, M.R., and Tanori, D. (2015). Benefits of Zumba Fitness® among sedentary adults with components of the metabolic syndrome: A pilot study. *J. Sports Med. Phys. Fitness*, *55*, 1227–1233.

Atan, T., Ayyıldız, T., & Ayyıldız, A., P. (2012 Some physical fitness values of female athletes engaged in different team sport branches. *Selçuk University Journal of Physical Education and Sport Science, 14*(2), 277-282.

Aukštuolytė, E., Mauricienė, V., Daunoravičienė, A., Knispelytė, G., & Berškienė, K. (2018). Dynamics of body composition and body image of sedentary working women who attend zumba or functional training programs: Pilot study. *Baltic Journal of Sport and Health Sciences, 2*(109), 2-8. https://doi.org/10.33607/bjshs.v2i109.190

Barene, S., Krustrup, P., Jackman, S., Brekke, O., & Holtermann, A. (2014). Do soccer and zumba exercise improve fitness and indicators of health among female hospital employees? A 12-week RCT. *Scandinavian Journal of Medicine & Science in Sports, 24*(6), 990-999. https://doi.org/10.1111/sms.12138

Bayrakdar, A., Kılınç, H., Kayantaş, İ., & Günay, M. (2020). The effect of 12-week regular zumba exercises on antropometric properties. *Journal of Human Sciences, 17*(1), 154-161. https://doi.org/10.14687/jhs.v17i1.5913

Benjamin, E.J., Blaha, M.J., Chiuve, S.E., Cushman, M., Das, S.R., Deo, R., & Muntner, P. (2017). Heart disease and stroke statistics 2017 update: A Report from the American Heart Association. *Circulation*, *135*(10), e146-e603. https://doi.org/10.1161/cir.0000000000000485

Borg, G. (1998). *Borg's perceived exertion and pain scales*. Human kinetics.

Brocherie, F., Babault, N., Cometti, G., Maffiuletti, N., & Chatard, J. C. (2005). Electrostimulation training effects on the physical performance of ice hockey players. *Med Sci Sports Exerc.*, *37*(3), 455-460. https://doi.org/10.1249/01.mss.0000155396.51293.9f

Büyüköztürk, Ş., Çakmak, E., K., Akgün, Ö., E., Karadeniz, Ş., ve Demirel, F. (2012). *Bilimsel araştırma yöntemleri*. (11. Baskı). Pegem Akademi. http://dx.doi.org/10.14527/9789944919289

Cugusi, L., Wilson, B., Serpe, R., Medda, A., Deidda, M., Gabba, S., & Mercuro, G. (2015). Cardiovascular effects, body composition, quality of life and pain after a Zumba fitness program in Italian overweight women. *The Journal of Sports Medicine and Physical Fitness*, *56*(3), 328-335.

Donath, L., Roth, R., Hohn, Y., Zahner, L., & Faude, O. (2014). The effects of Zumba training on cardiovascular and neuromuscular function in female college students. *European Journal of Sport Science*, *14*(6), 569- 577. https://doi.org/10.1080/17461391.2013.866168

Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I. M., & Swain, D. P. (2011). American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. *Medicine and Science in Sports and Exercise*, *43*(7), 1334-1359. https://doi.org/10.1249/mss.0b013e318213fefb

Guthold, R., Stevens, G.A., Riley, L.M., & Bull, F.C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1· 9 million participants. *The Lancet Global Health, 6*(10), e1077-e1086. https://doi.org/10.1016/S2214-109X(18)30357-7

Herrero, J. A., Izquierdo, M., Maffiuletti, N. A., & Garcia-Lopez, J. (2006). Electromyostimulation and plyometric training effects on jumping and sprint time. *International Journal of Sports Medicine*, *27*(07), 533-539.

Impellizzeri, F.M., Rampinini, E., Coutts, A.J., Sassi, A., & Marcora, S.M. (2004). Use of RPE-based training load in soccer. *Medicine and Science in Sports and Exercise*, *36*(6), 1042-1047. http://dx.doi.org/10.1055/s-2005-865845

Jirathananuwat, A., & Pongpirul, K. (2017). Promoting physical activity in the workplace: A Systematic meta-review. *Journal of Occupational Health, 59*(5), 385-393. https://doi.org/10.1539/joh.16-0245-RA

Kemmler, W., Schliffka, R., Mayhew, J. L., & Von Stengel, S. (2010). Effects of whole-body electromyostimulation on resting metabolic rate, body composition, and maximum strength in postmenopausal women: The Training and Electrostimulation Trial. *The Journal of Strength & Conditioning Research*, *24*(7), 1880-1887. https://doi.org/10.1519/jsc.0b013e3181ddaeee

Kemmler, W., Von Stengel, S., Schwarz, J., & Mayhew, J.L. (2012). Effect of whole-body electromyostimulation on energy expenditure during exercise. *The Journal of Strength & Conditioning Research*, *26*(1), 240-245. https://doi.org/10.1519/jsc.0b013e31821a3a11

Kemmler, W., & Von Stengel, S. (2013). Whole-body electromyostimulation as a means to impact muscle mass and abdominal body fat in lean, sedentary, older female adults: Subanalysis of the TEST-III trial. *Clinical Interventions in Aging*, *8*, 1353-1364. https://doi.org/10.2147/cia.s52337

Kemmler, W., Weissenfels, A., Willert, S., Shojaa, M., von Stengel, S., Filipovic, A., & Fröhlich, M. (2018). Efficacy and safety of low frequency whole-body electromyostimulation (WB-EMS) to improve health-related outcomes in non-athletic adults. A systematic review. *Frontiers in Physiology*, 23(9), Article 573. https://doi.org/10.3389/fphys.2018.00573

Keskin, K., & Tokat, F. (2023). Alzheimer ve fiziksel aktivite. F. Hazar (Editör), *Fiziksel aktivite ve sağlık* içinde (ss.285-293). Efe Akademi Yayınları.

Krishnan, S., Tokar, T.N., Boylan, M.M., Griffin, K., Feng, D., Mcmurry, L., & Cooper, J.A. (2015). Zumba® dance improves health in overweight/obese or type 2 diabetic women. *American journal of health behavior*, *39*(1), 109-120. https://doi.org/10.5993/AJHB.39.1.12

Laskowski, M. (2013). Wykorzystanie czynników grywalizacyjnych w tworzeniu aplikacji użyteczności publicznej. *Nierówności społeczne a wzrost gospodarczy*, (36), 23-30.

Lassen, A.D., Fagt, S., Lennernäs, M., Nyberg, M., Haapalar, I., Thorsen, A.V., & Beck, A.M. (2018). The impact of worksite interventions promoting healthier food and/or physical activity habits among employees working 'around the clock' hours: A Systematic review. *Food & Nutrition Research, 62*, 1-13. Article 1115. https://doi.org/10.29219%2Ffnr.v62.1115

Ljubojević, A., Jakovljević, V., & Popržen, M. (2014). Effects of Zumba fitness program on body composition of women. *SportLogia*, *10*(1), 29-33. http://dx.doi.org/10.5550/sgia.141001.en.004L

Luettgen, M., Foster, C., Doberstein, S., Mikat, R., & Porcari, J. (2012). Zumba is the "fitness party" a good workout. *Journal of Sports Science and Medicine, 11*(2), 357-358.

Lukić, A. (2006). *Relacije između motoričkih sposobnosti i efikasnosti izvođenja osnovnih elemenata tehnike u sportskom plesu, magistarska teza*. FFViS, Banja Luka.

Maffiuletti, N.A., Bramanti, J., Jubeau, M., Bizzini, M., Deley, G., & Cometti, G. (2009). Feasibility and efficacy of progressive electrostimulation strength training for competitive tennis players. *J. Strength Cond. Res.*, *23*(2), 677–682. https://doi.org/10.1519/jsc.0b013e318196b784

Micallef, C. (2015). Associations of weight loss in relation to age and body mass index in a group of Maltese overweight and obese women during an 8-week Zumba programme. *Sport Sciences for Health*, *11*(1), 97-102. https://doi.org/10.1519/jsc.0b013e318196b784

Perez, B., & Greenwood-Robinson, M. (2009). *Zumba: Ditch the workout, join the party! The Zumba weight loss program.* Wellness Central.

Schink, K., Reljic, D., Herrmann, H.J., Meyer, J., Mackensen, A., Neurath, M.F., & Zopf, Y. (2018). Whole-body electromyostimulation combined with individualized nutritional support improves body composition in patients with hematological malignancies–A pilot study. *Frontiers in Physiology, 9,* Article 1808. https://doi.org/10.3389/fphys.2018.01808

Stamatakis, E., & Chaudhury, M. (2008). Temporal trends in adults' sports participation patterns in England between 1997 and 2006: The Health survey for England. *British Journal of Sports Medicine, 42*(11), 901- 908. http://dx.doi.org/10.1136/bjsm.2008.048082

Stojanovic, E., Ristic, V., McMaster, D. T., & Milanovic, Z. (2017). Effect of plyometric training on vertical jump performance in female athletes: a systematic review and meta-analysis. *Sports Med*., 47, 975–986. https://doi.org/10.1007/s40279-016-0634-6

Tokat, F., & Keskin, K. (2023). Sağlıklı bireylerde sanal gerçeklik uygulamalarının kas ve kuvvete etkisinin incelenmesi: Literatür tarama. C. Özmen (Editör), *Sporun evrensel yolculuğu: Beden eğitimi, kültürel değişim, motor gelişim, dijital pazarlama, fiziksel aktivite ve mutluluk ilişkisi, sanal gerçeklik, kadının rolü ve metaforik algılar* içinde (ss. 99-112). Gazi Kitabevi.

Tiggemann, C.L., Korzenowski, A.L., Brentano, M.A., Tartaruga, M.P., Alberton, C.L., & Kruel, L. (2010). Perceived exertion in different strength exercise loads in sedentary, active, and trained adults. *J. Strength Cond. Res., 24,* 2032–2041. https://doi.org/10.1519/jsc.0b013e3181d32e29

Vanderthommen, M., & Duchateau, J. (2007). Electrical stimulation as a modality to improve performance of the neuromuscular system. *Exerc. Sport Sci. Rev., 35,* 180–185. https://doi.org/10.1097/jes.0b013e318156e785

Vendramin, B., Bergamin, M., Gobbo, S., Cugusi, L., Duregon, F., Bullo, V., & Ermolao, A. (2016). Health benefits of Zumba fitness training: A Systematic review. *PM&R: The Journal of Injury, Function, and Rehabilitation, 8*(12), 1181-1200. https://doi.org/10.1016/j.pmrj.2016.06.010

Wirtz, N., Zinner, C., Doermann, U., Kleinoeder, H., & Mester, J. (2016). Effects of loaded squat exercise with and without application of superimposed EMS on physical performance. *J. Sports Sci. Med., 15*(1), 26–33.