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The Effect of Calisthenic Exercises on Some Physical Characteristics and Muscle Strength in Women Who Underwent Mastectomy

Mastektomi Geçirmiş Kadınlarda Kalistenik Egzersizlerin Bazı Fiziksel Özellikler Ve Kas Kuvveti Üzerine Etkisi

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THE EFFECT OF CALISTHENIC EXERCISES ON SOME PHYSICAL PARAMETERS AND MUSCLE STRENGTH IN WOMEN WHO UNDERWENT MASTECTOMY

ABSTRACT

This study was conducted to determine the effects of calisthenic exercises on certain physical parameters and muscle strength in women who have undergone mastectomy surgery. A total of 30 women, aged between 40 and 60 years, who were receiving post-mastectomy treatment at Çanakkale Onsekiz Mart University Training and Research Hospital, voluntarily participated in the study. Participants were selected using a simple random sampling method. Individuals deemed eligible for measurements by a specialist oncologist were included in the study. Institutional permission and ethical approval were obtained from the Faculty of Medicine at Çanakkale Onsekiz Mart University. The participants' ages were determined based on official identification. Measurements included height, body weight, body fat percentage, circumference measurements, handgrip strength, leg and back strength. The results were presented as arithmetic means ($\bar{x}$) and standard deviations (s_d). Independent samples t-test was used to determine differences between groups. The level of significance was set at $p<0.05$. According to the findings, differences in body mass index, body fat percentage, waist circumference, waist-to-hip ratio, back strength, and relative strength values were statistically significant between the groups ($p<0.05$). Although numerical differences were observed in other variables, these were not statistically significant ($p>0.05$). In conclusion, the more favorable values observed in certain physical characteristics and strength parameters among women who engaged in calisthenic exercises after mastectomy suggest that calisthenic resistance exercises may have a positive impact on muscular system function.

Keywords: Calisthenic Exercise, Mastectomy, Physical Characteristics, Strength.

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MASTEKTOMİ GEÇİREN KADINLARDA KALİSTENİK EGZERSİZLERİN BAZI FİZİKSEL PARAMETRELER İLE KAS GÜCÜ ÜZERİNE ETKİSİ

ÖZ

Bu çalışma, mastektomi operasyonu geçiren kadınlarda kalistenik egzersizlerin bazı fiziksel parametreler ile kas gücüne etkisini belirlemek amacı ile yapılmıştır. Çalışmaya, Çanakkkale Onsekiz Mart Üniversitesi Eğitim ve Araştırma Hastanesi'nde mastektomi sonrası tedavi gören 40-60 yaş aralığında olan, basit rastgele

örneklem yöntemi ile belirlenen 30 kadın gönüllü olarak katılmıştır. Çalışmaya, uzman onkolog doktor tarafından ölçümleri alınması uygun bulunan kişiler dahil edilmiştir. Çalışma için Çanakkale Onsekiz Mart Üniversitesi Tıp Fakültesi'nden *kurum izni* ve *etik kurulu* alınmıştır. Katılımcıların yaşların belirlenmesinde kimlik bilgisi esas alınmıştır. Boy uzunluğu, vücut ağırlığı, vücut yağ yüzdesi, çevre ölçümü, kavram kuvveti, bacak ve sırt kuvveti **ölçümleri alınmıştır.** Ölçüm sonuçları aritmetik ortalama ($\bar{x}$) ve standart sapma (s_s) olarak sunulmuştur. Gruplar arası farkın belirlenmesinde bağımsız gruplarda t testi uygulanmıştır. Anlamlılık seviyesi $p<0.05$ olarak kabul edilmiştir. Elde edilen bulgulara bakıldığında, vücut kütle indeksi ve vücut yağ yüzdesi, bel çevre, bel-kalça oranı, sırt kuvveti ve relatif kuvvet değerlerindeki fark gruplar arasında istatistiksel olarak anlamlı ($p<0,05$), diğer değişkenlere ait bulgularda ise numerik olarak farklı olmasına rağmen istatistiksel olarak anlamsız bulunmuştur ($p>0,05$). Sonuç olarak, mastektomi operasyonu geçiren kadınlarda uygulayan kalistenik egzersizlerin bazı fiziksel özellikler ve kuvvet parametrelerine ait değerlerin daha iyi düzeyde olması, kalistenik direnç egzersizlerinin kas sistemi fonksiyonunu pozitif yönde etkilendiği düşünülmektedir.

Anahtar Kelimeler: Kalistenik Egzersiz, Mastektomi, Fiziksel Özellikler, Kuvvet.

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INTRODUCTION

Cancer is a disease characterized by the uncontrolled growth of cells due to DNA damage caused by genetic or environmental factors. Currently, it is the second leading cause of death after cardiovascular diseases. As a major global health issue, cancer remains the leading cause of mortality worldwide (Wu, 2025). According to projections, cancer-related deaths are expected to reach 13.1 million by 2030 (Bray et al., 2018). Breast cancer, which is the focus of this study, is the most commonly diagnosed cancer among women and has a high mortality rate (Karakuş and Kurt, 2020).

Breast cancer is the fifth leading cause of cancer-related deaths worldwide, accounting for 6.6% of all cancer fatalities. Its incidence is notably higher in developed countries (Bray et al., 2018). Research indicates that long-term treatment protocols and associated side effects of breast cancer therapy lead to significant declines in health-related quality of life parameters, including muscle strength, muscular endurance, flexibility, and body composition (Fong et al., 2012).

Accordingly, the effects of breast cancer treatment on the musculoskeletal system, particularly in women, lead to a decline in physical function and a reduced quality of life. Studies have reported that these treatment methods are linked to

adverse outcomes such as decreased muscle strength, fatigue, and limitations in joint range of motion (flexibility) (Courneya and Mackey, 2000; Garber et al., 2011).

Exercise programs implemented during oncological treatments have been reported to positively impact body composition, muscle strength, muscular endurance, and joint range of motion. Additionally, these programs contribute to cognitive and psychological well-being. The literature highlights that exercise plays a crucial role in cancer prevention, management, and rehabilitation (Karakuş and Kurt, 2020).

Exercise is a crucial component in maintaining and enhancing human health. Recognizing its significance, the American College of Sports Medicine and the American Heart Association classify exercise as a form of medicine for preventing and treating chronic diseases (Garber et al., 2011). Scientific literature supports that regular physical activity has a protective effect against various types of cancer and serves as a strong preventive measure (Warburton and Nicol, 2006; Friedenreich et al., 2010).

In public health studies, it is stated that activities performed 5 days a week, especially at moderate intensity, reduce the risk of colon and breast cancer, which are the most common, by approximately 20-40% and provide a 26-40% decrease in the recurrence rate (Thune and Furberg, 2001). It is also stated that exercise reduces fatigue in individuals undergoing cancer treatment, increases aerobic capacity, muscle strength, and flexibility, and provides positive effects on mental health and quality of life (Warburton and Nicol, 2006; Durstine et al., 2009; Speck et al., 2010).

Recent studies on cancer diagnosis and treatment emphasize the importance of maintaining an ideal body weight through regular exercise in breast cancer patients (Thune and Furberg, 2001). Weight gain and obesity are common concerns during this process, which can negatively impact treatment outcomes. Exercise plays a crucial role in enhancing venous and physiological lymphatic return in the affected extremity by stimulating skeletal muscle activity. Moreover, muscles are recognized as an endocrine organ due to their secretion of myokines, which contribute to various physiological functions (Pedersen, 2010; Chang and Cormier, 2013).

However, the loss of muscle mass over time can negatively impact blood glucose regulation, leading to metabolic disorders such as insulin resistance, type 2 diabetes, and obesity. These conditions, in turn, contribute to increased morbidity and mortality rates (Perry et al., 2016; Akın et al., 2019).

These findings highlight the critical importance of preserving skeletal muscle mass for maintaining overall health. In women, post-mastectomy exercise prog-

rams play a vital role in sustaining muscle strength and endurance, preserving joint range of motion (flexibility), and enhancing coordination (Hanchard et al., 2012).

Several scientific studies suggest that exercise enhances resistance to tumorigenesis and that the increased energy demand associated with physical activity may slow tumor growth (Kwan et al., 2011; Dönmez and Kapucu, 2017). Additionally, research indicates that resistance exercises positively impact the body post-surgery, leading to significant improvements in quality of life, particularly in social and emotional functioning (Ammitzbøll et al., 2019).

Studies on the effects of exercise in breast cancer treatment indicate that physical activity plays a crucial role in both physical and psychosocial recovery (Düver and Atasavun, 2016; Kaş, 2021). Furthermore, research findings suggest that physical activity extends life expectancy by reducing cardiometabolic risk factors in breast cancer patients (Williamson et al., 2021; Dieli-Conwright, 2022).

Calisthenic exercises have been recognized as a safe and effective approach in the rehabilitation process following breast cancer treatment (Joaquim et al., 2022). However, a review of the current literature reveals a limited number of studies evaluating the effects of calisthenic exercises on body composition, leg-back and grip strength, as well as fundamental motor characteristics such as flexibility and arm movement speed in breast cancer patients. This gap highlights the need for more comprehensive and systematic research in this field.

Studies demonstrating the benefits of calisthenic exercises on both physical fitness and metabolic health could reinforce their role in cancer rehabilitation and facilitate their integration into broader clinical practices (Zullig et al., 2022). To establish a more conclusive understanding of their impact, further research involving larger sample sizes and repeated trials is essential.

The fundamental principle of calisthenic resistance exercises is to apply resistance to muscles, activate motor units, and enhance muscle fiber function. These exercises engage multiple muscle groups simultaneously, promoting high-calorie expenditure and contributing to improvements in body composition. Additionally, calisthenic exercises play a significant role in weight management by facilitating fat burning (Brown et al., 2021).

These bodyweight exercises support long-term sustainable physical development by minimizing the risk of joint and ligament damage while also reducing the likelihood of injury (Koç, 2019). The primary focus of these exercises is to utilize one's own body weight, prevent excessive muscle fatigue, and gradually increase exercise volume by promoting anatomical adaptation (Lasinski et al., 2012).

Regular calisthenic exercises lead to muscle hypertrophy, accompanied by increases in muscular strength and endurance. These improvements are attributed to intracellular protein synthesis, an increase in the number of myofibrils and mitochondria within the muscle, and the enhancement of the phosphagen system (Koç, 2019).

Literature review on post-mastectomy exercise interventions has focused on the impact of physical activity levels on depression and the effects of rehabilitation on physical and psychosocial functions. However, there is a limited amount of research on the effects of calisthenic resistance exercises on basic motor skills, physiological parameters, and physical characteristics following mastectomy. This gap highlights the originality and importance of our study. Therefore, our research aims to evaluate the effects of calisthenic exercises on physical and motor characteristics in women who have undergone mastectomy, while contributing to the existing body of literature."

MATERIAL AND METHOD

Study Participants

This study was conducted to examine certain physical and basic motor characteristics of women undergoing breast cancer treatment in Türkiye. It is a pioneering study involving 30 female participants, aged 40-60 years, residing in the city center and districts of Çanakkale. These participants, who are receiving post-mastectomy treatment at Çanakkale Onsekiz Mart University Training and Research Hospital, were selected through simple random sampling."

Power analysis was conducted once the sample size reached 30 volunteers. The study was concluded when the statistical power reached 0.80. Participants were selected from individuals receiving treatment at Çanakkale Onsekiz Mart University Training and Research Hospital, who were deemed eligible to participate in the exercise program by a specialist oncologist."

Physical Activities

The women participating in the study were divided into two groups: the 'active group,' which engaged in 30 minutes of varied physical activities daily, and the 'inactive group,' which did not participate in any physical activity. The women in the active group followed a physical activity program for 30 minutes, five days a week.

The women in the inactive group did not participate in any physical activity program. According to the World Health Organization (World Health Organizati-

on, 2010), adults aged between 18 and 64 should engage in at least 150 minutes of moderate-intensity aerobic exercise (30 minutes for 5 days) or at least 75 minutes of vigorous aerobic exercise per week. It is also recommended that each exercise session should last at least 10 minutes. According to this protocol, the 15 female volunteers in the active group performed a total of 48 stair-step exercises daily, divided into 3 sets, with complete rest between sets.

Measurement Methods

Anthropometric measurements, strength assessments, measurements were conducted on the female volunteers participating in the study. For anthropometric measurements, height was recorded using a portable stadiometer with ± 0.1 mm sensitivity, ensuring the participant's heels were together, body weight was evenly distributed across both feet, and the trunk was in an anatomical position. Body weight (BW) was measured with a scale having 0.05 kg sensitivity. During all measurements, participants were instructed to remain barefoot and wear sportswear. Each measurement was repeated three times, and the averages were recorded.

Body mass index (BMI) was calculated using the formula: body weight (kg) / height (m^2) (kg/m^2). Waist and hip circumference measurements were taken at the end of exhalation, with the abdomen in a relaxed state, at the level of the umbilicus while the participants stood upright. Hip circumference was measured at the most protruding part of the hips using a cuffed tape measure.

Leg strength was assessed using a dynamometer. Participants positioned their feet on the dynamometer platform with their knees bent between 130°-140°, arms extended, back straight, and body slightly leaning forward. They then pulled the dynamometer bar, held with their hands, vertically upward using their legs at maximum effort. For the back strength measurement, the legs were kept straight. Hand grip strength for both the right and left hands was measured using a hand-held dynamometer.

The researcher positioned the handle of the tool in the participant's preferred hand, with the feet slightly apart. Participants were instructed to apply maximal force, as if bending a spring, in a single attempt (Tamer, 2000).

Ethics Considerations

Permission for the study was obtained from the Clinical Research Ethics Committee of the Faculty of Medicine, Çanakkale Onsekiz Mart University, on 05.07.2024, with approval number E-66779070-050.04-2400153680. Participants

were given detailed information about the study and the tests involved. A signed 'Research Volunteer Participation Form' was obtained from each participant.

Statistical Methods

The SPSS 23.0 statistical software was used to analyze and process the data. The results are presented as the arithmetic mean ($\bar{x}$) and standard deviation (s_d). The normality of the data was assessed using the Shapiro-Wilk test and histogram Q-Q (Quantile-Quantile) plots. Since the data followed a normal distribution, an independent samples t-test was applied to compare the differences between groups. A significance level of $p<0.05$ was considered statistically significant.

FINDINGS

Physical Measurements

Examination of Table 1 reveals that, when comparing the physical characteristics of active and inactive women who underwent mastectomy, the differences in body mass index and body fat percentage values were found to be statistically significant in favor of the active group ($p<0.05$). The findings for other variables, though numerically different, were not statistically significant ($p>0.05$).

Table 1. Distributions of participants' physical measurements(n=15)

Variables	Group	Mean	S_d	t	p
Age (Years)	Inactive	47.60	5.15198	1.384	0.179
	Active	44.00	8.29019		
Height (m)	Inactive	1.55	0.07005	-1.202	0.241
	Active	1.58	0.06020		
Body Weight (kg)	Inactive	76.81	11.18346	1.801	0.084
	Active	69.78	8.46467		
Body Mass Index (BMI) (kg/m²)	Inactive	31.94	5.07185	2.377	0.025
	Active	27.87	3.41614		
Body Fat Percentage (%)	Inactive	21.76	1.75	2.68	0.013
	Active	19.15	3.22		

Environmental Measurements

Results given in Table 2 reveal that, the difference in waist circumference and waist-to-hip ratio was statistically significant in favor of the active group ($p<0.05$).

However, the findings for the other variables, though numerically different, were not statistically significant (p>0.05).

Table 2. Distributions of Participants' Environmental Measurements (n=15)

Variables	Group	Mean	S_d	t	p
Waist Circumference (cm)	Inactive	97.7333	11.90118	**2.679**	**0.013**
	Active	84.9167	12.90143		
Hip Circumference (cm)	Inactive	113.8667	9.28799	1.489	0.149
	Active	108.3333	9.96661		
Waist Hip Ratio (WHR) (cm)	Inactive	0.85	0.072	**2.501**	**0.019**
	Active	0.78	0.081		

The Basic Motor Characteristics

Table 3 shows that, when comparing the basic motor characteristics of active and inactive women who underwent mastectomy, the differences in back strength, relative strength, were statistically significant in favor of the active group (p<0.05). However, the findings for the other variables, although numerically different, were not statistically significant (p>0.05).

Table 3. Distributions of Basic Motor Characteristics of Participants (n=15)

Variables	Group	Mean	S_d	t	p
Grip Strength-Right (kg)	Inactive	21.9780	6.38885	0.744	0.464
	Active	20.0000	7.42233		
Grip Strength-Left (kg)	Inactive	19.5000	6.60325	-1.168	0.254
	Active	25.1667	17.34586		
Back Strength (kg)	Inactive	30.0213	7.63845	**-5.266**	**0.000**
	Active	46.9167	9.03989		
Leg Strength (kg)	Inactive	30.5713	6.42500	-1.153	0.260
	Active	36.4167	18.35735		
Relative Strength (kg)	Inactive	71.90	18.57	**-2.495**	**0.020**
	Active	92.62	24.61		

DISCUSSION AND CONCLUSION

Studies on cancer patients have highlighted issues such as pain, fatigue, muscle weakness, and the need for rehabilitation programs. However, there is a lack of research on the outcomes of oncological rehabilitation during the active treatment

phase (Klassen et al., 2017), which underscores the importance of such studies. Research has also shown that a sedentary lifestyle is one of the main contributors to various non-communicable diseases, including cancer, musculoskeletal disorders, coronary heart disease, hyperlipidemia, diabetes, hypertension, and obesity (Atar, 2020; Eryılmaz, 2020).

It has been reported that an inactive lifestyle increases the risk of developing cancer by approximately 9-19% (Friedenreich et al., 2010). Regular exercise has been scientifically proven to have a protective effect against various types of cancer, providing strong defense against the disease (Warburton and Nicol, 2006; Friedenreich et al., 2010). Additionally, resistance exercises have been shown to improve the quality of life post-surgery, with clinically significant improvements in emotional functioning (Ammitzbøll et al., 2019).

There are very few studies examining the effects of calisthenic exercises on physical and basic motor characteristics in women who have undergone mastectomy. The scarcity of research in this area enhances the significance of our study; however, it also limits the disscussion.

It has been reported that breast cancer treatment, along with long-term treatment protocols and side effects, leads to significant declines in health-related quality of life parameters, including muscle strength, muscle endurance, flexibility, and body composition (Fong et al., 2012).

It has also been reported that, particularly in women after breast cancer, the effects of treatment on the musculoskeletal system lead to deterioration in physical functions and a decrease in quality of life. During this process, treatment methods are associated with negative outcomes such as reduced muscle strength, fatigue, and limited joint range of motion (Winters-Stone et al., 2017). Studies have shown that cancer patients' physical activity is often restricted due to fatigue and other side effects during treatment. However, exercise can help increase physical activity levels by reducing fatigue (Dimeo et al., 1999).

In the presented study physical and basic motor characteristics of active and inactive women were compared. significant differences were found in body mass index, body fat percentage, waist circumference, waist-to-hip ratio, back strength, relative strength, all in favor of the active group ($p<0.05$). other variables owever, were not statistically significant ($p>0.05$). Specifically, the body mass index was 31.9480±5.07 kg/m² in the inactive group and 27.8781±3.41 kg/m² in the active group. The body fat percentage was 21.76±1.75% in the inactive group and 19.15±3.22% in the active group.

When these findings are evaluated, it is evident that regular exercise has a positive effect on body weight, body mass index, and body fat percentage. Maintaining ideal body weight through regular exercise in patients after mastectomy is considered important in cancer treatment (Thune and Furberg, 2001). Studies have indicated that individuals tend to gain excess weight during this process. The exercises performed enhance muscle function by activating skeletal muscles, which are considered an endocrine organ due to the myokines they secrete (Pedersen, 2010).

These findings emphasize the crucial role of preserving muscle mass in maintaining overall health (Akın et al., 2019). The calisthenic resistance exercises implemented in this study aim to load the muscles, activate motor units, and enhance muscle fiber function. By engaging multiple muscle groups, these exercises contribute significantly to body composition improvements through high caloric expenditure. Additionally, they have been shown to support weight management by promoting the use of fat stores as an energy source (Brown et al., 2021).

Research indicates that calisthenic exercises contribute to fat loss by improving body composition, enhance muscle strength, and assist in postural control (Kocamaz and Düger, 2017; Joaquim et al., 2022). These findings align with the results of the present study.

In our study, a statistically significant difference ($p<0.05$) was observed in the circumference and diameter measurements between active and inactive women who underwent mastectomy. Waist circumference was measured at 97.73±11.90 cm in the inactive group and 84.91±12.90 cm in the active group. The waist-hip ratio was found to be 0.85±0.072 in the inactive group and 0.78±0.081 in the active group. These findings suggest that regular calisthenic resistance exercises have a positive effect on waist circumference and waist-hip ratio.

The waist-hip ratio is the ratio of waist circumference to hip circumference and is commonly used to assess the distribution of body fat. It is also a key indicator in evaluating overall health (www.diyetkolik.com/bel-kalca-orani). This ratio reflects the amount of fat in the abdominal area and its potential impact on health risks. For women, a waist-hip ratio between 0.85 and 0.90 indicates a moderate health risk, while a ratio below 0.85 is generally associated with a healthier status.

The waist-hip ratio, which was 0.85 cm in the inactive group, was found to be 0.78 cm in the active group. Regular daily physical activity, particularly through exercises that promote fat burning, helps maintain the waist-hip ratio within the ideal reference range. Research indicates that calisthenic resistance exercises enhance body composition by increasing fat burning, improve muscle strength, and support postural control (Kocamaz and Düger, 2017; Joaquim et al., 2022).

The results obtained in this study regarding the effect of calisthenic exercises align with the existing literature. The fundamental principle of calisthenic resistance exercises is to load the muscles, stimulate motor units, and enhance muscle fiber function. This results in high calorie expenditure, as multiple muscle groups are engaged, which positively influences abdominal fat and its associated health risks. Ultimately, this contributes to an improved waist-hip ratio, a key indicator of overall health (Brown et al., 2021).

In the present study significant differences were observed in back strength, relative strength, all favoring the active group. Back strength was found to be 30.02±7.63 kg in the inactive group and 46.91±9.03 kg in the active group. Relative strength, which refers to the force produced per kilogram of body weight, was measured at 71.90±18.57 kg in the inactive group and 92.62±24.61 kg in the active group.

The study observed that regular calisthenic exercises led to an increase in normal upper extremity joint movements in individuals participating in physical activity after mastectomy. Post-mastectomy exercises for women play a crucial role in maintaining muscular strength, muscular endurance, and coordination (Hanchard et al., 2012).

Several studies in the literature have indicated that exercise enhances resistance to tumorigenesis, with the increased energy demand from exercise helping to slow tumor growth (Kwan et al., 2011; Keilani et al., 2016; Dönmez and Kapucu, 2017). Exercise programs implemented during oncological treatments have been shown to have positive effects on health-related parameters, such as muscle strength, muscle endurance, joint range of motion, and body composition (Karakuş and Kurt, 2020). Exercise is recognized as a key factor in maintaining and improving human health. Consequently, both the American College of Sports Medicine and the American Heart Association advocate for exercise as a treatment option in the prevention and management of chronic diseases (exerciseismedicine, 2025).

Research highlighting the benefits of calisthenic exercises on both physical fitness and metabolic health can enhance the role of these exercises in cancer rehabilitation, promoting their wider integration into clinical practices (Zullig et al., 2022). Studies demonstrate that calisthenic exercises contribute to improvements in body composition, support fat loss, increase muscle strength, and aid in postural control (Dimeo et al., 1999; Joaquim et al., 2022).

Calisthenic resistance exercises promote significant calorie expenditure by stimulating motor units and enhancing muscle fiber function through the engagement of multiple muscle groups. These exercises contribute to reduced body fat, increased muscle mass, enhanced physiological functions, and improved quality of life by alleviating stress (Koç and Kafkas, 2019).

Calisthenic exercises, which are performed using an individual's own body weight, prioritize the prevention of muscle fatigue and the enhancement of training volume through anatomical adaptation (Lasinski et al., 2012). Regular calisthenic exercises lead to muscle hypertrophy, with an associated increase in intracellular proteins, a rise in myofibril and mitochondria count within the muscle, and improvements in the phosphagen system. As a result, muscle strength and endurance improve. Additionally, body fat decreases, lean body mass increases, and body composition improves (Lasinski et al., 2012). To establish norms and create guidelines for patients, studies with large sample sizes and multiple repetitions are necessary.

CONCLUSION

In conclusion, for women who underwent mastectomy, performing calisthenic exercises positively impacts certain physical and basic motor characteristics. This suggests that calisthenic resistance exercises positively affect muscle system functions in women after mastectomy.

Journalism Ethical Considerations

Ethical issues (icluding plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

Author Contribution Sections and Rates

Design of Study: BU(%40), ŞE(%20), BT(%20), HK(%20)

Data Acquisition: BU(%50), ŞE(%20), BT(%20)

Data Analysis: BU(%20), HK(%80)

Writing Up: BU(%40), ŞE(%10), BT(%10), HK(%40)

Submission and Revision: BU(%100)

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