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RELATIONSHIP BETWEEN BURPEE TEST AND BODY COMPOSITION: A SAMPLE OF FEMALE UNIVERSITY STUDENTS

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Abstract: In this study, the aim was to investigate the relationship between the 30-second Burpee test administered to female university students and body composition, as well as certain physical parameters. A total of 50 students voluntarily participated in the study from the Private Security and Protection program at Çankırı Karatekin University, with an average age of 19.24±0.89 years, average height of 164.66±5.94 cm, average body weight of 60.94±4.44 kg, average body fat percentage of 22.93±1.82%, and average BMI of 25.92±2.68 kg/m^2. Variance homogeneity of the data was assessed using Levene's Test, and normal distribution analyses were conducted using the Shapiro-Wilk Test. Pearson Correlation Analysis was performed for the correlational analysis of all parameters. According to the findings of this study, which examined the relationship between the 30-second Burpee test and certain physiological parameters, positive statistically significant relationships were observed between body mass and Burpee, standing long jump and height (cm), and sit-up test and body fat percentage (%) ($p<0.05$). However, no statistically significant relationship was found between body composition and Flamingo balance, Assisted pull-up, and the 10x5m tests ($p>0.05$). In conclusion, the 30-second Burpee test may provide benefits in assessing strength endurance among physiological parameters, particularly body mass. In terms of body composition, the statistically significant negative relationship between body weight and the 30-second Burpee (reps) suggests that body weight should be considered as a determining factor during test trials.

Key Words: Burpee, fitness, athletic performance, physical education

BURPEE TESTİ İLE VÜCUT KOMPOZİSYONU ARASINDAKİ İLİŞKİ; KADIN ÜNİVERSİTE ÖĞRENCİLERİ ÖRNEĞİ

Öz: Bu çalışmada, üniversitede öğrenim gören kadın öğrencilere uygulanan 30 saniye Burpee testi ile vücut kompozisyonu ve bazı fiziksel parametreler arasındaki ilişkinin ortaya koyulması amaçlanmıştır. Yapılan çalışmaya Çankırı Karatekin Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Özel Güvenlik ve Koruma programı kadın öğrencilerinden yaş ortalamaları 19.24±0.89 yıl, boy uzunluğu ortalamaları 164.66±5.94 cm, vücut ağırlığı ortalamaları 60.94±4.44 kg, vücut yağ yüzdesi ortalamaları 22.93±1.82 %, BKI ortalamaları 25.92±2.68 kg/m2 50 öğrenci gönüllü olarak katılmıştır. Verilerin varyans homojenitesi Levence Testi ile normal dağılım analizleri ise Shapiro-Wilk Testi ile yapılmıştır. Tüm parametrelerin ilişkisel analizinde Pearson Korelasyon Analizi yapılmıştır. Elde edilen bulgulara göre, 30 saniye Burpee testi ile bazı fizyolojik parametreler arasındaki ilişkinin incelendiği bu çalışmada, sırasıyla; vücut kütlesi ile burpee, boy uzunluğu (cm) ile standing long jump, vücut yağ yüzdesi (%) ile sit up testi, egzersiz tekrar sayıları arasında pozitif yönde yüksek düzeyde istatistiksel olarak anlamlı ilişkiye rastlanmıştır ($p<0.05$). Vücut kompozisyonu ile Flamingo denge, Assisted pull up ve 10x5m testleri arasında ise istatistiksel olarak anlamlı ilişkiye rastlanmamıştır ($p>0.05$). Sonuç olarak, 30 saniyelik Burpee testi, vücut kütlesi olmak üzere fizyolojik parametreler içinde kuvvet dayanıklılığın değerlendirme aşamasında fayda sağlayabilir. Vücut kompozisyonu açısından, vücut ağırlığı azaldıkça 30-saniye Burpee (freg) arasındaki ilişkinin istatistiki olarak negatif yönde anlamlı olması vücut ağırlığının test denemeleri sırasında belirleyici etken olarak dikkate alınmalıdır.

Anahtar Kelimeler: Burpee, fitness, atletik performans, beden eğitimi

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INTRODUCTION

Humans are inherently mobile beings, capable of movement from birth. The development and enhancement of this ability rely on various methods, which exhibit independent variances based on gender and age. Physiologically and anatomically, gender differences manifest in the proportions of muscle, bone, and fat tissue within our bodies (Nyenhuis et al., 2018). In contemporary society, physical activity is integral to a healthy lifestyle. However, a sedentary lifestyle, characterized by low levels of physical activity and irregular exercise, is prevalent today. This lack of physical activity contributes to health issues among individuals, particularly affecting young people (Patel et al., 2019).

In contemporary society, the wide array of conveniences offered by technology has resulted in a general neglect of comprehensive physical activities encompassing the full range of human body movements and active engagement aimed at maintaining fundamental physical variables. Instead, a sedentary and passive lifestyle has become widespread. This sedentary lifestyle, particularly prevalent among young individuals, is associated with various adverse health outcomes such as rapid weight gain, obesity, and psychological issues (Martins et al., 2016). It is widely accepted that negative health consequences linked to conditions such as excessive weight gain, muscle atrophy, and loss of strength, especially among young individuals, can be mitigated through motor strengthening facilitated by physical activity or exercise (Siervo et al., 2014).

Standards for body composition and physical activity, international health organizations have established standards based on body composition, including the body mass index (BMI) template, which categorizes individuals into four levels: underweight, normal, overweight, or obese (Reuter and Dawes, 2016). These values are indicative of overall health, with the recommendation that they fall within the normal range. However, due to modern dietary habits and physiological differences, women often experience higher weight gain and a greater percentage of body fat compared to men, underscoring the importance of engaging in physical activity (Podstawski et al., 2016).

Role of fitness activities for women, in recent years, there has been a notable increase in women's participation in various fitness activities, driven by the pursuit of both health and aesthetic goals. It is imperative to identify fitness parameters that enhance women's performance, increase energy expenditure, and contribute to achieving the desired body composition, thereby promoting overall health. Moreover, identifying exercise practices that positively influence body composition is essential (Thomson et al., 2007). Fitness parameters, as defined by various researchers, encompass characteristics that influence physical and motor performance. These include coordination, agility, versatility, strength, power, endurance, and body composition (Gibala et al., 2006). Both body composition and elements of motor abilities contribute to fitness suitability (Fernandes et al., 2013). The evaluation of fitness suitability is typically carried out through a range of field tests (Cale, 2014).

İmplementation of Field Tests in Schools, when considering feasibility, field tests can be efficiently and economically implemented in schools in terms of time and organization (Ruiz et al., 2011). Various performance tests are utilized in assessing fitness suitability. Alongside numerous fitness tests administered during preschool and school periods, the Burpee test has gained popularity as a valuable tool for evaluating the fitness performance of both athletes and sedentary individuals (Bingley et al., 2019).

The Burpee test involves an individual beginning in a squat position, touching the ground with their legs, abdomen, and chest, then rising up with the entire body and performing a jump or leap. This test comprises a series of movements executed in a cyclical manner. It should be conducted at a consistent pace without interruptions according to the test protocol, timed for duration, and the maximum number of repetitions achieved is recorded on a chart. The test tempo is considered low to medium, and as it involves maximal repetitions, it serves as a measure of the aerobic system (Bingley et al., 2019).

Today, there are various versions of the Burpee test available, with the most commonly used ones based on test duration: the 3-minute (3MBT), 1-minute (1MBT), and 30-second (30SBT) versions (Borylawski et al., 2020). Research indicates that the Burpee test is an effective method for assessing individuals' endurance performance. While the 1 and 3-minute tests primarily measure muscle endurance, the 30-second test is considered more reliable and applicable for assessing body composition and multiple variables compared to the longer durations (Podstawski et al., 2019). Recent studies suggest that, particularly among sedentary young adults, the 1 and 3-minute tests may lead to increased fatigue levels and decreased perception (Borylawski et al., 2020). The shorter test version is considered more suitable and practical for both children and young adults, as well as adults, due to its greater applicability (Podstawski et al., 2013).

Security guards, being the first to welcome and the last to bid farewell to guests in the institutions they work for, need to maintain a physically fit appearance, a sporty posture, and a proportional body structure to effectively safeguard their areas. Engaging in sports activities is essential for them to always maintain a sturdy physical posture, ready for intervention. Furthermore, considering the significant role of sports and physical activity in various professional fields, this study aims to examine the relationship between body composition (body weight, body mass index, body fat percentage) and aerobic-anaerobic performance variables (explosive leg power, body balance, upper body strength-endurance, and cardiovascular endurance) using the Burpee test (30-second application model) among female university students (prospective security guards). Additionally, it is hypothesized that the findings of this study will contribute to enhancing the athletic performance of this professional group in the field of physical performance testing. The objectives of the study include examining changes in body composition over a 14-week period based on training load variables, as well as changes in physical fitness and aerobic-anaerobic variables, including explosive leg power, body balance, upper body strength-endurance, and cardiovascular endurance.

METHOD

Ethical approval

This study followed ethical standards and received approval from the Atatürk University Faculty of Sports Sciences Ethics Committee in Turkey with reference number (dated: 18/05/2022; decision no:22/5; reference code:E-70400699-050.02.04-2200151951). Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Participants

The sample size for this study was determined through a priori power analysis using G-power software, with a target correlation value (r) of 0.3, an alpha level of 0.05, and a power (1-ß) of 0.80 (Eng, 2003). The study included voluntary female students (n=50) enrolled in the Private Security and Protection program of a university during the second semester of the 2nd year of their associate degree education in 2023, spanning a duration of 14 weeks. The participants had a mean age of 19.24±0.89 years, a height of 164.66±5.94 cm, a body weight of 60.94±4.44 kg, a body fat percentage of 22.93±1.82%, and a BMI of 25.92±2.68 kg/m^2. The sample was chosen to represent the entire population, and institutional approval was obtained for the study. The purpose and details of the study were explained to the students, and their participation was voluntary. The tests were conducted in a closed gym on various days throughout the semester. The study took place at a university-affiliated indoor sports hall during the 2022-2023 academic year. Students interested in participating were instructed to arrive at the designated time and location wearing appropriate sports attire and footwear. Ultimately, the study was completed with the voluntary participation of 50 out of 69 students.

The inclusion criteria for this research are as follows:
being a 1st-year student in the Private Security and Protection program, having taken the Physical Education and Bodybuilding course, coming to the tests wearing suitable sports attire and shoes, completing all test batteries, and being willing to participate in the study, not having an active sports background

The exemption criteria from the study are:
having an orthopedic condition, having a surgical history related to the lower extremities, regular medication use, having a chronic or metabolic disease, experiencing any acute pain or discomfort, and not wanting to continue participating in the study.

Experimental Procedures

The students who participated in the study followed Burpee test-compatible training programs prepared and designed by the researcher for a duration of fourteen weeks. Furthermore, they did not engage in any other training programs during this period. Prior to the commencement of the study, the students were briefed on its design, structure, and content, as well as the potential risks and benefits associated with participation. Detailed information regarding the study was provided beforehand, and the students expressed their voluntary consent to participate by signing consent forms.

Research Design and Tests

This study was designed, implemented, and conducted in a pre-test-post-test experimental design, starting in early February and ending at the end of May (fourteen weeks). The detailed design of the physical exercise program is provided in Table 1. For the physical and physiological assessments of the students in the study, pre-test evaluations were conducted within 1 day before the start of the fourteen-week period, while post-test evaluations were conducted within 48 hours after the end of the fourteen-week exercise period. Fitness variables related to changes in body composition and physical parameters during the 14-week physical exercise period were also examined.

Table 1. Detailed design of the Burpee test-compatible training programs

1.week	**2.week**	**3.week**	**4.week**	**5.week**
10dk jogging ısınma 10 dk streching 20 squat 20 crıs cross 20 climber 20 lunge 10 box jump 5 assist.barfix 10 burpee 30 m sprint 2 dk dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 20 squat 20 crıs cross 20 climber 20 lunge 10 box jump 5 assist.barfix 10 burpee 30 m sprint 2 dk dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 20 squat 20 crıs cross 20 climber 20 lunge 10 box jump 5 asissit. barfix 10 burpee 30 m sprint 2 dk dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 20 squat 20 crıs cross 20 climber 20 lunge 10 box jump 5 asissit. barfix 10 burpee 30 m sprint 2 dk dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 50m sprint*3 20 squat*3 30 jumping jump 30 burpee 20 climber*2 10 trx row*3 10*3 kettlebell swing 5dk jogging streching
6.week	**7.week**	**8.week**	**9.week**	**10.week**
10dk jogging ısınma 10 dk streching 50m sprint*3 20 squat*3 30 jumping jump 30 burpee 20 climber*2 10 trx row*3 10*3 kettlebell swing 5dk jogging streching	10dk jogging ısınma 10 dk streching 50m sprint*3 20 squat*3 30 jumping jump 30 burpee 20 climber*2 10 trx row*3 10*3 kettlebell swing 5dk jogging streching	10dk jogging ısınma 10 dk streching 50m sprint*3 20 squat*3 30 jumping jump 30 burpee 20 climber*2 10 trx row*3 10*3 kettlebell swing 5dk jogging streching	10dk jogging ısınma 10 dk streching 40 squat 20 box jump 20 v-up *3 200m sprint %80 20 sn bosu balance 40 burpee 20*3 ball slam 15*3 kettlebell press *2 dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 40 squat 20 box jump 20 v-up *3 200m sprint %80 20 sn bosu balance 40 burpee 20*3 ball slam 15*3 kettlebell press 2 push up *2 dinlenme 5dk jogging streching
11. week	**12.week**	**13.week**	**14.week**	
10dk jogging ısınma 10 dk streching 40 squat 2 push up 20 box jump 20 v-up *3 200m sprint %80 30 lunge 20 sn bosu balance 40 burpee 20*3 ball slam 15*3 kettlebell press 3 assist. barfix *2 dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 40 squat 2 push up 20 box jump 20 v-up *3 200m sprint %80 30 lunge 20 sn bosu balance 40 burpee 20*3 ball slam 15*3 kettlebell press 3 assist. barfix *2 dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 40 squat 2 push up 20 box jump 20 v-up *3 200m sprint %80 30 lunge 20 sn bosu balance 40 burpee 20*3 ball slam 15*3 kettlebell press 3 assist. barfix *2 dinlenme 5dk jogging streching	10dk jogging ısınma 10 dk streching 40 squat 2 push up 20 box jump 20 v-up *3 200m sprint %80 30 lunge 20 sn bosu balance 40 burpee 20*3 ball slam 15*3 kettlebell press 3 assist. barfix *2 dinlenme 5dk jogging streching	

Figure 1. Experimental Test Setup

Monday: All tests' practical demonstration
Tuesday
09:00 - Body composition measurements, Push up test
13:00 - Standing Long Jump Test (Broad Jump), Assisted Pull-up Machine Endurance
Thursday
09:00 - Sit-up Test for 30 seconds Test, Flamingo Balance Test
13:00 - 10x5 meter Shuttle run, 30SBT
Burpee test-compatible training programs / 14 weeks (total)
Study Conclusion and Analysis Evaluation

Body Height Measurements

The participants' heights were measured in centimeters using a wall-mounted stadiometer (Holtain Ltd, England) following the procedure outlined below: participants stood in the anatomical position with bare feet, heels together, holding their breath, head in the frontal plane, and the top of the head touching the vertex point of the headrest (Gordon et al., 2015).

Body Composition Measurements

To determine the body composition parameters of all participating students, the Gaia 359 Plus BodyPass bioelectrical impedance analyzer was utilized. This measurement method generates and computes information about tissue based on the resistance encountered by low electrical currents passing through body tissues. With the Gaia 359 Plus BodyPass, measurements were obtained for body weight, body fat percentage, and body mass index (BMI) ratios. Students were instructed to stand barefoot on the analyzer, ensuring that the entire sole of their foot made contact with the device. During the measurement process, students were required to remove any metal objects and wear only a T-shirt and shorts. Measurements were conducted in the morning on an empty stomach, with students wearing only shorts and no additional accessories. Shoes and socks were removed, and students stood barefoot on the device, following standard techniques (Nana et al., 2012).

Standing Long Jump Test (Broad Jump) for assessing explosive leg power

The standing long jump test is used to assess the power output of the leg muscles. Athlete participants start by placing their toes just behind the designated line, with their feet positioned in a normal stance parallel to the ground. With arms extended in front and knees bent, they jump forward as far as possible while swinging their arms. Upon landing, both heels of the feet touch the ground simultaneously. This measurement process is repeated twice, and the best distance achieved by the athletes is recorded in centimeters (Plisky et al., 2009; Sassi et al., 2011).

Flamingo Balance Test(s) for assessing body balance

The static balance was assessed using a specific protocol. Students placed their dominant foot on a wooden block measuring 50 cm in length, 4 cm in height, and 3 cm in width. With the other leg bent at the knee and pulled towards the hip, they held the foot with the same-side hand. The timer was initiated while the student maintained balance in this position, standing on one foot on the apparatus for one minute. If the student's balance was compromised by releasing the foot, falling from the platform, or holding onto another surface, the timer was stopped. Once balance was regained and the student stepped back onto the apparatus, the

timer resumed from where it left off. Each attempt made by the students to maintain their balance was considered as a point. The test was conducted twice, and the best performance was recorded (Tsigilis et al., 2002).

Assisted Pull-up Machine Endurance(s) for assessing upper body strength-endurance
The repetitions of pulling up on a pull-up bar were measured using a pull-up bar that was 190 cm in height and had a diameter of 2.5 cm. Students stood under the pull-up bar, hanging, with their arms shoulder-width apart and using a straight (overhand) grip. They pulled themselves up until their chin reached above the pull-up bar and then returned to the starting position. Each completion of this movement was recorded as 1 repetition (Mcquire et al., 2011).

Push-up (freq) for assessing trunk strength
Participants performed the movement by lying face down on the floor, with their bodies lifted and lowered while their body weight was supported by their toes and arms, ensuring that their knees did not touch the ground. The number of push-ups that the participant could complete within 30 seconds was recorded (Pekel, 2007).

10x5 meter Shuttle run (s)
This test was used to evaluate running speed, coordination, and agility. In a 10-meter area marked by two lines, students were instructed to run from the starting line to the opposite line as quickly as possible upon the start command, return to the starting line, and repeat this cycle continuously for 5 times. The time was scored in tenths of a second (Tsigilis et al., 2002).

30SBT measures the Number of Exercise Repetitions (burpees; freq) in 30 seconds
The purpose of the test is to measure the speed of changing body positions. It is also used to assess muscular endurance, and the evaluation is based on the number of test components completed in 10 seconds. The student being evaluated is instructed to squat by bending their knees and waist from a standing position, place their hands on the ground in front of their feet, then kick their legs back to assume a stretched position, return to the squat position, and then stand up. Each position is scored as one point. They are instructed to perform the movement from the "start" command to the "stop" command as quickly as possible. The correct number of repetitions performed by the student in 30 seconds is recorded (Gavkare et al., 2011 & Verstegan and Marcello, 2001).

Data Analysis
For the statistical analysis of the data obtained in the study, SPSS 23 (SPSS Inc., Chicago, IL, USA) package program was used. Normality of the data was assessed using the Shapiro-Wilk Test. Pearson Correlation Analysis was conducted for normally distributed parameters, while Spearman Correlation Analysis was performed for non-normally distributed parameters. The statistical significance level was set at $p < 0.05$.

FINDINGS

Table 2. Descriptive data for the body composition and physical test variables

Variables	n	Mean±sd
Age (years)	50	19.24±0.89
Height (cm)		165±5.94
Weight (kg)		60.9±4.45
Body Fat Percentage (%)		22.9±1.83
Body Mass Index (kg/m^2)		25.9±26.7
Burpee (freq)		12.3±2.67
Standing Long Jump (m)		200±0.05
Flamingo (sec)		181±2.98
Assist. Pull-up (sec)		4.31±1.99
Sit-up (sec)		21.02±3.67
10x5 m shuttle run (sec)		36.8±4.35

Table 2 shows that the average age is 19.24±0.89 years, the average body height is 165±5.94 cm, the average body weight is 60.±4.45 kg, the average body fat percentage is 22.9±1.83%, the average body mass index is 25.9±26.7 (kg/m^2), the average score in the burpee test is 12.3±2.67 (freq), the average standing long jump distance is 200±0.05 meters, the average time in the Flamingo test is 181±2.98 seconds, the average time in the Assisted pull-up test is 4.31±1.99 seconds, the average score in the 30 sec. Sit up test is 21.2±3.67 (freq), and the average time in the 10x5 m shuttle run is 36.8±4.35 seconds.

Table 3. Relationships between parameters

Variable	Height	Weight	BMI	BFP	Burpee	Standing Long Jump	Flamingo	Assisted pull up	Sit up	10 x 5 m
Height (cm)	1									
Weight (kg)	**.727****	1								
Body Mass Index (kg/m^2)	0.011	0.091	1							
Body Fat Percentage	-0.078	-0.098	-0.012	1						
Burpee (freq)	-0.248	**-.321***	-0.152	-0.091	1					
Standing Long Jump (m)	**.382****	0.265	0.251	0.044	0.104	1				
Flamingo (s)	-0.065	-0.043	-0.013	-0.116	0.189	0.095	1			
Assisted pull up (s)	0.163	0.209	0.049	-0.087	0.074	0.215	0.121	1		
Sit up (freq)	-0.146	0.002	0.172	**.304***	0.226	0.166	-0.010	0.122	1	
10 x 5 m (s)	0.221	0.142	-0.203	-0.267	0.202	0.086	0.048	**.437****	-0.055	1

*<0.05, **<0.01

Burpee Test (freq): A statistically low and insignificant negative relationship exists between participants' Burpee scores and their height (cm) (r = -0.248; p = 0.082). A statistically low and insignificant negative relationship exists between participants' Burpee scores and their body mass index (BMI) (r = -0.152; p = 0.291). A statistically low and insignificant negative relationship exists between participants' Burpee scores and body fat percentage (%) (r = -0.091; p = 0.529). A statistically medium and significant negative relationship exists between participants' Burpee scores and body weight (kg) (r = -0.321; p = 0.023).

Height (cm): There is a statistically low and insignificant relationship between participants' height (cm) and the Burpee test (freq) (r = 0.248; p = 0.082). There are statistically low and insignificant relationships between participants' height (cm) and the Flamingo balance test (r = -0.065; p = 0.653), Assisted pull-up test (r = -0.214; p = 0.136), 30 sec. sit-up test (r = -0.100; p = 0.490), and 10 x 15m shuttle run (r = -0.221; p = 0.490). There is a statistically medium and significant positive relationship between participants' height (cm) and Standing Long Jump (m) (r = -0.382; p = 0.006).

Body Mass (kg): There are statistically low and insignificant negative relationships between participants' body weight (kg) and the Flamingo balance test (r = -0.094; p = 0.516) and 30 sec. sit-up test (r = -0.139; p = 0.336). There are statistically low and insignificant positive relationships between participants' body weight (kg) and Assisted pull-up test (r = 0.120; p = 0.408) and 10 x 15m shuttle run (r = 0.106; p = 0.464). A statistically medium and significant negative relationship exists between participants' body weight (kg) and the Burpee test (r = -0.290; p = 0.041). A statistically medium and significant positive relationship exists between participants' body weight (kg) and the Standing Long Jump test (r = 0.286; p = 0.044).

Body Mass Index (kg/m^2): There are statistically low and insignificant relationships between participants' body mass index (BMI) and the Burpee test (r = -0.186; p = 0.195), Flamingo balance test (r = -0.078; p = 0.590), and 10 x 15m Shuttle run (r = -0.099; p = 0.494). There are statistically low and insignificant positive relationships between participants BMI and the Standing Long Jump test (r = 140; p = 0.333), Assisted pull-up test (r = 0.051; p = 0.724), and 30 sec. sit-up test (r = 0.116; p = 0.422).

Body Fat Percentage (%): There are statistically low and insignificant negative relationships between participants' body fat percentage (%) and the Burpee test (r = -0.091; p = 0.529), Flamingo balance test (r = -0.116; p = 0.421), Assisted pull-up test (r = -0.074; p = 0.609), and 10 x 15m (r = -0.267; p = 0.061). A statistically low and insignificant positive relationship exists between participants' body fat percentage (%) and the Standing Long Jump test (r = 0.044; p = 0.761). A statistically low and significant negative relationship exists between participants' body fat percentage (%) and 30 sec. sit-up test (r = -0.284; p = 0.046).

DISCUSSION AND CONCLUSION

The study hypothesized that when applied to female university students, the Burpee test positively affects their body composition. The age range of the included students was suitable for the test, and an enhanced Burpee test measuring aerobic capacity was utilized (Podstawski et al., 2019). Despite assuming a relationship between all parameters, the study's results revealed that the 30-second Burpee test had a statistically significant effect on weight loss (body mass (kg) ($r=-0.321$; $p=0.023$), indicating a moderate negative relationship ($p<0.05$) (Table 3). When examining the literature, it's noted that there are few studies regarding the enhanced Burpee test exercise. The current study aims to determine whether the Burpee test affects body composition and to establish the effect size based on existing literature. The study was conducted to explore the relationships between the Burpee (30 sec.) test and body composition parameters in university students.

Upon reviewing the literature, it was found that the results obtained from the thirty-second Upon reviewing the literature, it was found that the results obtained from the thirty-second Burpee test applied to female undergraduate students in various disciplines at universities were significantly negatively correlated with body mass index (BMI), one of the variables in body composition parameters (Koviç et al., 2021). In another study, Bastuğ (2018) reported significant differences in body weight between pre-test and post-test data after the Burpee test. Additionally, a study by Arfanda et al. (2022) conducted on sedentary female students concluded that the six-week Burpee test increased anthropometric and motoric values. The results obtained are consistent with previous studies. A statistically medium and significant negative relationship exists between participants' body weight (kg) and the Burpee test ($r = -0.290$; $p = 0.041$). There are also statistically low and insignificant relationships between participants' body mass index (BMI) and the Burpee test ($r = -0.186$; $p = 0.195$).

On the contrary, Podstawski et al. (2016) conducted a study involving teachers and students, revealing a significant inverse correlation between the Burpee test and variables such as height, body mass, and body mass index (BMI). Similarly, Nindl et al. (2008) explored the impact of physical activity on body composition in sedentary yet healthy women, observing a 2.2% reduction in total body mass following twenty-four weeks of aerobic capacity-enhancing strength exercises, consistent with existing literature. However, no significant difference in BMI values was observed after a 30-second Burpee exercise. Mandolesi et al. (2018) examined the BMI of female students engaging in various strength-based exercises, finding no significant divergence. Likewise, Kemmler et al. (2010) reported negligible BMI changes following resistance exercises. Additionally, the study detected no substantial variance in body fat percentage, a crucial metric for assessing weight loss. Elsangedy et al. (2021) investigated physically inactive women, finding no meaningful fluctuation in body fat percentage after twelve weeks of resistance training.

On the other hand, the Burpee test exercise is recognized for effectively enhancing parameters crucial for maintaining athletic performance and body composition. The efficient and safe utilization of movements throughout the day holds paramount importance. In this regard, the Burpee test exercise encompasses elements of balance, endurance, strength, power, and agility (Cook et al., 2010). The 30-second Burpee Test is considered a suitable model for evaluating various motor skills, including agility, strength, and balance tests, as it exhibits a high correlation with a range of motor tests. Notably, the most significant determinants of 30-second Burpee Test scores include exercises such as the 10x5 m shuttle run, assisted pull-up, and sit-up. This suggests that performance in the 30-second Burpee Test predominantly relies on bodyweight-based strength and agility, making it a valuable tool for assessing these specific physical fitness components. Studies have demonstrated a relationship between Burpee durations (30 sec) and strength capacity (McRae et al., 2012; Boraczynski et al., 2015). Given that strength is a multidimensional construct (Lammle et al., 2010) and can be assessed using various test protocols (Lopes et al., 2012), this correlation is likely attributed to body weight. Upon examining the obtained data, it is believed that individuals engaging in training aimed at enhancing body composition and aerobic-anaerobic strength levels in various professional fields, particularly those requiring athletic performance and a physical appearance, such as law enforcement personnel (security guards), may benefit from the implementation of Burpee test-based exercises. When considered in a multidimensional context, these exercises are thought to be beneficial for achieving such objectives. The inclusion of university students in the study within a young age range has indicated the suitability of administering tests measuring body composition and aerobic-anaerobic capacity, as well as the enhanced applicability of the Burpees test. The incorporation of both lower and upper body extremities and the trunk in this test has facilitated the measurement of all targeted parameters. Furthermore, to ensure the reliability and validity of the test, the maximal number of repetitions was recorded, indicating that the absence of pauses or hesitations during the test stemmed from the efficient utilization of specific and overall strength in this age group. Consequently, the uninterrupted implementation of the test has yielded valid and reliable results regarding body composition and aerobic-anaerobic capacity.

In a study conducted with forty-five female and fifty-one male university students, it was found that parameters of body composition were significantly correlated with strength endurance in 18-29-year-old females and males, while parameters indicating obesity (BMI, BFM, and VFM) were negatively correlated, but least significantly, with motor performance (number of completed cycles) during excessive effort (Podstawski et al., 2019). In a study by Polevoy et al. (2022) focusing on different age groups, they evaluated the effects of the Burpee exercise on endurance and short-term memory in 15-16-year-old adolescents. They found a significant improvement in variables like endurance and cognitive abilities, such as memory, when physical exercise with Burpees was performed in every Physical Education class for adolescents aged 15-16 years.

Ficarra et al. (2022) mentioned that a 4-week, five-day-a-week online Burpee exercise could be a suitable method to improve the quality of life, upper body strength, and heart rate variability in 13 young adults (aged 22.5±1.39 years, weight 71.8±10.1 kg) during the Covid-19 period. Sperlich et al. (2017) evaluated the effects of two 9-week interventions on overweight women. They reported improved quality of life, physical fitness (i.e., strength and oxygen consumption), and body composition.

The burpee test can be employed as an exercise assessment tool that offers a broad spectrum of physical benefits for female students in professional settings (Kojić et al., 2021). The findings of the study may demonstrate similarities and discrepancies when compared to existing literature. The variances observed could be attributed to the absence of a sports background among female students. However, concerning body composition and physical development, the burpee test effectively engaged various muscle groups of students using their body weight and contributed to overall strength development. As a high-intensity exercise, it accelerated metabolism and increased calorie expenditure, potentially assisting in weight control. It also improved body mobility, particularly enhancing flexibility in squat and plank positions, and targeted functional muscle groups relevant to daily activities, thus enhancing effectiveness in everyday tasks.

In conclusion, it was determined that the results of the Burpees test, which contributes not only to determining aerobic capacity but also to improving anaerobic capacity, showed significant positive changes in some values and were effective at the level of association. Considering that body composition and aerobic-anaerobic endurance are specific characteristics, it is thought that Burpee training programs can be modified by increasing the duration and frequency of training, thus providing the necessary functionality in daily life and within various professional groups. Also, these changes collectively indicate that regular burpee exercises across diverse occupational fields for women could enhance their overall physical health, fitness level, and quality of life.

CONCLUSION AND SUGGESTIONS

In conclusion, the 30-second Burpee test proves to be beneficial in assessing body composition and certain motor skills. From an anthropometric perspective, the statistically significant negative relationship between body weight and the 30-second Burpee (freq) should be considered as a determining factor during test trials, and its scope should be expanded to include additional anthropometric and physiological parameters. Considering the test's accessibility for numerous participants and its low cost and equipment requirements, the 30-second Burpee variation can be applied to assess motor dimensions in pre-school, school, and university populations, both within physical education classes and performance measurements.

The parameters obtained from the study are significant components for students enrolled in university Special Security and Protection programs. Therefore, we believe that clarifying the relationships among these parameters could significantly contribute to the development of course programs. The limitations of this study include factors such as the wide age range of the training groups and the diverse sports backgrounds of individuals. Additionally, if the training duration, frequency, and intensity were higher, the percentage decrease in fat mass obtained might have exceeded the predictions based on current results. Since the focus of the study was on body composition (fat burning), the lack of control over nutrition parameters may have influenced the results. In future studies, we believe that the evaluation of body composition should include the inclusion of nutrition criteria in addition to training.

We know from the literature that a positive protein balance is characterized by muscle gain and fat burning. Therefore, when evaluating future studies related to nutrition plus resistance exercise alongside the results of this study, we believe it will contribute more to the topic.

Data Availability Statement

The datasets are available from Mehmet SOYLER and Hamza KÜÇÜK on reasonable request.

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