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ORIGINAL STUDY

The Effect of Burpee and Plank Exercises on Cardiovascular Fitness Among First-Year Female Students With Central Adiposity (Waist and Abdominal Obesity)

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Abstract

The abdominal area is one of the most prone regions to fat accumulation in women, which negatively impacts cardiorespiratory fitness and overall health. With the growing interest among female university students in improving physical appearance and cardiovascular health there has been an increasing need to adopt effective functional exercises such as the Burpee Plank which combines cardiovascular endurance, muscular strength, and core stability. The study aimed to design and implement Burpee Plank exercises to investigate their effect on the cardiorespiratory fitness of the research sample. The two researchers concluded that the prepared exercises had a positive impact on cardiorespiratory fitness. They hypothesized that there would be statistically significant differences between the pre-test and post-test results of the research population in the selected variables. Research Fields included the human field consisted of 12 first-year female students with central fat accumulation in the abdominal area. The time field extended from December 15, 2024 to March 15, 2025. The place field was the fitness hall at the College of Physical Education and Sports Sciences for Women, University of Baghdad. A training methodology for Burpee-Plank exercises was prepared appropriately to suit the fitness level of the research sample. The implementation of the training program began on December 15, 2024, and continued until March 6, 2025. The duration of the Burpee-Plank training program was 12 weeks, with 2 training sessions per week, totaling 24 training units throughout the program. The research sample consisted of 12 first-year female students aged between 18 and 25 years. The researcher concluded that the positive impact of the exercises led to an improvement in cardiorespiratory fitness. The exercises used had a clear positive effect on body circumference measurements, as well as on the muscular endurance of the abdominal muscles. and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Good Health)

Keywords: Burpee plank exercises, Cardiorespiratory fitness, Core muscles

1. Introduction

These exercises are considered bodyweight-based workouts. Although this approach is not new it continues to be a major trend in fitness due to its unique advantages over other types of training. One of its key benefits is that it requires no equipment just a small space is enough to perform the exercises. These workouts consist of various types of strength training exercises that use the individual's own body weight instead of free weights to provide resistance against gravity. This type of training focuses on the fundamentals and includes a wide range of exercises designed to target all major muscle groups. These exercises are highly popular worldwide due to their effectiveness in building muscle increasing strength, enhancing flexibility, and improving endurance. Most importantly they are suitable for individuals of all fitness levels. Some of the most well-known and effective bodyweight exercises include push-ups the high

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plank and the traditional squat. Sometimes jumping is incorporated and the exercises are performed in three or four stages. Combined these movements form what is commonly known as the burpee exercise (Ficarra et al., 2022). Health fitness is a fundamental component in building a balanced and healthy lifestyle. Its importance is not limited to athletes but extends to all segments of society—especially female university students who face various challenges during the transition from school education to university life.

Numerous studies indicate that the decline in physical activity levels among first-year university students is a widespread phenomenon that requires early intervention due to its strong association with increased health risk factors such as obesity, poor cardiorespiratory fitness, and low muscular and physical efficiency. This issue becomes more apparent among applicants to faculties of physical education and sports sciences, where specific physical standards are required for admission. However, due to the limited number of applicants to this field, some are admitted despite their low physical competence.

From this, the need emerges to design highly efficient training programs that combine effectiveness with ease of implementation and are tailored to the needs of this specific population.

In this context, the idea of applying Burpee-Plank exercises stands out as one type of compound training that merges two functional movement patterns—burpees and planks. These exercises are notable for their ability to simultaneously enhance multiple components of health-related fitness such as muscular strength, muscular and cardiorespiratory endurance, flexibility, and balance. Moreover, they require no equipment, relying solely on body weight as resistance, which makes them especially suitable for this age group that often suffers from low physical competence—provided the training is introduced and performed using a gradual, progressive approach.

Despite the proven effectiveness of burpees and planks individually in fitness programs, there is a notable lack of scientific research addressing the combined impact of these exercises on health-related fitness components in female students with low physical competency, particularly during the early university stage. This represents a knowledge gap both academically and practically. Most previous studies have focused on athletes, males, or examined burpees in general without specifically exploring the combined Burpee-Plank format, which blends stability with dynamic movement in a continuous training style.

Based on the above, the justification for this research arises from the need to:

- Evaluate the effect of Burpee-Plank exercises as a training tool for improving health-related fitness in low-fit female students.
- Provide a training model that can be replicated or adapted to similar contexts.
- Support modern fitness trends that emphasize compound exercises.

Thus, this research aims to fill a research gap identified through an observation of the current physical fitness levels of female students.

Typically, burpee exercises are used to assess performance in strength, endurance, and agility tests(Chandana (2023).

A question that may come to mind is regarding the benefits of burpee exercises, as they are effective in burning excess calories in the body. The average calorie burn for burpee exercises is about 20 calories per minute, and performing around 100 burpees helps burn about 50 calories. Therefore, it can be said that this exercise helps burn calories easily and is useful in achieving an ideal body. However, does the burpee exercise build muscle mass? And does it contribute to increasing appetite and improving metabolism in the body? Taking into account the training doses.

From here the idea for the research arose after reviewing related studies and research. If we harness these exercises with certain additions and a scientifically controlled approach, we might achieve additional benefits that previous studies have not addressed. This research could fill a gap in the literature, responding to an unmet need for studying this independent variable that has not been sufficiently addressed. When focusing on identifying and addressing the negative points in a clear and precise manner this means that there is a problem that we need to find suitable solutions for through the researcher's observation of the phenomenon and reviewing previous sources, books, and similar studies. This generates several questions in the researcher's mind, to which they should apply their research capabilities to answer:

1. *Are Burpee Plank exercises suitable for the study sample?*
2. *Will the newly introduced exercises (Burpee Plank) be effective in muscle building, cardiovascular fitness, and waist circumference measurement for the study sample leading to a noticeable change?*

The research aimed to develop Burpee Plank exercises and to identify the effect of these exercises on improving a key component of health-related fitness, namely cardiorespiratory fitness and muscular endurance of the core muscles (abdomen) among

Table 1. Shows the arithmetic mean and standard deviation, median and skewness coefficient of the research sample.

Variables	Mean	Median	Deviation	Skewness
Weight	75.02	73.30	15.20	.757
Height	165.6	167.0	2.601	.747
Age	19.43	20.11	1.641	.245

first-year female students at the College of Physical Education and Sports Sciences for Women.

The researchers hypothesized that there would be statistically significant differences between the pre-test and post-test results of the study population across the selected research variables. The research encompassed the following domains:

- **Human Domain**: The sample consisted of 12 first-year female students presenting with central fat accumulation in the waist and abdominal regions.
- **Temporal Domain**: The study was conducted from December 15, 2024, to March 15, 2025.
- **Spatial Domain**: The research was implemented in the Fitness Hall of the College of Physical Education and Sport Sciences for Women, University of Baghdad.

2. Methodology and procedures

The research methodology is grounded in experimentation and field testing, guided by observational techniques, practical trials, and the use of instruments and devices in a scientifically modern approach (Jawad and Jassim, 2011). Accordingly, the experimental method using a one-group design was adopted as it aligns with the conditions of the study. Al-Saadaoui and Al-Janabi (2013) noted that "the sample is the model upon which the researcher conducts the entirety and focus of their work." (p. 13). Therefore, the researchers identified the research population as first-year female students with central fat accumulation (waist and abdominal area), aged 18–20 years, at the College of Physical Education and Sport Sciences for Women. The total number of students was 15; however, 3 students were excluded due to their noncompliance with the prescribed training regimen, resulting in a final sample size of 12 students—equivalent to 80% of the research population. To ensure homogeneity among participants, the researchers calculated the skewness coefficient for the research variables (height, weight, and age), as presented in Table 1.

The methods used for data collection in the research included Arabic and foreign sources and references, the World Wide Web (internet) observation, tests and measurements and data recording forms. Additionally, various devices and tools were used including one stopwatch, one whistle, a metric measuring tape, a laptop (DILL) and a handheld electronic calculator (Casio).

2.1. Field research procedures

When selecting research variables and their corresponding tests, it is essential to ensure that they align with the study's objectives and are measurable across the required variables. Accordingly, the researchers selected the tests and measurements used in the study based on prior literature, scientific sources, and expert opinions. These tests are standardized and represent some of the most widely used tools in empirical research.

- Body Weight and Height**:** Measured using the TCS-180L device, which is designed to assess both weight and height.
- Waist Circumference**:** Measurement of the central region (waist and abdomen).
- **International Burpee Test** (Podstawski et al., 2019)

Purpose of the test: To assess muscular endurance in the core area (waist and abdomen).

Appropriate Age Range: 18 to 25 years.

2.2. Performance and calculation method

The individual starts by standing with arms extended in front, performs a squat, then lowers into a push-up position and returns to the starting position. This motion is repeated for three minutes and the number of repetitions performed during this period is recorded.

- **Queens College Step Test** (Radwan, 1998)

Purpose of the test: This test is designed to measure cardiorespiratory fitness associated with a submaximal workload.

2.3. Required tools and equipment

- A step box with a height of 16–17 inches (41–43 cm).
- A stopwatch to measure performance time and heart rate (pulse) recovery time.
- A metronome device to regulate the stepping pace.

2.4. Performance procedure

The examiner first demonstrates the test in front of the students before administering it. Each student is

then given a single trial to practice the movement for 15 seconds.

The student stands in front of the step box, and upon receiving the start signal, begins stepping up onto the box continuously for 3 minutes. When the allotted test time (3 minutes) ends the examiner announces the completion of the test, and the student stops the performance.

At that point the student remains standing on both feet, while a member of the assisting team measures the pulse for 15 seconds starting a few seconds after the student stops.

2.5. Scoring

The pulse measured over a 15-second period is multiplied by 4 to calculate the heart rate in beats per minute

The preliminary tests were conducted as follows:

The researchers performed a pilot study on December 1/ 2024, on a sample of female students from the research population. The purpose of this study was to assess the implementation process of the tests, and the objectives of the pilot study were as follows:

1. To determine the suitability of the exercises for the sample.
2. To ensure the validity of the tests for the sample.
3. To verify the appropriateness and adequacy of the location for conducting the main experiment.

Upon completion of the pilot study, the researchers found that the College of Physical Education and Sports Sciences for Women was the most suitable place to conduct the fieldwork, as all necessary facilities were available. The researchers proceeded to implement the required procedures to facilitate the process.

The pilot study was conducted to evaluate the appropriateness of the tests and the prepared program for the targeted group as well as the competence of the assisting team (Appendics 1) in applying the procedures. The pre-tests which were approved by experts and specialists (names listed in Appendics 2) were carried out on January 29 2024 in the Fitness Hall at the College of Physical Education and Sports Sciences for Women University of Baghdad.

Subsequently the main field experiment was implemented from December 15/ 2024 to March 16 2025.

The specific exercises Burpee Plank were selected by the researchers, and their preparation was based on scientific sources, academic references, and specialized studies in physical fitness. These exercises were presented to the experts (Appendics 2) to assess the difficulty level, sequencing (load mechanism), and suitability for the sample. After evaluation, the appropriate exercises were selected and approved based on the nature of the research and the level of the research sample.

The researchers observed the following foundations in the application of the program:

- The Burpee plank exercises were designed appropriately according to the level of the research sample.
- The training program began on December 15/ 2024 and continued until March 16, 2025.
- The duration of applying the Burpee plank exercises was 12 weeks.
- The training was conducted at a rate of 2 sessions per week totaling 24 sessions.
- The Burpee plank exercises were applied during the main part of the training unit.
- The training unit duration ranged between 25–30 minutes for all parts while the main part ranged between 15–20 minutes.
- The training days were Sunday and Wednesday at 10:00 a.m.
- The training method used was continuous training, and the intensity ranged from 55% to 80%.
- The researcher implemented a gradual increase in training load intensity taking into consideration the number of training sessions per week the number of training weeks in the program the duration of each training unit and the number of repetitions performed. Table 2 illustrates the endurance mechanism

3. Results and discussion

Based on the analysis of Table 3, which presents the significant differences between the pre- and post-test scores of the research sample in the variables of cardiorespiratory fitness, waist circumference, and muscular endurance of the core region (waist and abdomen), the researchers attribute these improvements to the implementation of the Burpee-Plank exercises. These exercises contributed notably to the enhancement of the selected variables and the observed differences between the two testing phases. As noted by Salvador Vicarra (2022, p. 45), "Certain physical exercises have recently been emphasized for their effectiveness in improving health-related fitness and reducing body fat percentage." This observation underscores the nature of the Burpee-Plank as a series of transitional, compound exercises targeting specific muscle groups, with the primary aim of increasing cardiovascular and respiratory efficiency. In turn, these exercises enhance oxygen utilization (Al-Juhani, 2020), nutrient delivery to working tissues, and the

Table 2. Shows the endurance mechanism.

Weeks	Warm-up	Main section	Final section	Total time	Intensity	Intensity determined by heart rate	Rest between exercises
First week	5–10 minutes	Burpee plank exercises 10–15 minute	Relaxation exercises for 5 minutes	25–30 minute	55%	1. Resting heart rate measurement 2. Maximum heart rate = 220 - ag	No rest between exercises when using the continuous training cream
Second week	5–10 minutes	10–15 minute	5 minutes	20–30 minute	55%		
Third week	5–10 minutes	10–15 minute	5 minutes	20–30 minute	60%		
Fourth week	5–10 minutes	12–15 minute	5 minutes	20–30 minute	60%		
Fifth week	5–10 minutes	8–10 minute	5 minutes	20–30 minute	65%		
Sixth week	5–10 minutes	8–10 minute	5 minutes	20–30 minute	65%		
Seventh week	5–10 minutes	8–12 minute	5 minutes	20–30 minute	70%		
Eighth week	5–10 minutes	8–10 minute	5 minutes	20–25 minute	70%		
Ninth week	5–10 minutes	7–10 minute	5 minutes	20–25 minute	75%		
Tenth week	5–10 minutes	5–8 minute	5 minutes	20–25 minute	80%		
Eleventh week	5–10 minutes	5–8 minute	5 minutes	20–25 minute	80%		
Twelfth week	5–10 minutes	8–10 minute	5 minutes	20–25 minute	70%		

Table 3. Mean, standard deviation, calculated T-value, error level, significance level, mean differences, and standard deviation of differences in the Pre-test and Post-test for the research sample variables.

Research Variables	N	Unit of Measurement	Pre-test		Post-test		MD	SDD	t-Value	Significance level (Sig)	Statistical Significance
			AM	± SD	AM	± SD					
Beep Test for Strength Endurance	15	Repetition	32.46	9.146	36.42	9.237	2.446	1.175	11.08	0.16	Significant
Queens College Cardio Fitness Test		Pulse	133.2	19.58	125.5	20.55	3.556	6.879	2.775	0.34	Significant
Abdominal Circumference		Cm	81	20.66	77	19.75	4.033	5.59	3.o2	0.21	Significant

removal of metabolic waste resulting from muscular activity (Pérez-Ifrán et al., 2024). Consequently, the Burpee-Plank exercises have proven effective in developing core muscular strength and endurance in the waist and abdominal regions (Nawaf and Al-Badri, 2024). These findings confirm the functional and physiological benefits of such exercises, particularly in addressing issues of central adiposity and fitness deficiencies (Jawad and Jassim, 2011).

Structured and systematic training enhances the functional performance of the body's physiological systems, enabling them to cope more efficiently with physical exertion while conserving energy expenditure (Kim, 2021). The commitment of the research participants to consistent training contributed to improvements in cardiorespiratory fitness, as evidenced by the Queens Step Test, as well as in core muscular endurance (waist and abdominal muscles) and a reduction in waist circumference. According to Guyton (1997), "Improving the muscular endurance of the core area (waist and abdomen) plays a significant role in increasing the oxygen content in cells by enabling the body to intake larger volumes of oxygen beyond its usual capacity." Reducing fat accumulation in specific areas of the body also enhances pulmonary capacity, which in turn elevates overall cardiorespiratory fitness (Podstawski et al., 2019). Additionally, the effectiveness of the exercises designed by the researchers, combined with a carefully structured training load—including appropriate repetitions and duration—based on credible scientific references, played a crucial role in achieving these improvements (Radwan, 1998).

4. Conclusions

Based on the results, the researchers concluded the following:

1. The exercises had a positive effect, leading to improvements in cardiovascular fitness.
2. The exercises used had a clearly positive impact on midsection circumference measurements as well as on the endurance of the core muscles (midsection and abdominal areas).

5. Recommendations

1. Include the Burpee-Plank exercise in health fitness programs with appropriate intensity levels.
2. Work on integrating the exercises in a balanced and coordinated manner to achieve additional goals and address research gaps.

The authors formally declare that the content of this paper is the original work of themselves

Conflicts of interest

None.

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethical-clearance

This manuscript approved by University of Baghdad/ College of Physical Education and Sports Sciences for Women on (4583/4).

Author's contributions

All contributions of this study were done by the researchers (Tabark Ali and Mona Talib) who get the main idea and work on writing and concluding also with number of experts, **Ms. Sana Khalil** in Statistics, **Tariq Ali Yousef** in revision.

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Data availability

The data that support the findings of this study are available on request from the corresponding author.

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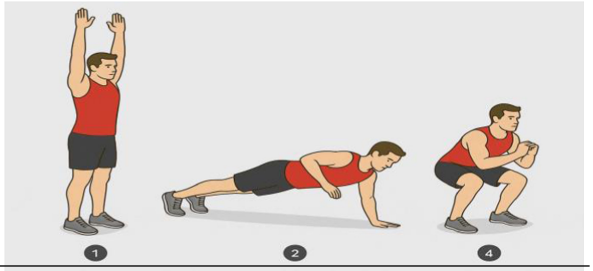
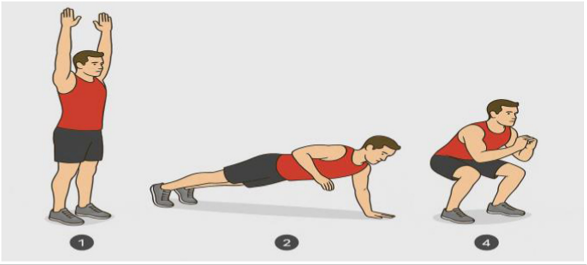
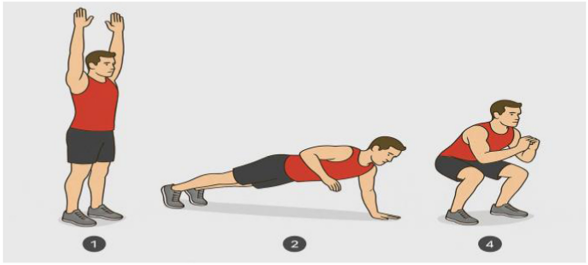
Appendix No. 1

Exercise Number	Exercise Description	Exercise Image
1	From a standing position perform a triple Burpee. At the point of contact perform 3 push-ups then lower to your forearms and perform a plank twist for 8 counts. Return to the starting position and repeat the exercise continuously for 3 sets.	
2	From a standing position perform a Burpee with an open squat to the sides. Upon reaching the point of contact hold a high plank position and perform 8 counts of mountain climbers. Repeat the exercise continuously without stopping for 3 sets.	
3	From a standing position perform a Burpee with a front open squat. Upon reaching the point of contact perform a low plank position while lifting one foot then the other alternately for 8 counts. Repeat the exercise continuously without rest for several sets.	
4	From a standing position perform a jump Burpee Quad Burpee. Upon reaching the point of contact perform a plank by transitioning from high to low plank and vice versa from low to high plank for 8 counts. Then return to the starting position and repeat the exercise continuously without rest for 3 sets.	
5	From a standing position perform a triple Burpee. Upon reaching the point of contact perform a high side plank, first to the right and then to the left for 8 counts (4 counts for each side). Then, return to the starting position and repeat the exercise continuously without rest for 3 sets.	

Appendix No. 2 Shows the names of the experts who were consulted

	Names	Specialization	Academic Title	Workplace
1	Sanaa Khalil Obaed	Professor	Physical Fitness	Al-Mustansiriya University / College of Physical Education and Sports Sciences
2	Ahmed Hassan Yass	Assistant Professor	Sports Science	Al-Mustansiriya University / College of Physical Education and Sports Sciences
3	Hussam Jemaah Rashid	Lecturer	Physiology	Al-Mustansiriya University / College of Physical Education and Sports Sciences
4	Haidar Ali Salman	Assistant Professor	Sports Science	Al-Mustansiriya University / College of Physical Education and Sports Sciences
5	Osama Ahmed Hussein	Professor	Testing & Measurement / Physical Fitness	University of Baghdad / College of Physical Education and Sports Sciences
6	Lamia Abdul Sattar Khalil	Assistant Professor	Rehabilitation / Physical Fitness	University of Baghdad / College of Physical Education and Sports Sciences
7	Mohammed Jawad Kazem	Professor	Sports Science	University of Baghdad / College of Physical Education and Sports Sciences
8	Laila Abdul Amir Ibrahim	Lecturer, PhD	Sports Science	University of Baghdad / College of Physical Education and Sports Sciences