The Effect of Boot Camp Training on Enhancing Physical and Coordinative Abilities and the 200-Meter Event Performance of Female Students

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Effect of Boot Camp Training on Enhancing Physical and Coordinative Abilities and the 200-Meter Event Performance of Female Students

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Abstract

Study Purpose. Through this instructional engagement, the researcher identified a noticeable deficiency in both physical and coordinative abilities, which appeared to adversely affect athletic performance particularly in the 200-meter sprint. This prompted the researcher to explore contemporary methods for enhancing these capacities. Among the approaches identified, Boot Camp training a high-intensity regimen emerged as a promising strategy capable of contributing effectively to this area of physical development.

Materials and Methods. The researcher designed a boot camp training program targeting the enhancement of physical and coordinative skills among fourth-year female students. The program was applied, and its impact was measured through pre-and post-intervention assessments of the variables under investigation.

Results. The findings revealed that boot camp training had a positive effect on the development of both physical and coordinative abilities. This improvement was also evident in the students' enhanced performance in the 200-meter event.

Conclusions. The study concluded that boot camp training is an effective method for improving physical and motor abilities, especially those related to event-specific sprint performance. Based on these results, the researcher recommends emphasizing fitness components associated with running and prioritizing the development of physical and motor capacities in female students' training programs.

Keywords: Boot Camp Training, Physical Abilities, Coordinative Abilities, 200-Meter Event Performance

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Introduction

Sports training is understood as an educational and instructional process that aims, in particular, to prepare athletes of varying levels and physical abilities to reach their highest potential physically, technically, tactically, and psychologically. This is achieved through systematic and precise influence on the body using structured training exercises. These exercises induce specific physiological changes in the functioning of organs and systems within the athlete's body, which in turn lead to improved efficiency of these systems and contribute to achieving elite athletic performance on the international stage.Boot Camp training is closely associated with speed endurance, as this type of training leads to enhanced physiological responses, adaptations, and functional changes within the body's systems under hypoxic conditions. These effects contribute to improving the capacity of bodily cells, systems, and organs to resist oxygen deficiency (Suliarno et al., 2024). Modern theories and methods of sports training have significantly contributed to achieving this goal. The level of training does

not reach a fixed endpoint; rather, it is characterized by continuous progression. What is considered an adequate level today may no longer be deemed sufficient tomorrow (Nasif & Hassan, 2020).

These methods have been carefully developed, refined, and standardized, making them more effective in daily practice. Sports sciences have significantly advanced, evolving from a descriptive approach to a rigorously scientific model. This progress is largely the result of empirical and field-based research conducted on athletes. Among the most prominent foundations of development in the training process is sports planning, which serves as the basis for constructing training curricula and models across short-, medium-, and long-term levels. Coaches are tasked with executing these models by utilizing their practical and scientific expertise, as well as the findings of applied research. This generates a contemporary knowledge base that contributes to guiding athletes toward achieving the required performance levels at the appropriate time. As Qasim et al. (2018) noted, although sports training encompasses a variety of methods and approaches, each with distinct physical characteristics and advantages, modern training is increasingly marked by a shift toward specialization. This is achieved by focusing on the specific performance demands of a given sport through increased training volume during the specialized preparation phase, which serves as an effective means of mobilizing functional physical capacity and stimulating adaptive processes.

Based on her practical experience as a faculty member in the College of Physical Education and Sports Sciences, specializing in track and field, the researcher observed a noticeable slowness and hesitation in the 200-meter event performance among female students. This prompted her to investigate the true causes behind this decline and to search for effective training solutions aimed at improving performance levels. Through continuous observation, the researcher noted that optimal performance in the 200-meter event requires the integration of several physical components, including speed, strength, and motor coordination. These elements play a critical role in developing the muscular efficiency necessary for executing the technical demands of sprinting. However, these capacities were insufficiently developed among the female students, which contributed to a noticeable weakness in their performance Polevoy et al. (2024) emphasize that achieving elite performance levels requires athletes to endure high-intensity efforts involving speed and strength under extremely demanding conditions.

Achieving high-level performance remains one of the primary objectives pursued by the sports system across various individual and team events. To reach this goal, multiple requirements must be fulfilled, foremost among them being physical components. These physical attributes play a pivotal role in developing athletic performance and ensuring continuous progress. The progress and changes observed in these physical components are often the direct result of training, which serves as a true reflection of athletic achievement. Al Maliki and Al Obaidi (2020) define the ability to perform specific movements in the shortest possible time as a key indicator of neuromuscular efficiency. For this reason, researchers are committed to generating scientific findings that assist coaches in improving performance levels, both physically and technically. Guided by this objective, the researcher sought to explore modern training methods, exercises, or instructional strategies that could enhance the physical abilities of female track and field athletes particularly in the 200-meter event. This event demands several key performance components, most notably strength, speed, and coordination, especially during the curve-running phase.

As a faculty member teaching track and field at the College of Physical Education, the researcher observed a noticeable weakness in the students' performance in the 200-meter event. She found that this event requires a range of physical abilities that were insufficiently developed among the students. Through continued observation of their performance levels, it became evident that these abilities did not meet the demands of the event. This realization prompted her

to consult a variety of sources on training methods and modern exercise approaches in order to identify more effective strategies.

The researcher found that boot camp training represents one of the modern, intensive exercise methods that, when performed correctly, can effectively contribute to improving physical abilities. Therefore, she decided to adopt and apply this form of training to the female students under study to examine whether it would lead to measurable differences and improvements in their physical capacities and 200-meter event performance.

Based on this premise, the study aimed to achieve the following objectives:

- To design a boot camp training program intended to improve the physical and coordinative abilities of second-year female students in the 200-meter event.
- To examine the effect of boot camp training on enhancing physical and coordinative abilities, as well as on the performance of second-year female students in the 200-meter event.

To verify the study's objectives, the following hypotheses were formulated:

- There are statistically significant differences between the pre-test and post-test measurements in the physical abilities of the research sample.
- There are statistically significant differences between the pre-test and post-test measurements in the coordinative abilities and 200-meter event performance of the research sample.

The scope of the study was defined as follows:

1. **Human Domain:** The research sample consisted of ten second-year female students from the College of Physical Education and Sport Sciences for Women.
2. **Temporal Domain:** The duration of the study extended from December 14, 2023, to February 15, 2024.
3. **Spatial Domain:** The practical component of the study was conducted at Al-Kashafa Stadium, Baghdad.

To test the research hypotheses and accurately assess the impact of the applied exercises, it was essential to select a scientific method appropriate to the nature of the problem.

The research problem is what determines the appropriate methodology to be used (Hassan & Ali, 2015).

Accordingly, the researcher employed the experimental method, as it is well-suited to applied studies that aim to determine the effect of an independent variable boot camp training on the dependent variables, namely physical and coordinative abilities. This choice was based on the definition of the experimental method, which states: A research method is the approach an individual follows in order to achieve a specific objective (Allawi et al., 1999).

Materials and methods

Study participants

The sample represents all individuals participating in the experiment who share the variables required for the study (Jawad, 2015). Accordingly, the research sample was selected from fourth-year female students in the College of Physical Education and Sports Sciences. The total number of participants was ten (10) students out of a population of ninety-three (93). The sample was randomly selected from Section B, and homogeneity was established among them in the variables of height, weight, and age, as detailed in Table 1.

Table 1. Presents the distribution of the research sample across the variables of height, weight, and age

No.	Statistical Characteristics / Unit of Measurement	Mean	Median	SD	Skewness Coefficient

	Variables					
1	Height	cm	163,8	164	2,89	0,753
2	Weight	kg	68,41	68	0,34	0,442
3	Age	Years	21,83	22	1,18	0,328

Table 1 indicates that the sample is normally distributed, conforming to the Gaussian curve, as the skewness coefficient values fall within the acceptable range of (±1).

Study organization

The experimental method was adopted using the approach of two equivalent groups, with the aim of examining the effect of high-intensity Boot Camp training on the development of selected physical abilities among fourth-year female students. Specifically, the study focused on enhancing the following components:

- Explosive power
- Maximum speed
- Speed endurance
- Coordination ability
- Performance in the 200-meter event

The sample was divided into two groups:

- An experimental group that underwent the training program.
- A control group that did not receive any training intervention.

The researcher ensured control over spatial and temporal conditions and standardized the measurement tools. A pilot study was conducted, followed by pre- and post-tests based on a carefully planned schedule. Statistical analysis was employed to evaluate the differences and their significance.

Research Instrument

The researcher employed the necessary instruments and tools, including data, samples, and equipment, as outlined by Yaqub et al. (2021). These included the following:

- Observation
- Personal interviews
- Testing and measurement
- Internet
- Ropes
- Benches
- Weights
- Weighing scale
- Measuring tape
- Laptop computer

Tests Used in the Research

A series of tests was adopted based on the consensus of a panel of specialized experts, namely:

- Prof. Dr. Aseel Jalil
- Prof. Dr. Israa Fouad
- Assist. Prof. Dr. Eman Sabeeh

The approved tests included the following:

1. Explosive Power: Measured using the *Standing Broad Jump* test (Naji & Ahmed, 2019).

2. Maximum Speed: Assessed by the *30-Meter Sprint from a Flying Start* (Al-Bayk et al., 2018).
3. Speed Endurance: Evaluated using the *150-Meter Sprint from a Standing Start* (Jamal, 2021).
4. Coordinative Ability: Measured through the *Numbered Circles Test* (Rogers, 2020).
5. Performance in the 200-Meter Event: Assessed using the *200-Meter Sprint from a Crouch Start* (Al-Mohsen, 2018).

Pilot Study

The researcher conducted the pilot study on Sunday, December 17, 2023, at 10:00 a.m. at Al-Kashafa Stadium in Baghdad. The study was carried out on a sample of two (2) fourth-year female students. The pilot study served as a scientific trial designed to identify potential strengths and weaknesses that might arise during the administration of the tests, with the aim of addressing and mitigating them prior to the main implementation. Furthermore, the pilot study sought to determine potential challenges in executing the training program and testing procedures, to estimate the time required for each test, and to ensure the readiness and proper functioning of all tools and equipment used (Al-Mandlawi et al., 2020).

Pre-Tests

The researcher conducted the pre-tests, which had been approved by the panel of experts, on Monday, December 18, 2023, at 10:00 a.m. at Al-Kashafa Stadium in Baghdad.

Training Program

- The Boot Camp exercises were implemented with a group of female students from Section B, who were randomly selected. These exercises were conducted during the main section of the training session.
- The training program was applied over a duration of four (4) weeks, at a frequency of two sessions per week.
- The total number of training sessions delivered was eight (8) instructional units.
- Each training session allocated 30 minutes to the main phase of the program.
- The researcher employed high-intensity interval training (HIIT) as the primary training modality.
- The number of repetitions and rest intervals were carefully regulated in accordance with established training principles.
- A variety of training tools and equipment were utilized to support the implementation of the program.

Post-Tests

The researcher conducted the post-tests on Thursday, January 18, 2024, at 10:00 a.m., at the same location as the pre-tests and under identical environmental and procedural conditions to ensure the accuracy and validity of the comparative measurements.

Statistical analysis

The researcher utilized the Statistical Package for the Social Sciences (SPSS) to analyze the pre-test and post-test data for both the experimental and control groups. The statistical tools employed in the analysis included the following:

- Mean
- Standard Deviation

- Median
- Skewness Coefficient
- Percentage
- Paired Samples t-test
- Independent Samples t-test

Results

This study aimed to evaluate the impact of Boot Camp training on enhancing the physical and coordinative abilities of female participants in the experimental group, in addition to improving their performance in the 200-meter event. Pre- and post-tests were administered, and the statistical differences between the two sets of measurements were analyzed using the SPSS software package. The results are presented in the following tables and include means, standard deviations, calculated *t* values, and levels of statistical significance, in order to assess the effectiveness of the implemented training program.

Table 2. Presents the means, standard deviations, calculated *t* values, and significance levels between the pre-test and post-test measurements.

No.	Variables	Unit of Measurement	Pre-Test		Post-Test		Calculated t-value	Significance Level	Statistical Significance
			Mean	SD	Mean	SD			
1	Explosive power	cm	1,25	0,11	1,35	0,13	3,51	0,003	Significant
2	Maximum speed	Sec.	7,08	1,33	6,52	1,21	4,94	0,023	Significant
3	Speed endurance	Sec.	23,27	5,15	21,88	5,58	3,61	0,000	Significant

Table 2 demonstrates statistically significant differences between the pre- and post-test results for the study sample across the physical performance variables: explosive power, maximum speed, and speed endurance. All calculated *t* values exceeded the critical *t* value at a degree of freedom (df) of 9 and a significance level of 0.05, with the differences favoring the post-test outcomes.

The elevated standard deviation values (e.g., speed endurance, SD = 5.58) indicate considerable variability in participants' responses. This suggests the presence of individual differences in the training effect, underscoring the importance of accounting for personal variability when interpreting the program's outcomes.

Table 3. Presents the means, standard deviations, calculated *t* values, and significance levels for the pre- and post-test measurements related to coordinative ability and performance in the 200-meter event

No.	Variables	Unit of Measurement	Pre-Test		Post-Test		Calculated t-value	Significance Level	Statistical Significance
			Mean	SD	Mean	SD			
1	coordinative ability	Sec.	9,1	1,22	7,4	1,82	4,25	0,001	Significant
2	performance in the 200-meter event	Sec.	32,03	5,91	30,4	5,77	3,71	0,195	Significant

Table 3 shows a statistically significant difference in coordinative ability in favor of the post-test. Additionally, performance in the 200-meter event was statistically significant at the 0.05 level of significance with 9 degrees of freedom.

Although the statistical analysis in this study employed tools appropriate to the nature of the sample such as the paired-samples t-test it could have been further strengthened by incorporating additional metrics, particularly measures of effect size, such as Cohen's *d*. These indicators provide a more nuanced understanding of the practical significance of the training intervention and allow for more robust interpretation of its real-world impact. The use of such indicators represents a modern analytical approach that is increasingly being adopted in sports science research particularly in studies involving small sample sizes due to their added precision in evaluating the effectiveness of training programs. Accordingly, the future integration of these metrics is recommended to deepen the level of analysis and enhance the practical validity of the results.

Discussion

Based on the results presented in Tables 2 and 3, statistically significant differences were observed between the pre- and post-test measurements for the study variables. The researcher attributes these differences to the effectiveness of the training program, which employed Boot Camp exercises. The researcher attributes these improvements to the effectiveness of the Boot Camp training regimen, which played a direct role in enhancing explosive power and maximal running speed. An increase in running speed requires a sustained application of force that aligns with the nature of the athletic performance. There is a strong interrelationship between enhanced muscular strength and the acceleration of motor execution (Hussein, 2018). As for speed endurance, it showed improvement as a result of exercises performed using body weight and supplementary tools such as dumbbells, resistance bands, and plyometric jumps. These modalities contributed to greater recruitment of motor units involved in muscular activity. This was affirmed by Majid (2017), who stated, "The force produced and the muscular contraction are directly related to the number of motor units engaged in that contraction" (p. 48).

Moreover, the proposed exercises, implemented through a structured and purpose-driven training approach, contributed significantly to achieving the intended outcomes by elevating the trainees' motor performance to a higher level. This was accomplished by relying on scientifically grounded principles for correct movement pathways and effective coordination during task execution. The application of these exercises using modern training methodologies and diverse equipment enhanced the trainees' efficiency and effectiveness in developing both physical and coordinative abilities in alignment with the specific demands of specialized athletic performance. Furthermore, performing the exercises at high speed and with carefully regulated repetitions aligned with the intensity and velocity of motor performance constituted a critical factor, especially in light of the rapid advancements in achieving elite athletic standards, which are now closely linked to the integration of sports training technologies (Zaki, 2020).

Additionally, consistent adherence to weekly training sessions contributed to notable improvements in both physical and coordinative abilities, which was directly reflected in the enhanced 200-meter event performance among the female participants. Hohmann et al. (2007) emphasized that contemporary training methods and strategies are designed to deepen both theoretical and practical understanding of the scientific foundations of sports training, thereby contributing effectively to the enhancement of the athlete's training status.To enhance instantaneous explosive power, reactive strength training is considered one of the most effective methods (Makenize, 2005). Furthermore, Al Mohsen (2018) emphasized that the integration and variation in exercise design when applied progressively and systematically in terms of intensity and repetitions should be grounded in a gradual load progression, ultimately aimed at achieving maximal speed.

Therefore, implementing the proposed exercises during the main part of the lesson for the experimental group had a clearly positive impact on achieving significant improvement in the variables under investigation. In this context, Prieto-González et al. (2022) argue that improvement in performance level is closely linked to the physical fitness components possessed by the runner, as well as to the ability to direct them appropriately toward achieving better results. This is attained through targeted exercises and physical efforts, which induce physiological adaptations within the body's internal systems, ultimately contributing to a higher level of athletic achievement (Altermann & Gröpel, 2024). This was clearly reflected in the students' 200-meter performance results, indicating that the implemented training exercises effectively addressed many of the challenges they had previously encountered during the execution of the 200-meter sprint event.

Although the proposed exercises demonstrated a positive impact on most physical and coordinative variables, performance in the 200-meter sprint remains an event that demands a high level of integration between physical, technical, and skill-based capabilities. These include start mechanics, curve-running technique, and specific endurance. Therefore, it is recommended that future studies adopt longer training durations ranging from 8 to 12 weeks in order to achieve more pronounced and statistically meaningful improvements in 200-meter performance.

Conclusions

The study concluded that Boot Camp training significantly contributed to the development of the students' specific physical capacities required for successful performance in the 200-meter event. It also had a positive impact on enhancing their coordinative abilities. Consequently, the observed improvements in both physical and coordinative capacities represent a strong foundation for achieving measurable progress in 200-meter performance among the female participants. Accordingly, the study recommends placing greater emphasis on the development of specific fitness components related to sprint performance among female students in physical education and sport sciences programs. This should be achieved through the application of modern training methods.

Furthermore, the integration of knowledge from other scientific disciplines—particularly biomechanics and physiology is essential for the systematic design and regulation of training curricula across various track and field events, in alignment with principles derived from these sciences. Therefore, it is recommended that physical education and sport science instructors conduct regular performance assessments to identify key technical errors, and based on these assessments, implement targeted training interventions aimed at correcting such deficiencies and enhancing overall athletic performance. The researcher also recommends designing a 12-week training program to yield more significant results in the targeted event, which can subsequently be compared with the outcomes of an 8-week training protocol.

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Conflict of interest

The author declares that they have no conflicts of interest that could influence the outcome of this study.

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Appendix 1. Proposed Boot Camp Exercises

1. Leg raises from a supine position – 30 seconds
2. Traditional squat
3. Dumbbell squat
4. Jump squat
5. Lunge with a forward jump from a standing position using one leg
6. Push-up from a plank position, with hands placed directly under the shoulders, lowering the body slowly by bending the elbows in a controlled descent.
7. Box jumps from a standing position onto a box 40 cm high, with emphasis on landing technique.
8. Jump rope exercise for 30 seconds.
9. Sprint running for 30 seconds.
10. Standing broad jump forward.
11. Lateral dumbbell raises
12. Single-leg stand for 30 seconds (each leg)
13. Bent-over dumbbell lift
14. Squat for 30 seconds
15. Stair climbing for 30 seconds

Appendix 2. Training Unit Model

Unit Duration: 30 seconds

Main Section of the Unit: Development of physical and coordinative attributes

Week & Unit	Section	Exercise	Repetitions	Execution Time	Rest Between Repetitions	Sets	Rest Between Sets	Intensity
Week One	Main	1	10	10 sec.	1 sec.	3	60sec.	90 %
		7	10	20 sec.	2 sec.	2	120 sec.	
		8	10	30 sec.	–	2	120 sec.	
Unit One		15	5	60 sec.	30 sec.	2	120 sec.	
		9	5	30 sec.	30 sec.	2	120sec.	
		5	10	30 sec.	30 sec.	3	60sec.	

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