



AN ANALYTICAL STUDY OF EXPLOSIVE POWER OF LOWER LIMBS AND DYNAMIC BALANCE ON ACHIEVEMENT LEVEL IN HIGH JUMP AMONG FIRST-STAGE PHYSICAL EDUCATION STUDENTS

Dr. Zainb Juni Kotti

Baghdad Education Directorate, Al-Rusafa
IRAQ

Corresponding Author: amzynbj@gmail.com

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ABSTRACT

Background. This research included the introduction and the importance of the high jump event. **Objectives.** The research aims to conduct an analytical study to identify the explosive power, dynamic balance, and pushing force in the high jump event among first-stage students at the College of Physical Education and Sports Sciences / University of Baghdad. **Method.** The descriptive approach was selected as the most appropriate for the study, and the research population was determined purposively, including first-stage students. The researcher used the descriptive approach with a single-group survey method. Several tests appropriate to the research requirements were conducted, and the Statistical Package for the Social Sciences (SPSS) was used to extract and analyze the results. **Results.** The researcher reached several conclusions: there are contribution percentages for the research variables that are related to the high jump. There is an effect for each variable according to its contribution percentage. **Conclusion.** The researcher made several recommendations, including conducting extensive studies on the physical and skill abilities in the high jump, as well as other jumping events.

Keywords; Analytical study, Explosive power of the lower limbs, Dynamic balance, High jump.



A. INTRODUCTION

Improving the level of sports performance in general requires knowledge of the physical and technical abilities that contribute to the performance of each event and skill. The high jump event is considered one of the technical skills that requires high motor accuracy and high coordination among body parts, as well as numerous and varied requirements. The ability to control the body during movement is one of the prerequisites that ensure safe and effective sports performance, especially in the high jump, which requires special technique and changes in directions and continuous movement between jumping, flying, crossing, and then landing.

The vertical jump is considered one of the fundamental motor skills in the high jump, especially during flight and then crossing, as it is a primary factor that directly affects the player's ability to cross the coordination between muscle power (especially of the lower limbs), speed, balance, in addition to correct performance (technique) makes the performance successful. Hence lies the importance of the research in identifying the contribution percentage and the effect of balance and explosive power on the achievement of the high jump event.

Through the information adopted from the first-stage professors at the College of Physical Education and Sports Sciences, the researcher's experience as a former player and current coach, and her observations of the students' level in this stage, the researcher was prompted to conduct an analytical study on the high jump event. Through correct diagnosis, special training curricula can be developed according to studied scientific foundations.

The objectives of the research are identifying the level of achievement in the high jump among the sample, identifying the relationship between explosive power and dynamic balance, and identifying the percentage of the effect of these variables on achieving in the high jump among first-stage students at the College of Physical Education and Sports Sciences. The hypotheses of the research state that there is no statistically significant relationship between explosive power moreover, the high jump among the sample, and there is no statistically significant relationship between dynamic balance and the high jump among the sample.

The fields of research include first-stage students at the College of Physical Education and Sports Sciences/University of Baghdad for the academic year 2025-2026, with the temporal field spanning 17/2/2026 – 18/3/2026 at the athletics field.

B. METHOD

Participant.

It consists of students from the College of Physical Education and Sports Sciences / University of Baghdad (First Stage). The research population was selected purposively, while the sample was selected randomly and consisted of (10) students from Section (1-B). Table 1 shows the homogeneity of the research sample individuals in the research variables.

Table 1. Homogeneity of the research sample individuals.

STATISTICAL MEANS VARIABLES	UNIT OF MEASUREMENT	MEAN	STANDARD DEVIATION	TORSION COEFFICIENT	VARIANCE
Height	cm	1.72	5.982	-0.308	35.789
Weight	kg	59.600	5.399	0.757	29.156

STATISTICAL MEANS VARIABLES	UNIT OF MEASUREMENT	MEAN	STANDARD DEVIATION	TORSION COEFFICIENT	VARIANCE
Age	Year	19.8	1.045	1.144	1.094

Where the skewness coefficient percentage of (± 3) indicates the homogeneity of the sample.

Research Design.

Researcher chose the descriptive approach with a survey method because it is consistent with the study's problem and objectives, as the study aims to identify and analyze the contribution percentages of physical and skill abilities of the research population.

Instrument.

Devices and tools used in the research include high jump apparatus, measuring tape, medical scale, running track, whistle, DELL laptop computer, and registration forms.

Procedures.

The researcher prepared a list of a set of tests that included some physical tests specific to jumping, leg pushing force, and balance, and presented them to some experts. She selected the tests that obtained the highest percentage, as shown in Table 2.

Table 2. Expert opinions on physical tests

NO.	TEST NAME	OBJECTIVE OF THE TEST	AGREE	DISAGREE	PERCENTAGE
1	Standing Broad Jump	Explosive power of the legs			75%
2	Dynamometer test (Leg and back muscles)	Leg and back muscle strength			65%
3	Balance (Three-step jump)	Balance and coordination			90%
4	Standing Vertical Jump	Measuring explosive power of the lower limbs			85%

The tests used in the main experiment (Tuesday and Wednesday, 17-18/2/2026) were:

- Sergeant Vertical Jump Test: Measures the explosive power of the lower limbs and determines the maximum height that can be reached by a vertical jump.
- Three-Step Balance Test: Measures balance and coordination (measuring speed-strength, muscular ability of the legs).
- High Jump Test (Achievement): Measuring the best result achieved by the tested person in the high jump

An exploratory experiment was previously conducted on 15-16 / 2 / 2026 to identify the difficulties that might appear during the main experiment and to ensure the safety and suitability of the tools.

Analysis plan.

The statistical package SPSS was used to process the data resulting from the tests, using the arithmetic mean, median, standard deviation, skewness coefficient, regression coefficient, and correlation coefficient.

C. RESULTS AND DISCUSSION

Results

To identify the relationship between the research tests and their impact on high jump achievement, Table 3 presents the arithmetic means, median, and standard deviations of the research variables.

Table 3. Arithmetic means, median, and standard deviations of the research variable

NO.	STATISTICAL MEANS TESTS	UNIT OF MEASUREMENT	MEAN	STANDARD DEVIATION	TORSION COEFFICIENT	VARIANCE
1	Vertical Jump	cm	0.44	0.606	-0.014	0.004
2	Balance (Three jumps)	meter	6.21	0.234	-1.100	0.055
3	High Jump Test	m/cm	1.27	0.122	0.122	0.015

Table. 3 shows the arithmetic means and standard deviations for each variable of the research. The arithmetic mean of the vertical jump test was (0.44) with a standard deviation of (0.606). The three-step balance test arithmetic mean was (6.21) with a standard deviation of (0.234), and the high jump test arithmetic mean was (1.27) with a standard deviation of (0.122).

Table 4. Multiple correlation coefficient, coefficient of determination, and significance level (Sig)

STATISTICAL TREATMENTS VARIABLES	MULTIPLE CORRELATION COEFFICIENT (R)	COEFFICIENT OF DETERMINATION (R ²)	F VALUE	VARIANCE PERCENTAGE	SIGNIFICANCE LEVEL (SIG)
High Jump Achievement	.941	.885	14.135	94.6 %	.012

At a significance level of (0.05)

Table 5. Calculated Beta value (R), t value, and significance level (Sig)

STATISTICAL MEANS VARIABLES	BETA COEFFICIENT VALUE	T VALUE	SIGNIFICANCE LEVEL (SIG)	SIGNIFICANCE
Vertical Jump	0.989	7.271	0.001	Significant
Balance	-0.470	-3.457	0.011	Significant

Discussion

From Table 4, it is evident that the multiple correlation coefficient (R) reached (0.941), which is an excellent level and indicates a strong correlation between the standing vertical jump, dynamic balance and coordination, and achievement in the high jump. The coefficient of determination (R²) reached (0.885), which explains that all these variables together represent (88.8%) of the variance percentage in high jump achievement. The remaining percentage (11.2%) is attributed to other factors not included in the research tests or to random error.

From Table 5, the standing vertical jump test is considered the most positively influential on high jump achievement among the other variables (Beta value: 0.989, Sig: 0.001), reflecting the importance of the explosive power of the legs in achieving the best performance in the high jump. This agrees with biomechanical principles that confirm that

the speed and force of takeoff directly affect the rise of the body's center of gravity. For the balance test (three-step jump), despite the Beta coefficient being negative (-0.470), the effect of balance is statistically significant (Sig: 0.011). This reflects the athlete's ability to maintain neuromuscular stability and motor coordination, contributing to improving the control of body movement through the approach and takeoff.

Explosive power is not limited to overcoming external resistances only, but extends to include the individual's ability to move his body mass or part of it at maximum speed. Balance is considered one of the essential elements during movement or stillness; it is a system that integrates neuromuscular control, physiology, and physics.

From a physiological perspective, the contribution of the standing vertical jump can be explained by its association with the explosive power of the lower limb muscles, as the production of height depends on the speed of motor unit recruitment and utilization of the muscle stretch-shortening cycle. Production of explosive power does not depend only on the cross-sectional area of the muscle, but depends primarily on the efficiency of the nervous system, including intramuscular and intermuscular coordination.

The results of the study showed that balance and the standing vertical jump have a contribution to explaining the level of high jump achievement. Successful performance in the high jump requires integration between explosive muscular power and balance, leading to reducing energy loss during the takeoff phase and improving the direction of force.

D. CONCLUSION

The researcher reached the following conclusions: there is a positive statistically significant relationship between explosive power and high jump achievement; there is a positive statistically significant relationship between dynamic balance and high jump achievement; and there is a positive relationship between explosive power and dynamic balance. The researcher made several recommendations, including conducting similar studies with a larger sample size to yield more results that are accurate, and conducting similar studies on other jumping events.

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F. AUTHOR CONTRIBUTION STATEMENT

ZJK conceptualized the research idea, designed the methodology, conducted the field experiments, performed the statistical data analysis, and wrote the manuscript.

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