
Research Article

Formulation of standard and benchmarks for weight lifting maximum strength and muscular power test for students Faculty of Physical Education and Sports Sciences

¹Mahmoud Adnan Mahmoud kaid al-Rubaie, ²Dheyaa Jalil Hussein and ³Nabeel Abdulkadhim Athab

¹⁻²*University of Babylon, The College of Physical Education and Sport Sciences, Iraq*

³*University of Babylon, The College of Physical Education and Sport Sciences, Ph.D. in Sports Medicine, Iraq*

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Abstract: The aim of the present study was to emphasize on establishing the norms and standards for test maximum strength and weight lifting muscular power at second year students – College of Physical Education and Sports Sciences – University of Babylon. The methodology used in this research was a descriptive survey method that was considered to be the most appropriate type of research for the researcher. The study sample was 40 male students with duration October 15, 2025 - May 3, 2026. Various anthropometric measurements and physical tests, such as height, body mass, one-repetition maximum (1RM) test for maximum strength and vertical jump and medicine ball throw for muscular power were used by the researcher. The data was analyzed using mean, standard deviation, skewness coefficient, Z-scores and T-scores as well as percentages to find the standard level. The results showed the possibility of creating standards and benchmarks for scientific procedures in assessing the maximum strength and muscular strength and put participants into different standard levels based on their differences. The results of the research indicated that the standards provide an objective means of judging students and can be utilised as a tool for designing educational and training courses and for assessing and selecting weightlifters in faculties of physical education and sports science.

Corresponding Author:

Mahmoud Adnan Mahmoud kaid al-Rubaie

University of Babylon, The College of Physical Education and Sport Sciences, Iraq

INTRODUCTION

Testing and measurement is an integral part of physical education and sports science. It includes accurate scientific instruments for assessing physical and skill levels, measuring performance and making decisions on objective data. It is a significant factor in sports that require physical strength and muscle power, especially weightlifting, where a combination of physical fitness and technique is essential for success.

Weight Lifting involves maximum strength and muscular power, neuromuscular coordination, technique and precision in performing the snatch and clean and jerk movements. Hence, it is important to assess these factors based on prescribing standard science tests to assess student learning progress and reveal their weaknesses and strengths. Also aids in the creation of training and educational programmes as per their individual levels^[1]. The setting of standards and benchmarks, is an important part of sports measurement. It facilitates a comparison between performance of individuals and the performance of other people in the same community, and includes quantitative measures to provide teachers and coaches with more meaningful and objective assessment of test result. Standards also help to place students in groups, increasing the efficiency of assessing/selection/advising procedures and increase the equity and reliability of decisions based on test results^[2].

Especially in university settings, such as the faculties of physical education and sports science, the demand for individual standards which are applicable to students according to their age, physique and level of theoretical and practical training is strongly felt. The creation of normal values for maximum strength and muscular power tests involving lifting activities, therefore, is one of the contributions to the scientific reference area that allows using in periodical evaluations, in the establishment of practical curriculum and in the improvement of the quality of school outcomes^[3].

Therefore, it is necessary to develop the standards and benchmark levels of strength and muscular power test according to the weightlifting requirements for the students at Faculty of Physical Education and Sports Science. This will help provide correct and reliable instruments used to examine, assess physical performance and in the educational and training aspects of sports and also in the scientific examination areas which will help to raise the quality of students and reach the optimum level in sports.

Research Problem: The main problem of this research is the absence of accurate local standards and benchmarks in assessing the results for the test of maximum strength

and muscular power in weight lift related to psychomotor field instructions in the Faculty of Physical Education and Sports Sciences. This can result in either personal judgment or standards constructed in different subgroups characterized by differing training, age and physical abilities. This makes it challenging to make an objective and scientific evaluation of the students' performance. As such, it was necessary to develop standards and benchmarks, which were rooted in actual research sample data, to enhance the accuracy of evaluation, planning for educational and training purposes and necessary decision making.

Research Objectives:

- To create standards of maximum strength and muscular power test in weightlifting for the second year College of Physical Education and Sports Sciences students.
- To set normal standard values for the classification of the students' results in maximum strength and muscular power tests by scientific and statistical principles.
- To ensure an evaluative reference to help coaches and instructors evaluate student performance and use it for education and training in weightlifting..

Research Hypotheses:

- In the College of Physical Education and Sports Sciences, scientifically important standards and levels can be prepared for maximum strength and muscular power tests for second year students.
- The research sample has individual differences in the maximum strength and muscular power results obtained from the tests, thus individual differences can be classified based on their test results in accordance with the standard levels.

Research Scope:

- Human Scope: Second-year male students at the College of Physical Education and Sports Sciences, University of Babylon, totaling (40) students.
- Timeframe: From September 15, 2024, to May 3, 2025.
- Location: The laboratories, sports halls, and training facilities of the College of Physical Education and Sports Sciences at the University of Babylon.

MATERIALS AND METHOD

Research Methodology: The researcher used descriptive survey method because it is appropriate in dealing with the type of the research which is to determine maximum strength and muscular power tests for college of physical

education and sports sciences students. This approach enables collection, analysis and description of the data and derivation of the appropriate standards according to the results obtained from the sample data.

Research Population and Sample: Second-year students of College of Physical Education and Sports Sciences, University of Babylon for the academic year (2024–2025) were the population of the study. The sampling technique adopted was purposive sampling and the sample comprised of (40) male students representing the study population who attend practical weightlifting class.

Sample Homogeneity: The homogeneity of sample was ensured by calculating the basic statistics for the age, height, and weight such as the average, standard deviation, and skewness coefficient. When the Skewness coefficient values fall in the statistically acceptable range (around plus or minus 1 or plus or minus 3 depending on the references) then it is said the data distribution is homogeneous.

Equipment and Tools Used in the Research:

- Standard Olympic barbell with various weight plates.
- Weightlifting platform.
- Rack for performing some strength tests.
- Digital stopwatch.
- Electronic medical scale for measuring mass.
- Stadiometer.
- Measuring tape.
- Pictures to show results.
- Electronic calculator and computer for data entry and analysis.
- A statistical software like SPSS or similar is available.

Pilot Study: To test the suitability of the equipment and tools, to understand the steps in conducting tests, to know the duration of each test, to find the possible obstacles in organizing, and to train the support team towards the procedures of measuring and recording the results, the researcher conducted a pilot study with some limited students beyond the sample^[4].

Measurements and Tests Used in the Research (Specialized Version for Weightlifting): The researcher took up care to take those tests which were directly related to the performance requirement of the weightlifting as they were reliable in the measurement of muscular power which is required during snatches and clean and jerk and maximum strength.

First: Anthropological Measurements:

- Height (cm) measured using a height measuring device.

- Body Mass (kg) measured using an electronic medical scale.
- Chronic Age (years) recorded.

Second: Maximum Strength Tests:

- Back Squat 1RM Test
- Purpose: To measure the maximum strength of the lower limb muscles.
- Equipment: Olympic barbell, weight plates, barbell rack.
- Performance: After a gradual warm-up, the student performs one attempt to his or her maximal strength and to proper technique.
- Recording: The highest weight (in kilograms) successfully lifted is recorded.
- One-Repetition Clean Pull (1RM) Test
- CONTRACTION: pull motion strength for weightlift.
- Equipment: Olympic Barbells and weight plates. The weight of the most successful throw following the technical instructions is recorded.

Third: Muscular Strength Tests:

- Standing Vertical Jump
- This test is to test the explosive strength of the leg muscles.
- Equipment: Jumping apparatus or board.
- Scoring: The student's best height achieved in centimeters out of three attempts is recorded.

Medicine Ball Forward Throw Test:

- Purpose: To measure the muscular power of the arms and shoulder girdle.
- Equipment: Medicine ball weighing (3–5 kg) and a measuring tape.
- Scoring: the best distance (in meters) of three trials by the student is scored.

Test Procedures:

- Have general and specific warm-up prior to the tests.
- Give a common reason to everyone.
- Provide sufficient recovery times in between tries to prevent fatigue. All tests are done under same condition and with same equipment.
- Each student's best attempt is used in statistical analysis.
- Establishing Standards and Normative Levels.

Table 1: Show mean, standard deviation and torsional coefficient for the ultimate strength test (back squat 1RM)

Variable	Mean	Std	Skewness
Maximum strength (kg)	112.40	14.85	0.41

Table 2: Show Mean, Standard Deviation and Torsion Coefficient for the Vertical Jump Test

Variable	Mean	Std	Skewness
Vertical jump (cm)	48.25	5.72	0.18

Table 3: Show Mean, Standard Deviation and Skewness Coefficient for Medicine Ball Throw Test

Variable	Mean	Std	Skewness
medicine ball throwing (m)	6.84	0.91	-0.22

Table 4: Show distribution of sample members according to standard levels

Level	Number of students	Percentage
Excellent	5	12.5%
Very Good	8	20.0%
Good	11	27.5%
Average	9	22.5%
Acceptable	5	12.5%
Poor	2	5.0%
Total	40	100%

Table 5: Show model for converting raw scores to standardized scores (Z and T)

level	Grade T	Grade Z	Raw grade (kg)
Excellent	68.6	1.86	140
Very Good	58.5	0.85	125
Good	49.7	-0.03	112
Average	41.6	-0.84	100
Acceptable	33.5	-1.65	88

Table 6: Show standard levels for maximum strength and muscular power tests related to weightlifting among second-year students in the College of Physical Education and Sports Sciences

Appreciation	T-Score	Standard level
Excellent	< 70	70 and over
Very Good	60–69	60 – 69
Good	50–59	50 – 59
Average	40 – 49	40 – 49
Acceptable	30 – 39	30 – 39
Poor	< 30	Less than 30

The scores are all tallied and the raw scores are subsequently transformed to standardized scores (Z-scores), t-scores and the subsequent standardized levels^[5]:

- Excellent
- Very Good
- Good
- Average
- Acceptable
- Poor

The following classification is accepted as scientific criterion to evaluate the level of maximum strength and muscular power of the second year students of the

College of Physical Education and Sports Sciences – University of Babylon and to monitor the physical development of these students and guide their education and training programmed in weightlifting^[6].

Main Experiment: The pilot study was completed during the nominated research project period, with the main experiment having been carried out afterwards. All participants were standardized about testing location, warm-up, sequence of their performances, and rest time. Response was recorded on specially adapted forms to be statistically analyzed and to set out norms and standard levels.

Statistical Methods: The Statistical Package for the Social Sciences (SPSS) was used to process the data and extract the results.

RESULTS:

The results from the tests and data collected from the research sample were statistically analyzed after the tests had been completed using statistical techniques such as mean, standard deviation, skewness coefficient, z-scores, t-scores and percentage. These analyses were conducted to determine the percentage of maximum strength and muscular power that the subjects had attained as well as to provide an acceptable measure for student's assessments. Each of the following tables provides the research results, followed by an explanation and scientific discussion of the results.

Discussion of Results: The research findings demonstrated the feasibility of establishing standards and benchmarks for maximum strength and muscular power tests related to weightlifting among second-year students at the College of Physical Education and Sports Sciences. This corresponds to the main goal of the research which was to give scientific foundations for the assessment of those physical qualities. The results showed significant differences among the members of the sample for all the tests, which reflects the innate differences in strength and muscular power. These differences, which lead to differences in the result, are significant for setting standards, since the variation in the results helps to generate standards that can separate different levels of performance^[7].

Moreover, it was observed that the means and standard deviations of the tests were within the acceptable limits and the distribution of the test scores was approaching normal distribution, thus showing the homogeneity of the sample and that there was no

significant deviation on the test scores^[8]. This promotes the possibility of applying statistical techniques for norming and specifically computing norm scores^[9].

The results that related to distribution of the students in standard level indicated that the majority of the samples were within the average level and good level of students while the percentage of students within excellent and weak levels decreased. The reason for this distribution is logical, in that sample members are at the same grade level and receive similar kinds of educational and training programs. However, their physical fitness, experience and the training hours commitment were not equal which led to varying performances. This testifies that standard levels give a more accurate indication of abilities than raw scores^[10].

In addition, easily interpretable and comparable results between students were found in the process for the raw scores to be translated into standardized scores (Z) and then t-scores. This process facilitated the identification of performance clearly into - (Excellent, Very Good, Good, Average, Acceptable, Weak). These levels are of immense significance in sports measurement and evaluation as this facilitates the teacher and/or coach to identify the level of each pupil and to track physical development of pupils over the course of the academic year. They are also applied to periodic assessments and sports selection process^[11].

The results also show that the selected maximum strength and muscular power tests have also been important in determining the performance in the weightlifting sport, as weightlifting mainly depends on developing the greatest force in the shortest time possible, the characteristics of which require a high level of maximum strength and muscular power.. Therefore, students possessing good levels in these variables contribute to improving their technical performance in the snatch and clean and jerk lifts and increases their chances of achieving higher levels of performance^[12]. Furthermore, the results emphasize the importance of developing local standards specific to students at the College of Physical Education and Sports Sciences at the University of Babylon. Relying on foreign standards or standards developed for societies with different physical and age characteristics may lead to inaccurate assessments of students' abilities. Therefore, the standards developed in this research represent a scientific reference that can be used to evaluate current and future students and can also be adopted in developing practical weightlifting curricula and designing training programs that consider the individual differences among students^[13].

Based on the foregoing, the results support the research hypotheses, as scientific standards and

benchmarks for maximum strength and muscular power tests were established^[14]. Furthermore, the results demonstrated individual differences among the participants, contributing to their classification into multiple benchmark levels. Therefore, these standards represent an objective tool that can be employed in evaluation, selection, and athletic guidance, and provide a scientific basis for developing the educational and training process in weightlifting within faculties of physical education and sports science.

CONCLUSIONS

- Standards and benchmarks for maximum strength and muscular power tests related to weightlifting were established for second-year students at the College of Physical Education and Sports Sciences, based on the results of the research sample. It was found that the test result individual differences of children in their maximum strength and muscular power level were clearly seen and it enables the children to be classified to the various standard levels.
- Maximum Strength and Muscular power tests were able to test the general physical ability that is required for a successful weightlifting performance.
- Standardized scores (z and t) helped in the scientific and objective interpretation of test results and comparison of the sample.
- The standards formulated by the research become a scientific reference for evaluating students and developing educational and training programs for weightlifting.

Recommendations:

1. The standards and benchmarks derived from the research should be used for the evaluation process for the students of weightlifting at College of Physical Education, Sports Sciences, University of Babylon.
2. Perform regular (every couple years) updates to the standards to accommodate changes in student performance and educational programs.
3. Conduct research on a larger scale in other Iraqi Universities to food a more comprehensive national standard.
4. Focus on scientific terming programs to enhance student performances using scientifically based training programs to acquire maximum strength and muscular power.
5. Conduct future studies to establish standards for other physical, skill based, and physiological variables used with weightlifting.

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