

A CAUSAL MODEL OF SKILL PERFORMANCE BASED ON KEY ANTHROPOMETRIC AND PHYSICAL MEASUREMENTS FOR SELECTING FEMALE BASKETBALL PLAYERS

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ABSTRACT

The present study aimed to construct a causal model of skill performance based on the most important anthropometric and physical variables for selecting female basketball players. The study was conducted on female students of the Department of Physical Education and Sports Sciences at the College of Education for Women, University of Kufa, with a total sample of (36) students.

The researcher adopted the descriptive method using a correlational and causal approach. The variables included anthropometric measurements (body height, arm length, and leg length), physical attributes (explosive power, speed, agility, coordination, and balance), and skill performance (dribbling, passing, and shooting).

The results revealed significant correlations between all variables and skill performance. Physical attributes, particularly explosive power and coordination, showed the highest contribution to skill performance. The findings also indicated that anthropometric measurements have both direct and indirect effects on performance, mainly through their influence on physical attributes.

The causal model demonstrated that skill performance is not determined by a single factor, but rather by the interaction between body structure and physical abilities. The model showed good explanatory power in predicting performance levels among the students.

The study concluded that physical attributes represent the most influential factor in skill performance, while anthropometric measurements play a supportive and indirect role. The researcher recommends focusing on developing physical abilities and using scientific criteria in player selection.

KEYWORDS: Causal Model, Skill Performance, Anthropometric and Physical Variables

INTRODUCTION AND IMPORTANCE OF RESEARCH

Basketball is a team sport that demands a high degree of integration between physical, technical, and tactical aspects, as well as relying on quick and precise execution in constantly changing competitive situations. With the continuous advancements in sports training science, it has become essential to base the preparation and selection of players on scientific principles, particularly at the university level, which forms the foundation for developing future athletic talent.

Skillful performance in basketball is a key indicator of a player's level, as it relates to their ability to execute fundamental skills such as passing, dribbling, shooting, and defensive and offensive movements with high efficiency. However, this performance is not solely dependent on skill training; it is significantly influenced by the player's anthropometric measurements and physical capabilities.

Anthropometric measurements, such as height, weight, limb length, and body composition ratios, contribute to determining a player's suitability for the demands of the game, while physical capabilities, such as muscular strength, speed, agility, and endurance, affect the efficiency and consistency of skill execution during performance. The significance of this research lies in its application to female students in the Department of Physical Education and Sports Sciences. This group represents a crucial stage of academic and practical preparation, combining theoretical study with field application. Therefore, studying the relationships between anthropometric and physical measurements and skill performance in this group contributes to the development of preparation and training programs, as well as improving sports selection methods based on sound scientific principles.

Furthermore, the use of the causal model is a modern method in statistical analysis, as it helps to reveal the nature of direct and indirect relationships between variables and determine the extent to which each contributes to influencing skill performance.

RESEARCH PROBLEM

With the development of team sports, particularly basketball, it has become essential to adopt precise scientific methods for selecting players, especially in academic settings such as physical education and sports science colleges, which are fundamental to preparing athletic personnel.

Although numerous indicators related to anthropometric measurements and physical abilities are available, they are often treated in isolation, without examining the causal relationships that link them to skill performance. Furthermore, there is a clear disparity in skill performance levels among female students in physical education and sports science departments, despite their similarities in some anthropometric or physical attributes, indicating complex interactions between these variables.

Field observations revealed that some students possess suitable anthropometric measurements, yet their skill performance falls short of the required standard. Conversely, other students demonstrate good physical fitness but fail to effectively utilize it in skill performance, reflecting a flawed understanding of the relationship between these variables. Therefore, the research problem is defined by the following question:

Is it possible to build a causal model that explains skill performance in terms of the most important anthropometric and physical measurements among female students of the Department of Physical Education and Sports Science in basketball?

RESEARCH OBJECTIVES

The research aims to achieve the following:

1. Identify the level of skill performance among female students of the Department of Physical Education and Sports Sciences in basketball.
2. Identify the most important anthropometric measurements among female students of the Department of Physical Education and Sports Sciences.
3. Identify the level of physical abilities among female students of the Department of Physical Education and Sports Sciences.
4. Examine the correlational relationships between anthropometric measurements, physical abilities, and skill performance.
5. Construct a causal model that explains the nature of the direct and indirect effects of anthropometric and physical variables on skill performance.
6. Determine the contribution of anthropometric measurements and physical abilities in explaining skill performance among female students of the Department of Physical Education and Sports Sciences.

RESEARCH HYPOTHESES

The researcher hypothesizes the following:

1. There are statistically significant correlations between anthropometric measurements, physical abilities, and skill performance among female students of the Department of Physical Education and Sports Sciences.
2. There are statistically significant direct and indirect effects of anthropometric measurements on skill performance.
3. There are statistically significant direct and indirect effects of physical abilities on skill performance.

4. Anthropometric measurements and physical abilities contribute at varying levels to explaining skill performance among female students of the Department of Physical Education and Sports Sciences.
5. It is possible to construct a statistically significant causal model that explains the relationships among the variables (anthropometric measurements – physical abilities – skill performance).

RESEARCH DOMAINS

HUMAN DOMAIN

The human domain of the research consisted of first-year female students of the Department of Physical Education and Sports Sciences at the College of Education for Women. They were selected because they represent a group with both theoretical knowledge and practical application in the field of sports, which contributes to achieving the research objectives.

TIME DOMAIN

The research was conducted during the period from (1/3/2026) to (1/5/2026), which included the application of physical and skill tests and the collection of data related to the research variables.

SPATIAL DOMAIN

The research procedures were carried out in the sports hall of the College of Education for Women, Department of Physical Education and Sports Sciences, where a suitable environment was available for conducting basketball-related physical and skill tests.

RESEARCH METHODOLOGY AND FIELD PROCEDURES

RESEARCH METHOD

The researcher used the method appropriate to the nature of the problem under study, adopting the descriptive method using the survey approach and correlational relationships. This method focuses on studying the current state of the phenomenon and events, noting that the descriptive method often includes predicting future phenomena and events being studied, which helps in reaching the study results and understanding the nature of the phenomenon under investigation.

RESEARCH POPULATION AND SAMPLE

The population is defined as all individuals, persons, objects, or cases that constitute the subject of the research problem studied by the researcher. The researcher identified the population as female students of the Department of Physical Education and Sports Sciences at the College of Education for Women, University of Kufa, for the academic year (2025–2026), second stage, totaling (36) students.

As for the sample, the comprehensive enumeration method was used, where the entire population was used as the research sample.

TOOLS AND DEVICES USED IN THE RESEARCH

TOOLS

The researcher used the following research tools:

1. Arabic and foreign sources and references.
2. Personal interviews.
3. A questionnaire to survey the opinions of experts and specialists regarding the most important anthropometric measurements affecting the selection of female basketball players, as well as physical attributes.
4. A questionnaire to survey the opinions of experts and specialists regarding the most important basic skills in basketball.
5. A questionnaire to survey the opinions of experts and specialists regarding the most important tests for physical attributes as well as basketball skill tests.
6. A standard basketball court.
7. Basketballs (10).
8. Measuring tape (1, 25, 50, 100 meters).
9. Manual calculator type (Casio), number (1).
10. Whistles (4).

STEPS OF CONDUCTING RESEARCH

(DETERMINATION OF RESEARCH VARIABLES)

DETERMINING ANTHROPOMETRIC MEASUREMENTS AND PHYSICAL ATTRIBUTES

To determine the most important anthropometric measurements and physical attributes, the researcher relied on scientific references and sources, through which the most important measurements and attributes were identified and included in a questionnaire form. This form was then presented to experts and specialists in measurement and evaluation, sports training, and basketball to obtain their opinions on determining the physical attributes required for the game, as well as the anthropometric measurements that contribute to selecting female students.

Using the relative importance formula, the measurements and physical attributes that obtained a percentage of (54.54%) or higher were selected. The following variables were selected:

Table 1: Shows the anthropometric and physical variables selected for the research sample

No.	Anthropometric and Physical Variables
1	Body height
2	Arm length
3	Lower limb length
4	Explosive strength
5	Speed
6	Agility
7	Coordination
8	Balance

DETERMINING BASIC BASKETBALL SKILLS

To identify and select the most important basic basketball skills, the researcher conducted a careful review of several scientific sources and studies in basketball. A questionnaire (Appendix 6) was distributed to a group of (11) expert professors and specialists (Appendix 1) in training, measurement and evaluation, and basketball to determine their importance and relevance to students.

Each skill was rated, and experts were allowed to provide additional comments. After collecting and analyzing the data, and using the relative importance formula, the basic skills that obtained a percentage of (54.54%) or higher were selected.

Table 2: Shows the relative importance of selecting basic basketball skills

No.	Skills
1	Dribbling
2	Passing
3	Shooting

DETERMINING THE MOST IMPORTANT PHYSICAL AND SKILL TESTS:

To determine and select the most important physical and skill tests, the researcher reviewed several scientific sources and studies in measurement and evaluation. A questionnaire (Appendix 9) was distributed to (11) expert professors and specialists to evaluate the proposed tests.

Experts assigned scores to each test and provided suggestions. After collecting and analyzing the data, and using the relative importance formula, the tests that obtained a percentage of (54.54%) or higher were selected.

PILOT STUDY

Before conducting the main experiment, it is necessary to perform a pilot study on a small sample similar to the research sample. The purpose of this study is to test the research methods and tools, as well as to extract the scientific bases of the tests.

The pilot's study resulted in the following:

1. Identifying the suitability of the tests for the sample.
2. Ensuring the readiness of the tools.
3. Determining the time required for each test as well as the total testing time.
4. Ensuring the proper sequence of the tests.
5. Identifying the efficiency of the assisting work team.
6. Extracting the scientific bases (validity, reliability, and objectivity).

SCIENTIFIC BASES OF THE TESTS

The important and positive role played by the scientific coefficients of tests (validity, reliability, and objectivity) in the results obtained cannot be overlooked, especially in scientific research where testing and measurement are essential and effective tools. Therefore, the researcher must ensure these scientific coefficients to obtain tests that are scientifically sound and highly reliable.

TEST VALIDITY

FACE VALIDITY

Test validity depends on the extent to which the test measures the skill or trait it is intended to measure. A test “is considered valid when it measures what it claims to measure.” To obtain face validity, the researcher presented a questionnaire form to a group of experts and specialists in measurement and evaluation and sports training.

TEST RELIABILITY

Reliability refers to “the degree of accuracy, consistency, or precision with which the test measures the phenomenon it is designed to measure.” To determine test reliability, the researcher conducted the tests on a sample of (12) female students from the research population on 6/4/2026, and then re-administered the tests to the same sample after seven days (on 13/4/2026), while controlling all variables and conditions of the first test.

The data from both tests were then analyzed by calculating the simple correlation coefficient between them. The results indicated that the tests have good reliability.

TEST OBJECTIVITY

Objectivity refers to “the degree of agreement among scorers.” Since the physical and skill tests conducted by the researcher relied on objective measurement tools such as a stopwatch to measure time, a measuring tape for distance, and scoring points, these tests are not subject to interpretation or personal judgment among evaluators.

The researcher also ensured clarity of instructions regarding the administration, implementation, and recording of results, making the procedures simple and fair. Achieving a high objectivity coefficient requires that evaluators follow the same measurement procedures and conditions using the same tools, which leads to nearly identical results.

In addition, the researcher used evaluators to assess the scores of players in the physical and skill tests by calculating the simple correlation coefficient between their evaluations, which indicated that the tests have high objectivity.

DESCRIPTION OF ANTHROPOMETRIC MEASUREMENTS AND PHYSICAL TESTS

- Measurement of total body height, arm length, and lower limb length using a measuring tape.
- Explosive strength test (vertical jump from standing).
- Speed test (20-meter sprint) with time measurement.
- Agility test (figure-eight running).
- Coordination test (numbered circles).
- Description of Skill Tests:
 - Dribbling test.
 - Passing test.
 - Shooting test.
 - Passing test.

MAIN EXPERIMENT

The researcher conducted the main experiment for the tests and measurements (anthropometric and physical) on the following dates: 15–16–17/4/2026 in the morning at the sports hall of the College of Education for Women – University of Kufa.

The researcher considered the logical and scientific sequence of the tests based on references and expert opinions, while ensuring all testing conditions were met by providing the necessary equipment to achieve high accuracy in test results. The researcher relied on assisting staff to conduct the tests and divided them into testing stations to control the large sample size and ensure smooth test procedures.

The researcher also considered warm-up procedures and both physical and motivational preparation, which contributed to organizing and successfully completing the tests.

STATISTICAL METHODS

The researcher used the Statistical Package for Social Sciences (SPSS), as well as AMOS and Excel software, to process the results, extract findings, and produce graphical representations.

**PRESENTATION, ANALYSIS, AND DISCUSSION OF RESULTS
DESCRIPTIVE RESULTS OF THE STUDY VARIABLES**

Table 3: Means and Standard Deviations of the Research Variables

Skewness	Std. Deviation	Mean	Variable
0.21	5.8	162.5	Height
0.18	3.9	68.5	Arm Length
0.25	4.5	88.3	Lower Limb Length
-0.11	3.2	32.4	Explosive Strength
0.09	0.4	3.9	Speed
0.13	1.1	11.2	Agility
0.05	1.8	14.5	Coordination
-0.08	2.0	18.3	Balance
0.17	6.9	75.6	Skill Performance

It is evident that all skewness coefficients fall within ± 1 , indicating that the data are normally distributed.

CORRELATIONAL RELATIONSHIPS BETWEEN VARIABLES

Table 4: Correlation Matrix between Variables

Variable	Skill Performance
Height	0.52
Arm Length	0.55
Lower Limb Length	0.49
Explosive Strength	0.68
Speed	-0.61
Agility	0.63
Coordination	0.66
Balance	0.58

There are statistically significant correlations between all variables and skill performance.

REGRESSION ANALYSIS (CONTRIBUTION RATIO)

Table 5: Contribution of Variables to Skill Performance

Variable	Beta	R ²	Sig
Explosive Strength	0.34	0.46	0.000
Coordination	0.29	0.43	0.000
Agility	0.25	0.40	0.001
Arm Length	0.22	0.36	0.002

Explosive strength is the most contributing variable to skill performance.

CAUSAL MODEL

ANTHROPOMETRIC MEASUREMENTS → PHYSICAL ATTRIBUTES → SKILL PERFORMANCE

This model indicates that female students' skill performance is not directly influenced solely by anthropometric measurements, but rather primarily through their impact on physical attributes. In other words, anthropometric measurements such as height, arm length, and leg length serve as a foundational element that helps develop physical abilities like explosive power, agility, and coordination. These abilities are then reflected in their skill performance.

The research findings demonstrate that physical attributes are the primary mediator in transferring the influence of anthropometric measurements to skill performance. Students with good anthropometric measurements are more capable of developing high-level physical attributes, which helps them execute basic skills more efficiently.

This result confirms that skill performance in basketball is the product of an integrated interaction between body structure and physical abilities, not the result of a single factor. A student with suitable height or good arm length does not necessarily achieve high skill performance unless these measurements are supported by physical attributes such as strength and agility. Furthermore, the indirect impact of anthropometric measurements is a crucial indicator in the selection process.

Anthropometric measurements should not be relied upon solely, but rather viewed as a contributing factor to the development of physical attributes, which in turn directly influence skill performance.

Therefore, the causal model demonstrates that improving skill performance requires a primary focus on developing physical attributes, while considering anthropometric measurements as a supporting factor in the selection and training process.

CONCLUSIONS

1. There are statistically significant correlations between anthropometric measurements, physical attributes, and skill performance, indicating a functional and complementary relationship between these variables in influencing student performance levels.
2. Physical attributes, particularly explosive power, coordination, and agility, are the most influential factors in skill performance, confirming that developing physical abilities is fundamental to improving performance in basketball.
3. The results showed that anthropometric measurements (height, arm length, and lower limb length) not only have a direct impact but also contribute indirectly by influencing the development of physical attributes.
4. While anthropometric measurements can be used as initial indicators in the selection process, they are insufficient on their own unless supported by appropriate physical capabilities.
5. Skill performance in basketball is the product of a complex interaction between body structure and physical attributes, where these variables function in an integrated, rather than separate, manner.
6. The causal model used in the research proved its ability to explain the relationships between variables, confirming its potential as a scientific tool for predicting students' skill performance.
7. Individual differences existed among students in their skill performance levels despite similarities in some anthropometric measurements, reinforcing the importance of focusing on physical and motor aspects in training.
8. The research findings can be used to guide trainers in focusing on the most influential variables, thus contributing to increased efficiency in the training process and improved overall performance.

RECOMMENDATIONS

1. Focus on developing explosive power through specialized training programs (such as vertical jumps and plyometrics), implemented regularly and systematically, given its direct impact on improving skill performance, particularly shooting and follow-up skills.
2. Develop motor coordination and agility through combined drills (agility and coordination drills) that simulate real-life game situations, as these play a crucial role in decision-making speed and the accuracy of skill execution under pressure.
3. Adopt anthropometric measurements (height, arm length, lower limb length) as primary criteria in the initial selection of students, to be used as supporting indicators supplemented by physical ability assessments.
4. Integrate physical conditioning with skill development within training sessions, ensuring that acquired physical abilities are directly applied in performing basic skills (dribbling, passing, shooting).
5. Conduct periodic assessments using standardized tests (physical and skill-based) to monitor student progress and identify strengths and weaknesses, adjusting training programs based on the results.
6. Raising awareness among coaches about the importance of the causal model in understanding the relationships between variables, and avoiding reliance on a single factor when judging a player's level.
7. Emphasizing the importance of psychological preparation that supports performance (focus, emotional control), given its complementary role with physical abilities in enhancing skill performance

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