

The Relationship Of Some Anthropometric Measurements To Balance And The Level Of Technical Performance On The Balance Beam Among Gymnastics Female Students

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Article Info	Abstract
Article History Received: April 24, 2021 Accepted: September 30, 2021 Keywords : Anthropometric Measurements, Balance, Technical Performance, Balance Beam, Gymnastics DOI: 10.5281/zenodo.5542546	<i>The current study examined the relationship of some anthropometric measurements to balance and the level of technical performance on the balance beam among gymnastics female students. To achieve this purpose, a descriptive approach was employed. The study sample consisted of (22) gymnastics female students selected from the Faculty of Physical Education at Yarmouk University in the 2nd semester of 2020/2021 academic year. The results of the study revealed a negative correlation between the dynamic balance and anthropometric measurements (body height, body weight, the length of lower half of the body and body mass index "BMI"); a negative correlation between the static balance and each of (body height and the length of lower half of the body); a positive correlation between the static balance and each of (body weight and BMI), and a negative correlation between the level of technical performance and each of (body height, body weight, the length of lower half of the body and BMI) among gymnastics female students at Yarmouk University.</i>

Introduction

In addition to being an important means of assessing individuals, the study of anthropometric measurements also represents an opportunity to examine the relationship between the shape and size of the body and the dynamic performance. Regardless of his technical expertise, a coach cannot be a champion, unless he has the appropriate anthropometric measurements, being one of the main characteristics to consider upon selecting any gymnast. Each sporting activity requires certain anthropometric characteristics that must be taken into account upon choosing new athletes. This confirms the importance of selecting the appropriate anthropometric measurements prior to starting any training process. Undoubtedly, the participation of anthropometrically unfit athletes in competitions will lead to the emergence of an apparent lack of performance compared to other athletes having anthropometrical measurements fit for the specific type of sporting competition (Kersh, 2019).

Gymnastics is an individual sport that depends on one's high potentials in the physical, dynamic and psychological aspects. To obtain a high achievement, it is necessary for an athlete to fully exploit his potentials and to control the psychological emotions that may arise during the competitions. Unlike other gymnastics equipment, the balance beam requires high balance, focus and attention during the performance of dynamic skills and it also requires some technical characteristics, such as controlling emotions, internal potentials or even the external variables that may be encountered by chance or as a result of others' interruption or noise (Ali et al., 2017).

Without the integration of some anthropometrical and mechanical abilities, balance cannot be achieved, including the integration of muscular ability and its types (e.g. agility, flexibility and dynamic coherence), in addition to the fact that performing skills on the balance beam requires a high level of technical performance related to sound mechanical conditions, in addition to achieving coordination between the internal and external resistance training and the corresponding mechanical conditions. Failure to coordinate between the mechanical aspects and these two types of resistance training confirms the imbalance of muscular strength against external resistance training, leading therefore to a fall off the apparatus; Students' steadiness on the balance beam requires them to control the correct position of their body and the direction of their movement to achieve body balance upon movement. Thus, balance is one of the conditions that must be met on the balance beam, due to its important role in enhancing gymnasts' technical performance (Ali et al., 2017).

It is necessary for gymnastics coaches to consider all variables related to dynamic skills of high difficulty, whether from an anatomical, mechanical or training point of view, so that new training programs

contributing to the development of the technical performance can be designed. Technical Preparatory is a program aiming to provide players with the basic skills of a sport activity and showing them in the appropriate competitive settings (Hassan, 2021).

Importance of the Study

The significance of this study stems from its attempt to enrich the Arab library, in general, with a new reference related to some anthropometric measurements' relationship to balance and the level of technical performance on the balance beam among gymnastics female students. The practical significance of this study stems from its attempt to shed light on the reality of the technical performance on the balance beam among gymnastics female students, as well as identifying its relationship to anthropometric measurements and dynamic balance. Furthermore, the results of this study, and recommendations provided as well, would also contribute to enhancing awareness about the importance of anthropometric measurements for gymnastics female students to achieve the highest technical performance on the balance beam.

Gymnastics is an individual sport that requires special anthropometric measurements and parameters distinguishing it from other sports. The availability of such measurements and parameters to the player provides him/her with a greater opportunity to learn and master the skills of this sport, regardless of its difficulty. Due to the technical difficulty and complexity of Gymnastics, a player must have certain anthropometric and physical measurements and parameters to achieve a high level of technical performance. (Khasawneh, 2018).

Problem of the Study

Unlike other sports, Gymnastics requires certain anthropometric measurements and parameters not all female students of Physical Education possess, in terms of age, weight and height. This caused them develop negative attitudes about the possibility of learning and performing the skills of gymnastics, besides the fear and anxiety caused by the height of the balance beam apparatus and the effect of anthropometric measurements on achieving balance. Accordingly, the current study attempts to identify the effect of these factors through answering the study questions.

Study Hypothesis:

1. There is a statistically significant correlation at ($\alpha = 0.05$) between anthropometric measurements and balance among gymnastics female students.
2. There is a statistically significant correlation at ($\alpha = 0.05$) between anthropometric measurements and level of technical performance among gymnastics female students.

Purpose of the study

The present study aims to identify:

- The relationship between some anthropometric measurements and the static and dynamic balances among gymnastics female students at the College of Physical Education in Yarmouk University.
- The relationship between some anthropometric measurements and the technical performance on the balance beam among gymnastics female students at the College of Physical Education in Yarmouk University.

Methodology

Due its suitability in achieving the purposes of this study, a descriptive correlative design was used.

Study sample

The study sample consisted of (22) gymnastics female students selected purposefully (All female students enrolled in a gymnastics course at the Faculty of Physical Education at Yarmouk University during the second semester of 2020.

Table (1) shows Means, Standard Deviations, Values of Kurtosis and Skewdness to Characterize Performance Variables.

Variable	Unit of Measure	Lowest Value	Highest Value	Mean	Std. Devi.	Values of Kurtosis	Skewdness
Height	Meter	1.52	1.66	1.61	0.23	-0.91	-1.11
Weight	Kg	44.0	69.0	57.6	7.16	1.27	-0.66
Length of the body lower half	Cm	86.0	98.0	92.0	1.87	-0.48	-0.94
body mass index (BMI)	Kg / M2	16.66	30.10	23.20	3.55	0.73	-0.88

The previous table shows:

The heights of the study sample ranged between 1.52-1.66, where mean, Standard Devi, Kurtosis and Skewdness were (1.61, 0.23, -0.91, -1.11) respectively, which are an accepted values indicates the coherence of the study sample.

The weights of the study sample ranged between 44.0-69.0, where mean, Standard Devi, Kurtosis and Skewdness were (57.6, 7.16, -1.27, -0.66) respectively, which are an accepted values indicates the coherence of the study sample.

The length of the lower half of the body of the study sample ranged between 86.0-98.0, where mean, Standard Devi, Kurtosis and Skewdness were (92.0, 1.87, -0.48, -0.97) respectively, which are an accepted values indicates the coherence of the study sample.

The BMI of the study sample ranged between 16.66-30.10, where mean, Standard Devi, Kurtosis and Skewdness were (23.20, 3.55, 0.73, -0.88) respectively, which are an accepted values indicates the coherence of the study sample.

Tools

Stopwatch, Checklist, Whistle, Tape measure (meter), Medical scale, Balance beam apparatus.

Instruments

Anthropometric Measurements

- High: measured using a high scale (meter)
- Weight: measured using a calibrated medical scale (kg.)
- The length of the body's lower half: (meter).
- Body mass index: (BMI) = Weight (kg) / Square of Height (meters).

Tests

- Static Balance Test: Railway Test.
- Dynamic Balance Test: Walking forward and backward on the balance beam.
- Technical Performance Test on the Balance Beam: Performing a dynamic exercise. It was measured through observation, and was out of 20 marks.

Test Validity

to insure the validity of the tests used, they were distributed on a jury of (7) specialized members of faculty members in the colleges of Physical Education at the Jordanian universities, to give their remarks about the suitability of the tests to measure technical performance among the study sample. More than (89%) of the jury agreed on the tests validity to measure the study variables.

Test Reliability

In order to insure tests reliability, they were administrated and re- administrated after two weeks on a pilot sample consisted of (10) female students from the study population and out of the original sample, then test-retest reliability coefficient was calculated using Pearson Correlation between both times as seen in table (2).

Table (2): Results of Test-Retest Reliability Coefficient for the Study's Tests

Variable	Unit of Measure	Test-Retest Reliability Coefficient
Static Balance	Second	0.88
Dynamic Balance	Second	0.90
Technical Performance	Degree	0.92

Table (2) shows that test-retest reliability coefficient for ranged between (0.88-0.92), thus, all reliability coefficients were high and acceptable and indicates high levels of stability for the tests used.

Study Variables

- **Independent Variables:** anthropometric measurements (Height, weight, length of the lower half of body, body mass index "BMI")
- **Dependent Variables:** Balance (Static balance, dynamic balance), Technical performance on the balance beam.

Results and Discussion

This section represent the results and discussion of the study, which aims to identify the relationship between some of anthropometric measurements to balance and the level of technical performance on the balance beam among gymnastics female students, by testing the study hypotheses.

The descriptive statistics of the study variables:

Table (3): Means, Standard Deviations to Characterize Performance Variables

Variable	Unit of Measure	Lowest Value	Highest Value	Mean	Std. Devi.
Stable Balance	Second	32	58	45	1.37
Dynamic Balance	Second	24	10	17	1.45
Technical Performance	Degree	10	14	12	1.99

The previous table shows that:

- The time of static balance ranged between 32-58 seconds (M = 45, Std. Devi. = 1.37).
- The time of dynamic balance ranged between 10-24 seconds (M = 17, Std. Devi. = 1.45).
- Technical performance ranged between 10-14 seconds (M = 12, Std. Devi. = 1.99).

Results and Discussion (First Hypothesis): There is a statistically significant correlation at ($\alpha = 0.05$) between anthropometric measurements and balance among gymnastics female students.

To test the hypothesis, the vales of the variables have been calculated (static balance and dynamic balance), in addition correlation coefficients using Pearson Correlation between anthropometric measurements and balance among gymnastics female students, as seen in table (4).

Table (4): Correlation Coefficients using Pearson Correlation between Anthropometric Measurements and Balance among Gymnastics Female Students

Variable		Dynamic Balance	Static Balance
Height	Correlation Coefficient	-0.28*	-0.19
Weight	Correlation Coefficient	-0.33*	0.41**
Length of the lower half of the body	Correlation Coefficient	-0.29	-0.13
body mass index (BMI)	Correlation Coefficient	-0.22	0.38**

** Significant at ($\alpha \leq 0.05$)

* Significant at ($\alpha \leq 0.01$)

Table (4) shows:

1. A statistically significant correlation between (Height), static balance and dynamic balance among gymnastics female students (Correlation Coefficients = -0.19, -0.28), which are negative values, and this indicates that there is a negative correlation between height, static balance and dynamic balance.
2. A statistically significant correlation between (Weight) and dynamic balance among gymnastics female students (Correlation Coefficients = -0.33), which is a negative value, and this indicates that there is a negative correlation between weight and dynamic balance. In addition to a statistically significant correlation at ($\alpha = 0.05$) between (Weight) and static balance among gymnastics female students (Correlation Coefficients = 0.41), which is a positive value, and this indicates that there is a positive correlation between weight and static balance.
3. A statistically significant correlation at ($\alpha = 0.05$) between (Length of the lower half of the body), static balance and dynamic balance among gymnastics female students (Correlation Coefficients = -0.29, -0.13), which is a negative value, and this indicates that there is a negative correlation between the Length of the lower half of the body and balance.
4. A statistically significant correlation at ($\alpha = 0.05$) between (BMI) and dynamic balance among gymnastics female students (Correlation Coefficients = -0.22), which is a negative value, and this indicates that there is a negative correlation between BMI and dynamic balance. In addition to a statistically significant positive correlation at between (BMI) and static balance among gymnastics female students (Correlation Coefficients = 0.38), which is a positive value, and this indicates that there is a positive correlation between (BMI) and static balance.
5. These results can be attributed to the fact that the increase in height reduces the control level over the different body parts, as the weight center becomes far from the limbs as the length of the game increases, thus making it difficult to maintain balance especially the static balance. The same thing for weight gain, as it results in increased effort while moving the body or executing the skill characteristically, this increases the load on both arms while moving the body, or when attempting to achieve both dynamic and static's balance. This result is consistent with common theories of gymnastics and the previous studies related such as Kaur and Koley (2019) which aimed to define the anthropometric factors to predict higher performance levels in gymnastics.

Results and Discussion (Second Hypothesis): There is a statistically significant correlation at ($\alpha = 0.05$) between anthropometric measurements and level of technical performance among gymnastics female students.

To test the second hypothesis, correlation coefficients using pearson correlation between anthropometric measurements and the level of technical performance among gymnastics female students was calculated, as seen in table (5).

Table (5): Correlation Coefficients using Pearson Correlation between Anthropometric Measurements and the Level of Technical Performance among Gymnastics Female Students

Variable		Technical Performance
Height	Correlation Coefficient	-0.26
Weight	Correlation Coefficient	-0.48**
Length of the lower half of the body	Correlation Coefficient	-0.34*
body mass index (BMI)	Correlation Coefficient	-0.31*

** Significant at ($\alpha \leq 0.05$)

* Significant at ($\alpha \leq 0.01$)

Table (5) shows:

1. A statistically significant negative correlation between (Height) and the level of technical performance among gymnastics female students (Correlation Coefficients = -0.26).
2. A statistically significant negative correlation between (Weight) and technical performance among gymnastics female students (Correlation Coefficients = -0.48).
3. A statistically significant negative correlation between (Length of the lower half of the body) and the level of technical performance among gymnastics female students (Correlation Coefficients = -0.34).
4. A statistically significant negative correlation between (BMI) and the level of technical performance among gymnastics female students (Correlation Coefficients = -0.31).

Conclusion

The previous results showed that there is a negative correlation between anthropometric measurements (Height, weight, Length of the lower half of the body, BMI) and the level of technical performance on the balance beam. This result indicates that the longer the height becomes, the weight increased, or the Length of the lower half of the body increased, the lower the level of technical performance among female gymnasts. It should be pointed out that there's got to be balance between the height and the weight, and within normal rates, as BMI increases when the weight inconsistent with height, The balance beam depends on control of moving the center of body weight characteristically to achieve well exquisite performance, and this is affected by weight and height indicators and therefore the body mass indicator as a whole. Therefore, its necessary to carefully selecting female gymnasts taking into consideration some of anthropometric measurements which effect the level of the final technical performance for these skills. This is consistent with theories of gymnastics and the equipment training, this result is also consistent with the results of Al-Khasawneh (2018) study which indicated that height, weight, and BMI affect the performance level, and that there must be a consistent between the height and natural weight to reach a better performance levels especially on the balance beam.

Recommendations

In light of the results obtained, the current study recommends the following:-

- Careful selection and follow-up of female gymnasts in light of height, weight and BMI indicators, so that it does not affect the level of technical performance in gymnastics generally, and the balance beam particularly.
- Measuring the physical variables of female gymnasts, or female students of gymnastics courses, before starting training or application, in addition to providing instructions related to maintaining a consistent level for some anthropometric measurements, such as weight and BMI.
- Conducting further investigations on some other anthropometric measurements, such as shoulder and hip circumference and their relationship to technical performance in gymnastics generally, and on the balance beam particularly.
- Conducting further studies on other types of female gymnasts.

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