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Article: **Relationship Between the Anthropometric Measurements and Flexibility among Adolescent Cricket and Football Sport Participants**

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RELATIONSHIP BETWEEN THE ANTHROPOMETRIC MEASUREMENTS AND FLEXIBILITY AMONG ADOLESCENT CRICKET AND FOOTBALL SPORT PARTICIPANTS

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ABSTRACT

Anthropometric parameters are the quantitative methods that are more commonly applied to measure, record, and analyze a wide range of human structural measurements for establishing the size, form, proportion, and composition of humans. Flexibility is one of the important factors of healthful living and also a basic constituent of athletic performance. Understanding this relationship helps in tailoring training programs to enhance performance and reduce injury risks in young athletes. The present study explains the relation between anthropometric measurements. A sample of 94 adolescent sports participants were approached from which 30 football players and 64 cricket players were considered for the research study. The statistical technique correlation determined the association of the variables. The coefficient of correlation indicates a negative association between all anthropometric measurements with the sit and reach test, except for abdominal circumference, which is not significantly related. Shoulder hyperextension exhibits a negative insignificance with trunk length and a positive insignificance with other anthropometric measurements. Trunk hyperextension flexibility exhibits a non-significant negative correlation with all anthropometric parameters, except for trunk length, which demonstrates a substantial association with Arm length. All anthropometric measurements, except abdomen circumference, show a negative correlation with the sit-and-reach test, while shoulder hyperextension negatively correlates with trunk length but positively correlates with other measures, and no significant correlation exists between trunk length and other anthropometric measurements except for its negative association with trunk hyperextension flexibility.

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Keywords: Anthropometric measurements, Flexibility, Correlation, Fitness, Performance, Trunk Hyperextension, Trunk Height.

1. Introduction

Anthropometric parameters are quantitative strategy tools and are normally used to determine human size, shape, proportion, and composition by making use of measurements, recordings, and studies, especially on specific measurements of human structures. This is commonly observed in anthropometry, as well as in '*sports and sports medicine*' of applied health sciences. However, in different periods, researchers have assigned and used various terminologies as biometry, physiological anthropometry, dynamic anthropometry, sports anthropometry, anthropometrical, kin anthropometry etc. for producing some interaction between body shapes and the specific capabilities for varying works.[1] Since everyone in this world is unique and the extent of variability among individuals ensures that no humans can ever be same. Physical differences among people can be influenced by a combination of hereditary factors, socio-environmental influences, and personal adaptations.[2]

One of the major ones besides fitness lifestyles, flexibility, particularly the health-related type of component has been found to also be a constituent part of general basic sports-related performance element.[3] Flexibility is crucial in certain sports, such as football, where inadequate flexibility can hinder players' performance by limiting their range of motion and impairing their specialized technical skills.[4,5] Research indicates that the flexibility of the human body in sports is affected by both gender and tactical position.[6] An extension on any side of the body [7] and a higher level of the contest.[8]

Anthropometry is an assessment of the human body. It is the scientific study of the measurements and proportions of the human body to understand physical variation and its applications in areas like ergonomics, health, and design. It includes measurements such as body height, weight, arm length, leg length, trunk length, and the circumferences of the abdomen and other body areas. The extended range of motion that muscles exhibit at the joint without experiencing any kind of discomfort is defined as Flexibility. This is a vital aspect of physical fitness related to health. Although flexibility is classified as a health-related fitness component, its impact on athletes in attaining performance-related fitness components is

remarkably strong. Flexibility denotes the potential range of motion at a joint facilitated by the corresponding muscles. The quantity of flexibility assessments employed to evaluate various body segments in diverse positions and movements, including static and dynamic states.

The present study aims to analyze the relationship between anthropometric measurements and flexibility parameters among adolescent cricket and football players to identify sport-specific physical and functional correlations. Understanding this relationship helps in tailoring training programs to enhance performance and reduce injury risks in young athletes. This study will also provide insights into how anthropometric factors influence flexibility demands unique to each sport, aiding coaches and trainers in optimizing athlete development.

A research study was carried out in Brazil, and the objectives were to examine the relationship of anthropometric measurements of the human body with health-related and fitness-related parameters specific to physical condition. The number of participants involved in this research was twenty, all male footballers, aged twenty. This study was carried out over three days, with participants recruited and categorized according to the positions at which they play and their roles, including attacking players (attackers), midfielders, and defensive players (defenders). This study concludes that body composition is substantially correlated with fat-free mass, lean mass, and fat mass. The most interesting aspect found during the study is the fact that increases in acceleration or speed in any one direction and the quickness to change body position correlate well with the different footballers' playing positions.[9] Fat-Free Mass (FFM) includes all components of the body except fat, such as muscles, bones, water, organs, and tissues, whereas Lean Mass excluding fat and other non-fat components like bones and water, and Fat Mass represents the total amount of fat in the body, both essential fat (necessary for physiological functions) and stored fat (used for energy reserves).

Chen et al. (2020)[10] conducted another research study that aimed to establish the relationship that exists between General fitness components and BMI. The six elements were; the 50-meter run/dash, the air exhaled in maximal exhalation, taken right after maximal inspiration-vital capacity, and relative to the distance flexed the arm over back is covered by sit and reach, horizontal long jumping where an individual is tested upon landing, aerobic,

using a 800 and/or 1000 meters; both sexes completed respective amounts and pull-ups sit or bent leg.[10] A total of 8,548 students participated willingly in this study. A majority of the female participants (74.7%) exhibited normal BMI values, while men demonstrated elevated BMI values, categorizing them as overweight or obese. Students with normal BMI levels also demonstrated impressive physical performance. Individuals classified as underweight, overweight, or obese exhibited poor performance in physical fitness assessments.

In 2018 a study was conducted in Bosnia and Herzegovina dealing with exploring the criteria of body composition football players. A set of 10 variables, including human body height and weight, were used to calculate Body Mass Index (BMI), while body fat percentage was evaluated through muscle mass and measurements of waist circumference, as well as skinfolds on the back, abdomen, triceps, and biceps. The research indicated statistically significant mean differences between the footballers of the two specified teams across all three parameters for evaluating waist circumference, as well as the triceps and biceps muscles skinfold thickness.[11]

Another study analyzed the fitness levels and BMI of school-aged children, concluding that there is a substantial difference in total fitness components and various body mass categories.[12] Another study was done to ascertain the association between weight status and overall physical fitness components in teenagers. The study encompassed 3,204 participants.[13] The research findings revealed that guys were overweight relative to girls. BMI appears to affect the sit-up and sit-and-reach tests. Nonetheless, daily life function was demonstrated to be significantly affected by rising BMI.

2. Materials and methodology

Research Design

The Quantitative research design was used in the current study to indicate how anthropometric measurements correlate with flexibility in male adolescent sports participants from age 12 to 19 years.

Study variable

In this manuscript, the abdomen circumference, trunk length, arm length, and leg length are considered anthropometric measurements, and sit and reach shoulder hyperextension. Flexibilities are used.

Area of Study

This research was conducted at different sports clubs and educational institutions across the Hyderabad Division District of Sindh Province, Pakistan.

Study Population

Study participants: Selected participants were male adolescent athletes aged 12-19 years, in good health and active, from several football clubs within their respective regions.

Sample size

A sample of 94 sports participants adolescent was approached from which 30 football players and 64 cricket players were considered for the research study.

Anthropometric measurements

These measurements, including length of arm, length of trunk, abdominal circumference, and length of leg, were manually obtained using a one-and-a-half-meter measuring tape.

Sit and reach flexibility.

It also measures the amount of trunk flexion, which is to say, the amount whereby one stretches the lower hamstrings and back muscles. They were not able to start the test when the body was not thoroughly heated up. Place your feet on either side of the ruler and apply pressure to the front pan for this assessment. Maintain straight knees and ensure the posterior aspect of the lower limbs contacts the floor without bending the knees; Bend your torso and lean forward as far as you can. Reaching the limit of your stretch, maintain the position for 3 seconds. Participants were provided with three attempts, each followed by sufficient recovery intervals, and the best effort was recorded. The value indicates the distance to the edge (toes cannot be reached); any value exceeding this is reported using pass scores relative to the norms.

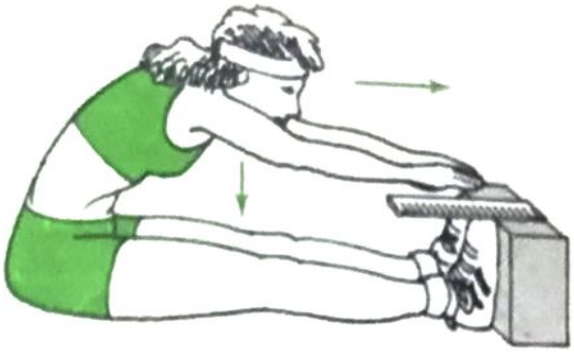

Figure 1 Sit and Reach Flexibility

Table No. 1: Norms of Sit and Reach Flexibility

Ratings	**Score**
Excellent	17 to 27
Good	6 to 16
Average	0 to 5
Satisfactory	-1 to -8
Poor	-9 to -19

Source: Flexibility 2000 Normative values for body flexibility

Shoulder hyper-extension flexibility

Chest and shoulder muscles were measured for shoulder hyperextension through long-range movements. Which includes a set of instructions. Participants must lie on the floor positioned shoulder-width apart with their arms extended, grasping a stick with their hands. Elevate your arms to their maximum height and maintain the position for 3 seconds, throughout the stretch, ensure that your chin remains on the floor. Subsequently, measure the height of the stick from the ground at its underside.

Figure 2 Shoulder Hyperextension Flexibility

Table No. 2: Norms of Shoulder Hyperextension Flexibility

Rating	**Score (cm)**
Excellent	≥32
Good	30 – 32
Average	21 – 29
Satisfactory	16 – 21
Poor	≤ 15

Source: Flexibility 2000 Normative values for body flexibility

3. Results

Table no. 3: Summary statistics of cricket

	Abdomen circumference (cm)	Trunk length (cm)	Arm length (cm)	Leg length (cm)	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Mean	70.95	42.48	71.11	98.89	11.11	33.41
Std. Deviation	7.467	4.602	8.782	7.370	9.673	8.459
Skewness	.302	-.580	-.883	-.837	-.118	.834
Kurtosis	.240	-.098	.238	-.369	-.644	1.852
Minimum	53	32	43	80	-12	16
Maximum	88	53	83	110	27	61

Cricket participants' anthropometrics and flexibility measurements' descriptive statistics reveal the data's form, minimum, maximum, mean, median, mode, etc. values, and location with variation.

Table No. 4: Correlation between the Abdomen Circumference and flexibilities variables of Cricket

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Abdomen circumference (cm)	-.181	.008
Sig. value	.153	.948

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It also indicates that abdominal circumference is positively correlated with shoulder hyperextension flexibility. It shows a negative correlation with anterior sit-and-reach flexibility, trunk hyperextension flexibility, and dynamic bend-twist-and-touch flexibility. Consequently, the relationship among all variables can be classified as insignificant.

Table No.5: Correlation between the Trunk Length and flexibilities variables of Cricket

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Trunk length (cm)	-.258*	-.015
Sig. value	.039	.904

The coefficient of correlation indicates a positive correlation between trunk length and trunk hyperextension flexibility. It is inversely correlated with sit and reach (anterior) flexibility, shoulder hyperextension flexibility, and bend, twist, and touch dynamic flexibility. All the variables have an insignificant association with each other.

Table No.6: Correlation between the Arm Length and flexibilities variables of Cricket

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Arm length (cm)	-.503**	.155
Sig. value	.000	.222

The coefficient of correlation reveals a positive correlation between arm length and shoulder hyperextension flexibility. It exhibits a negative correlation with anterior sit and reach flexibility, trunk hyperextension flexibility, and dynamic flexibility in bending, twisting, and touching. Besides that, the relationship among all the variables is also perceived to be insignificant.

Table No.7: Correlation between the Leg Length and flexibilities variables of Cricket

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm
Leg length (cm)	-.358**	.075
Sig. value	.004	.557

The correlation between leg length, shoulder hyperextension flexibility, bend twisting, and touch dynamic flexibility is positive. This is reflected in the coefficient of correlation. The

correlation between this and the ability to sit and reach and hyperextension in the front side is negative. A minor relationship exists among all variables.

Table No.8: Summary Statistics of Football

	Abdomen circumference (cm)	Trunk length (cm)	Arm length (cm)	Leg length (cm)	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Mean	72.20	45.27	75.25	97.07	6.40	38.13
Std. Deviation	3.178	4.593	5.529	7.225	5.405	6.590
Skewness	-.133	.102	-.096	.263	.000	-.190
Kurtosis	-.364	-.343	-.155	-.525	-.586	-.749
Minimum	66	37	63	84	-3	24
Maximum	79	56	85	110	18	48

The shape of the data, including its location and variation, is reflected in descriptive statistics that include anthropometrics measurements and flexibility measurements. This data was collected by football participants.

Table No.9: Correlation between the Abdomen Circumference and flexibilities variables of Football

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Abdomen circumference (cm)	-.053	-.159
Sig. value	.781	.400

The correlation coefficient indicates a positive relationship between abdominal circumference and trunk hyperextension flexibility, bend twisting, and dynamic touch flexibility. There is an inverse correlation between front-side flexibility, sit and reach, and shoulder hyperextension. It has a minimal impact on all variables.

Table No.10: Correlation between the Trunk Length and flexibilities variables of Football

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Trunk length (cm)	.022	-.068
Sig. value	.908	.719

The correlation coefficient indicates that trunk length is positively linked to trunk hyperextension flexibility or bend twisting, touch dynamic flexibility sit and reach (front side) flexibility. Further, it also indicates that a negative correlation exists between this and the flexibility of shoulder hyperextension. There is no significant correlation between all variables.

Table No.11: Correlation between the Arm Length and flexibility variables of Football

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Arm length (cm)	.182	.091
Sig. value	.335	.631

Arm length is positively correlated with shoulder hyperextension, trunk hyperextensions, sit and reach (front side), bend twist, and touch dynamic flexibility. These values are expressed in percentage terms. While, on all variables, it has a minimal impact.

Table No.12: Correlation between the Leg Length and flexibilities variables of Football

	Sit and reach (front side) flexibility (cm)	Shoulder Hyper extension flexibility (cm)
Leg length (cm)	.028	.113
Sig. value	.885	.553

The correlation coefficient indicates a positive relationship between leg length and sit and reach (front side), shoulder hyperextension, trunk hyperextensions, and bend twist and touch dynamic flexibility. Among all these variable, non-significant correlation coefficient exists.

4. Discussion and Conclusion

Anthropometric measurements, such as height, weight, and limb lengths, significantly influence flexibility levels among adolescent cricket and football players, as these sports require varying ranges of motion. The results show that most anthropometric measurements, except abdomen circumference, were negatively correlated with the sit-and-reach test, suggesting that larger body size might limit flexibility. The negative correlation between shoulder hyperextension and trunk length indicates the limiting effect of a longer trunk on upper body flexibility, while positive correlations with other measures indicate a change in flexibility requirements. Interestingly, trunk height showed no significant correlation with other anthropometric measures, except for a negative correlation with trunk hyperextension

flexibility. These results highlight the need to tailor sport-specific flexibility training to the unique physical characteristics of young cricket and football players to optimize performance and reduce injury risk.

Except for abdomen circumference, the coefficient of correlation demonstrates that all anthropometric measurements have a negative correlation between sit and reach. There is a negative correlation that exists between shoulder hyperextension and trunk length, while there is a positive correlation with other anthropometric measures. There is no significant correlation between trunk length and anthropometric measurement, except for the extent of its negative correlation with trunk hyperextension flexibility.

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