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RELATIONSHIP OF ANTHROPOMETRIC MEASUREMENT WITH FUNDAMENTAL SKILLS

Tanuja S. RAUT[1] & Saurav TRIPATHY[2]

[1] *Associate Professor, PGTD of Physical Education, Sant Gadge Baba Amravati University, Amravati, India.* 0000-0002-8073-4770

[2] *Ph.D. Scholar, PGTD of Physical Education, Sant Gadge Baba Amravati University, Amravati, India.* 0000-0003-0461-3990

Abstract : *Anthropometric measurement has revealed correlation between body structure physical characteristics and motor abilities. Assessment of anthropometric parameters and motor abilities will provide more accurate information on the developmental process of children. The aim of the study was to find out the relationship between selected anthropometric measurement and fundamental skills. The study was delimited in loco-motor skills and ball skills only of fundamental movement skills. For fulfilling the purpose, the data were estimated from the Primary school students of Amravati city, Maharashtra. Forty-eight male primary school students, whose ages ranging from 7-10 year-old were taken by simple random sampling technique. To measure the fundamental skill the some physical tests were administered and the raw data were collected. The anthropometric measurements were carried out by using standardized equipment. After that the collected raw data was analyzed statistically by using the Pearson Correlation Matrix. It was found that there was a significant relationship between anthropometric measurement and fundamental skills of children.*

Keywords : *Anthropometry, Loco-motor Skill, Ball skill, Primary school students.*

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Sorumlu Yazar/Corresponding Author tanujaraut13@gmail.com Associate Professor, PGTD of Physical Education, Sant Gadge Baba Amravati University, Amravati, India.

Anthropometry is a method of anthropology that refers to the measuring and testing of the human being and to the connection between the sizes of its individual parts. Anthropometry has a special significance where information of the physical dimensions of an individual with accuracy is measured. The task of anthropometry is to exactly as probable quantitatively distinguish the morphological features of the human body. Human body proportions give us information about the growth of each body segment. Physical growth of an individual is measured by changes in body size and composition as well as physical outline. These variations help or create barriers in accomplishment of different motor activities (Casadei & Kiel, 2020).

A fundamental movement skill (FMS) is a structured sequence of basic activities. It involves the combination of movement patterns of two or more body segments. If children fail to fully develop and improve these fundamental skills during early childhood or adulthood i.e. in school time, they often fade up or feel depressed as they are unable to successfully participate in school sport or other sports events. Because, motor abilities which are developed from fundamental skills represents an integrated outcome of most bodily functions involved in physical activity. But, this didn't mean that they cannot develop FMS later, instead it is much easier to develop these skills during childhood (Mazzardo, 2008).

Such inability influences different psychological pressures in them, that they are negatively motivated towards physical activity, which leads them towards physical inactivity and more on. So, it is very much needed to develop fundamental skills during early childhood (Nunes et al., 2004).

Anthropometric measurement has revealed correlation between body structure, physical characteristics and motor abilities. In all the activities, height, weight, and other Anthropometric variables play a vital role. The measurement of anthropometric parameters allows monitoring of children's growth in terms of physical dimensions, body composition, and sex dimorphism (Kautiainen et al., 2002; Argyle, 2003; Wells, 2007; Krebs et al., 2007), also in relative to physical fitness (Westerstahl et al., 2003).

Milanese et al. (2010) relates the anthropometry with physical fitness of children aged 6-12, whereas Pomohaci and Sopa (2017) find out the importance of anthropometry measurements for sports activities.

Assessment of anthropometric parameters and motor abilities will provide more accurate information on the developmental process of children (Franjko et al. 2013). As the measurements of the individual parts are an integral part for efficiency in particular activity, so the researchers aim to identify the interrelationship of anthropometry measurements with fundamental skills.

The aim of this investigation was to evaluate the possible relationships between selected anthropometric measurements with FMSs of male school students of Amravati city, Maharashtra.

On the basis of available literature, it was hypothesized by the researchers that significant relationship will be observed between anthropometric measurements and FMSs of male school students of Amravati city, Maharashtra.

Methods

Subjects

The data was collected from Mahamana Malviya Primary School students of Amravati city, Maharashtra, India. Forty-eight male primary school students were selected, whose ages ranging from 7-10 year-old by simple random sampling technique. The researchers wanted to know the development of basic FMS in primary school children without considering their daily physical activities. So, they had chosen sample randomly from the school mentioned above.

Criterion Measures

For the anthropometric measurement following tools and units were used:

Table 1: Anthropometric Measurements, Tools and Measuring Units

No.	Anthropometric Measurements	Test/Tool	Unit/Measures
1.	Body Mass Index	Weight (kg) /Height (m)^2	kg/m^2
2.	Arm Length	Measuring Tape	centimeter
3.	Palm Length	Measuring Tape	centimeter
4.	Leg Length	Measuring Tape	centimeter

Body Mass Index (BMI)

The testing protocol was explained to the students. The students were asked to stand straight with their heels against the wall of the stadiometer by removing their shoes. Then the height in meters was recorded. The weight of the students were measured by a digital weighing machine. The students were asked to stand on the platform of the weighing machine with minimal cloths and without shoes. The weight was recorded in kilograms. The formula below was used to calculate the student's BMI:

BMI = weight (kg) / height (m)^2

Arm Length Measuring Procedure

The student was asked to stand with his arms hanging by the side of his body with his fingers outstretched. A measurement was made from the acromial, the bony tip of the shoulder, to the tip of the middle finger by using the measuring tape. Measurement was taken to the nearest 0.1 cm. and recorded. Measurements were repeated for 3 times and the average of the measurements were calculated to avoid the error of the measurement.

Palm Length Measuring Procedure

The student was asked to put the palm on a table. The length between the wrist crease, ulnar styloid process, to tip of the middle finger was measured by using the measuring tape. Measurement was taken to the nearest 0.1 cm. and recorded. Measurements were repeated for 3 times and the average of the measurements were calculated to avoid the error of the measurement.

Leg Length Measuring Procedure

The students were asked to lie down straight on the mat. A direct measurement was done using a tape. The distance from the umbilicus, the anterior superior iliac spine, to the medial malleoli of the ankle was measured. Measurements were repeated for 3 times and the average of the measurements were calculated to avoid the error of the measurement (Sabharwal & Kumar, 2008).

For measuring the fundamental movement skill following skills was measured:

Table 2: List of FMS Measuring Tests and Measuring Units

No.	Type	Skills	Unit/Measures
1.	Loco motor Skills	50 m.Run	s.
		Vertical jump	m.
		Horizontal Jump	m.
2.	Ball Skills	Dribble	No. of dribble/60 s.
		Catch	Total no. of catches/10 trials
		Kick	No. of right kicks/10 trials

Administration of the Tests

Two types of tests were taken to measure the performance of the fundamental skills of 7-10 year-old boys. First one was loco-motor skill which included 50 m. run, vertical jump and horizontal jump. In the second phase, ball skills included dribbling, catch the ball and kick for accuracy.

Table 3: Administrations of FMS Measuring Tests

Loco Motor Skills	**50 m. Run**	Marked a starting line on an even ground by chalk powder. Apart 50 m. from the starting line, the end line was marked. From behind the starting line, the subject was asked to run up to end line on the clapping of the tester. The duration for completing 50 m. distance measured by stopwatch in seconds. The average of the 3 trials were recorded to avoid the error.
	Vertical Jump	The subject stood near a wall by raising his hand and marked the spot where his middle finger touched. The subject was asked to deep the tip of his middle finger of the task performing hand in pink color dust. Then the subject jumped and touched on the wall by raising his hand. The spot was marked again and the distance between two spots in centimeters was measured. The measurements were repeated for 3 times and the best of three trials was recorded as the score.
	Horizontal Jump	Marked a starting line on the ground by chalk powder. The subject stood behind the line marked on the ground with feet slightly apart. A two feet take-off and landing was used, with swinging of the arms and bending of the knees to provide forward drive. The subjects attempted to jump as far as possible, landing on both feet without falling backwards. Three attempts were allowed. The measurements were taken from take-off line to the nearest point of contact on the landing. Distance was measured in centimeters. Best of three was the score.
Ball Skills	**Dribble**	Marked a starting line with 2 feet width. 5 cones were placed ahead the starting line 3 feet apart from each other. The subject was asked to dribble a basketball (No. 4) on the cemented floor from the starting line on the command 'Go'. He was asked to dribble continuously for 1 min parallel to cones in 'to and fro' manner. Also, the subjects were asked to control the ball during dribble. If the ball was out of control, they had to go to collect the ball and continue the dribbling. The number of cones passed out during 1 min was the score of the dribbling test. 3 trials were given. Best of 3 was taken as the score.
	Catch	The tester threw a tennis ball to a specific height towards the subject. The subject were instructed to catch the ball by using two hands. Each subject had 10 trials. The number of catches done properly was counted as the score. 3 sets of trials were given. Best of 3 was taken as the score.
	Kick	From behind the starting line, the subject kicked a football to strike a target (3 feet width) 10 meter ahead. Balls that hit the target got 1 point and no scores were awarded for the missing balls. Number of kicks that hit the target was the score. 3 sets of trials were given. Best of 3 was taken as the score.

Collection of Data

The data were collected from the primary school students of Amravati. The subjects were first explained about the tests/skills they had to perform; thereafter some trials of each test were done by the students for their better understanding. After that the tests were conducted one by one and the scores were recorded.

Statistical Analysis

The descriptives were given in mean and standard deviation. Pearson's correlation coefficients were calculated to assess the corelations between the variables. Statistical significance was set at $p<.05$.

Results

Table 4 contains the results of basic statistics for the anthropometric characteristics of the subjects. Here, the mean value of different anthropometric variables was calculated. According to the table, the average age of the subjects was 8.27±1.16 years.

Table 4: Descriptives of the Anthropometric Variables

Variables	Mean	SD
Age (years)	8.27	1.16
Height (meters)	1.29	0.06
Weight (kg)	26.6	4.46
BMI (kg/m²)	15.83	1.22
Arm length (cms)	55.84	3.43
Palm length (cms)	15.14	1.23
Leg length (cms)	76.57	5.12

The average BMI of the subjects was found to be 15.83±1.22 kg/m², which indicates they are in the

normal weight category according to their age. Also, the arm length (55.84±3.43 cm), palm length (15.14±1.23 cm) and leg length (76.57±5.12 cm) found satisfactory according to their age and BMI (Table 4).

Table 5: Descriptives of FMS Measuring Skills

Type	Skills	Mean	*SD*
Loco motor Skills	50 m.Run	7.85	0.69
	Vertical Jump	20.88	5.09
	Horizontal Jump	128.52	15.06
Ball Skills	Dribble	35.27	9.05
	Catch	7.23	1.64
	Kick	6.04	1.99

Table 5 contains the descriptives of different skills for measuring FMS. The mean and standard deviation (*SD*) values of each skill were calculated.

Table 6: Pearson's Correlation Coefficients (*r*) between Anthropometric Characteristics Measures and Different Elements of the Loco Motor Skills

Variables	BMI		Arm Length		Palm Length		Leg Length	
Loco motor Skills	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
50 m. Run	0.689*	0.00	0.631*	0.00	0.486*	0.00	0.744*	0.00
Vertical Jump	0.551*	0.00	0.576*	0.00	0.621*	0.00	0.772*	0.00
Horizontal Jump	0.353*	0.01	0.297*	0.04	0.291*	0.04	0.572*	0.00

*df=46, Critical Value (r)=0.284, * p<.05*

According to the Table 6, the Pearson's correlation between the anthropometric measurements and elements of loco-motor skills found significant on the total sample. As 50 m. run found significant with anthropometric measures (BMI: r=0.689, p<.05, arm length: r=0.631, p<.05; palm length: r=0.486, p<.05; leg length: r=0.744; p<.05). The arm length and leg length found to be significant in the correlation with the timing of 50 m. run, as both are helpful for running a certain distance or running skill. Similarly the arm length helps in proper swinging which is alternative with leg. So, the arm length also helps in running performance by maintaining the coordination with leg. Also, vertical jump found significant with anthropometric measures (BMI: r=0.551, p<.05; arm length: r=0.576, p<.05; palm length: r=0.621, p<.05; leg length: r=0.772, p<.05). Vertical jump is also found significant with all the anthropometric characteristics. Body Height, arm length, palm length and leg length each have significant role for better performance in vertical jump and all these parameters help in the performance of jumping. The horizontal jump also found significant with the, BMI (r=0.353, p<.05), arm length (r=0.297, p<.05), palm length (r=0.291, p<.05), and leg length (r=0.572; p<.05). Also, leg muscle and leg length increases the performance of horizontal jump. So, the relationship between them also found to be significant.

Figure 1: Showing the Relationship between Anthropometric Characteristics Measures and Different Elements of the Loco Motor Skills

Table 7 shows Pearson's correlation between the anthropometric measurements and elements of ball skills found significant on the total sample, as the calculated value is greater than the critical value (0.444) of Pearson's r. Dribbling was found to be significantly correlated to anthropometric measures (BMI: r=0.582, p<.05; arm length: r=0.597, p<.05; palm length: r=0.612, p<.05; leg length: r=0.741, p<.05). In Table 7, all the relationships are found to be significant. It's due to their direct or indirect relationship between them. In dribbling all the parameters help significantly. Like finger length which is include in palm length helps to control the ball during dribbling. So, the performance for dribbling is developed due to finger length. Also, Catching skill found significant with anthropometric measures (BMI: r=0.678, p<.05; arm length: r=0.638, p<.05;

palm length: r=0.511, p<.05; leg length: r=0.718, p<.05).

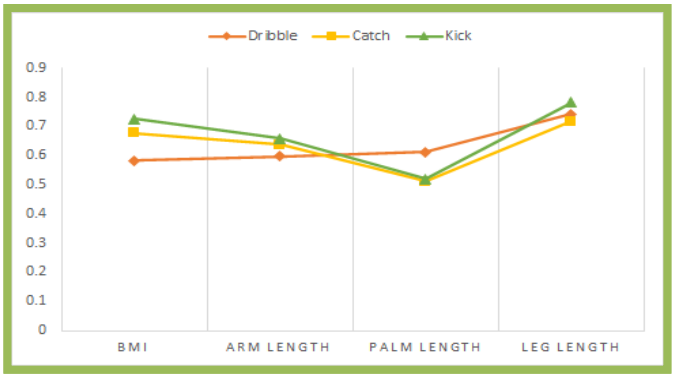
Table 7: Pearson's Correlation Coefficients (r) Between Anthropometric Characteristics Measures and Different Elements of the Ball Skills

Variables	BMI		Arm Length		Palm Length		Leg Length	
Ball Skills	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Dribble	0.582*	0.00	0.597*	0.00	0.612*	0.00	0.741*	0.00
Catch	0.678*	0.00	0.638*	0.00	0.511*	0.00	0.718*	0.00
Kick	0.726*	0.00	0.659*	0.00	0.519*	0.00	0.770*	0.00

*df =18, Critical Value (r) = 0.444, * p<.05*

Similarly, for catching skill palm length and arm length both found significant due to their direct relationship with the skill. The Kick for achieving the target also found significant in relationship with anthropometric measurements (BMI: r=0.726, p<.05; arm length: r=0.659, p<.05; palm length: r=0.519, p<.05; leg length: r=0.770, p<.05). In kicking skill leg length plays an important role. Beside, arm length and BMI, leg length is also found significant in relationship with kicking skill. So, the researchers' hypothesis is accepted.

Figure 2: Showing the Relationship between Anthropometric Characteristics Measures and Different Elements of the Ball Skills



Discussion

By reviewing another studies (Wrotniak et al., 2006) that analyzed the concern of relations between the fundamental motor skills measured by the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) and the BMI, it can be noticed that overweight and obese children have a lower level of fundamental movement skills performance compared with the normal-weight children. In this study, also the age group (8.27±1.16 years) with the BMI (15.83±1.22 kg/m²) which is the normal weight category according to their age found significant relationship with fundamental skills and all the relationships are positive. So, this study supports the previous result. Similar results were gained in investigations (Southall et al., 2004; Hondt et al., 2009). Also, some other researchers (Hondt et al., 2009) found significant relations between the BMI and the fundamental movement skills in school children, which also support this study. This could lead to more accurate conclusions about the potential for fundamental movement skills development of normal weight category children.

Generally, it is to be expected that significant relations between BMI and FMS occur only in a targeted sample (homogeneous group of subjects) that, according to their anthropometric measurements. Undoubtedly, BMI as a measure provides an incomplete image of true fundamental skill, and BMI relations, especially in heterogeneous groups. As this study was taken on a homogeneous group, so the result shows this difference. To get actual qualitative and quantitative FMS results, Body fat percentage should be included in anthropometric measurements.

Researchers tried to find out the reviews from many research articles, journals and online sources on the related topic. Where, they found only the abundance material regarding relation between BMI and FMS but not the studies related to relationship between anthropometric measurement and FMS. So, this is quite difficult to explain the relationship between anthropometric measurement and FMS with proper references.

Conclusion

It was concluded that there is a significant and positive relationship between the anthropometric measurement and fundamental skills of children. According to the norms of correlation there is no high

correlation between anthropometric measures and loco-motor skills as well as object handling skills. The reason to this may be the children are not having practice of such physical activities. No doubt performance is depending on anthropometric measures but it is also true for the best performance practice is also needed.

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