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Anthropometric variables as predictors of speed ability of physical education students

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Abstract
Purpose:-The first purpose of the study was to find out correlation between Independent Variables (selected Anthropometric Parameters) and Dependent Variable (Speed Ability). The second purpose of the research was to study the joint contribution of Independent Variables in estimating Dependent Variable and the third purpose was to establish regression equation for predicting Dependent Variable on the basis of Independent Variables.
Methodology: - Total of 40 male students were selected from Department of Physical Education, Guru Ghasidas Vishwavidyalaya Bilaspur. Age of the subjects was ranging between 22 to 26 years. Selected Variables were Height, Weight, Leg Length, Thigh Circumference and Calf Circumference (Independent Variables). Speed was considered as Dependant Variable. The selected variables were measured by different tests and instruments. To find out correlation between Independent Variables (Height, Weight, Leg Length, Thigh Circumference and Calf Circumference) and Dependent Variable (Speed Ability), Product Moment Method of correlation was used. To study the joint contribution of Independent Variables in estimating Dependent Variable, Multiple correlation method was used. Regression equation was established for predicting Dependent Variable on the basis of Independent Variables.
Findings: - There exists a significant relationship between speed and Height (r = .785, p <.05), Weight (r= -.479, p < .05), Leg length (r = .780, p < .05) and Thigh Circumference (r = .465, p < .05). There exists an insignificant relationship between Speed and Calf Circumference (r = .083, p > .05). Regression equation Speed ability = 22.500-.078 (Height) -.045 (Leg Length) + .025 (Weight).

Keywords: Speed, Anthropometric variables, Leg Length, Thigh Circumference, Calf Circumference.

Introduction
From the earliest times running has been a natural part of man's existence, whether he was catching animals for food or escaping from predators. However, he also began to run for pleasure and then competitively, leading to a desire to improve on his speed or ability to run farther. Running is the most natural of athletics movements. Children run, as part of their play and practically every game requires reserves of stamina and the ability to run fast. Every track event has running as its essence, sometimes alone, sometimes with a team and sometimes between obstacles. Every training and conditioning program contains an element of running, and tests of fitness or physical ability always include running for speed.
Running is a means of locomotion allowing humans to move rapidly on foot. It is simply defined in athletics terms as a gait in which at regular points during the running cycle both feet are off the ground. A characteristic feature of a running body from the viewpoint of spring-mass mechanics is that changes in kinetic and potential energy within a stride occur simultaneously, with energy storage accomplished by springy tendons and passive muscle elasticity (Cavagna, Saibene, and Margaria, 1964) [2]. Several study reported strong correlation between different motor abilities with anthropometric variables (Fogelholm *et al*. 2008, Halme *et al*. 2009; D'Hondt *et al*. 2009, Milanese *et al*. 2010) [7, 8, 5, 14].
Anthropometrics measurements were central concerns of the first phase of the scientific era of measurements, which have been began in the 1860's current interest in anthropometrics measurements focus in three areas, girth measures, body type and body composition. Assess of such measures include classification, prediction of growth patterns and prediction of success in motor activities as well as assessment of ability (Allen Philips and James E. Harnok, 1979) [1].
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Through body measurement, sports scientists will be able to gain the necessary information about the physical form, physical fitness and physical condition of athletes (Zapartdis *et al.*, 2009) [23]. Many accurate predictions about individual and team performance over the past two decades have been solely based on height and body mass. According to many experts, anthropometric indices or physical and size dimensions is of the determining factors in the exercise and has dramatically been included in the new talent finding (Kazemei *et al.*, 2006)[11].

Objectives of the study

1. To find out correlation between Independent Variables (Height, Weight, Leg Length, Thigh Circumference and Calf Circumference) and Dependent Variable (Speed Ability).
2. To establish regression equation for predicting Dependent Variable on the basis of Independent Variables.
3. To study the joint contribution of Independent Variables in estimating Dependent Variable.

Methodology

Selection of subjects

A total of 40 Male students were selected from Department of Physical Education, Guru Ghasidas Vishwavidyalaya Bilaspur. Age of the subjects was ranging between 22 to 26 years.

Selection of variables and Criterion measures

These following variables were selected for this study:

Table 1: Selected variables and their criterion measures

Sr. no.	Variables	Nature	Tools	Measuring Unit
1	Speed	Dependent	50-yard dash	sec.
2	Height	Independent	Stadiometer	cm.
3	Weight	Independent	Weighing Machine	kg.
4	Leg length	Independent	Anthropometric rod	cm.
5	Thigh girth	Independent	Flexible steel tape	cm.
6	Calf girth	Independent	Flexible steel tape	cm.

Statistical technique

- To find out correlation between Independent Variables (Anthropometric parameters) and Dependent Variable (speed ability), Product Moment Method of correlation was used at 0.05 level of significance.
- To study the joint contribution of Independent Variables in estimating Dependent Variable, Multiple correlation method was used at 0.05 level of significance.
- Regression equation was established for predicting Dependent Variable on the basis of Independent Variables.

Result and Findings of the Study

Table 2: Descriptive Statistics of selected variables

Variables	Mean	Std. deviation	N
Speed	7.1230	.76945	40
Height	1.6620E2	6.38377	40
Weight	65.4300	9.06750	40
Leg Length	90.5300	7.17868	40
Thigh Circumference	51.1375	4.71901	40
Calf Circumference	34.9250	2.88353	40

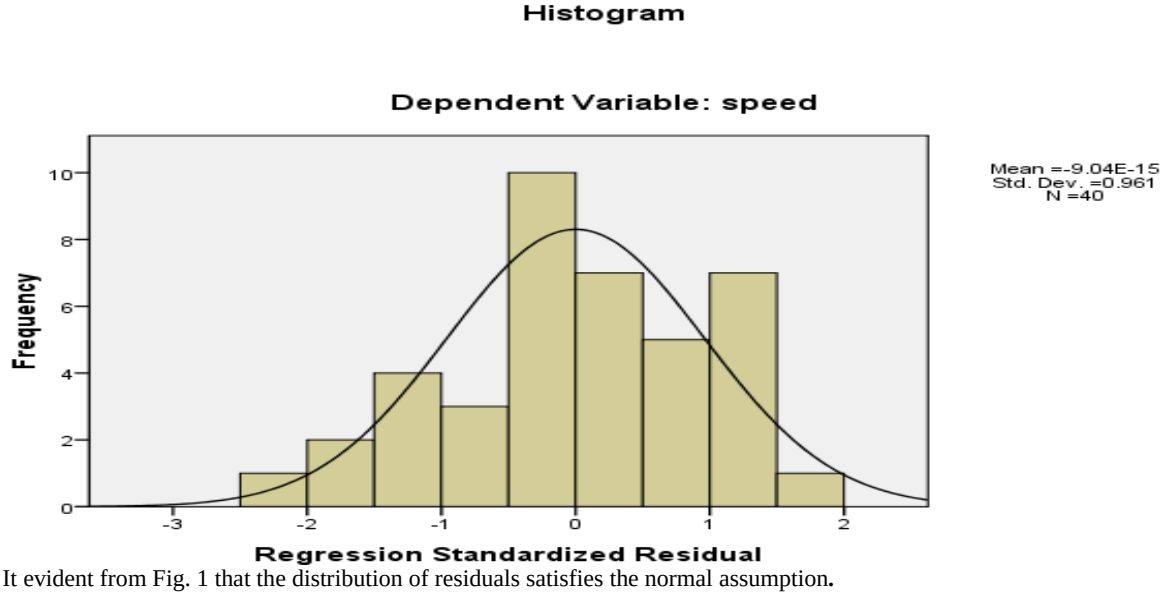
Table 2 shows that the descriptive analysis (Mean, SD & N) of selected variables i.e. Speed, Height, Weight, Leg Length, Thigh Circumference and Calf Circumference.

Table 3: Residuals statistics for checking outliers

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	5.3654	8.6935	7.1230	.64126	40
Std. Predicted Value	-2.741	2.449	.000	1.000	40
Residual	-.92094	.82777	.00000	.42525	40
Std. Residual	-2.081	1.870	.000	.961	40

a. Dependent Variable: speed

The table 3 reveals that std. (standardized) residual, maximum value (1.870) and minimum value (-2.081), both values doesn't exceed +3 & -3. This proves that the range doesn't have any outliers.



It evident from Fig. 1 that the distribution of residuals satisfies the normal assumption**.**

Fig 1: Normality curve in relation to speed ability of physical education students

Table 4: Correlation between Dependent Variable (speed) and Independent Variables (Height, Weight, Leg Length, Thigh Circumference and Calf Circumference)

Variables	N	Correlation coefficient (r)	Sig. value
Height	40	-.785*	.000
Weight	40	-.479*	.001
Leg Length	40	-.780*	.000
Thigh Circumference	40	-.465*	.001
Calf Circumference	40	-.083	.306

Table - 4 clearly indicates that there exists a significant relationship between speed ability and Independent Variables i.e. Height, Weight, Leg Length and Thigh Circumference as the sig. values were found lesser than the .05.

On the other hand there exists an insignificant relationship between speed ability and Independent Variable i.e. Calf Circumference as the sig. value was found higher than the .05.

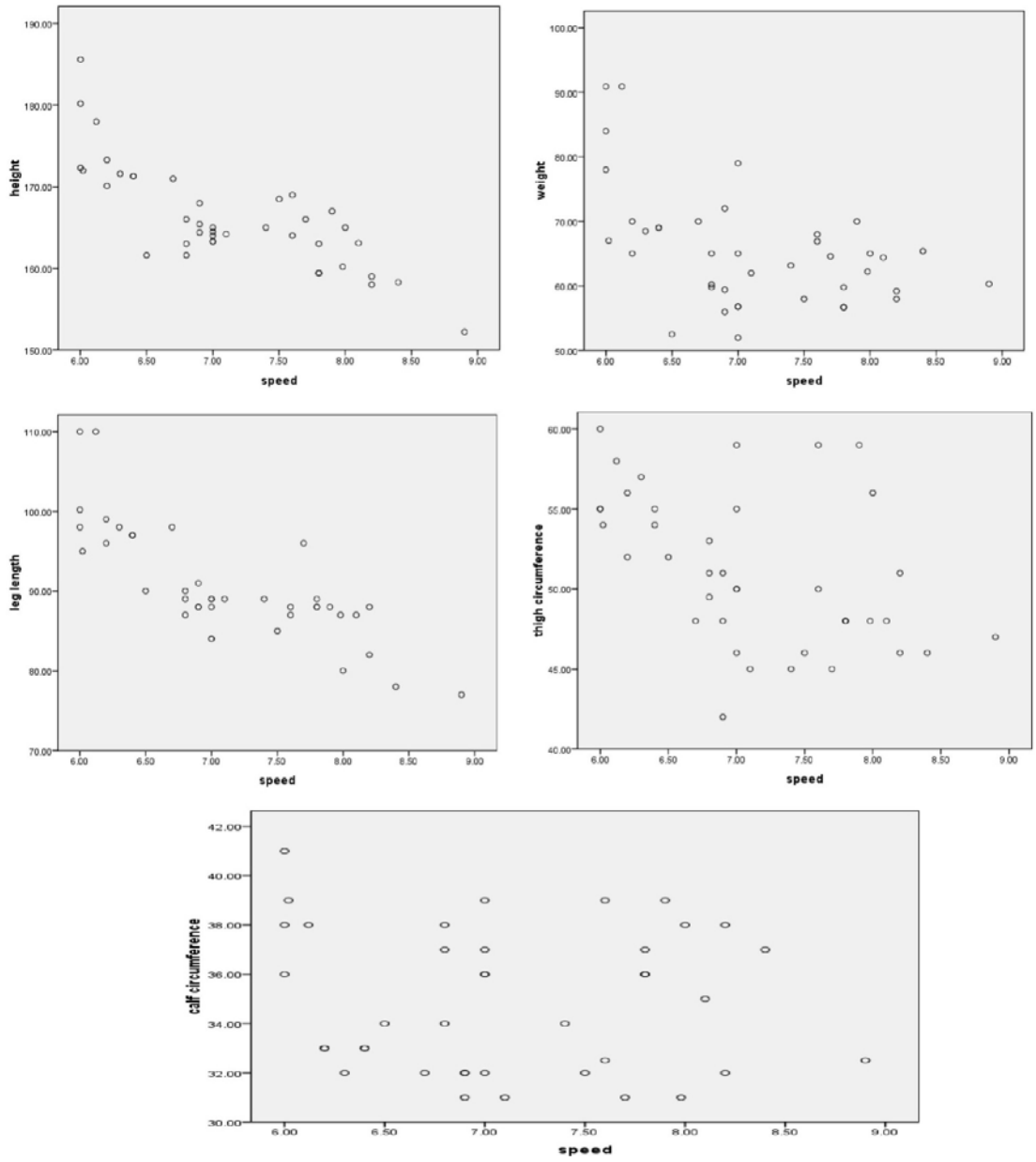


Fig 2

Table 5: Model Summary showing Pearson's correlation between speed ability and selected anthropometric variables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.785[a]	.616	.606	.48280	.616	61.058	1	38	.000
2	.812[b]	.659	.641	.46124	.043	4.636	1	37	.038
3	.833[c]	.695	.669	.44262	.035	4.179	1	36	.048

a. Predictors: (Constant), height
b. Predictors: (Constant), height, leg length
c. Predictors: (Constant), height, leg length, weight

Three regression models have been presented in table 5. In the third model the value of R square is 0.695 which is maximum and, therefore; third model was used to develop regression equation. It also can be seen from the table 5 that in the third model three independent variables viz. height, leg length, weight have been identified so regression equation will be developed these three independent variables only. Since R square value for this model is 0.695, which impales that 69.5% of speed ability is obtained by these three independent variables.

Table 6: The ANOVA table of the linear regression model in relation to speed ability on the basis of selected anthropometric variables

Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	16.037	3	5.346	27.287	.000[c]
	Residual	7.053	36	.196		
	Total	23.090	39			

c. Predictors: (Constant), height, leg length, weight

Table 6 shows that the usefulness of the linear regression model. This model has found useful in estimating the performance of speed ability on the basis of three independent variables i.e. height, leg length, weight, since F value (27.287) has found significant (p<0.05).

Table 7: Regression coefficient of selected variables in predicting Dependent variable (speed ability)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.851	2.014		11.345	.000
	Height	-.095	.012	-.785	-7.814	.000
2	(Constant)	19.845	2.377		8.348	.000
	Height	-.053	.022	-.440	-2.359	.024
	leg length	-.043	.020	-.402	-2.153	.038
3	(Constant)	22.500	2.625		8.572	.000
	Height	-.078	.025	-.644	-3.143	.003
	leg length	-.045	.019	-.420	-2.341	.025
	Weight	.025	.012	.289	2.044	.048

Dependent Variable: speed

Table 7 shows that the quantification of relationship between selected anthropometric variables and speed ability.

Regression model for estimating speed ability on the basis of selected anthropometric variables

Model 3

Y = 22.500 - 0.078 (X1) - 0.045 (X2) + 0.025 (X3)

Where: Y= Speed Ability, X1= Height, X2= Leg Length, X3= Weight.

So the regression model is

Speed ability = 22.500 -0.078 (Height) - 0.045 (Leg Length) + 0.025 (Weight)

Discussion of the Findings

Speed is the ability to cover a short distance in as short a period of time as possible. As the age grew the standing height, length of leg, arm and foot of the boys increased. Increase in different body parts especially the length of leg leads to increase in stride length. Increase in length and frequency of strides of the boys were the main reason of strong correlation between running speed with other anthropometric variables. Heyward and Stolarczyk (1996) [9] reported a low body fat while a large muscle mass was important for speed and strength activities. These might be also the main reason for strong correlation between speed with Height, Weight, Leg length and Thigh circumference. The linear gains in speed by increase in anthropometric variables were similar with the findings reported by other studies (Cratty, 1975; Corbin, 1976; Sohi, 1986) [4, 3, 20]. Increase in strength and speed performance with size and maturity of the boys have also been found and demonstrated by several other studies (Hunsicker and Greey, 1957; Dhaliwal, 1990) [10, 6].

Conclusions

1. Significant relationship was found between Speed and Height (r = .785, p <.05).
2. Significant relationship was found between Speed and Weight (r = -.479, p < .05).
3. Significant relationship was found between Speed and Leg length (r = .756, p < .05).
4. Significant relationship was found between Speed and Thigh Circumference (r = .465, p < .05).
5. Insignificant relationship was found between Speed and Calf Circumference (r = .083, p > .05).
6. Multiple Relationship (R) between Speed and selected anthropometric variables is R=0.833 and R square is .695, which shows that 69.5% of Speed is obtained by three independent variables i.e. Height, Weight, Leg length.
7. Regression equation Speed ability = 22.500-.078 (Height) - 0.045 (Leg Length) + 0.025 (Weight) was found fructiferous in estimating speed ability on the basis of selected Variables *(*Height, Weight and Leg Length.

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