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Determination of athletic ability from selected hand grip strength and vital capacity variables of school boys

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Abstract
A repeated measure research design was used with athletic ability as the criterion variable and selected anthropometric, physical fitness and physiological variables as the predictor variables. The selected 100 school boys, who have participated at inter school athletic meets were measured of their physical fitness variable hand grip strength, physiological variable vital capacity To determine the athletic ability of the subjects, the norms prescribed by the Sports Development Authority was used and the scores of the selected tests were converted into standard scores. The obtained data were analysed using Pearson Correlation Coefficient to find out the relationship between athletic ability and selected criterion variables. Multiple Regression Analysis used to predict the athletic ability of the school boys from selected anthropometric, physical fitness and physiological variables. In all cases 0.05 level was fixed.

Keywords: hand grip strength and vital capacity

Introduction
The method by which athletes are selected for a team can have a significant impact on that team's success. In the past, decisions have been made based largely on judgments of an individual's physical characteristics with little attention given to the psychological factors that contribute to athletic success. Coaches are experts in identifying the physical characteristics needed for success in their field; however, they lack the skills necessary to assess the psychological factors that have been proven to have a significant impact on athletic performance. Coaches have relied on informal judgments of constructs such as an athlete's motivation and level of aggression to determine their potential to succeed quantification and implementation of these psychological attributes in selection decisions can therefore have a significant impact on a program's success.

Statement of the Problem
The purpose of this study was Determination of Athletic Ability from Selected Hand Grip Strength and Vital Capacity Variables of School Boys

Hypotheses
Keeping in mind the statement of the problem the following hypotheses were formulated.

1. It was hypothesized that there would be significant relationship between athletic ability and anthropometric variables height, hand span, arm length and arm girth among school boys.
2. It was hypothesized that there would be significant relationship between athletic ability and physical fitness variables, hand grip strength, speed, leg strength, and endurance.
3. It was hypothesized that there would be significant relationship between athletic ability and physiological Variables, mean arterial blood pressure, vital capacity, resting pulse rate and breath holding time.
4. It was hypothesized that athletic ability of the school boys can be predicted successfully from the selected anthropometric, physical, and physiological variables.

Significance of the Study
In the recent years physical educators, coaches' sports experts and even most of the players have realized the importance of athletic ability. The significance of the study is based on the fact that athletic ability can be predicted from selected anthropometric, physical, and physiological variables. Maximum degree of skill development and physical fitness are required to be mastered for outstanding performance in athletic events.

1. This study will help to evaluate and compare the abilities and capacities of the athletes by themselves and by coaches and physical educators.
2. The result and findings of this study would provide criteria for selecting potential athletes.
3. This study might be utilized as a screening instrument in analyzing and classifying the athletes.
4. The outcome of the results shall be helpful to Athletes coaches and physical educationists to concentrate at the selected determinant variables of this study, which might be having high correlation with performance, to design the training programme.
5. The result of the study would be making it clear whether the selected independent variables are directly or indirectly related to the criterion variables.
6. The result and findings of this study, may guide an athlete to event based on the assessed athletic ability.
7. This study will help the budding researchers to take up similar studies in other areas and disciplines.

Delimitations
The study was delimited in the following ways:

1. This study was confined only hundred to school boys in Andhra Pradesh.

2. The subjects selected were in the age group between 13 to 14 years.
3. The study was delimited to anthropometric variables height, hand span, arm length and arm girth among school boys.
4. The physical fitness variables selected for this study were hand grip strength, speed, leg strength, and endurance.
5. The physiological variables selected for this study were mean arterial blood pressure, vital capacity, resting pulse rate and Breath holding time.
6. The predictor performance variable, athletic ability was determined through Sports Development Authority norms fixed for this study converted into standard scores.
7. The predictive variables, anthropometric, physical fitness and physiological, selected for the study were assessed by standardized test items.

Limitations

This study is limited in the following aspects and these limitations have to be taken into considerations.

1. The students were from different social, economic and cultural status which was taken as a limitation for this study.
2. Heredity and environmental factors which contribute to performance have not been controlled.
3. No effect would be made either to control or to assess the quality of the food ingested, life style, Effect of metabolic functions as these are recognised as a limitations for this study.
4. No other motivational techniques were followed to assess selected physical, physiological and performance variables.

Definition of Terms

Hand Grip Strength

Hand Grip strength is the force applied by the hand to pull on or suspend from objects and is a specific part of hand strength (Clarke and Clarke, 1989).

Vital Capacity

The volume of air that can be moved out of the lungs after maximum inspiration is called vital capacity (P.J. Strukic, 1981).

The maximal volume of air that can be forcefully exhaled from the lungs following maximal expirations.

Methodology

Selection of Subjects

To achieve the purpose of the study, the investigator selected 100 school boys studying in Schools in Andhra Pradesh. The subjects selected were in the age group between 13 to 14 years. All the subjects had participated in the inter-school athletic meets in different events. Only volunteer, healthy and physically fit subjects were selected for this study. The subjects were oriented on the purpose of the study, benefits and the Subjects whole heartedly participated in all testing procedures.

Selection of Variables

The researcher reviewed number of books, journals, research articles, coaching manuals and found that athletic ability may have relationship with selected anthropometric, physical fitness and physiological variables. Based on these observations, the investigator selected the following variables for this study."

Dependent Variable

Athletic Ability of School boy

Independent Variables

Physical Fitness Variables

Hand Grip Strength

Physiological Variables

Vital capacity,

Research Design

A repeated measure research design was used with athletic ability as the criterion variable and selected anthropometric, physical fitness and physiological variables as the predictor variables. The selected 100 school boys, who have participated at inter school athletic meets were measured of their physical fitness variable hand grip strength, physiological variable vital capacity To determine the athletic ability of the subjects, the norms prescribed by the Sports Development Authority was used and the scores of the selected tests were converted into standard scores. The obtained data were analysed using Pearson Correlation Coefficient to find out the relationship between athletic ability and selected criterion variables. Multiple Regression Analysis used to predict the athletic ability of the school boys from selected anthropometric, physical fitness and physiological variables. In all cases 0.05 level was fixed.

Criterion Measures

By glancing the literature, and in "consultation with professional experts the following measures were applied to collected data on selected criterion and independent variables.

1. Hand Grip strength was measured using hand grip dynamometer (Clarke and Clarke, 1988).
2. Vital Capacity was measured using Spiromter (Clarke, 1976).

Table-I shows the variables selected, the tests and tools used for measurement and the unit of measurement.

Table 1: Showing the Variables, Tests / Tools and the Measured Units

S. No	Variables	Test / Tools Administered	Unit of Measurement
1	Hand Grip Strength	Hand Grip Dynamometer	Kilograms
2	Vital Capacity	Spirometer	Milliliters

The intra class correlation coefficient obtained by test, retest method is presented in Table-II.

The Reliability Coefficient of the Subjects in Anthropometric, Physical, Physiological variables by Test and Retest Method

Table 2

S. No	Test Items	Coefficient of Correlation
1	Hand Grip Strength	0.87*
2	Vital Capacity	0.83*

Table value r = (0.01) (2, 7) = 0.735 * Significant at 0.01 level

Collection of Data
The method of data collected from the school boys on selected anthropometric, physical fitness, and physiological variables were explained below.

Handgrip Strength Test Objective
The purpose of this test was to measure grip or forearm muscle strength.

Apparatus Used
Handgrip dynamometer

Test Description
The subject was asked to hold the dynamometer in the hand to be tested, with the arm at "right angles and the elbow by the side of the body. The handle of the dynamometer was adjusted if required. The base should rest on first metacarpal (heel of palm), while the handle should rest on middle of four fingers. The subject squeezes the dynamometer with maximum isometric effort, which was maintained for about 5 seconds." No other body movement was allowed" (Yobu, 1988).

Score
Score was the record shown in the dynamomter in kilo grams. The score was taken to the nearest $1/100^{th}$ of a kilo gram.

Vital Capacity
Objective
The purpose of this test was to find out the maximum quantity of air that can be expired after a full inspiration."

Apparatus Used
Wet Spiro meter, mouth pieces and nose clips.

Test Description
Vital capacity was measured by wet Spiro meter in liters. The Spiro meter was equipped with a good length of rubber hose. "The Spiro meter was filled with water to within one inch of the top and water placed at a height where by all the subject can stand erect at the beginning of the test. The mouth piece was disinfected by an antiseptic solution after use by each subject (Mathew, 1988).
The subjects were asked to take a deep breath for test: There after the fullest possible inhalation, the subject exhaled slowly and steadily bending forward over the hose till the air within his control was expelled.
Care was taken to prevent air from escaping either through nose or around the edges of mouth piece and was also ensured that a second breath was not taken by the subject during the test." In case of doubt, the test was repeated. Care was taken to lower the drum without spilling the water, each time after use."

Statistical Analysis
The obtained data were analyzed statistically using the prediction equation. The Multiple Regression method as detailed by Thomas and Nelson (1990) was used. The SPSS PC (version 11.0) was used to determine the predictive equation.
The prediction formula resulting from multiple regression is basically an extension of the two variable regression model,
$Y = a + bx$.

In this research study there are twelve predictor variables, namely, height, hand span, arm length, arm girth, hand grip strength, leg strength, speed, endurance, agility, mean arterial blood pressure, vital capacity, resting pulse rate and Breath holding time." Hence the following statistical regression equation was used. The background regression method was used for the selection of variables (Thomas and Nelson, 1990).

$Y' = a + b_1x_1 + b_1x_1 + b_nx_n$

Where Y'= Y Predictor a = Constant
b_1, b_2 = Beta weights for predictor variables x_1, x_2 = predictor variables

Results and Discussions
Computation of Descriptive Statistics and Relationships
The descriptive statistics on selected physical fitness variables of subjects are presented in Table-III.
Table-III shows the descriptive statistics on selected physical fitness variables on the subjects.

Table 3: Descriptive Statistics on Selected Physical Fitness Variables of The Subjects

S. No.	Variables	N	Mean (M)	Standard Deviation (SD)	Range
1	Hand Grip Strength (kgs)	100	20.119	± 2.44	15.00-24.00

Table-III "shows the mean values, standard deviation and the range for selected physical fitness variables of the subjects. The mean of the hand grip strength was 20.12 with standard deviation of ± 2.44,
The correlation coefficient between athletic ability and the selected physical fitness variables were computed through Pearson Correlation Coefficient and the results are presented in Table-IV

Results on correlation coefficient between athletic ability and selected physical fitness variables of school boys

Table 4

S. No.	Athletic Ability Vs Anthropometric Variables	N	Mean (M)	Obtained 'r'	Significance
1	Hand Grip Strength (kgs)	100	20.119	2.04	Sig

Required table 'r' value to be significant at 0.05 level with df (1, 99) = 0.164 NS: Not Significant Sig: Significant at 0.05 level.

The results presented in Table-IV showed that there was significant relationship between athletic ability and hand grip strength of the school boys with obtained 'r' value of 2.0 4. Table-V shows the descriptive statistics on selected physiological variables of the subjects.

Descriptive Statistics on Selected Physiological Variables of the Subjects

Table 5

S. No,	Variables	N	Mean (M)	Standard Deviation (SD)	Range
1	Vital Capacity (milliliters)	100	2695	± 560.19	1780-3780

Table-V "shows the physiological variables of the subjects. The mean of vital capacity was 2695 with standard deviation of ± 560.19

The correlation coefficient between athletic ability and the selected physiological variables were computed through Pearson Correlation Coefficient and the results are presented in Table-VI.

Results on Correlation Coefficient Between Athletic Ability and Selected Physiological Variables Of School Boys

Table 6

S. No.	Athletic Ability Vs Anthropometric Variables	N	Mean (M)	Obtained 'r'	Significance
1	Vital Capacity (milliliters)	100	2695	0.125	NS

Required table 'r' value to be significant at 0.05 level with df (1, 99) = 0.164 NS: Not Significant Sig: Significant at 0.05 level.

The results presented in Table-VI showed that there was no significant relationship between athletic ability and vital capacity (r: 0.125)

Computation of Backward Multiple Regression

Table-VII shows "the backward method of variables entered and removed among the selected anthropometric, physical fitness and physiological variables based on the dependent variable and athletic ability."
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Table 7: Backward regression method of variables entered and removed

Model	Variable entered	Variables removed	Method
1	Hand grip Vital Capacity,		Enter
2		Vital Capacity	Backward (criterion: Probability of F-to-Remove >= .100).

- Predictor Variables: All the Variables selected
- Dependant variable: Athletic Ability

In table-VII, the backward regression method of removal of non-significant variables based on criteria set for F to remove the predictor variables was P > .10 by backward regression method. The following predictor variables namely, arm girth, arm length, height, speed, mean arterial blood pressure and vital capacity were removed based on the above criteria.

Conclusions

Within the limitation and delimitation of the present research study, it was concluded that:

1. It was concluded that athletic ability of schools boys were significantly related with physical fitness variables, hand grip strength,
2. The athletic ability could be best predicted from following variables, namely, hand grip strength,
3. It was concluded that vital capacity were not good predictors of athletic ability of school boys. For the above factors null hypothesis was accepted.

Recommendations

Based on the results and conclusions of the study, the following recommendations were "drawn:

1. This study could be conducted with more number of predictor variables, so that more meaningful predictor variables may be selected on the regression equation to predict the school boys athletic ability.
2. In view of the findings of this, it was suggested that the coaches and players can concentrate more on hand span, arm girth, arm length, hand grip strength, leg strength, endurance, resting pulse rate and breath holding time for improving their performances.
3. The contribution of psychological variables such as anxiety, aggressiveness, and other important psychological variables could be used to predict the athletic ability.

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