MATHEMATICAL MODULE FOR PREDICTING HEALTH FITNESS INDEX AMONG ADOLESCENTS MALE OF MUMBAI

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Abstract- The aim of this study was to develop the mathematical module Health Fitness Index of health related physical fitness of Adolescents Male of Mumbai District. The review of literature does not indicate any studies to evaluate the Mathematical Module for predicting Health Fitness Index among Adolescents Male of Mumbai District. The study was conducted by adopting the Multiple Regression Analysis. The Research Designs of the study was predicting new values for the dependent variable from the given independent variables (Predictive Modeling Technique). To accomplish this objective 3200 Boys / Adolescents Malefrom all the educational divisions of Mumbai District was taken for data collection. The subject's age group was range from 12 to 19years. The entire participants underwent 14 Physical Fitness Test i.e. Health Related Physical fitness Test components comprise of five test items and Edwin A. Fleishman Test Battery comprise of nine test items. Once the data were collected then the researcher solved the questionnaire and used IBMM SPSS-22 Software for analysis and the data were analyzed by employing Linear Regression Analysis (Analysis of Variance).The result of the study showed that In case of percentage of joint as well as individual contribution the best predictor of Health Fitness Index of Adolescents Male was found to be Muscular Strength, Muscular Endurance and Flexibility of Adolescents Male.Regression Equation for predicting Health Fitness Index on the basis of Age and Health Related Physical Fitness of Adolescents Male.$Y = 0.49 X_1 + 0.37 X_2 + 0.39 X_3 + 0.09 X_4 + 0.43 X_5 + 0.10 X_6 + 42.921$ {Y =Health Fitness Index X_1 =Age X_2=Muscular Strength X_3 =Muscular Endurance X_4 =Cardiovascular Endurance X_5 =Flexibility X_6 =BodyComposition}.

Keywords: Health Related Physical Fitness, Mathematical Module, Muscular Strength, Muscular Endurance, Cardio Vascular Endurance, Flexibility, Body Composition, Edwin A. Fleishman Test battery.

I.   INTRODUCTION:

Health is an important input in the development process. An unhealthy society cannot be a high-achieving society and will not make a nation great. The need for a healthy society and a system of education to support it is beyond doubt and debate. If a nation is to succeed and face the opportunities and challenges of the next generation, it cannot ignore health, education and physical education. It is not only a humanitarian, moral and ethical investment in health, it is an economic necessity. Health is a continuum from circumstances of maximum dependency and incapacitation to a blissful life of maximum self-reliance. "Etymologically" the word "Health" is derived from the English term meaning "whole," which in turn means a well-integrated holistic living condition. The equivalent word in Sanskrit is 'SWASTHYA,' which means depending on one's own blissful state (Rao, 1999).

Healthrelatedfitnessisdefinedastheabilitytoperformstrenuousactivitywithout excessive fatigue showing evidence of traits thatlimit the risks of developing diseases and disorders which affect a person's functional capacity. Components of health-related physical fitness are identified as muscular strength, endurance, flexibility, cardio- respiratoryenduranceandbodycomposition.However,thedegreeofdevelopmentofeach varies with the type of physical activity (Siedentop, 1994).

Considering the weightage given to physical education in the recent syllabus, measurement and evaluation would be an important problem encountered. This study proposed to develop a simple and objective method of assessing the students with to their health related physical fitness.
The study would help in-

- MathematicalModelwhichcanhelpineasycalculationofHealthFitnessIndexonthe basis simple test conducted inschool.
- Norms of the 'Health Related Physical Fitness Test' may help to categorize /classify the players in forming a homogeneous group judiciously forcompetition.
- ***Diagnosing*** the ***present status*** of Mumbai City and Mumbai Suburban School going boys and girls students.
- Physical education teacher and sports coaches will get a standardized test for measuring the fitness status of their students and can establish the relationship with health status aswell.
- ***Comparing***the***health-relatedphysicalfitness***componentsbetweenMumbaiCityand Mumbai Suburban School going boys and girls so as to be able to prescribe an adequate curriculum and means ofevaluation*.*
- ***Motivating*** the students to achieve better level of ***health-related physicalfitness.***
- The students having good level of Health Related Physical fitness can be directed for specified sports training to enrich topperformance.
- The knowledge evolve in this study may useful to conduct similar studies so as to develop new norms of Health Related Physical Fitness for college level students and even for the generalpublic.
- ***Teaching effectiveness could be evaluated*** by analyzing student performance effectively.

OBJECTIVES OF THE STUDY:

1. **a.** To study the joint contribution of Age and Health Related Physical Fitness i.e. MuscularStrength,MuscularEndurance,CardiovascularEndurance,Flexibility and Body Composition in predicting Health Fitness Index ofAdolescentsMale.

    b. To study the individual Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and BodyComposition in predicting Health Fitness Index of Adolescents Male.

    c. To establish Regression Equation for predicting Health Fitness Index on the

    Basis of Age and Health Related Physical Fitness of Adolescents Male.

HYPOTHESIS OF THE STUDY

$H0_1$ **a.** There is no significant joint contribution of Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Health FitnessIndex of Adolescents Male.

b. There is no significant individual Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Health Fitness Index of Adolescents Male.

II.   MATERIAL & METHOD:

Design of the study:
The study was conducted by adopting the Multiple Regression Analysis. The Research Designs of the present study was predicting new values for the dependent variable from the given independent variables (Predictive Modeling Technique).
Selection of Sample:
Considering the stratified random sampling a sample of 3,200 Boys / Male students from all the educational divisions of Mumbai District was taken for data collection. The subject's age group was range from 12 to 19years.
To obtain a representative sample from all over Mumbai District and to make the study more authentic and reliable, the present investigator chalked out a list of secondary schools to locate the region-wise data.

However, the blue print of subjects' distribution has been presented in Table.

Blue Print of Age wise and Gender Wise Sampling

AGE GROUP	Boys / Adolescents Male		TOTAL
(Years)	City	Suburban	
12	200	200	400
13	200	200	400
14	200	200	400
15	200	200	400
16	200	200	400
17	200	200	400
18	200	200	400
19	200	200	400
TOTAL	1600	1600	3200

SELECTED VARIABLES AND CRITERION MEASURES

Sr. No.	Dependent Variable/ Test Items	Test	Criterion Measures/Unit
	HEALTH RELATED PHYSICAL FITNESS		
1.	Muscular Strength	Push-ups(Modified for Girls)	Count/Min
2.	Muscular Endurance	Bent knee sit ups	Count/Min
3.	Cardio-Vascular Endurance	Harvard Step Test	Fitness Index
4.	Flexibility	Sit and reach	Centimeter
5.	Body Composition	Bioelectrical Impedance Analyzer (Omron Body Fat Monitor HBF-306)	In Percentage

EDWIN A. FLEISHMAN TEST BATTERY

Sr. No.	Independent Variables/ Test Items	Test	Criterion Measures/Unit
	Edwin A. Fleishman Test Battery		
1	Extent Flexibility	Twist and Touch abdominal Stretch	Inch
2	Dynamic Flexibility	Lateral Band, One Foot Tapping Bend Twist and Touch for Time	Count/Second
3	Explosive Strength	Standing Broad Jump	Meter
4	Static Strength	Hand Grip Strength	Kilogram
5	Dynamic Strength	Pull Ups, Bent Arm Hang	Count, Min/Seconds
6	Trunk Strength	Leg Lift	Count/Seconds
7	Gross Body Equilibrium	Stand on Stick with Preferred Foot for Time	Min/Seconds
8	Gross Body Coordination	Jump Through a Rope	Count/Seconds

9	Cardiovascular Endurance	548.78 Meter Run Walk for Time	Min

PROCEDURE OF THE STUDY:

The researcher made a list of Colleges located in Mumbai City. The researcher visited all the Colleges and tried to discuss and convinced the Principal of each Schools & Colleges about the purpose and importance of the study. Before the collection of data through questionnaire, the researcher explained the purpose and procedure of physical fitness test.

Total 3200 Adolescents Male students participated in this study. All subjects voluntarily agreed to participate in the program out of their own interest. The entire participants underwent 14 Physical Fitness Test and Edwin A. Fleishman Test Battery. **STATISTICAL TECHNIQUE:**

Once the data were collected then the researcher solved the questionnaire and used IBMM SPSS-22 Software for analysis and the data were analyzed by employing Linear Regression Analysis (Analysis of Variance).

III.   RESULTS:

1.   JOINT CONTRIBUTION OF AGE AND HEALTH RELATED PHYSICAL FITNESS I.E. MUSCULAR STRENGTH, MUSCULAR ENDURANCE, CARDIOVASCULAR ENDURANCE, FLEXIBILITY AND BODY COMPOSITION IN PREDICTING FITNESS INDEX OF ADOLESCENTS MALE

The Objective was to study the joint contribution of Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Fitness Index of Adolescents Male. The data were analyzed with the help of Regression Analysis and the results are given in Table No-1.

Table No-1, Multiple Correlation Coefficient in predicting Fitness Index of Adolescents Male on the basis of their Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition

Table No-1

Variables	Remark
$R_{1(2344567)} = 0.984$ 1: Fitness Index 2: Age 3: Muscular Strength 4: Muscular Endurance 5: Cardiovascular Endurance 6: Flexibility 7: Body Composition	$p < 0.01$

From Table 4.1, it is evident that Multiple Correlation Coefficient is 0.984 which is significant at 0.01 level with df = 6/3192. It indicates that the joint contribution Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Fitness Index of Adolescents Male is significant and high. Thus, the null hypothesis that there is no significant joint contribution of Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition of Adolescents Male is rejected. Further the joint contribution of Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Fitness Index of Adolescents Male is 79.43% which is quite high. It may, therefore, be said that there was a high significant joint contribution of Age and Health Related Physical Fitness in predicting Fitness Index of Adolescents Male.

2.   INDIVIDUAL CONTRIBUTION OF AGE AND HEALTH RELATED PHYSICAL FITNESS I.E. MUSCULAR STRENGTH, MUSCULAR ENDURANCE, CARDIOVASCULAR ENDURANCE, FLEXIBILITY AND BODY COMPOSITION IN PREDICTING FITNESS INDEX OF ADOLESCENTS MALE

The Objective was to study the individual Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Fitness Index

of Adolescents Male. The data were analyzed with the help of Regression Analysis and the results are given in Table No-2.

Table No-2, Percentage of individual contribution of Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Fitness Index of Adolescents Male.

Table No-2

Predictor	Beta Coefficient	t-value	r	% contribution
Age	0.49	8.139**	0.295	14.46
Muscular Strength	0.37	2.512**	0.66	24.42
Muscular Endurance	0.39	3.407**	0.36	14.04
Cardiovascular Endurance	0.09	1.449	0.22	1.98
Flexibility	0.43	8.186**	0.51	21.93
Body Composition	0.10	0.791	0.26	2.60

** Significant at 0.01 level.

From Table No-2, it can be seen that Beta coefficients for Age 0.49, Muscular Strength 0.37, Muscular Endurance 0.39, Cardiovascular Endurance 0.09, Flexibility 0.43 and Body Composition 0.10 respectively which are positive and significant at 0.01 level. It indicates that Age and Health Related Physical Fitness individually contribute significantly in the prediction of Fitness Index of Adolescents Male. Thus, the null hypothesis that there is no significant individual Age and Health Related Physical Fitness i.e. Muscular Strength, Muscular Endurance, Cardiovascular Endurance, Flexibility and Body Composition in predicting Fitness Index of Adolescents Male is rejected. Since Beta Coefficients are negative, it shows that both Age and Health Related Physical Fitness help in reducing Fitness Index of Adolescents Male. Further the individual contribution of Age 14.46%, Muscular Strength 24.42%, Muscular Endurance 14.04% and Flexibility 21.93% respectively. The contribution of Cardiovascular Endurance and Body Composition in predicting Fitness Index of Adolescents Male is 1.98% and 2.60% which is too small. It may, therefore, be said that the best predictor of Fitness Index of Adolescents Male and was found to be Age, Muscular Strength, Muscular Endurance and Flexibility ofAdolescents Male.

3.   REGRESSION EQUATION FOR PREDICTING FITNESS INDEX ON THE BASIS OF AGE AND HEALTH RELATED PHYSICAL FITNESS OF ADOLESCENTS MALE

The Objective was to establish Regression Equation for predicting Fitness Index on the basis Age and Health Related Physical Fitness of Adolescents Male The data were analyzed with the help of Regression Analysis and the results are given in Table No-3.

Table No-3, Regression Equation for predicting Fitness Index on the basis of Age and Health Related Physical Fitness of Adolescents Male.

Table No-3

$$Y = -1.45\,X_1 - 0.08\,X_2 + 221.94\,X_3 + 221.94\,X_4 + 221.94\,X_5 + 221.94\,X_6 + 221.94$$

Y = Health Fitness Index
X_1 = Age
X_2 = Muscular Strength
X_3 = Muscular Endurance
X_4 = Cardiovascular Endurance
X_5 = Flexibility
X_6 = Body Composition

The Regression Equation given in Table No-3, can be used for predicting Fitness Index of Adolescents Male on the basis of Age and Health Related Physical Fitness of Adolescents Male For using this Regression Equation, the user should get scores of Adolescents Male in respect of Age and Health Related Physical Fitness by administering the same Physical Fitness Tests as used in this study.

RESULTS ON ESTABLISHING NORMS OF ADOLESCENTS MALE
Percentile of Fitness Index Variables of AdolescentsMale

Table No-4

		Fitness Index
Percentiles	10	37.16
	20	45.58
	30	47.36
	40	48.63
	50	49.81
	60	50.98
	70	52.10
	80	53.31
	90	54.79
	100	56.93

The result of percentile norms indicates that the P10 and P100 values of the Fitness Index were "56.93 & above" and "37.16 & below" for Adolescence Male.

RESULTS ON DERIVATION OF GRADES OF FITNESS INDEX OF ADOLESCENCE MALE
The results of the percentile norms presented above were further substantiated to find out grade in the performance Fitness Index for Adolescence. The grade of raw scores in each test-item can be identified on the basis of Likert'sFive points scale. The raw score achieved in each event can be well interpreted easily so that an individual's performance in each event is either excellent or good or average or fair or poor can easily be determined. They have been presented in Table No-4.

Grading Norms of Fitness Index of Adolescence Male belonging to age of 12 to 19 Years

Table No-5

		Adolescence Male
Norms	Poor	48.11
	Fair	49.04
	Average	50.98
	Good	52.90
	Excellent	54.01

IV.   FINDINGS:

This study, within limitations, helped to warrant following conclusions:

➢ In case of percentage of joint as well as individual contribution the best predictor of Health Fitness Index of Adolescents Male was found to be Muscular Strength, Muscular Endurance and Flexibility of Adolescents Male.

➢ Regression Equation for predicting Health Fitness Index on the basis of Age and Health Related Physical Fitness of Adolescents Male.

$Y = 0.49 X_1 + 0.37 X_2 + 0.39 X_3 + 0.09 X_4 + 0.43 X_5 + 0.10 X_6 + 42.921$

Y =Health Fitness Index
X$_1$ =Age
X$_2$ =Muscular Strength
X$_3$ =Muscular Endurance
X$_4$ =Cardiovascular Endurance
X$_5$ =Flexibility
X$_6$ =BodyComposition

➢ Merely, establishing the norms does not have value until the norms are graded. In this study, the researcher has formulated the grades on the basis of Likert's five-point scale. Now the new Fitness Index has developed and standardized in this study and got a full form to be administered to assess Fitness Index of any Adolescents Male in the age group 12 to 19 years belonging to the Maharashtra State.

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