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STUDY OF RELATIONSHIP OF ADIPOSITY TO PERFORMANCE AMONG CHILDREN BETWEEN AGES 13 TO 16 YEARS USING KRAUS-WEBER TEST

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ABSTRACT

The promotion of physical fitness in youth is an objective of many agencies, institutions and organizations. Growth is a sign of life and all living animals, irrespective of their status in the biological hierarchy, have to grow, starting their life almost from an invisible dot. The purpose of this study was to find out the relationship of adiposity to performance among children between ages 13 to 16 years. As many as two hundred and one girls ranging between 13 to 16 years of ages and studying in 7th, 8th, 9th & 10th classes of the Pathanamthitta District who did not have much background in sports participation were selected randomly as subjects. Kraus weber test was used to establish the relationship of adiposity to performance among the children. The analysis of data in the study revealed that an insignificant relationship exist between adiposity and performance in Kraus – Weber Test. Kraus – Weber Test results showed more than half of the subjects (52.24%) failed in the test. ie. fifty percentage of the students had only minimum muscular strength. We hope the study will give the educators an insight to understand the interrelationship of adiposity to performance and will give an additional information about body types.

Keywords- Kraus – Weber Test, adiposity

INTRODUCTION

Sports and games provide children with healthy physical exercise and therefore help them to be physically fit. But there is a limit to the amount of fitness a sport can provide, as some sports require and develop strength, others flexibility and some other eye-hand co-ordination. Many sports entail a combination of several fitness parameters. Because of malnutrition or some other environmental factors, the functional capacity of the child may not improve yet she has to grow and become bigger to the extent to which their heredity has set limits **[1]**.

Growth refers to an increase in size, length, height and weight. Development implies overall changes in shape, form or structure resulting in improved working or functioning. With the help of the rate of growth and development of a child it is possible for us to predict the range within which her mature development is going to fall.

Fat is located under the skin (subcutaneously) in general, but particularly at specific sites such as the back of the arms, hips, thighs, abdomen and bust. During earlier childhood, girls have only slightly more body fat than boys. For example at the age of 8 a girl may have 18 percent and a boy 16 percent body fat. During and following the growth spurt, girls tend to put on fat, increasing it to about 25 per cent at 17, while boys tend to lose it, declining to 12-14 per cent at the same age. Some fat is essential as an energy source, to hold body organs in place, and to insulate nerves, among other functions. Obesity can be defined as how much higher body fat percentage than that considered normal for the age and sex of the child.

Lack of exercise is a vitally important factor, even in 6 month old infants, percentage of fat is positively related to lack of activity rather than to calorie intake. In adolescents, lack of exercise or physical activity is a major cause of obesity. An increase in body fat occurs due to increases in fat cell size, or an increase in number until early adolescence, after which increase in body fat occur mainly by increasing the size of the existing adipose cells.

This extra fat can be an advantage to girls. It gives them greater buoyancy and streamlining which will help them in swimming. It also keeps them warmer under cold conditions, as in sea, lake and lock swimming, higher altitude and winter climbing, and sailing **[2]**. On an average, women are better sea and loch swimmers, for example, eight out of the ten fastest swims across the English Channel to date have been by women, and this is at least partly due to

their better subcutaneous fat insulation **[3]**. The fat increase at puberty is largely responsible for the changing shape of the female adolescent, a change which brings with it alteration to the centre of gravity both in the body and in individual limb segments. This may adversely influence some high skill sports such as gymnastics, diving trampoling, dance and ice skating **[4]**.

The fat content of the body however, showed a marked increase with age in the man from a mean value of about 11 kg fat in the 17 to 27 years old group, to over 22 kg in the group aged 50 years and older, and in women from a mean value of about 15 kg fat in the 17 to 29 year old group to about 27 kg in the over 50 year older. The adipose tissue component of the body that tends to increase with age not fat value, and adipose tissue comprises about 64 per cent fat, 22 per cent cell residue and 14 per cent extra cellular water become a part of the fat free mass **[5]**.

Importance of body fitness

The body composition permits quantification of the major structural components of the body, muscle, bone and fat. Normally body composition can be determined by the direct and indirect method. Obesity of the individual is a great concern in sports. In measuring this aspect of body composition, the total body weight is divided into two components, lean body weight and fat body weight. Lean body weight includes, muscle, bone and vital organs. The underlying assumption is that total body eight equals lean body weight plus fat body weight. An increase in lean body mass contributes to strength and power development. Strength and power are related to muscle size. Thus, an increase in lean body mass enables the athlete to generate more force in a specific period of time **[6]**.

Assessment of human body composition

The 0-scale system is an approach to the assessment of human body composition. It arose out of a need to replace the out of date model height/weight tables and the densitometric and skin fold caliper predictions of percentage of body fat presently used by Health and Fitness Professionals. The 0-scale system features the use of an inexpensive plastic skinfold caliper, a metric measuring tape, a height triangle and a weight scale **[7]**. The 0-scale system requires the accurate measurement of weight, height, six skinfolds and three girths which permit comparison of individual's data to appropriate sex/age norms. The six skinfolds are measured, at the triceps, subscapular, supraspinale, abdominal, front thigh and medial calf sites. The 0-scale system provides alternate tables for the use of either the Harpender Skinfold Caliper or the inexpensive and robust slim guide caliper.

As the health status of a person can be determined from the body fat, so are the Kraus- Weber Tests for muscular fitness. These tests indicate a level of strength and flexibility in certain group of muscles. If one does not maitain the minimum muscular fitness, there are more chances of her posture being deformed. It is found that children brought up in slum, hilly areas and other unhygienic environments do not have a correct posture due to malnutrition, lack of facilities etc.

Importance of Kraus-Weber Tests

The Kraus-Weber Tests were constructed from clinical experience over a period of eighteen years. The six tests selected for administration are considered the most valid out of a larger battery administered designed to identify students of age six to eighteen whose strength is below minimum level **[8]**. To pass each item the student must make the maximum score without having done warm up exercise prior to the test.

Significance of the Study

Growth is an important factor, generally, the fatter the person, the greater his or her buoyancy. The whole-body density will indicate the proportional mass of each fat compartment and non-fat compartment **[9]**.

Fitness programmes in schools are not even enough for the development of minimum fitness of children. The adiposity rate of the children also increased than what the body required. It will affect the student's existence in relation to physical fitness in the field of physical education. This study will help to find out the relationship of adiposity rating to the performance of a minimum fitness test (Kraus-Weber Test) **[10]**. The effect of obesity ranges from reduction of performance in a sporting contest to 'morbid' obesity.

Objectives of the study and Selection of subjects

The study aimed for finding out a relationship of adiposity to performance using Kraus - Weber test among children between ages 13 to 16.

For the purpose of this study two hundred and one girls ranging between 13 to 16 years of ages and studying in 7^{th}, 8^{th}, 9^{th} & 10^{th} classes in the Pathanamthitta District without any experience in sports and games was selected.

Collection of data

For the collection of data, the investigator selected all the subjects on the basis of their age. They were explained the purpose of the study and various test activities were demonstrated to them, so that the subjects could form a mental picture of the various tasks which they were going to

attempt. The required data was taken within a span of twelve days.

Assessment of Adiposity

For assessing the adiposity, six skin folds and height measurements were taken viz., triceps, subscapular, supraspinale, abdominal, front thigh, and medial calf using slim guide skin fold caliper and scale.

Equipment Used for Measurements and procedure

1. Slim Guide Skin fold Caliper
2. Scale

Height

Height was measured against a vertical scale marked on the wall, the subject stood without shoes and a vertical board was kept on his head to locate the reading on the scale. The height was then read as the vertical distance from the floor to the head board mark. Reading was to the nearest 0.1 cm with 0.05 cm rounded up.

Triceps Skin folds

The subject stood, arms hanging relaxed by the sides, palms against legs. Measurement of triceps skinfold using a Lange caliper. With the subject's arm in a relaxed position, the skinfold is picked with thumb and index fingers at the midpoint of the arm. The triceps skinfold is necessary for calculating the upper arm muscle circumference. Its thickness gives information about the fat reserves of the body, whereas the calculated muscle mass gives information about the protein reserves.

The calipers were applied 1 cm. below the fingers.

Sub scapular Skin fold

The subjects stood, shoulder erect and relaxed. The fold was raised by the right of the inferior angle of the right scapula. The grasp encompassed the double layer of skin and subcutaneous tissue in the encompassed the double layer of skin and subcutaneous tissue in the natural fold which runs obliquely downwards at about a 45 degree angle. The calipers were applied at right angles to the fold 1 cm. lateral to the grasping fingers. It was recorded nearer to 0.1 cm.

Supra Spinale Skin folds

The ilio-spinale is the undermost tip of the anterior superior iliac spine. The fold was picked up three to five centimeters above the anterior superior iliac spine on the diagonal line going downwards and inwards. Reading to the nearest 0.1 cm was recorded as the score.

Abdominal Skin fold

A vertical fold adjacent to the left of the onphalion (Navel) with the grasp of the fold at this level and the application of the calipers were below and at right angles to the

fold. Reading to the nearest .1 cm was recorded.

Front Thigh Skin fold

The subject was seated to give support to the right hamstring muscles which tends to taken tension off the front thigh skin fold which was raised at the mid-inguinal-parallel to the long axis of the femur. The grasp encompassed a double fold of skin and the subcutaneous tissue. The calipers were applied at right angle to the fold which was firmly controlled.

Medial Calf Skin fold

The medial calf skinfold site is one of the common locations used for the assessment of body fat using skinfold calipers. The subject with knees flexed and placed her foot on a box or chair. A vertical fold was raised by a grasp of the right medial calf skin fold (inner side) at the level of the estimated greatest girth. The caliper applications were at right angles to the fold 1 cm. below the grasping fingers.

Administration of Kraus-Weber Tests

The test items were conducted strictly, following the procedures described by Donald K. Mathews. Similar and identical conditions were ensured for testing and obtaining the reliable data. Scoring was done on the basis of pass and fail. No warm up was given prior to the administration of tests.

Equipment

1. Three stop watches
2. Table
3. Pillow

Test 1 : In this test the strength of the abdominal and psoas muscles were determined.

Designation – "Abdominal Plus Psoas" as A+

The Subject was in supine position, with hands behind neck the examiner held the subject's feet down on the table and asked try to roll up into a sitting position.

Grading

If the subject was able to reach a sitting position without any help she passed the test. Those who were unable to reach the same failed.

Test 2

This was also a further test for abdominal muscles.

Designation – "Abdominal Minus Psoas" or A-

The subject was in supine position with hands behind the neck and knees bent. The examiner held the subject's feet down on the table and asked her try to roll up into a sitting position.

Scoring: Same as Test 1.

Test 3: This tests the strength of the psoas and lower abdominals.

Designation – "Psoas" or P.

The subject was in supine position with hands behind the neck, and legs extended. She was then asked to lift her feet 10 inches, off the table without bending the knee and maintain for ten seconds.

Scoring:

Those who maintained for ten full seconds passed and those who were unable failed.

Test 4: This tests the strength of the upper back muscles.

Designation – "Upper back" or UB.

The subject was in prone position with a pillow under her abdomen which gave the feeling of being on a seesaw, one end of which could be held in the air if the other end were weighted. The commands aided in getting the subject in the proper position. Examiner held down her feet while the subject raised her chest, head and shoulders with her hands behind the neck. Maintain for 10 seconds.

Scoring:

Pass for those holding for 10 seconds and less than 10 seconds failed.

Test 5: This tests the strength of the upper back muscles.

Designation – "Lower back" or UB.

The subject remained prone over the pillow but removed her hands from behind the neck, placed then down on the table, and rests her head on them. The examiner held her chest down on the table and asked her to lift her legs up, without bending the knees. Holding of this position was for 10 seconds.

Scoring

Pass for those holding for 10 seconds and less than 10 seconds failed.

Test 6: This tests the length of the back and hamstring muscles.

Designation – "Back and Hamstrings" or BH

The subject stood erect in stockings or bare feet, with hands at her sides, feet together, knees straight and asked the subject to lean down slowly and touch the floor with finger tips. Stay down for 3 seconds. The examiner should held the knees of the person being tested in order to prevent any bend.

The person who touched the floor and remained for 3 seconds passed and those who were unable to do it failed.

Reliability of instruments

The stop watches, scale and skin fold calipers used in the study were procured from reliable companies. All the instruments used were available in the Department of physical education, Catholicate college, Pathanamthitta and their calibration was accepted as accurate enough for the purpose of this study.

Reliability of data

For establishing the reliability of the test, the test-retest method was used. For this

the anthropometric measurements and Kraus-Weber Tests were conducted twice. The scores of the tests thus obtained in a duration of two days were correlated and coefficient of reliability obtained for each tests of Kraus Weber, Height and Skin fold measurements were established.

Table 1: Coefficient of reliability of test retest scores of skin folds and height measures

Variables	Coefficient of Reliability
1. Triceps Skin fold	0.91
2. Sub scapular Skin fold	0.93
3. Supra Spinale Skin fold	0.94
4. Abdominal Skin fold	0.91
5. Front Thigh Skin fold	0.96
6. Medial Calf Skin fold	0.97
7. Height	0.98

It is evident that the reliability coefficients obtained were fairly high and thus were accepted for the purpose of this study.

Table 2: Coefficient of reliability in test retest method of Kraus-Weber test

Test Items	Coefficient of Reliability
1. Abdominal Plus Psoas	0.98
2. Abdominal Minus Psoas	0.96
3. Psoas	0.91
4. Upper back	0.96
5. Lower back	0.95
6. Back and Hamstring	0.98

It is evident that the reliability coefficients obtained were fairly high and thus were accepted for the purpose of this study.

Findings of the study

Mean of scores in Kraus – Weber Test and the adiposity measures (triceps Skin fold, Sub scapular skin fold, supraspinale skin fold, abdomen skin fold, thigh skin fold, Medial calf skin fold and Height) for ages 13 to 15 have been described in **Table 3**.

It is evident from Table 3 that Mean scores of 16 year old girls were 12.17 for triceps, 12.1 for subcapular, 12.17 for supraspinale, 15.8 for abdomen, 31.86 for thigh, 15.17 for medial calf and 153.93 for height. The standard deviation of 13 year old girls were 5.26 for triceps, 5.95 for subscapula, 2.36 for supraspinale, 7.38 for abdomen, 6.58 for thigh, 4.92 for medial calf and 5.08 for height.

Mean scores of 15 year old girls were 9.69 for triceps, 9.13 for subscapula, 9.78 for supra spinale, 12.36 for abdomen, 26.68 for thigh, 12.3 for medial calf and 151.51 for height. Standard deviation were 3.52 for triceps, 3.31 for subscapula, 4.2 for supraspinale, 6.47 for abdomen, 9.41 for thigh, 4.47 for calf and 1.27 for height.

Table 3: Mean and standard deviation of anthropometric variables

Age (yrs)	13		14		15		16			
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	Sd	Mean	SD
1.Triceps Skin fold	7.91	1.77	9.57	32.78	9.69	3.52	12.17	5.26	9.67	15.29
2.Sub scapular Skin fold	6.58	2.03	9.89	5.53	9.13	3.31	12.10	5.95	9.17	4.66
3.Superaspinale Skin fold	7.43	3.11	10.06	4.80	9.78	4.20	12.17	2.36	9.66	4.07
4.Abdominal Skin fold	9.01	4.63	17.17	404.54	12.36	6.47	15.80	7.38	13.12	4.46
5. Thigh Skin fold	22.89	6.91	25.99	9.00	26.68	9.71	31.86	6.58	26.52	8.74
6.Calf Skin fold	10.04	4.24	13.30	7.67	12.30	4.47	15.17	4.92	12.46	5.60
7. Height	145.12	8.47	149.24	5.35	151.51	1.27	154.93	5.08	149.91	6.63

Mean scores of 14 year old girls were 9.57 for triceps, 9.89 for subscapula, 10.06 for supra spinale, 17.17 for abdomen, 25.99 for thigh, 13.3 for calf and 149.24 for height. Standard deviation were 32.78 for triceps, 5.53 for subscapula, 4.8 for surpaspinale, 404.54 for abdomen, 9 for thigh, 7.67 for calf and 5.35 for height.

Mean scores of 13 year old girls were 7.91 for triceps, 6.58 for subscapula, 7.43 for supraspinale, 9.01 for abdomen, 22.89 for thigh, 10.04 for calf and 145.12 for height. Standard deviation were 1.77 for triceps, 2.03 for subscapula, 3.11 for supraspinale, 4.63 for abdomen, 6.92 for thigh, 4.24 for calf and 8.47 for height.

Mean scores of total subjects between the ages 13 to 16 were 9.67 for triceps, 9.17 for subscapula, 9.66 for supraspinale, 13.12 for abdomen, 26.52 for thigh, 12.46 for calf and 149.91 for height. Standard deviation were 15.29 for triceps, 4.66 for subscapula, 4.07 for supraspinale, 4.46 for abdomen, 8.74 for thigh, 5.6 for calf and 6.63 for height.

Table 4:Measurement of adiposity of subjects at different age levels

Age Levels	Mean	SD
16 year old	109.19	35.42
15 year old	89.85	30.14
14 year old	92.19	17.06
13 year old	74.44	20.09
Total Group	89.93	33.46

The mean adiposity and standard deviation are presented in **Table 4**. It is evident from the **Table 4** that mean score at 16 year on adiposity was 109.19 and S.D. was 35.42, 89.85 and 30.14 for 15 year, 92.19 and 17.06 for 14 year, 74.44 and 20.09 for 13 year, 89.93 and 33.46 for total subjects. The Stanine Scale to be used as Adiposity Rating Scale was constructed and is given in **Table 5** for age 13 to 16 years.

Table 5: Female adiposity rating

Age Level 1	2	3	4	5	6	7	8	9	10
13 yrs	39.28	49.33	59.38	69.43	79.48	89.53	99.58	109.63	119.68
14 yrs.	62.33	70.86	79.39	87.92	96.45	104.98	113.51	122.04	130.57
15 yrs.	37.10	52.17	67.24	82.31	97.38	112.45	127.52	142.59	157.66
16 yrs	47.21	64.92	82.63	100.34	118.05	135.76	153.47	171.18	188.89

Table 6: Percentage of failures in Kraus- Weber test performance

Test Item	16 year	15 year	14 year	13 year
1.Abdominal Plus Psoas	26.19%	28.81%	28.57%	20.69%
2. Abdominal Minus Psoas	28.57%	52.54%	30.95%	44.83%
3.Psoas	00.00	16.69%	11.90%	06.90%
4.Upper Back Muscle	02.38%	03.39%	11.90%	00.00
5. Lower Back Muscle	02.38%	13.56%	19.00%	00.00
6.Flexibility of Back and Hamstring	04.76%	15.25%	00.00	06.90%

Table 7: Failures in Kraus- Weber test performance between ages 13 to 16 years

Test Item	Percentage of Failures	Total Number of Failure
1. Abdominal Plus Psoas	25.87%	52
2.Abdominal Minus Psoas	40.80%	82
3. Psoas	09.45%	19
4. Upper Back	03.98%	8
5. Lower Back	09.95%	20
6. Flexibility of back and Hamstring	07.46%	15

It is evident from **Table 6 and 7** that the percentage of failures in Kraus – Weber Test items were 25.87% for abdominal plus psoas, 40.8% for abdominal minus psoas, 9.45% for paoas, 3.98% for upper back, 9.95% for lower back and 7.46% for flexibility of back and hamstring muscles. The maximum percentage of failures were in abdominal minus psoas muscle (40.8%). Total percentage of failures in Kraus-Weber Tests among children between ages 13 to 16 years were 52.24%. Biserial Correlation was developed in order to determine the relationship of adiposity to performance in Kraus – Weber Test.

The scores of the continuous variables (Anthropometric measures) and dichotomous variables (Pass and fail of Kraus – Weber Test performance) were correlated in order to find out the relationship between the adiposity and Kraus – Weber Test.

Table 8: Mean and standard deviation of the dichotomus variables

Dichotomous	Mean	SD
1. Passed group (Mp)	87.2	22.6
2. Failed group (Mq)	92.2	16.55
3 Total group (Ot)	-	43.1

The relationship of adiposity to Kraus – Weber Test performance was obtained as 07. It can be seen that performance in Kraus – Weber Test showed an insignificant correlation with adiposity. This was insignificant at 0.5 level of confidence (df). Since the obtained correlation was less than the required value of 1.97 at 05 level of confidence. Hence it may be concluded that adiposity did not have any significant influence in the Kraus- Weber test among children between the ages 13 to 16 years.

Discussion of Findings

The analysis of data in the study revealed insignificant relationship between adiposity and performance in Kraus – Weber Test. Among the Kraus – Weber Test result, more than half the subjects (52.24%) failed in the test. It may be due to some other factors of minimum muscular fitness (strength, flexibility etc).

The available literature indicates that adiposity does play an important role in performance but its role may be limited mainly at high adiposity levels only. In the present study all the subjects ranging from 13 to 16 have been selected not on the basis of adiposity. This may be reason for obtaining insignificant relationship between adiposity and performance on Kraus – Weber Test. Therefore, the reason of failure may be lack of physical education performance in the school.

CONCLUSIONS

It was concluded that more than 50 per cent of the students were lacking minimum muscular strength. Study reveals that there is no significant relationship between the adiposity and performance in Kraus-Weber Test

Implications of the study

The adiposity rating scale as proposed may be conveniently used by school physical education teachers for rating children in adiposity. This study will help educators to understand the interrelationship of adiposity to performance in Kraus-Weber Test and will give additional information about body types. This will help the coaches, physical educators and other concerned people to find out the status of a person in obesity. It helps to evaluate school curriculum with respect to general health of the overall student population. The study also motivates other physical educators to take up similar studies with some other variables on different category of students. Finally the study helps to enlighten the importance of physical and body fat aspects of the students in the total educational system.

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