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## **DEVELOPING NORMS FOR THE TEST BATTERY MEASURING THE PHYSICAL FITNESS LEVEL OF THE EARLY ADOLESCENTS**

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### **ABSTRACT**

*As a matter of common observation, many batteries of tests have been in practice for measuring the fitness level of the different attributes of different age groups. Each test battery has its test norms for each age group. Most of the available test batteries have been developed in developed countries where socio-economic and cultural conditions have been quite different from those of Pakistan. The existing performance testing batteries differ in terms of suitability to measure our different capabilities on the ground that we have been deficient in facilities, we belong to an area having low income, and our climatic conditions have also been different to the developed countries. For data collection, different tests like Vertical Jump, Hand Grip, Sit and Reach, Beep Test (Multistage Fitness Test), Sit-Ups and Body Mass Index (BMI) were conducted with the help of physical education teachers of the concerned schools. These tests were employed to evaluate different health-related components of the physical fitness of the early adolescents aged 12-14 years in the selected areas. The data were noted on a properly constructed chart that was later tabulated using SPSS*

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*(Statistical Package for Social Sciences) version 16.0 with the help of computer in order to get authentic results.*

**KEYWORDS**

*Battery measuring, Physical fitness, Body mass index, Hand grip, Beep test.*

**INTRODUCTION**

The term physical fitness refers to the state of the body associated with an individual's capability to efficiently meet the different types of tough and critical situations in everyday life. It is one of the prerequisites for promptly discharging the routine engagements of life. Physical fitness, as a whole, is a composite phenomenon. Elaborating on the term physical fitness Haga (2008) has declared it as a combination of the physical traits that a person has or strives to have, its association with the ability concerned with promptly discharging the physical assignment. The literature relates several elements to the acquisition of physical fitness. The existing literature has repeatedly endorsed a few components e.g., a) Cardio-Respiratory Endurance, which refers to the body's ability to supply fuel during strenuous physical activity, b) Muscular Endurance, is associated with the repeated contraction of the muscles without being fatigued, c) Muscular Strength, which deals with the output of the muscle resulting in a single contraction, d) Flexibility, concerned with the maximum limit of movement at a joint and e) Body Composition, stands for comparison of the body fats with the lean body mass. "Physical fitness comprises some components: muscular endurance, muscular strength, flexibility, cardiorespiratory fitness, coordination, and speed" (Deforche. et al., 2003).

Physical fitness is a heavenly gift. Physical fitness is one of the prerequisites for a healthy and comfortable life and promptly performing the routine engagements of the life. Vitality and significance of physical fitness has universally been confessed irrespective of the age and field or profession. According to Malina (2004) physical fitness plays a pivot role in human's lives. The author further stated that people who are physically fit can perform their routine matters effectively and efficiently and more significantly physically fit people are less prone to disease and infirmities. Physical fitness has been one of the pre-requisites of successful sports career. In the field of sports, Domination in performance of an athlete is depends upon his physical fitness level. Fitness of the players has got vital role in the world of sports. In a research study, William and Wikins (2007) concluded that physical fitness of the players is significantly related to the sports performance. Physical fitness is a multidimensional phenomenon, composed of different components. Generally, these components include aerobic power, anaerobic capacity, strength, endurance and mobility of the joints. Different sports activities need specific fitness components. According to Routledge (2007) identification of the fitness components contribute to better

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performing in sports.

### **LITERATURE REVIEW**

To measure the fitness level of a person is considered as a very strong tool to select a player for specific activity in sport. It provides a clear indication to the coach/trainer to choose a right player for a right activity. A study conducted by Wikins (2007) illustrated that as effective fitness testing helps the coaches in the proper selection of the players in connection to their respective sports. Different types of tests are being employed in this regard in the shape of Test Batteries. Physical fitness is considered as prime need for doing any job with vigour and alertness and every person is endowed with a varied amount of it. In the world of sports, fitness of the players carries vital significance. To measure the fitness level of a person has not been an ordinary assignment. It needs consolidated, technical & professional approach to determine the fitness level of an individual. Test Battery comprises of the combination of several fitness tests measuring varied physical requirements of the different sporting events. *“The battery of tests consists of valid, reliable, manageable and secure field tests that can be used to monitor public health”* (Dragan *et al.*, 2013). Globally, a numeral Test Batteries have been settled which have effectively been serving in measuring the level of fitness of the athletes. A Battery is regarded as perfect that has the capacity to evaluate the different constituents of physical fitness allied with the health of the children and adolescents (Dragan *et al.*, 2013).

Each and every Test Battery commonly used in the world for determining the fitness level of the athletes has its own set of tests and Norms. Norms are the test performance charts or tables of the subjects. The term norm is associated with measuring the physical output in comparison to other individuals of the same age, sex and at a specific performance level (Sankar, 2012). Norms are developed to offer the scale of performance in terms of efficiency. To measure the fitness level of the subject, the attained score of the subject is compared with the approved norms of the concerned test. Early Adolescence is the age group between 12-14 years of age. *“Adolescence is divided into three phases, early (twelve to fourteen years), middle (fifteen to seventeen years), and late (eighteen to twenty years). Although certain approaches, manners, and physical milestones tend to occur at certain ages, a wide spectrum of development and behavior for each age is normal”* (Theodoratou-Bekou, 2008). This is the most vital stage of the life as during this particular age, the child tends to join the sport event. Therefore, on the basis of the fitness test, the coaches will be in a better position to recommend right person to the right event.

As a matter of common observation, for measuring the fitness level of the different attributes of the different age-groups, a number of test batteries have been in practice. Each test battery has its own test norms according to the specific age. Develop norms

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for the test batteries which will be used to measure the fitness level of the early adolescents was the objective of the in-hand study. Most of the available test batteries have been developed in the developed countries where economic and socio-cultural conditions have been quite different from that of ours. On the other hand, we have still been lacking in developing our own test battery that could be applied for measuring the physical fitness of the adolescents considering the economic and socio-cultural conditions of our country.

Viewing this situation, the researcher decided to carry a study to develop norms for the test battery measuring physical fitness of early adolescent. For this purpose, the researcher engaged 550 volunteer students of the specified age group from the Boys High Schools in randomly selected districts of Khyber Pakhtunkhwa. Different tests like Vertical Jump, Hand Grip, Sit and Reach, Multistage Fitness Test (Beep Test), Sit-Ups and Body Mass Index (BMI) were conducted with the help of the physical education teachers (PET) of the concerned schools for the collection of data. Purpose of the conduct of the aforementioned tests was to evaluate the different physical components of the early adolescents aging 12-14 years in the selected areas. The data were carefully recorded on a specially designed chart and later on the same was tabulated using Statistical Package for Social Sciences (SPSS) version 16.0 to get the authentic results.

### **RESEARCH OBJECTIVES**

1. To develop a test battery for measuring the physical fitness level of the early adolescents aged 12-14 years.
2. To formulate new norms for the test battery measuring the physical fitness level of the early adolescents.
3. To review the composition of the in-practice test batteries measuring the physical fitness level.
4. To compare the composition of the newly developed test norms with existing test norms concerning measuring the physical fitness level of the early adolescents.

### **RESEARCH METHODOLOGY**

#### **Population of the Study**

The population for this study comprised of all the early adolescents aging 12-14 years representing various public and private sector educational institutions of Khyber Pakhtunkhwa, this study was conducted at the province level of KP that consists of twenty-five (25) Districts

#### **Sample and Sampling Procedure**

For this study, the researcher has taken a sample from the population after careful consideration of different aspects of the problem. A sample of Five (05) Districts,

Peshawar, Nowshera, Karak, Dera Ismail Khan and Swat (20% percent of the total 25 districts) was randomly selected using L.R Gay (1987) method. With reference to the number of subjects for developing norms, there exists no hard and fast binding for the researcher. Overall the researcher selected a sample of 550 volunteers of the specified age group from the educational institutions of the selected districts.

### **Instrument used for data collection**

For the purpose of data collection, the researcher, under the guidance of supervisor and in light of the available literature, employed suitable and standardized tests like Handgrip Strength Test, Sargent Jump, Sit and Reach, Multistage Fitness Test (Beep Test), Body Mass Index (BMI) and Sit-Ups to evaluate the different physical components of the early adolescents aging 12-14 years in the selected areas. Illustration of the items is hereby given as under

#### **Handgrip Strength Test**

The Handgrip Strength Test is used to measure the extreme strength of the forearm and hand muscles.

#### **Sargent Jump**

This test is an in-practice to measure the power of muscles of the total body.

#### **Sit & Reach Test**

The researcher has employed this test to evaluate the flexibility, particularly the flexibility of the hamstring muscles and lower back.

#### **Beep Test (Multistage Fitness Test)**

Beep Test (Multistage Fitness Test) has been used to determine optimum aerobic fitness level of the body.

#### **Sit-Ups**

The researcher has employed Sit-ups for measuring the endurance and strength of the hip flexor muscles and abdominals.

#### **Body Mass Index**

Body mass index has been employed for assessing the body composition of the subjects.

#### **Data Collection Procedure**

Before data collection, the researcher contacted all heads of the concerned schools to take them in confidence and to obtain approval concerning the conduct of the research study. After getting formal approval, the researcher with the help of Physical

Education Teacher (PET) of selected schools, employed the tests items upon the volunteers and their performance was noted accordingly. In the beginning, the researcher personally demonstrated the procedure of performing various tests items before the students to enable them to follow the procedure satisfactorily. Separate charts were prepared for recording the data of each test which was the part of the study. The researcher noted performance of the subjects on respective charts. In this way data were collected which was later on treated through statistical tools for drawing findings and conclusions.

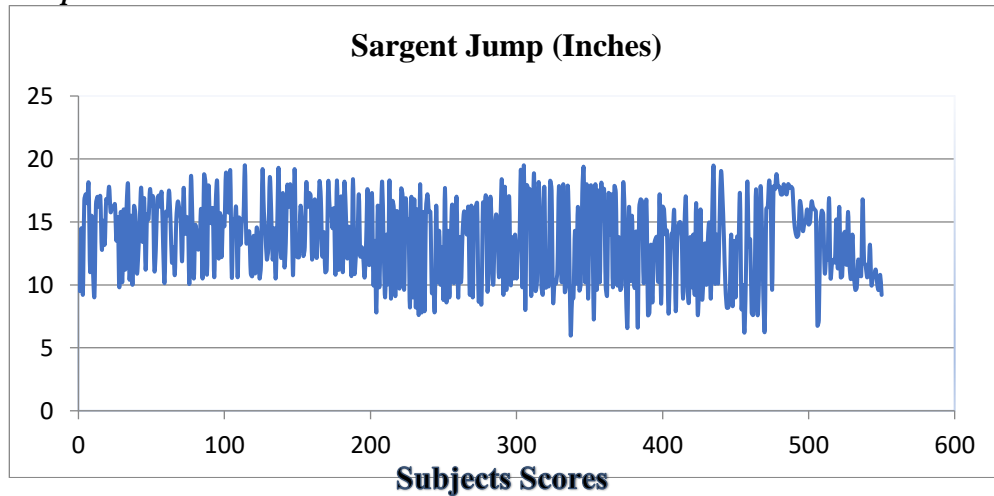
**FINDINGS AND DISCUSSION**

The collected data were tabulated and analyzed through using appropriate statistical techniques like mean, standard deviation and percentile, as Benneyan *et al.* (2003) states that application of appropriate statistical methods helps in drawing purposeful conclusion. Concerning the tabulation, the figures of the collected data were put into five categories ranging from very good, good, average and poor to very poor. SSPS 22 and Microsoft Excel 20210 were used to analyzed the data.

**Result**

Based on data analyses, the following findings were made.

**Figure No 1: Showing the overall Graphic performance of the subjects in Sargent Jump**

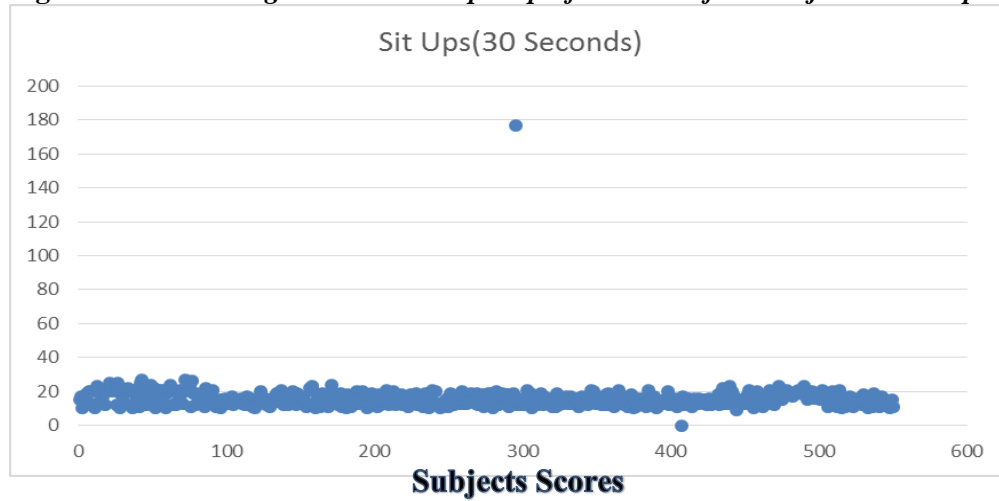


**Table No 1: Showing Standard Deviation and Mean Scores of the subjects in Sargent Jump.**

Test Item	Standard Deviation	Mean
Sargent Jump (Inches)	3.25	13.61

The above table No. 1 illustrates that the Mean score of the subjects (N=550) is 13.61 inches whereas, the Standard Deviation is 3.25 inches.

**Figure No 2: Showing the overall Graphic performance of the subjects in Sit Ups.**

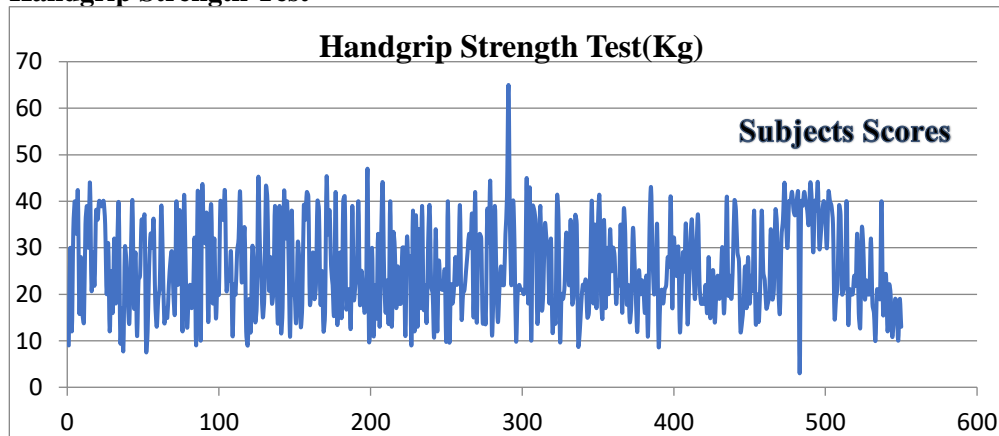


**Table No 2: Showing the Standard Deviation and Mean scores of the subjects in Sit-ups.**

Test Item	Standard Deviation	Mean
Sit Ups (30 Seconds)	7.72	15.78

According to the figures in the above table Mean score of the subjects in 30 seconds Sit up is found 15.78 while Standard Deviation is found as 7.72.

**Figure No 3: Showing the overall graphic performance of the subjects in the Handgrip Strength Test**

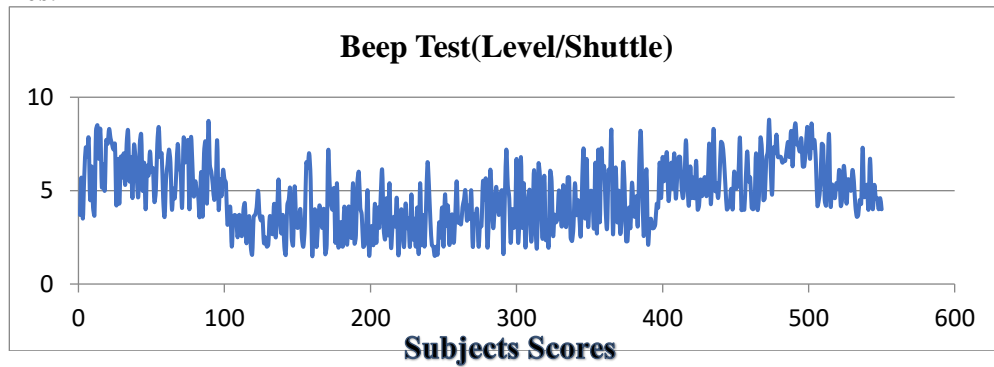


**Table No 3: Showing Standard Deviation and Mean scores of the subjects in the Handgrip Strength Test**

Test Item	Standard Deviation	Mean
Handgrip Strength Test (Kg)	3.25	13.61

The analyzed data show that the Mean score of the subjects (N=550) is 25.64kg and in Standard Deviation it is 9.89kg.

**Figure No 4: Showing the overall Graphic performance of the subjects in the Beep Test**

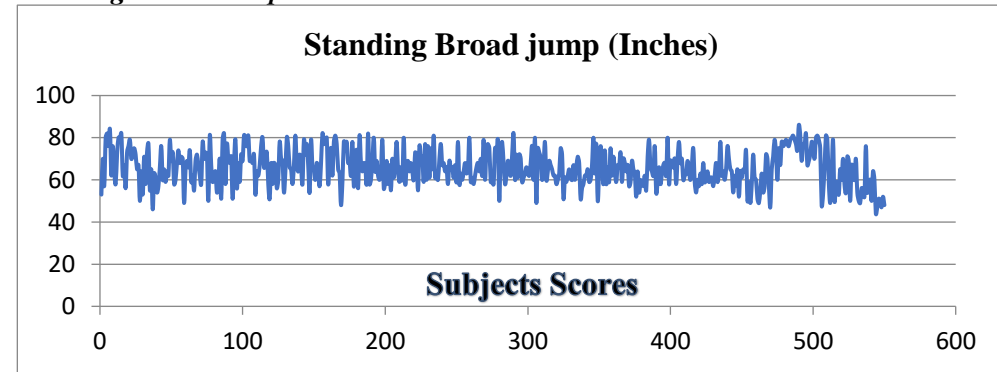


**Table No 4: Showing the Standard Deviation and Mean of the subjects in the Beep Test**

Test Item	Standard Deviation	Mean
Beep test (Level/Shuttle)	1.74	4/8

The data shows that the Mean score of the subjects (N=550) is 4/8 Level/Shuttle and Standard Deviation is found as 1.74 Level/shuttle.

**Figure No 5: Showing the overall Graphic performance of the subjects in Standing Broad Jump**



**Table No5: Showing the Standard Deviation and Mean scores of the subjects in Standing Broad Jump.**

Test Item	Standard Deviation	Mean
Standing Broad jump (Inches)	8.54	65.68

The above table indicates that the Mean score of the subjects (N=550) is 65.68 inches whereas, the standard deviation is 8.54 inches.

**Figure No 6: Showing the overall Graphic performance of the subjects in Sit & Reach**



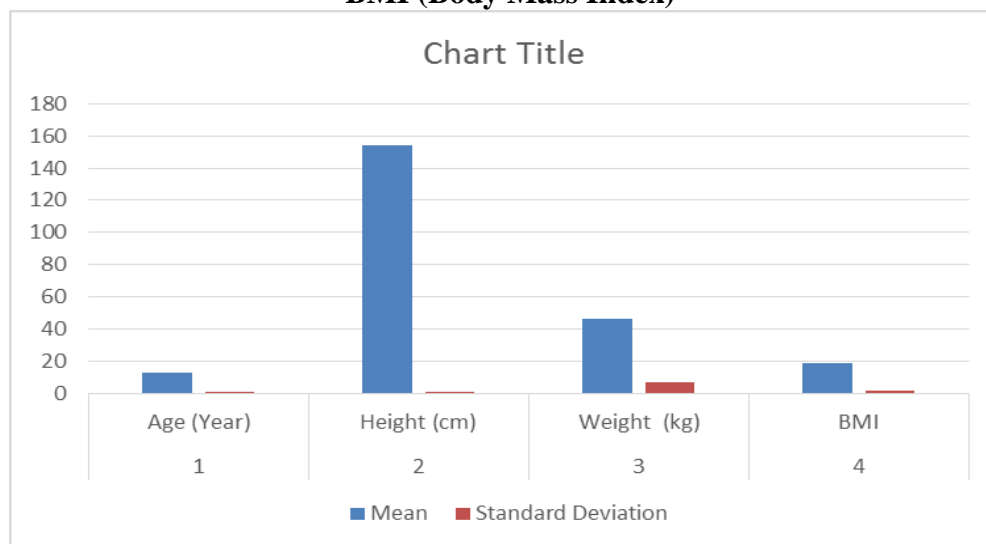
**Table No 6: Showing Standard Deviation and Mean scores of the subjects in Sit & Reach.**

Test Item	Standard Deviation	Mean
Sit & Reach (Inches)	2.91	10.02

The analyzed data shows that the mean score of the subjects (N=550) is 10.02 inches and the standard deviation is found as 2.91 inches.

**Figure No 7: Showing Body Mass Index (BMI) of the Subjects (N=550)**

**BMI (Body Mass Index)**



**Table e No 7: Showing Body Mass Index (BMI) of the Subjects (N=550)**

Item	Mean	Standard Deviation
Age (Year)	13	0.63
Height (cm)	154	0.46
Weight (kg)	46	7.17
BMI	19	1.45

The above table elaborates Age, Height and Weight for calculating BMI of the total subjects (N=550). According to the table, the age Mean of the subjects is 13 years and Standard Deviation is 0.63 years, similarly height Mean is 154cm and Standard Deviation: 0.46 cm, weight Mean is 46kg and Standard Deviation is 7.17kg whereas Mean and Standard Deviation of BMI is respectively 19 and 1.45.

**Table No 8: Showing the Developed Norms**

Test Item	Poor	Below Average	Average	Above Average	Excellent
Sargent Jump (Inches)	< 10	10-13	13-15	15-17	>17
Sit Ups (30 Seconds)	< 12	12-14	14-16	16-19	>19
Handgrip Strength Test(Kg)	< 10	10-13	13-15	15-17	>17
Beep test	< 3/1	3/1-4.1	4/1-5/2	5/2-6/5	>6/3

(Level/Shuttle)					
Standing Broad jump (Inches)	< 59	59-63	63-68	68-75	>75
Sit & Reach (Inches)	< 6.8	6.8-9.6	9.6-10.8	10.8-13	>13

**Table No 9: Showing Internationally Developed (In-practice) Norms**

Test Item	Poor	Below Average	Average	Above Average	Excellent
Sargent Jump (Inches)	<8	8-12	12-16	16 – 20	20 – 24
Sit Ups (One Minute)	25	35	41	48	58
Beep Test (Level/Shuttle)	< 3/3	3/3-3/1	5/2 - 6/4	6/5 - 7/3	7/6 - 8/8
Standing Broad jump (Inches)	<52	52-62	62-75	75-84	>84
Sit & Reach (cm)	<13	13-22	22-26	26-30	30-36
	<b>Weak</b>	<b>Normal</b>	<b>Strong</b>		
Handgrip Strength Test(Kg)	< 9.4	19.4-31.2	> 31.2		

Table No. 8 and 9 are sketched for comparison. The Norms of the present study are shown in table No. 4.9 and similarly the internationally developed Norms are shown in table no. 4.10. The comparison shows that the norms developed in the present study are weaker than the internationally developed Norms used for measuring the fitness level of the early adolescents.

## FINDINGS

After careful data analyses, the researcher reached at certain findings which are summarized as follows:

1. The researcher found that the Mean score of the subjects (N=550) in Sargent Jump is 13.61 inches whereas, the Standard Deviation is 3.25 inches. (See Table 4.2)
2. The data revealed that the Mean score and Standard Deviation concerning 30-second sit-ups are found respectively as 15.78 and 7.72. (See Table 4.3)
3. When the Handgrip Strength Test was applied, the researcher noted the Mean score of the subjects' 13.61kg and a Standard Deviation of 3.25kg. (See Table 4.4)
4. In the Beep Test, the researcher found the Mean score as 4/8 (Level/Shuttle) whereas Standard Deviation is found as 1.74 (Level/Shuttle). (See table 4.5)
5. Similarly, in Standing Broad Jump; the Mean score is found 65.68 inches

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while the Standard Deviation is found as 8.54 inches. (See Table 4.6)

6. In the last item of Sit & Reach, the data revealed that the Mean score is 10.02 inches and the Standard Deviation is found as 2.91 inches. (See table 4.7)

According to table No. 4.8, the Mean the age is 13 years and Standard Deviation is 0.63 years, the Height mean is 154cm and Standard Deviation is 0.46cm, the weight mean is 46kg and Standard Deviation is 7.17kg whereas the Mean and Standard Deviation of BMI is 19 and 1.45 respectively.

## DISCUSSION

This study was conducted to develop norms for the test battery measuring the physical fitness level of early adolescents. Conveniently available 550 volunteer students were selected from five randomly selected districts of KP who take part in the study. At the time of conducting the study, the researcher applied six different tests namely Sargent Jump, Sit Ups, Handgrip Strength Test, Beep Test, Standing Broad Jump and Sit & Reach in directive to measure the performance of different capacities of the subjects.

The data revealed poor performance particularly in Beep Test and Sargent Jump in respect of the subjects. The same stance has also been found in the study conducted by Franks *et al.* (1998) who conducted the Sargent Jump and Beep Test, and found deficient level of back muscle strength and cardio-vascular endurance. The study has further found that this weak condition of the back muscles leads to low back pain and heart disease. The findings of the in-hand study are also supported by Cvejic *et al.* (2013) who conducted a study, "Assessment of physical fitness in children and adolescent" and found low results in testing of components of fitness. The same study has further suggested that concrete measures should be applied to increase the fitness level of adolescents.

The present study showed satisfactory score in Standing Broad Jump and Sit & Reach, whereas the study of Baltaci *et al.* (2003) supported the findings of the in-hand study who found satisfactory score in Standing Broad Jump and Sit & Reach Test. Similar stance has also been found in the study of López-Miñarro *et al.* (2008), whereas the findings of the study did not support by Lemmink *et al.* (2003) who found poor score in Standing Broad Jump and Sit & Reach. As for as Sit Up and Handgrip Strength Test are concerned, the result showed weak performance as compared with others.

The study has several limitations with reference to its prompt conduct. First, the subjects were found inexperienced in performing such exercise. So, the exterior evaluation may not reflect the true intervertebral movement because of hesitation in performing such exercises particularly during the conduct of Beep Test. Secondly; this was a pioneer study in the field conducted locally, which limits the generalization of

the results. Hence, additional studies may be conducted by selecting different age groups children and adolescents as well as selecting different types of tests used for measuring the fitness level of the subjects for adding new information to the field of sports.

It has been concluded that the subjects have shown different scores in various test items employed in the study. In Sargent Jump the score is a Mean of 13.61 inches, a Standard Deviation of 3.25 inches, 30 seconds Sit Ups score is a Mean of 15.78, Standard Deviation of 7.72 and Handgrip Strength Test Mean is 13.61kg, Standard Deviation is 3.25kg. similarly, the Beep Test was found as Mean of 4/8 Level/Shuttle, Standard Deviation of 1.74 Level/Shuttle, and Standing Broad Jump is as Mean of 65.68 inches, Standard Deviation is 8.54 inches, whereas Sit & Reach Mean is 10.02 inches and Standard Deviation is 2.91 inches (See Table No.4.7).

After applying the tests, the data was processed through three main statistical tools e.g. Mean, Standard Deviation, and Percentile (20<sup>th</sup>, 40<sup>th</sup>, 60<sup>th</sup>, and 80<sup>th</sup>). The performance of the subjects was put up into five different categories Poor, Below Average, Average, Above Average, and Excellent which were named as Norms. According to the data, the performance of the subjects in all six tests is marked as, in Sargent Jump (below 10 inches -poor), (10-13 inches, Below Average), (13-15 inches, Average), (15-17 inches, Above Average) and (17 inches and above, Excellent). In 30 seconds Sit-ups (below 12 Score-poor), (12-14 Score, Below Average), (14-16 Score, Average), (16-19 Score, Above Average) and (19 Score and above, Excellent), Hand Grip Strength Test (10kg-poor), (10-13 kg, Below Average), (13-15 kg, Average), (15-17 kg, Above Average) and (17 kg and above, Excellent). And Beep Test (Below 3/1Level/Shuttle-poor), (3/1-4/1 Level/Shuttle, Below Average), (4/1-5/2 Level/Shuttle, Average), (5/2-6/5 Level/Shuttle, Above Average) and (6/3 Level/Shuttle and above, Excellent). Similarly, Standing Broad Jump (Below 59 inches -poor), (59-63 inches, Below Average), (63-68 inches, Average), (68-75 inches, Above Average) and (75 inches and above, Excellent) and Sit & Reach (6.8 inches - poor), (6.8-9.6 inches, Below Average), (9.6-10.8 inches, Average), (10.8-13 inches, Above Average) and (13 inches and above, Excellent).

Concerning the comparison of the norms developed in the in-hand study with the internationally developed in-practice norms, a notable difference has been found which reveals that performance levels in the developed norms are lower than the internationally developed in-practice norms. As for as the test items included in the test battery used by the researcher for measuring the fitness level of the subjects, most of the tests have been part of the most of the internationally developed in-practice test batteries.

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## RECOMMENDATIONS

The data show that physical fitness is an excellent indicator of health. Therefore, the researcher suggests that assessment of physical fitness may be ensured regularly.

As the study is a pioneer in nature; therefore, its findings may have limits to generalizing on the whole population. Therefore, the researcher recommends to conduct additional in-depth studies in the area.

It has been a matter of common observation that adolescents, particularly students, are associated with Physical Education teachers concerning their engagement in sports and promotion of health. It has been the prime responsibility of the Physical Education teacher to pave the way for the students to attain and maintain good health. It is, therefore, recommended that Physical Education Teachers should play their due role in boosting and promoting the fitness level of the adolescent.

The researcher further recommends that in addition to the health-related constituents, skill-related components of physical fitness may also be evaluated to know about the overall condition of the physical fitness of the subjects.

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