ANALYSIS OF MUSCULAR ENDURANCE AMONG SCHOOL BOYS AND GIRLS
OF DIFFERENT AGE GROUPS

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Abstract

Objectives: To achieve the purpose of the present study one hundred and eighty (180) boys and girls of different age categories (U-14, U-17, U-19 players) studying in the various schools of cuddalore district, Tamil Nadu India were randomly selected as subjects. Among the selected ninety boys (thirty boys U-14, thirty boys U-17 and thirty boys U-19 players) and the selected ninety girls (thirty girls U-14, thirty girls U-17 and thirty girls U-19 players) with the age of the subjects ranging between 12 to 19 years were selected as subjects. Design: The static group design was used as experimental design in this study. Method: The data collected from (U-14, U-17, U-19 players) for both genders (boys and girls players) on selected health related physical fitness, variable such as muscular endurance was measured by using one-minute bent knee sit-ups, and statistically analysed by using 2 x 3 factorial ANOVA (gender x categories). Whenever, the obtained ‘F’ ratio value for interaction effect was found to be significant, the simple effect test was applied as follow up test. In all cases, the 0.5 level of confidence was fixed to test the level of significance which was considered as appropriate. Results & Conclusion: The results of the study shows that the (boys U-19 and boys U-17 players) had significant increase in muscular endurance as compared to the (boys U- 14 players). The result also reveals that the increase in muscular endurance is significantly more for (boys U- 19 players) as compared to (boys U-17
players). Also, (girls U-19 and girls U-17 players) had significant increase in muscular endurance as compared to the (girls U-14 players). whereas for muscular endurance there was no significant difference between (girls U-17 players) as compared to (girls U-19 players).

**Key Words**: Health-related physical fitness and muscular endurance

### Introduction

Physical fitness is an adaptive state which can be defined as a set of attributes that people have or achieve which relate to the ability to perform physical activity ([Howley, 2001](#)). Physical fitness can be divided into health-related fitness and skill or performance-related fitness. Health-related fitness consists of those components of physical fitness that are affected by habitual physical activity and that are related to health status. Health-related fitness has been defined as a state of being able to perform daily activities with vigor, and traits and capacities that are associated with a low risk of premature development of hypokinetic diseases and conditions ([Bouchard & Shephard, 1994](#)). On the other hand, skill or performance-related fitness is linked to the attributes related to performance outcomes in various sports or in certain occupations.

Many investigations have been conducted to improve or develop health-related criterion-referenced standards for physical fitness. ([Meredith et al., 2005](#)). Physical fitness of children and adolescents has been largely examined in several studies. Health-related physical fitness batteries usually include tests for flexibility, muscular strength, endurance and cardiorespiratory fitness. The assumption for presence of muscle strength and endurance tests is that these are important factors in carrying out daily activities and preventing injury, pain, and postural deviations.
(Potthoff, et al 2013). In addition, muscle strength and endurance are inversely correlated with body fatness, they can discriminate the nutritional status of children and adolescents and their habitual physical activity and training status (Esmaeilzadeh, 2011).

Physical fitness is a significant indicator of the health of children’s and adolescents. In recent years interest in the evaluation of fitness has increased in the public domain (Cvejic, et al., 2013). Physical fitness to health for all individuals has been well documented. Physical fitness is a required element for all the activities in our society (Bazyar & Shabani 2014). Keeping in view the fact that childhood physical fitness has important health consequences during adulthood (Sallis et al., 1992). Health-related physical fitness should not only consider gender and age of school children, but also selected sociodemographic and behavioral factors, especially socioeconomic class and leisure activities (Guedes et al., 2002). The improper development of muscular endurance in boys may be due to their habitual life style which leads on attractive physical appearance. Down fall of body fat percent was observed among boys in 8 to 13 years of age groups and sharp rise in body fat percentage was exhibited in the age group of 14 to 17 years of age. Worldwide health planners have reported the importance of the contribution of health education and physical fitness in the development of total fitness among children (Dutt, 2005).

There is growing evidence to support the benefits of muscular strength and endurance in children. Muscular strength and endurance are domains of health-related fitness, which also include body composition, aerobic fitness, and flexibility (Ervin et al., 2014). Optimal levels of muscular strength and endurance may help improve motor development and relates to a lower incidence of physical activity and sport-related injuries (Myer et al., 2011). Some studies have linked higher levels of muscular strength and endurance to lower prevalence of cardio-metabolic diseases (Peterson et al., 2014). Muscular strength and endurance are becoming an increasingly
researched component of health-related fitness in children. (Moliner et al., 2010). Optimal levels of muscular strength and endurance may help improve motor development athletic performance and may have a protective effect on the incidence of sport-related injuries such as low back pain (Behringer et al., 2011).

Muscular endurance is the important component of physical fitness. Muscular endurance is the ability of a muscle to maintain a certain level of tension or to repeat identical movements or pressure over the maximal period of time with one’s maximal effort. The duration for which the muscle groups may perform work maximally is known as muscular endurance. Muscular Endurance, depending upon the category of muscular work, is also divided in two types. The endurance of isometric muscles (when tenseness of muscles changes without changing the metric length of muscle) is usually referred to as isometric endurance while the working ability (in duration) of isotonic muscles (when same tone tenseness is maintained by changing the length of muscles) is called isotonic muscular endurance. Depending upon the types of muscular endurance there are three types of practical tests for the measurement of muscular endurance Flex Arm Hang Test, Grip Dynamometer Muscular Endurance Test, and Bent Knee Sit Ups. The level of physical fitness is directly dependent on three categories of physical activity stretching, weight bearing and aerobic activities (Sarungbam, 2021). Thus, the present study was undertaken to analyze of muscular endurance among school boys and girls of different age groups.
Methodology:

The purpose of this study was to find out the significant difference between boys and girls of the different age categories (U-14, U-17, U-19 Players). The selected health related physical fitness, such as muscular endurance was selected as criterion variable. To achieve the purpose of the present study one hundred and eighty (180) boys and girls players of different age categories (U-14, U-17, U-19 players) studying in the various schools of cuddalore district, Tamil Nadu India were randomly selected as subjects. Among the selected ninety boys (thirty boys U-14, thirty boys U-17 and thirty boys U-19 players) and the selected ninety girls players (thirty girls U-14, thirty girls U-17 and thirty girls U-19 players) with the age of the subjects ranging between 12 to 19 years were selected as subjects. The data collected from U-14, U-17, U-19 players for both gender (boys and girls players) on selected health related physical fitness variable such as muscular endurance was measured by using one-minute bent knee sit-ups, and statistically analyzed by using 2 x 3 factorial ANOVA (gender x categories). Whenever, the obtained ‘F’ ratio value for interaction effect was found to be significant, the simple effect test was applied as follow up test. In all cases, the 0.5 level of confidence was fixed to test the level of significance which was considered as appropriate.
Result of study

Table – I

MEAN AND STANDARD DEVIATION OF MUSCULAR ENDURANCE AMONG GENDER (B & G) AND DIFFERENT AGE CATEGORIES (U-14, U-17, U-19 PLAYERS)

<table>
<thead>
<tr>
<th>Gender / Ages</th>
<th>Under- 14</th>
<th>Under- 17</th>
<th>Under- 19</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>21.13</td>
<td>26.4</td>
<td>30.40</td>
<td>26.31</td>
</tr>
<tr>
<td>SD</td>
<td>3.10</td>
<td>4.77</td>
<td>5.08</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>19.40</td>
<td>22.53</td>
<td>23.36</td>
<td>21.73</td>
</tr>
<tr>
<td>SD</td>
<td>2.87</td>
<td>3.23</td>
<td>3.35</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>20.76</td>
<td>24.46</td>
<td>26.88</td>
<td></td>
</tr>
</tbody>
</table>

Table – I indicates that the mean and standard deviation value of muscular endurance between U-14 boys and U-14 girls were 21.13 ± 3.10 and 19.40 ± 2.87 with combined mean value of 20.76. The U-17 boys and U-17 girls mean and standard deviation values on muscular endurance were 26.4 ± 4.77 and 22.53 ± 3.23 with combined mean value of 24.46. The U-19 boys and U-19 girls mean and standard deviation values on muscular endurance were 30.40 ± 5.08 and 23.36 ± 3.35 with combined mean value of 26.88. The combined mean value on
The muscular endurance of boys U-14, U-17, U-19 players was 26.31. The combined mean value on muscular endurance of girls U-14, U-17, U-19 players was 21.73.

Table – I-A

**TWO FACTOR ANOVA FOR MUSCULAR ENDURANCE OF GENDER (B & G) AND DIFFERENT AGE CATEGORIES (U-14, U-17, U-19 PLAYERS)**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of squares</th>
<th>Df</th>
<th>Mean squares</th>
<th>‘F’ ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor A (Gender)</td>
<td>929.33</td>
<td>1</td>
<td>929.33</td>
<td>63.12*</td>
</tr>
<tr>
<td>Factor B (Age categories)</td>
<td>1138.87</td>
<td>2</td>
<td>569.43</td>
<td>38.68*</td>
</tr>
<tr>
<td>Factor A &amp; B (Interaction)</td>
<td>149.01</td>
<td>2</td>
<td>74.5</td>
<td>5.06*</td>
</tr>
<tr>
<td>Residual</td>
<td>2561.5</td>
<td>174</td>
<td>14.72</td>
<td>-</td>
</tr>
</tbody>
</table>

*Significant at 0.05 level of confidence.

(The required table value for significant at .05 level of confidence with df 1 and 174 is 3.05).

Table I-A shows that the obtained ‘F’ ratio value on muscular endurance was 63.12 for factor-A (Gender- B and G players) irrespective of their different age categories (U-14, U-17,
U-19 players) which was greater than the table value of 3.05 with df 1 and 174 required for significance at .05 level of confidence. The result shows that significant difference exist between boys and girls irrespective of different age and categories of players on muscular endurance.

The obtained ‘F’ ratio value on muscular endurance was 38.68 for factor-B different age categories (U-14, U-17, U-19 players) irrespective of gender boys and girls players which was greater than the table value of 3.05 with df 2 and 174 required for significance at .05 level of confidence. The results shows that significant difference exist among different age categories (U-14, U-17, U-19 players) irrespective of gender (boys and girls) on muscular endurance.

The obtained ‘F’ ratio value on muscular endurance 5.06 for interaction [AB factor - (Gender × Age categories) was also greater than the table value of 3.05 with df 2 and 174 required for significance at .05 level of confidence. Since, the obtained ‘F’ ratio for the interaction effect was found significant, the simple effect test was applied as follow up test and it is presented in Table I-B.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>Boys</th>
<th>Girls</th>
<th>Sum of squares</th>
<th>Df</th>
<th>Mean squares</th>
<th>F- ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender and Under 14</td>
<td>21.13</td>
<td>19.40</td>
<td>44.89</td>
<td>1</td>
<td>44.89</td>
<td>3.04</td>
</tr>
</tbody>
</table>

**TABLE I-B.**

**SIMPLE EFFECT FOR GENDER (BOYS & GIRLS) AND DIFFERENT AGE CATEGORIES (U-14, U-17, U-19 PLAYERS) ON MUSCULAR ENDURANCE**
Table I-B shows that the obtained ‘F’ ratio values on muscular endurance is 3.04, 15.26 and 50.54 for (gender and under 14 players), (gender and under 17 players) and (gender and under 19) respectively was greater than the table value of 3.05 with df 1 and 174 required for significance at .05 level of confidence. The results shows that significant difference exist between U-14, U-17, U-19 age categories of boys and girls on muscular endurance.

Table I-C

SIMPLE EFFECT SCORES FOR DIFFERENT AGE CATEGORIES (U-14, U-17, U-19 PLAYERS) AND GENDER (BOYS & GIRLS) ON MUSCULAR ENDURANCE
Table I-C also revealed that the obtained ‘F’ ratio value on muscular endurance was 44.05 and 8.88 for different age (U-14, U-17 and U-19) categories of boys and girls players which was greater than the table value of 3.05 with df 2 and 174 required for significance at .05 level of confidence. The muscular endurance performance differs among different age (U-14, U-17 and U-19) categories of boys as well as different age categories of girls. To find out the mean differences Scheffe’s test was applied. Table I-D

<table>
<thead>
<tr>
<th>Test and Girls</th>
<th>19.4</th>
<th>22.53</th>
<th>23.36</th>
<th>261.67</th>
<th>2</th>
<th>130.83</th>
<th>8.88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td></td>
<td></td>
<td></td>
<td>2561.5</td>
<td>174</td>
<td>14.72</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at .05 level of confidence.

(The table value required for significance at .05 level of confidence with df 2 and 174 were 3.05 respectively).

Table – I-D

SCHEFFES TEST FOR THE DIFFERENCE ON MEAN VALUES OF MUSCULAR ENDURANCE AMONG GENDER (BOYS & GIRLS) DIFFERENT AGE CATEGORIES

(U-14, U-17, U-19 PLAYERS)
Table – I-D shows that the mean difference between BU-14 and BU-17 players, BU-14 and BU-19 players, BU-17 and BU-19 players are 5.27, 9.27 and 4.00 respectively on muscular endurance of gender boys and different age categories which are greater than the confidence interval value of 2.44 at .05 level of confidence. GU-14 and GU-17 players, GU-14 and GU-19 players and GU-17 and GU-19 players are 3.13, 3.96 and 0.83 respectively on muscular endurance of gender girls and different age categories which are greater than the confidence interval value of 2.44 at .05 level of confidence. The results of the study shows that the (boys U-19 and boys U-17 players) had significant increase in muscular endurance as compared to the (boys U-14 players). The result also reveals that the increase in muscular endurance is significantly more for (boys U-19 players) as compared to (boys U-17 players). Also, (girls U-19 and girls U-17 players) had significant increased in muscular endurance as compared to the (girls U-14 players). whereas for muscular endurance there was no significant difference between (girls U-17 players) as compared to (girls U-19 players).
Discussion of study

The results of the study show that the (boys U-19 and boys U-17 players) had a significant increase in muscular endurance as compared to the (boys U-14 players). The result also reveals that the increase in muscular endurance is significantly more for (boys U-19 players) as compared to (boys U-17 players). Also, (girls U-19 and girls U-17 players) had a significant increase in muscular endurance as compared to the (girls U-14 players). whereas for muscular endurance there was no significant difference between (girls U-17 players) as compared to (girls U-19 players). There are many studies in support of the findings of the present study. (Nayana Nimkar et al., 2020), have examined the study of results indicated significant differences (p value < 0.05) in male category across all the age groups. Whereas, in female category there were only 3 significant differences (out of 10) found between age 14 – 15, 14 – 13 and 14 – 11. It shows that the muscular strength endurance for male students changed significantly across these 5 years as compared to female students, which were found to be more consistent. Muscular strength endurance for male students was greater in all terms than the female students. (Tomkinson et al., 2018), have found significance difference results on children and adolescents from 30 European countries, extracted from 98 studies. On average, 78% of boys (95% CI 72% to 85%) and 83% of girls (95% CI 71% to 96%) met the standards for healthy CRF, with the percentage meeting the standards decreasing with age. Boys performed substantially (standardized differences >0.2) better than girls on muscular strength, muscular power, muscular endurance, speed-agility and CRF tests, but worse on the flexibility test. Physical fitness generally improved at a faster rate in boys than in girls, especially during the teenage years. (Huang et al., 2010) have found the results of study significantly improved muscular endurance,
jump and distance run was evident in boys and girls with higher BMIs in each age group. Slopes of decline with increasing BMI varied by age group and sex. Relationships became parabolic for the three fitness items with age and peaks of the parabola were sharper in adolescent boys than girls. Relationships for the sit and reach contrasted with the other tests and differed among age groups and between sexes. (Al-Asiri & Shaheen., 2015), have proved the results revealed variable relationships among tests significant improvement muscular strength endurance were recorded in girls aged from 11 to 15 years. Relationships between muscular endurance differed among all age groups. (Andreasi et al., 2010), conducted a study was cross sectional school student’s physical fitness levels observed were significantly improved muscular endurance influenced by age (all levels), sex. (Garai, 2016), have proved results of study revealed that the muscular strength endurance was found better in high age group male students. (Pena Reyes et al., 2003), have conducted study significant improved explosive power (standing long jump) and abdominal strength and endurance (timed sit-ups) were better in urban than in rural children without and with adjustment for age and body size. Urban-rural differences in running speed (dash) and flexibility (sit and reach) varied by age group and sex. The size advantage of urban children does not necessarily translate into better levels of performance- and health-related physical fitness.

Conclusion

The results of the study shows that the (boys U-19 and boys U-17 players) had significant increase in muscular endurance as compared to the (boys U-14 players). The result also reveals that the increase in muscular endurance is significantly more for (boys U-19 players) as compared to (boys U-17 players). Also, (girls U-19 and girls U-17 players) had significant increase in muscular endurance as compared to the (girls U-14 players). whereas for muscular
endurance there was no significant difference between (girls U- 17 players) as compared to (girls U- 19 players).

References


