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## Examining muscular endurance in different age categories of junior college boys from rural and urban environments

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### Abstract

The objective of the current study was to analyze muscular endurance disparities among junior college boys in different age categories, differentiating between rural and urban backgrounds. To achieve this research goal, a cohort of 300 junior college boys from both rural and urban areas in Narmada District, Gujarat, India, was randomly selected as study participants. The sample was divided into two groups: 150 rural junior boys, with 75 falling in the age range of 15 to 16 years and the other 75 aged between 16 to 17 years, and 150 urban junior boys, similarly distributed by age. Muscular endurance served as the criterion variable, while the groups were categorized as rural junior boys aged 15 to 16 years, rural junior boys aged 16 to 17 years, urban junior boys aged 15 to 16 years, and urban junior boys aged 16 to 17 years as independent variables. The data on muscular endurance in junior boys of different age categories, from both rural and urban settings, were collected using standardized test items, specifically pull-ups. These data were subjected to statistical analysis through a 2 x 2 factorial ANOVA. When the obtained 'F' ratio value for the interaction effect proved to be significant, subsequent simple effect tests were conducted as follow-up assessments.

**Keywords:** Muscular endurance, 2x2 factorial ANOVA, urban junior college boys, rural junior college boys, age category

### Introduction

Human settlements are classified into rural and urban areas based on population density and the presence of human-made structures in a given region. Urban areas encompass towns and cities, while rural areas comprise villages and hamlets. Rural regions may evolve haphazardly, influenced by the natural flora and fauna of the area, whereas urban settlements are systematically planned and developed through a process known as urbanization. Governments and development agencies often prioritize the transformation of rural areas into urban centers. Urban areas are characterized by their advanced public services, enhanced educational, sports, transportation, business, healthcare, and social amenities, leading to an overall improved quality of life. Socio-cultural norms predominantly stem from urban residents, while rural areas rely more on natural resources and occurrences. Urban inhabitants benefit from human advancements in science and technology, reducing their dependence on nature for daily functioning. Residing in areas distinguished by population size can correlate with differences in dietary preferences, access to sports facilities, availability of healthcare services, and opportunities for physical fitness activities (Tsimeas *et al.*, 2005) <sup>[1]</sup>.

As per Bucher (1985) <sup>[2]</sup>, physical fitness can be defined as "the individual's capacity to lead a rich and harmonious life, encompassing physical, mental, emotional, social, and spiritual dimensions and their potential for wholesome expression." Physical fitness encompasses practical engagement in exercises that elicit a range of experiences, such as the joy derived from correctly executing movements, feelings of confidence, self-satisfaction, as well as surprise, and, conversely, moments of frustration and disappointment. It is a positive attribute that spans from vitality to a state of "abundant life."

Every living individual possesses a degree of physical fitness, which can greatly differ among individuals and even within the same person at different times. It is not as all-encompassing as the concept of 'total fitness.' Instead, it entails maintaining an adequate level of health, good posture, a well-functioning physique, proper functioning of vital organs, nutritional well-being, and healthy habits. This is coupled with an appropriate level of endurance, strength, stamina, and flexibility (Clark and David, 1978) <sup>[3]</sup>.

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**Muscular Endurance**

Muscular endurance is a crucial component of physical fitness that represents the ability of a muscle or group of muscles to sustain repeated contractions over an extended period without succumbing to fatigue. Unlike muscular strength, which focuses on exerting maximal force for a short duration, muscular endurance emphasizes the capacity to perform submaximal contractions repeatedly. This endurance is not limited to a specific muscle group but extends to the entire body's musculature, as it plays a fundamental role in various daily activities, athletic performance, and overall health.

**Here are some key aspects of muscular endurance**

**Muscle Groups:** Muscular endurance involves various muscle groups throughout the body. Common examples include the muscles in the legs, arms, and core. Different activities and exercises target specific muscle groups, but the general principle is the same: the muscles need to withstand prolonged contractions.

**Importance**

- **Daily Activities:** Muscular endurance is essential for performing everyday tasks such as walking, climbing stairs, carrying groceries, and maintaining proper posture while sitting or standing.
- **Athletic Performance:** It plays a crucial role in sports and activities that require sustained effort, like running, swimming, cycling, and sports like soccer and basketball.
- **Injury Prevention:** Strong, enduring muscles provide better support and stability, reducing the risk of injuries during physical activities.

**Training**

- **Repetition:** Muscular endurance training involves performing a higher number of repetitions at submaximal intensity. For example, doing multiple sets of exercises with lighter weights.
- **Resistance:** Weight lifting, resistance bands, and bodyweight exercises are common methods for building muscular endurance.
- **Cardiovascular Exercise:** Engaging in aerobic activities like running and cycling can help improve overall muscular endurance as the cardiovascular system plays a significant role in muscle performance.
- **Functional Fitness:** Incorporating functional exercises that mimic real-life movements, such as squats, lunges, and planks, can enhance muscular endurance in a practical context.

**Benefits**

- **Enhanced Stamina:** Improved muscular endurance enables individuals to engage in physical activities for longer periods without tiring quickly.
- **Reduced Fatigue:** Daily tasks become more manageable, and individuals experience less fatigue during and after activities.
- **Improved Athletic Performance:** Athletes can sustain their performance throughout a game or competition, leading to better results.
- **Testing:** Muscular endurance can be assessed through various tests and exercises. Common assessments

include the push-up test, sit-up test, plank test, and the step test, among others.

- **Nutrition and Recovery:** Adequate nutrition, including protein and carbohydrates, is essential for supporting muscle endurance. Proper rest and recovery between workouts are also crucial to prevent overtraining and promote muscle growth.
- **Progression:** Like any fitness component, progressive overload is key. As you develop muscular endurance, gradually increase the intensity and duration of your workouts to continue making gains.

In conclusion, muscular endurance is a critical aspect of physical fitness that contributes to overall health, everyday functionality, and improved athletic performance. Engaging in regular exercises and activities that target muscular endurance can lead to increased stamina, reduced fatigue, and a higher quality of life.

**Materials and Tools**

**Collection of Data**

To fulfill the research objectives, a total of three hundred junior college boys residing in both rural and urban areas of Narmada District, Gujarat, India, were chosen as participants. Among this cohort, one hundred and fifty junior boys were selected, comprising seventy-five from rural backgrounds, aged between 15 to 16 years, and seventy-five more from the same rural demographic, aged between 16 to 17 years. Additionally, an equal number of one hundred and fifty junior boys were selected from urban areas, with seventy-five aged between 15 to 16 years and seventy-five between 16 to 17 years.

**Table 1:** The Mean and Standard Deviation on Muscular Endurance of Rural and Urban Junior Boys with Different Age Categories

Gender / Area of Games		Age between	Age between
		15 to 16 Years	16 to 17 Years
Rural Junior Boys	Mean	13.73	17.64
	SD	1.64	1.38
Urban Junior Boys	Mean	15.37	17.59
	SD	2.54	1.30

**Results on Muscular Endurance**

Table 1 reveals the mean values for muscular endurance among various groups, including rural boys aged 15 to 16 years, rural boys aged 16 to 17 years, urban boys aged 15 to 16 years, and urban boys aged 16 to 17 years, with corresponding values of 13.73, 17.64, 15.37, and 17.59, respectively. The analysis of muscular endurance in rural and urban junior boys across different age categories is presented in Table 2 using a two-way factorial ANOVA.

**Table 2:** Shows two-way factorial ANOVA

Source of Variance	Sum of Squares	df	Mean	Obtained
			Squares	"F" Ratio
A factor (Areas)	47.2	1	47.20	14.65*
B factor (Age)	702.3	1	702.27	217.97*
AB factor (interaction) (Gender × Area of Games)	53.8	1	53.76	16.69*
Within or Error	953.7	296	3.22	

(The critical table value for significance at a 0.05 level of confidence, with degrees of freedom (df) as 1 and 296, was

3.871). In Table 2, it is evident that the computed 'F' ratio value for muscular endurance, regardless of age categories, was 14.65 for Factor-A (Areas - Rural and Urban). This value surpasses the critical table value of 3.871, with df of 1 and 296, needed for significance at the 0.05 level of confidence. The study's findings conclusively indicate a significant difference in muscular endurance between rural and urban junior boys, regardless of their age categories.

Similarly, the computed 'F' ratio value for muscular endurance was 217.97 for Factor B (Age Age between 15 to 16 years and Age between 16 to 17 years), irrespective of gender. This value significantly exceeds the critical table value of 3.871, with df of 1 and 296, required for significance at the 0.05 level of confidence. The research findings decisively demonstrate a significant difference in muscular endurance between junior boys aged 15 to 16 years and those aged 16 to 17 years, regardless of their residential areas (rural and urban).

Furthermore, the computed 'F' ratio value for muscular endurance, taking into account the interaction [AB factor - (Areas  $\times$  Age)], was 16.69. This value significantly exceeds the critical table value of 3.871, with df of 1 and 296, required for significance at the 0.05 level of confidence. The research outcomes undeniably indicate a significant difference in muscular endurance between rural and urban junior boys with different age categories.

### Conclusion

The study confirms a significant difference in muscular endurance between rural and urban junior boys, irrespective of their age categories. Additionally, there is a significant difference in muscular endurance between junior boys aged 15 to 16 years and those aged 16 to 17 years, regardless of their residential areas (rural and urban). Lastly, the research demonstrates a significant difference in muscular endurance between rural and urban junior boys with different age categories.

Urban junior college boys exhibit greater muscular endurance than their rural counterparts in the 15-16 years age category, while rural junior college boys demonstrate superior muscular endurance compared to urban junior college boys in the 16-17 years age category.

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