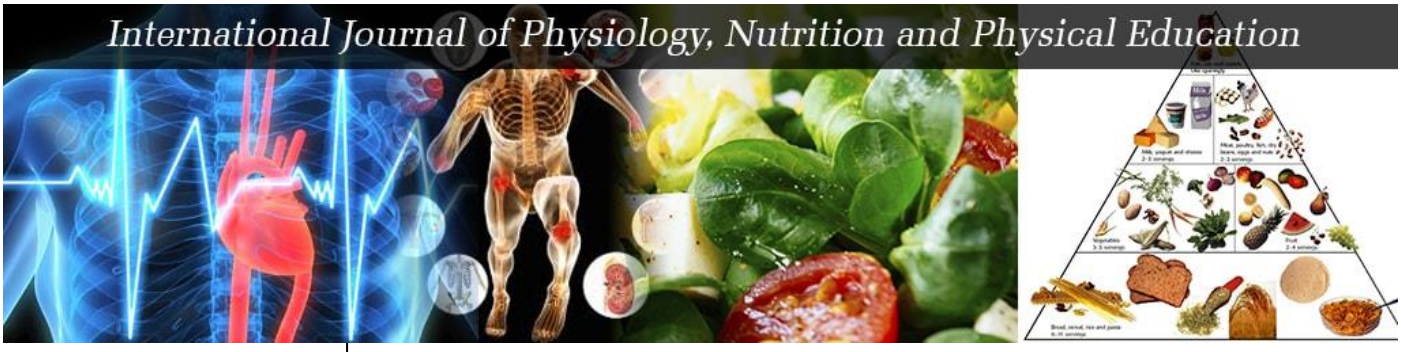

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A comparative study of body composition difference in teenager boys and girls

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Abstract
Global health planners have highlighted the importance of physical activity and health education in children's overall fitness development. The researcher looked at the fat percentage of different age groups and genders as part of the study's two major objectives. A total of 1200 participants, including 600 males and 600 girls, were selected for the study. Selected topics were divided into three age groups, 13–14, 15–16, and 17–18 years old, respectively. To assess the main and interaction effects (=0.05) of gender and age on fat%, a (2 X 3 factorial ANOVA) was used. Age and gender both demonstrated a substantial (p0.05) interaction impact on fat percentage, as well as a significant (p0.05) main effect on fat percentage. After significant effects were shown, post hoc analysis (Tukey test) was employed for pairwise comparisons. Girls had fatter % than males across all three age groups, with 17 to 18-year-olds having the highest fat% within the chosen age group. The findings showed that fat percentages varied by age group and by hormonal, nutritional, and physical activity factors.

Keywords: Fat%, gender, age-groups and factorial ANOVA

Introduction
Agriculture is the primary source of income for the majority of India's rural people. In the tribal territory, they engage in a variety of physical activities. In India, various tribal tribes are at various levels of development, although they are still behind metropolitan communities. These people are indigenous to our nation. Throughout their active lives, they have been analysed from many perspectives. Physical exercises of many kinds are beneficial to their physical development in their everyday lives. According to Saha and Haldar (2012) [1], a healthy body is required for a person to increase his working capacity and maintain his health-related physical fitness in order to accomplish his everyday responsibilities effectively [1]. Male college students had greater cardio respiratory fitness than female college students, according to Bandyopadhyay (2007) [2]. They also discovered that men had higher scores for all physical fitness indicators. Physical fitness is described as an individual's ability to do a daily exercise with appropriate capacity and ability in the face of exhaustion [2].
Cardio-respiratory fitness, muscular strength, speed-agility, and body composition are all examples of health-related physical fitness. The components of health-related fitness are modified by regular physical exercise and are connected to health status [3].
Gender and age of students should be included in interventions to increase health-related physical fitness, as well as chosen socio-demographic and behavioural characteristics. In all health-related physical fitness components as well as response ability, there was a substantial difference between rural and urban school-aged children. Children in rural schools performed better than children in urban schools [4]. Deep, Singh, and Kanchan (2012) found that rural children's static strength was considerably greater than that of urban schoolchildren. However, there was no discernible difference in the components of speed, explosive strength, flexibility, and cardiovascular endurance between urban and rural primary school students. Taleja (1986) found no significant differences in physical fitness between rural and urban high school pupils. Interventions to increase health-related physical fitness in schools should take into account not just gender and age, but also a number of sociodemographic and behavioural characteristics, including socioeconomic status and leisure activities [5]. According to Dutt (2005) [14], boys' muscular strength endurance is improperly developed, which might be attributed to their habitual living style seeking an appealing physical look [14].

The percentage of body fat in boys aged 8 to 13 years dropped, but the percentage of body fat in boys aged 14 to 17 years rose sharply [6-9].

The role of health education and physical fitness in the development of overall fitness in children has been acknowledged by global health planners. Many studies on health-related physical fitness, which includes cardio-respiratory fitness, muscular strength, speed-agility, and body composition components in boys and girls of all ages, have been undertaken [10-13].

Aim of the study

The study's main aim was twofold: the researcher examined the fat% of various age groups and genders.

Methodology

Delimitations

- The study was delimited to 1200 subjects with their age range between 13-18 years old boy and girl's students.
- The study was delimited to three age groups of schools i.e. 10th, 11th and 12th class students.
- The health related variable of the study was delimited to fat%.
- The area of study was further delimited to Rohtak region of Haryana only.

Table 1: Cross sectional groups according to age.

Cross-sectional groups of study		
Class	**Age Group**	**No. of subjects selected**
10th class	13-14	400
11th class	15-16	400
12th class	17-18	400

Limitations

1. The study was limited by factors such as daily routine, eating habits, and weather circumstances, which were outside the researcher's control.
2. As a result, it was necessary to keep in mind that the present research had limits in terms of both psychological and testing efforts.
3. The subjects came from varied socio economic and cultural background.

Statistical analysis

Standard statistical methods were used to calculate the mean and standard deviation. A 2-way analysis of variance together with a Turkey honestly significant difference post hoc test was used to determine if significant differences existed among selected males and females for 3 age groups.

Results

Table 2: Descriptive data of Body Composition of selected Boys and Girls

Boys/Girl		Mean	Std. Deviation	Minimum	Maximum
Boys	13-14 years	17.3050	1.44183	17	12
	15-16 years	19.6500	2.96800	18	12
	17-18 years	20.1275	3.52942	20	9
Girl	13-14 years	22.6975	3.45877	19	13
	15-16 years	21.7225	3.20713	18.7	12
	17-18 years	22.5525	4.23393	23.44	14.14

Table 2 and Fig 1 clearly indicates mean and standard deviation of body composition of different age groups. Where, body composition mean and standard deviations of three age groups i.e. 13-14 years, 15-16 years and 17-18 years are mentioned.

The mean and standard deviation of body composition for the 13–14 year group for boys were (17.30±1.44) and the maximum and minimum body composition were 17 and 12 respectively. For girls, body composition mean and standard deviation were (20.69±3.45) and maximum and minimum body composition was 19 and 13 respectively. For 15-16 year group body composition, the mean and standard deviation of body composition for boys were (19.65±2.96) and the maximum and minimum body composition were 18 and 12 respectively. For girls, body composition mean and standard deviation were (21.72±3.20) and maximum and minimum body composition was 18.7 and 12 respectively. The mean and standard deviation of body composition for the 17–18 year group for boys were (20.12±3.52) and the maximum and minimum body composition were 20 and 09, respectively. The mean and standard deviation for girls' body composition were (22.55±4.23), and the maximum and minimum body composition was 23.44 and 14.14, respectively.

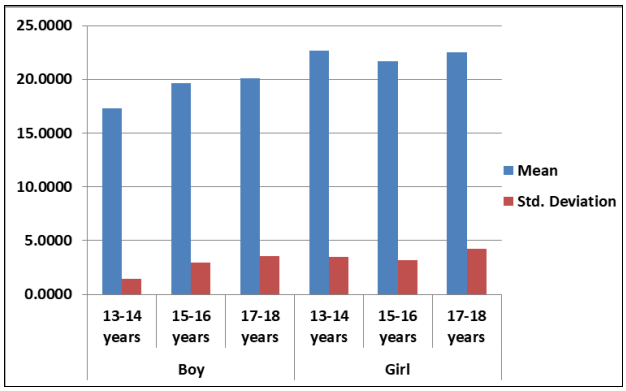

Fig 1: Graphical representation of descriptive data of Body Composition of selected Boys and Girls

Table 3: Two- Way ANOVA table.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	3260.403	1	3260.403	307.975	.000
Age Group	358.515	2	179.258	16.933	.000
Gender * Age Group	665.090	2	332.545	31.412	.000
Error	12640.390	1194	10.587		
Total	529912.50	1200			
Corrected Total	16924.399	1199			
a. R Squared = .253 (Adjusted R Squared = .250)					

The comparative analysis for the main and interaction effect is shown in Table 3. Gender has a significant effect (p<0.05) on Fat%. Age group had a significant effect (p<0.05) on Fat%. Gender *Age Group (Interaction) had a significant effect (p<0.05) on Fat%. Hence a significant effect was observed for gender, age group and age*gender, pair wise

comparison was done to determine which groups have had higher and lower fat%.

Table 4: Pairwise Comparisons of fat% for gender

(I) Boys/Girl		Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Boys	Girl	-3.297*	.188	.000	-3.665	-2.928
Girl	Boys	3.297*	.188	.000	2.928	3.665

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 4 represents the dependent variable comparison for independent variable i.e. gender. For boys and girls there was significant difference between for body composition (fat %) score and overall girls were having more body composition score than boys.

Table 5: Pairwise Comparisons of fat% for different age group

(I) Age of the students		Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
13-14 years	15-16 years	-.685*	.230	.003	-1.136	-.234
	17-18 years	-1.339*	.230	.000	-1.790	-.887
15-16 years	13-14 years	.685*	.230	.003	.234	1.136
	17-18 years	-.654*	.230	.005	-1.105	-.202
17-18 years	13-14 years	1.339*	.230	.000	.887	1.790
	15-16 years	.654*	.230	.005	.202	1.105

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 5 represents the dependent variable comparison for independent variable i.e. age group. For body composition (fat %)17-18 years old age group were having the highest body composition (fat %) score, whereas the body composition (fat %)of 13-14 years old age group were having the least body composition (fat %)score.

Table 6: Pairwise Comparisons of fat% for boys and girls of different age group

Age of the students			Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
13-14 years	Boys	Girl	-5.393*	.325	.000	-6.031	-4.754
	Girl	Boys	5.393*	.325	.000	4.754	6.031
15-16 years	Boys	Girl	-2.073*	.325	.000	-2.711	-1.434
	Girl	Boys	2.073*	.325	.000	1.434	2.711
17-18 years	Boys	Girl	-2.425*	.325	.000	-3.063	-1.787
	Girl	Boys	2.425*	.325	.000	1.787	3.063

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 6 represents the fat % comparison for independent variable interaction i.e. age group and gender. For 13-14 years old girls were having higher body composition than boys. For 15-16 years old girls were having higher body composition than boys. For 17-18 years old girls were having higher body composition than boys.

Conclusion

Males and females of a species vary systematically in body size and form, which is known as sexual size and shape dimorphism [15]. The development of phenotypic sex during puberty and adolescence is the result of the sex differentiation process, which begins with the establishment of chromosomal sex at fertilization, then the differentiation of the gonads, and finally the development of phenotypic sex during puberty and adolescence [16]. Males and females in many animals, but especially in humans, vary not only in size and form, but also in physical composition. Adult females have a greater absolute and relative quantity of subcutaneous fat tissue than men, whereas males have a greater quantitative amount of fat free body mass, including bone and soft tissue [17]. Gender variations in body composition during the pre-pubertal period of life were deemed minor since major gender disparities in sex hormone levels do not develop until after puberty in postnatal life [18]. However, a growing number of studies in the past 20 years have shown substantial gender variations in body fat and lean body mass, even in children aged 3 to 10 [18-20]. These findings are consistent with the findings of the current study. Even in the pre-pubertal stage of development, girls and boys varied statistically substantially in relative fat percent corrected for height in the current research. The typical gender disparities in relative fat mass and relative lean body mass grew throughout adolescence. The large rise in lean body mass in males throughout puberty and adolescence was primarily responsible for this considerable increase. Even throughout pre-puberty, girls had a high level of body fat, which rose somewhat during puberty and adolescence. Gender disparities in body composition in adulthood are stable until the fifth decade of life. Then, when women approach post-menopause in their sixth decade, the disparities

rise and diminish until they reach their eighth decade. These significant gender inequalities may be explained in both a proximal and ultimate way. The observed gender disparities in body composition are the outcome of gender-specific variances in sex hormone release and lipid metabolism from a proximate or physiological standpoint [21-22]. Gender disparities in sex hormone production, on the other hand, do not appear until adolescence. As a result, we must also think about ultimate or evolutionary reasons. Since a long time, the well-documented sexual dimorphism in stature height has been compared to the connection between intra sexual rivalry and body weight dimorphism in anthropoid monkeys as an evolutionary outcome of male-male competition for mates [23-25]. As a result of sexual selection, males have more muscular mass and women are taller. Gender differences in body fat tend to follow reproductive physiology's energy demands. Subcutaneous fat in the lower body is a critical energy store for the female body during pregnancy and lactation [26-27]. Negative energy balance, inadequate fat accumulation, and low weight status damage female reproductive success, hence gender differences in body fat may be a result of natural selection. But there's one problem: In infancy and childhood, boys and girls have identical energy demands; they don't differ in height or weight, and females don't have to deal with the energy costs of reproduction. Pre-pubertal females have greater fat tissue, which may signal early readiness for reproduction. Around the third century, culture-driven alterations in body shape and composition occur. Traditional beauty standards lead to low body fat in adolescent girls, as demonstrated by the high frequency of underweight in the present sample of 11 to 16 year old females. Increased calorie intake and superior living circumstances for infants in today's industrialized civilizations, especially in the West, result in acceleration of the female body's capacity to store energy deposits as early as possible as, much earlier than in human development and history.

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