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Analytical study of skeletal muscle in relation to age among teenage school girls

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Abstract
Skeletal muscle strength and muscle mass decline with age. These declines are associated with reduced functional capacity and an increased risk of musculoskeletal injury and dependent care. The study aimed to assess the skeletal muscle in relation to age among teenage school girls. In the present study an attempt has been made to report the skeletal muscle % among school girls of Punjab, total 6000 students were selected with stratified random sampling technique, ranging in age from 10-17 years. Height and weight were measured in all participants and the skeletal muscle percent (SM %) of each individual was calculated with the bio electrical impedance machine scale of HBF-361. Skeletal muscle percent classes on the basis of age groups (10, 11, 12, 13, 14, 15, 16 & 17 years) were calculated according to the skeletal muscle percent. The observations revealed that the overall mean value of various age group 10, 11, 12, 13, 14, 15, 16 & 17 years girls was 28.17, 28.56. 29.03, 28.69, 28.53, 27.69 & 27.80 respectively. Skeletal muscle percent showed decreasing trend with age increase.

Keywords: Prevalence, Skeletal muscle percent, Age, Bio electrical impedance machine, Anova

Introduction
Skeletal muscle makes up 40% of an organism's body mass and is the sink for nearly all the oxygen an animal consumes during maximum sustained exertion (Schaeffer, P. J. and Lindstedt, S. L., 2013) [10]. Engaging in regular physical activity is one of the best ways to improve general health. Physical activity has become the prime health indicator where it plays an essential role in enhancing physical fitness and health related behavior that could lower the risk of morbidity and mortality from diseases (Sundland *et al.*, 2008) [11]. Physical activity is key determinant of energy expenditure and thus fundamental to energy balance and weight control (WHO, 2010) [15]. (Kirkendall & Garrett, 1998) [5] aging results in a gradual loss of muscle function, and there are predictable age-related alterations in skeletal muscle function. The typical adult will lose muscle mass with age; the loss varies according to sex and the level of muscle activity. The bicycling does help build strong muscles, and having strong muscles helps build strong bones (U.S. Department of Health and Human Services, 2011) [12]. Kaur & Deol (2014) [4] compare the body composition variables of female employees of Punjabi University Patiala at different level of categories. The study revealed that selected variables that were body fat percent, basal metabolic rate and skeletal muscle have significant differences among teaching, non-teaching and class-d employees of Punjabi University Patiala. McCarthy *et al*. (2014) [6] Skeletal muscle is key to motor development and represents a major metabolic end organ that aids glycemic regulation, to create gender-specific reference curves for fat-free mass (FFM) and appendicular (limb) skeletal muscle mass (SMMa) in children and adolescents, to examine the muscle-to-fat ratio in relation to body mass index (BMI) for age and gender. The results of this study showed that muscle-to-fat ratio has the potential to provide a better index of future metabolic health. According to a survey, India is the third most obese country in the world. Obesity is further linked to a host of medical problems like high cholesterol, diabetes, joint pain, arthritis and heart diseases (Chowbey, 2016) [1]. More than 40 percent of the population in Punjab is overweight or obese. The survey pointed to the absence of physical activity among 75 percent as a reason for obesity, and said this may also be a contributing factor for high prevalence of hypertension (40 percent) in the state (Thakur, 2015) [10]. Punjabis are the most obese people in the country, Health Minister J P Nadda told the

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Rajya Sabha today, while men from Tripura and women from Meghalaya are the leanest. Men and women from Punjab followed by Kerala and Delhi are the most obese people with 22.2, 17.8 and 16.8 percent of men and 29.9, 28.1 and 26.4 per cent of women from respective states reporting a BMI of more than 25 (Naddu, 2016) [7].

Material and methods
Aim of the present study is to assess the skeletal muscle % in relation to age among teenage school girls by using skeletal muscle percent calculated with the bio electrical impedance machine scale of HBF-361. For this purpose total 6000 girl students (750 from each age group; 10, 11, 12, 13, 14, 15, 16, 17 years) were selected as a sample and the age ranges from 10-17 years. The data was obtained from different district schools of Punjab.

Variable and criterion measure
Skeletal Muscle Percent: (Measure in unit – percent %) Skeletal muscle percent was measured with the help of bio electrical impedance machine with scale HBF-361. Each subject was made to stand bare foot on bio electrical impedance machine with scale HBF-361. The subject's height, age, and gender were manually saved in the machine. System automatically calculates the actual values of skeletal muscle percent and displayed the same machine. If the test performed systematically then it was saved otherwise test was repeated again.

Statistical consideration
SPSS was utilized for interpretation of the data. The results were analyzed statistically by applying 'F' test and scheffe's post hoc test.

Results
Different types of descriptive statistic such as mean and standard deviation was computed to describe each variable statistically. The level of significance was set at .05. Its results have been depicted in the following tables.

Table 1: Skeletal Muscle % among Various Age Groups (10, 11, 12, 13, 14, 15, 16 And 17 Years)

Source of variation	Sum of Squares	Df	Mean Square	F-Value	P- value (Sig.)
Between Groups	1228.57	7	175.51		
Within Groups	46621.95	5992	7.78	22.55*	.000
Total	47850.52	5999			

Tabulated 'F' value is (2.21) at .05 level of significance

Table – 1 reveals that significant difference were found with respect to body skeletal muscle % among various age group of school girls because P-value (sig) .000 is less than 0.05 level of significance (P<0.05). Since the acquired F-ratio 22.55* was found significant, so, scheffe's post hoc test was utilized to access the direction and significance of difference between means among 10, 11, 12, 13, 14, 15, 16 and 17 year age group of school girls. The results of scheffe's post hoc test have been displayed in table- 2.

Table 2: Scheffe's post hoc test of skeletal muscle % among various age groups (10, 11, 12, 13, 14, 15, 16 and 17 years)

| Group Means		Mean Difference	Std. Error	Sig.
10 (N=750) (28.17)	11 (28.56)	-.38	.14	.408
	12 (29.03)	-.86*	.14	.000
	13 (28.69)	-.52	.14	.071
	14 (28.53)	-.35	.14	.530
	15 (27.69)	.48	.14	.130
	16 (27.87)	.30	.14	.713
	17 (27.80)	.37	.14	.457
11 (N=750)	12 (29.03)	-.47	.14	.147
	13 (28.69)	-.13	.14	.997
	14 (28.53)	.03	.14	1.000
	15 (27.69)	.86*	.14	.000
	16 (27.87)	.69*	.14	.002
	17 (27.80)	.76*	.14	.000
12 (N=750)	13 (28.69)	.33	.14	.591
	14 (28.53)	.50	.14	.092
	15 (27.69)	1.34*	.14	.000
	16 (27.87)	1.16*	.14	.000
	17 (27.80)	1.23*	.14	.000
13 (N=750)	14 (28.53)	.16	.14	.988
	15 (27.69)	1.00*	.14	.000
	16 (27.87)	.82*	.14	.000
	17 (27.80)	.89*	.14	.000
14 (N=750)	15 (27.69)	.83*	.14	.000
	16 (27.87)	.66*	.14	.004
	17 (27.80)	.72*	.14	.001
15 (N=750)	16 (27.87)	-.17	.14	.983
	17 (27.80)	-.10	.14	.999
16 (N=750)	17 (27.80)	.06	.14	1.000

* The mean difference is significant at 0.05 level.

From table- 2 the following conclusions were drawn:

i. Table 2 reveals that mean difference between 10 and 11 years was found to be insignificant (-.38). 10 years school girls (28.17) had exhibited insignificantly lower level on the prevalence of skeletal muscle % than their opposed group of 11 years (28.56) school girls. In the case of 10 & 12, 10 & 13, 10 & 14, 10 & 15, 10 & 16 and 10 &17 years the mean difference statistically shows the significant difference (-.86*), (-.52), (-.35), (.48), (.30) and (.37) respectively.

ii. Further the mean difference between 11 and 12 years school girls was found to be insignificant (-.47). 11 years school girls (28.56) had exhibited insignificantly lower level of prevalence of skeletal muscle % than their contrary group of 12 years (29.03) school girls. In the case of 11-13, 11-14, 11-15, 11-16 and 11-17 years the mean difference statistically shows the significant difference (-.13), (-.03), (.86*), (.69) and (.76*) respectively.

iii. Mean difference between 12 and 13 years school girls were found to be insignificant (.33). 12 years school girls (29.03) had exhibited insignificantly lower level of prevalence of skeletal muscle % than their across group of 13 years (28.69) school girls. In the case of 12-14, 12-15, 12-16 and 12-17 years the mean difference statistically shows the significant difference (.50), (1.34*), (1.16*) and (1.23*) respectively.

iv. The mean difference between 13 and 14 years school girls was found to be insignificant (.16). 13 years school girls (28.69) had exhibited insignificantly lower level of prevalence of skeletal muscle % than their polar group of 14 years (28.53) school girls. In the case of 13-15, 13-16 and 13-17 years the mean difference statistically shows the significant difference (1.00*), (.82*) and (89*) respectively.

v. Further the mean difference between 14 and 15 years school girls was found to be significant (.83*). 14 years school girls (28.53) had exhibited insignificantly lower level of prevalence of skeletal muscle % than their divergent group of 15 years (27.69) school girls. In the case of 14-16 and 14-17 years the mean difference statistically shows the significant difference (.66*) and (.72*) respectively.

vi. Mean difference between 15 and 16 years school girls was found to be insignificant (-.17). 15 years school girls (27.69) had exhibited insignificantly lower level of prevalence of skeletal muscle % to other group of 16 years (27.87) school girls. In the case of 15-17 years the mean difference statistically shows the insignificant difference (-.10).

vii. A 16 and 17 years school girl was found to be insignificant (.06). 16 years school girls (27.87) had exhibited insignificantly lower level of prevalence of skeletal muscle % than their counterparts group of 17 years (27.80) school girls.
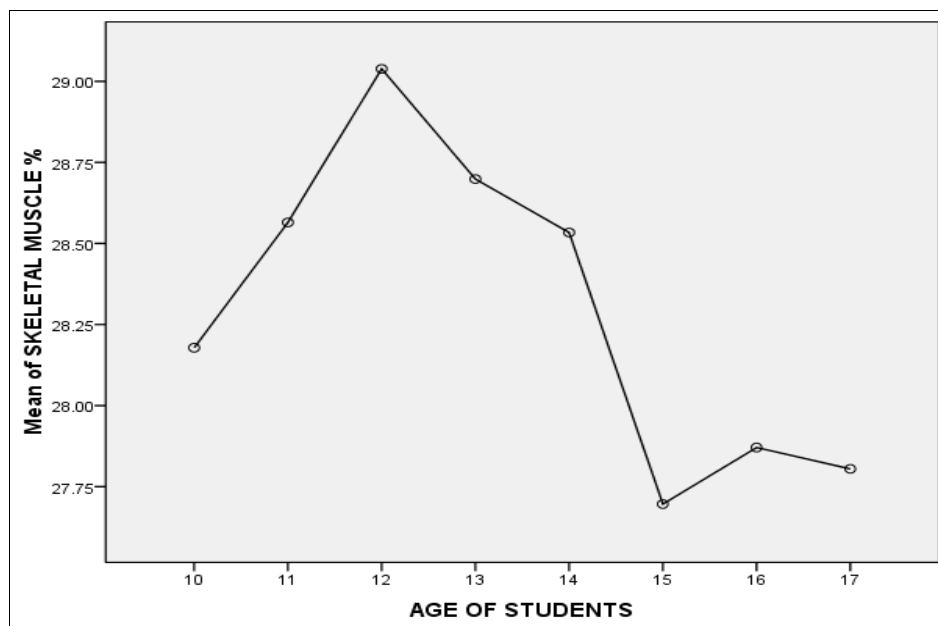
Fig 1: Mean scores of skeletal muscle % among various age groups (10, 11, 12, 13, 14, 15, 16 & 17 years)

The above results shows this skeletal muscle percent increases in the age of 10 to 12 and after 12 years there is a drop in the percent skeletal muscle up to the age of 15 years and in the age of 16-17 years its stabilize. This drop could be because of social factor as 12-15 years age in girls represents puberty & menarche. So in this stage there are lots of physiological & biological changes that occur in the female body. These causes drop the percent skeletal muscle because girls cannot continue their physical workout during the menstruation. They feel shy & self-conscious. Girls become sedentary in this stage. Further the literature also suggests that during this age females have increased growth rate and become of this there is decrease in the skeletal muscle percent (Figure 1).

Discussion of Findings
It is evident from the results of the study that there is significant difference among various age groups of skeletal muscle percent. The findings of the results showed a steadily decrease in the prevalence of skeletal muscle percent with the age because muscle loses size and strength as we get older, which can contribute to fatigue, weakness and reduced tolerance to exercise. This is caused by a number of factors working in combination, including: muscle fibres reduce in number and shrink in size, muscle tissue is replaced more slowly and lost muscle tissue is replaced with a tough, fibrous tissue & changes in the nervous system cause muscles to have reduced tone and ability to contract. Jang *et al*. (2011) [3]

undertook a study on "Skeletal muscle stem cells: effects of aging and metabolism on muscle regenerative function." Skeletal muscle maintenance depends on ongoing repair, regeneration and growth, all of which decline during aging. Obesity rates increase with aging, which is also accompanied by reduced regenerative capacity and muscle strength. Hopp (1993) [2] conducted a study on "Effect of age and resistance training on a skeletal muscle'' he has also found that the age-related decline in force-generating capacity may be due, in part, to a loss of motor units and to a decline in muscle mass. These findings are also armored with Kirkendall &_Garrett (1998) [5] who conducted a study on "The effects of aging and training on skeletal muscle'' he has also reported that the adult will lose muscle mass with age; the loss varies according to sex and the level of muscle activity. In line with the findings of Thompson (1994) [11] the age-related decrease in maximum isometric force may be due, in part, to a decline in muscle mass which is also supported to these findings. These findings are similar to the Mc Carthy *et al*. (2014) [6].

Conclusion
Skeletal muscle percent showed decreasing trend with age increase.

References
1. Chowbey. India ranks 3rd in world on obesity index. Punjab News Express. 2016, 12.
2. Hopp JF. Effects of age and resistance training on skeletal muscle: A review. Physical therapy. 1993; 73(6):361-373.
3. Jang YC, Sinha M, Cerletti M, Dall'osso C, Wagers AJ. Skeletal muscle stem cells: effects of aging and metabolism on muscle regenerative function. Cold spring harbor symposia on quantitative biology. 2011; 76:101-111.
4. Kaur K, Deol NS. Diagnostic study of prevalence of obesity among female employees of Punjabi University Patiala. Department of physical education Punjabi university, Patiala, 2014.
5. Kirkendall DT, Garrett WE Jr. The effects of aging and training on skeletal muscle. The American journal of sports medicine. 1998; 26(4):598-602.
6. McCarthy HD, Samani-Radia D, Jebb SA, Prentice AM. Skeletal muscle mass reference curves for children and adolescents. Pediatrics obesity. 2014; 9(4):249-59.
7. Naddu JP. People in Punjab most obese, followed by Delhi: health minister India news. Press trust of India, 2016, 8.
8. Schaeffer PJ, Lindstedt SL. How animals move: comparative lessons on animal locomotion. Compr. Physiol. 2013; 3:289-314. doi:10.1002/cphy.c110059
9. Sundland GB, Jansson A, Saartok T, Renstrom P, Engstrom LM. Self-rated pain and perceived health in relation to stress and physical activity among school students: a 3-year follow up. Pain. 2008; 136:239-242.
10. Thakur. Over 40% Punjab population obese. The Indian express. 2015, 20.
11. Thompson LV. Effects of age and training on skeletal muscle physiology and performance. Physical therapy. 1994; 74(1):71-81.
12. US. Department of Health and Human Services. Physical activity guidelines for Americans. (ODPHP Publication No. U0036), 2011. Retrived from: http://www.health.gov/paguidelines/guidelines/default.aspx.
13. WHO. Creating an enabling environment Kingdom, Geneva. For population-based salt reduction strategies: report of a joint technical meeting held by WHO and the Food Standards Agency, United Kingdom, Geneva, 2010.