Indian Journal of
Nutrition

Volume 3, Issue 2 - 2016

www.opensciencepublications.com

Age and sex differences in human body physique and its association with nutrition: A cross-sectional study among the Ao children from Nagaland, North-East India

Research Article

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Article Information: **Submission:** 06/07/2016; **Accepted:** 28/07/2016; **Published:** 03/08/2016

Abstract

The variation in human body physique has been a subject of interest to physical anthropologists and human biologists since time immemorial. It is important to understand and analyze the factors associated with body physique, in order to have a better understanding of the morphological structure of the human body. The present study has been carried out on the age and sex differences in body physique and its association with nutrition. Heath and Carter method of somatotyping was employed to access body physique, and Body Mass Index (BMI) to access nutritional status among the Ao Naga children aged 8 to 18 years from Mokokchung district of Nagaland, North-East India. The comparison of the somatotype components and categories between the age groups and between sexes were tested using t-test and chi-square test, and the comparison of somatotype components within the BMI classification was analyzed using one-way analysis of variance (ANOVA). A significant level at 0.05 was used for all analyses employing MS office excel and SPSS 17 for windows software. The result showed that, the somatotype component ratings of boys and girls were found to be 1.88-3.90-3.67 and 3.11-3.50-3.09 respectively. There was a clear age-related change of mean somatotype components among Ao girls, and only minor changes were evident among boys. Also, remarkable sexual dimorphism was revealed with regard to somatotype components. The classification of BMI revealed that, both underweight and overweight coexisted, although the prevalence of underweight was significantly higher. There was also significant association between somatotype components and BMI, depicting that, the increase in endomorphy and mesomorphy components were a risk factor having predisposition toward certain diseases. Various intervention programs and preventive measures are required to improve the overall health status.

Keywords: Body physique; Somatotype; Nutrition; Body Mass Index; Endomorphy; Mesomorphy; Ectomorphy; Ao Naga

Introduction

The study of human variability in body size, shape, and proportion is an age-old research interest to physical anthropologists and human biologists, and more specifically to physical anthropologists regarding the study on the morphological structure of the human body in order to understand and analyze both ancient and living populations. The technique used to study human physique has been a subject of interest since the time of Hippocrates, a great Greek philosopher and physician of the 5th century BC. Although several different techniques are useful to describe the physique, one method that has been frequently used to describe body type is somatotyping.W.H.Sheldon (in collaboration with S.S. Stevens and W.B. Tucker) in 1940 introduced the concept of somatotype in the book "The varieties of human physique". Although Sheldon's method of somatotyping provided new techniques for the analysis and classification of human physique, there were many drawbacks in his method. Heath and Carter tried to modify the somatotype method that began with

Heath (1963) and Heath and Carter (1967) [1,2], which was designed to avoid some of the limitations of Sheldon's work [3]. It was a dynamic and more useful physique classification, which is now in use throughout the world. According to Heath and Carter, somatotyping can be best thought as a numerical shorthand method of describing the present morphological conformation in terms of body shape and composition independent of body size. It is one of the established methods in human biology, which is widely applicable in the fields of growth, nutrition, sports activity, occupation, disease, etc. [4]. It is expressed in a three-number rating, representing three components of physique namely endomorphy, which refers to relative fatness; mesomorphy, which refers to musculoskeletal robustness relative to height; and ectomorphy, which refers to relative linearity.

Somatotype has been applied in a variety of ways to demonstrate similarities and differences between diverse groups or populations. Several factors such as age, sex, nutrition, physical activity, occupation, socio-economic differences, and genetic factors affect the somatotype of an individual. The first and second components (endomorphy and mesomorphy) are very sensitive to changes in body composition. For this reason, many authors have assessed the relation between somatotype and health. In fact, unlike ectomorphy, high endomorphy and mesomorphy have been related to an increase in risk of coronary diseases [5,6].

One of the major health problems in many developing countries is malnutrition (under nutrition and over nutrition), which refers to an impairment of health either from a deficiency or excess or imbalance of nutrients, which is of public health significance all over the world. It creates lasting effect on growth, development and physical fitness of a person. Overweight or obesity assessed by Body Mass Index (BMI) during childhood is a strong predictor of overweight or obesity and coronary heart disease risk factors in young adulthood [7]. It is noteworthy that individuals with somatotypes high in ectomorphy, and low in both endomorphy and mesomorphy, and those low in endomorphy but high in mesomorphy, are rarely found in distributions of coronary heart disease patients. Increasingly, high mesomorphy and high endomorphy in combination is believed to add to the risk of cardiovascular disease [4]. However, till date, no such study has been reported among the Ao children. Under this backdrop, the present study has been taken up inorder to understand the association between somatotypes and nutritional status among the Ao children.

Materials and Method

The present cross-sectional study has been carried out among the Ao boys and girls of Mokokchung district in Nagaland, Northeast India. The Ao community is a major tribal group in Nagaland, belonging to the mongoloid ethnic stock, and speaks the Tibeto-Burman language. The people of Nagaland are well known for their varied ethnic groups, with their distinct cultures and traditions. Nagaland is situated on the easternmost region of India, and is one of the North Eastern states, covered mostly by high-altitude mountains. Mokokchung is one of the major districts of the State that became a full- fledged district in 1957. The district headquarter, Mokokchung town, is considered the cultural center of the Ao People, and is economically and politically the most important urban center in Northern Nagaland. The district is located at a height of about 1,326 meters above sea level, and lies between 94.29 and 94.76 degrees east longitude, and 26.20 and 26.77 degrees north latitude. According to 2011 census, the total population of the district was 193,171, out of which, the urban population was about 55,654 and rural population of about 1,37,517 [8].

For the present study, urban area in Mokokchung District has been taken into account, where, seven wards were selected randomly using lottery method as mentioned in Snedecor and Cochran [9]. No statistical sampling of households and individuals was done for the purpose of collection of data, instead an attempt was made to include all those children who were willing to co-operate for the purpose of the present study. A total sample of seven hundred and ninety (790) Ao children were considered for the present study, out of which, four hundred and four (404) were boys and three hundred and eighty six (386) were girls. The age range was from 8 to 18 years.

Anthropometric somatotyping was done using ten conventional anthropometric measurements such as height, weight, triceps skin fold, sub-scapular skin fold, supra-iliac skin fold, calf skin fold, bone diameters of humerus and femur, and circumference of the arm and calf. Standard techniques of taking the anthropometric measurements were followed as described in Weiner and Lourie [10]. For taking skinfold measurement, Harpenden skinfold calliper was used. The somatotype components namely endomorphy, mesomorphy, and ectomorphy were estimated employing Heath and Carter Method.

Data on height and weight were collected using anthropometric rod to the nearest 0.1cm and weighing machine to the nearest 0.5kg. BMI was assessed computing the international cut off points for child and adolescent according to age and sex as recommended by Cole et al. [11,12]. No qualified athlete or sportsperson was included in sample under study.

After computing the age-wise statistics for somatotype, the comparison of the somatotype components and categories between the age groups and between sexes were tested using t-test and chi-square test, and the comparison of the somatotype components within the BMI classifications was analyzed using one-way analysis of variance (ANOVA). A significant level at 0.05 was used for all analyses employing MS office excel and SPSS 17 for windows software.

Result

The age-wise distribution of mean somatotype components in boys (Table 1) shows that, endomorphy component showed a fluctuating pattern with no regular trend from 8 till 18 years of age, and very little differences between each age groups, with an overall increase of 0.26 units. Mesomorphy component, on the other hand, showed a decreasing trend with a slight fluctuation,with very little mean differences between each age group, and an overall decrease of 0.24 units. Ectomorphy showed an increasing trend from 8 till 13 years, and a decreasing trend thereafter, with an overall increase of 0.41 units. On the whole, the somatotype component rating of the Ao boys was found to be 1.88-3.90-3.67, where, mesomorphy showed the highest value, and endomorphy the lowest.

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The age-wise distribution of mean somatotype components in girls (Table 1) shows that, endomorphy showed lower values during the younger age groups from 8 till 12 years, and became higher with the advancement of age in a fluctuating pattern. An overall increase of 1.66 units from 8 to 18 years was noticed. On the other hand, mesomorphy did not show much change with age, with an overall increase of 0.13 units. Ectomorphy was noticed to be higher during the younger age groups from 8 till 12 years, and lower during 13 till 18 years, and the trend showed a fluctuating pattern. There was an overall decrease of 1.01 units from 8 to 18 years. On the whole, the somatotype component rating of the Ao girls was found to be 3.11-3.50-3.09, where, mesomorphy and ectomorphy components were found to have the highest and lowest values respectively.

Figures 1 and 2 presents the age-wise somatotype component variation in boys and girls respectively. As seen in Figure 1, endomorphy showed minor values compared to mesomorphy and ectomorphy at all the age groups in boys. Mesomorphy showed higher values than ectomorphy at 8, 9, 10, and 18 years of age, and similar values during 11 to 17 years of age. Among girls (figure 2), endomorphy showed lower values from 8 till 13 years, and higher values from 14 till 18 years. On the other hand, mesomorphy and ectomorphy components showed similar values from 8 till 13 years, and mesomorphy showed higher values thereafter.

Table 2 presents the age-wise comparison of the mean somatotype components in boys and girls. As seen from the table, no statistically significant difference was noticed in mean somatotypes between any of the age groups compared in boys. The age change in mean somatotype component ratings at 8 and 18 years in boys (Figure 3) also showed that, the somatotype components had similar values with no significant differences.

Further, girls showed statistically significant differences in both endomorphy and ectomorphy components according to age. The differences were noticed between the age groups of 12 and 13 years ($t=2.44$, $p<0.05$) and 13 and 14 years ($t=4.10$, $p<0.05$) for endomorphy component, and between 13 and 14 years ($t=2.14$, $p<0.05$) for ectomorphy component (Table 2). The age change in mean somatotype component ratings at 8 and 18 years in girls (figure 4) showed that, endomorphy and ectomorphy components were significantly higher at 18 and 8 years respectively, and mesomorphy component showed similar values at both the age groups.

Thus, from the above finding, it can be noted that, both endomorphy and ectomorphy components were the main source of somatotype variations with regard to age in girls. Among boys, there was no statistically significant difference noticed in the somatotype components with regard to age.

Table 3 shows the age-wise comparison between boys and girls somatotype components. Remarkable differences were noticed in the somatotype components between boys and girls, more so within the endomorphy component. The endomorphy values were significantly higher among girls at all the age groups except during 9 years of age. The values of the mesomorphy component were closer between both sexes, although, at all ages, boys presented higher values in mesomorphy, and the statistically significant differences were noticed at 8, 9, 10, and 14 years. As for ectomorphy component, girls showed higher values from 8 till 10 years, with a significant difference during 8 years, and boys had higher values thereafter, with a significant difference during 13 till 18 years of age. The overall perusal of table 3 reveals that, the statistically significant differences in somatotype components between boys and girls were seen to be highest in endomorphy component, followed by ectomorphy component

Table 1: Age-wise distribution of mean somatotype components.

Age (years)	N		Statistics	Endomorphy		Mesomorphy		Ectomorphy	
	Boys	Girls		Boys	Girls	Boys	Girls	Boys	Girls
8	35	36	Mean	1.76	2.25	4.14	3.45	3.06	3.52
			SD	0.63	0.77	0.87	0.48	0.88	0.96
9	35	35	Mean	1.87	2.04	4.08	3.50	3.19	3.58
			SD	1.22	0.71	0.67	0.53	1.16	0.99
10	36	34	Mean	1.85	2.24	4.18	3.56	3.60	3.80
			SD	0.77	0.82	0.63	0.70	1.14	1.07
11	36	36	Mean	2.08	2.52	3.91	3.72	3.72	3.52
			SD	0.81	0.93	0.71	0.97	1.04	1.54
12	38	34	Mean	1.84	2.41	3.86	3.54	3.82	3.60
			SD	0.52	0.63	0.97	1.08	1.17	1.38
13	36	37	Mean	1.91	2.88	3.84	3.48	4.00	3.28
			SD	0.88	0.99	0.71	0.96	1.18	1.20
14	38	34	Mean	1.63	3.84	3.80	3.26	3.97	2.67
			SD	0.50	0.97	0.96	1.01	1.29	1.20
15	35	36	Mean	1.87	3.97	3.82	3.50	3.94	2.33
			SD	0.69	1.05	1.11	0.72	1.40	1.06
16	39	34	Mean	1.80	4.04	3.57	3.43	3.73	2.70
			SD	0.50	0.90	0.62	0.83	0.92	1.04
17	35	35	Mean	2.09	4.16	3.74	3.49	3.59	2.53
			SD	0.81	1.05	0.78	0.81	0.92	0.90
18	41	35	Mean	2.02	3.91	3.90	3.58	3.47	2.51
			SD	0.60	0.82	1.05	1.06	1.12	1.40
8-18	404	386	Mean	1.88	3.11	3.90	3.50	3.67	3.09

*SD=Standard Deviation

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Table 2: Age-wise comparison of the mean somatotype components in boys and girls.

Age (years)	Boys			Girls		
	Endo	Meso	Ecto	Endo	Meso	Ecto
8-9	0.51	0.30	0.54	1.23	0.39	0.27
9-10	0.09	0.66	1.50	1.10	0.43	0.85
10-11	1.24	1.74	0.46	1.32	0.77	0.89
11-12	1.52	0.25	0.38	0.59	0.71	0.25
12-13	0.39	0.07	0.66	2.44*	0.23	1.06
13-14	1.67	0.23	0.12	4.10*	0.95	2.14*
14-15	1.69	0.08	0.07	0.57	1.13	1.24
15-16	0.49	1.15	0.78	0.30	0.36	1.48
16-17	1.81	1.04	0.62	0.49	0.32	0.73
17-18	0.38	0.76	0.55	1.12	0.38	0.10
8 & 18	1.89	1.06	1.77	8.73*	0.65	3.55*

*Significant at 0.05 level, endo=endomorphy, meso=mesomorphy, ecto=ectomorphy.

Table 3: Age-wise sex comparison in somatotype components.

Age (years)	Sample	Mean somatotype	t_{Endo}	t_{Meso}	t_{Ecto}
8	Boys Girls	1.76-4.14-3.06 2.25-3.45-3.52	3.00*	4.07*	2.11*
9	Boys Girls	1.87-4.08-3.19 2.04-3.50-3.58	0.7	4.02*	1.51
10	Boys Girls	1.85-4.18-3.60 2.24-3.56-3.80	2.03*	3.87*	0.72
11	Boys Girls	2.08-3.91-3.72 2.52-3.72-3.52	2.11*	0.94	0.67
12	Boys Girls	1.84-3.86-3.82 2.41-3.54-3.60	4.09*	1.29	0.72
13	Boys Girls	1.91-3.84-4.00 2.88-3.48-3.28	4.45*	1.81	2.59*
14	Boys Girls	1.63-3.80-3.97 3.84-3.26-2.67	11.96*	2.31*	4.42*
15	Boys Girls	1.87-3.82-3.94 3.97-3.50-2.33	10.00*	1.43	5.45*
16	Boys Girls	1.80-3.57-3.73 4.04-3.43-2.70	12.87*	0.82	4.41*
17	Boys Girls	2.09-3.74-3.59 4.16-3.49-2.53	9.28*	1.31	4.88*
18	Boys Girls	2.02-3.90-3.47 3.91-3.58-2.51	11.23*	1.34	3.25*

*Significant at 0.05 levels.

mostly among the older age groups, and finally the mesomorphy component among the younger age groups.

The total frequency and percentage of boys and girls in various somatotype categories at all age groups combined (Table 4) shows that, the distribution of somatotype categories was more in girls than in boys. The maximum and minimum number of boys fell in mesomorph-ectomorph (34.41%) and mesomorphic endomorph (0.25%) categories respectively. As for girls, maximum number of them fell in mesomorph-endomorph category (18.91%) although the margin was close to central type (18.39%), and minimum number of them fell in endomorphic ectomorph category (1.04%). A statistically significant difference (χ^2 =232.06, p<0.05) was noticed in the distribution of somatotype categories between boys and girls.

The mean of Body Mass Index (BMI) according to age in boys and girls (Figure 5) reveals that, BMI increased with the advancement of age, with a slight fluctuating pattern at 10 years among boys and 16 years among girls. Boys were found to have higher BMI during 8 till 10 years, and it became higher in girls thereafter.

The distribution of BMI by age according to the classification by Cole et al. (2000,2007) in boys and girls (Figure 6 and 7) showed that, the prevalence of underweight was noticed at all the age groups in boys, and overweight at 9 (2.86%), 10 (2.78%), 11 (2.78%), 12 (2.63%), 15 (5.71%), and 18 (2.44%) years. As can be seen from figure 6, the prevalence of underweight was higher among younger age groups, and declined with the advancement of age in a fluctuating pattern. The prevalence of overweight, on the other hand, did not show any regular trend. Among girls (Figure 7), similar to boys, the prevalence of underweight was noticed at all the age groups, and overweight at the age of 9 (2.86%), 11 (8.33%), 13 (2.70%), 14 (2.94%), 15 (2.78%), 16 (5.88%), and 18 (8.57%) years. The prevalence of underweight and overweight was higher among younger and older age groups respectively, in a fluctuating pattern. Overall, the prevalence of underweight was higher among boys (31.44%) than in girls (25.13%), and the prevalence of overweight was higher among girls (3.11%) than in boys (1.73%). A significant difference in the distribution of BMI according to age was noticed in girls (χ^2 =39.69, p<0.05).

Table 4: Total frequency and percentage of boys and girls in various somatotype categories.

Somatotype categories	Boys	Girls	χ^2
	N (%)	N (%)	
Central	13(3.22)	71(18.39)	
Balanced endomorph	0 (0.00)	11(2.85)	
Mesomorphic endomorph	1(0.25)	22(5.70)	
Mesomorph-endomorph	9(2.23)	73(18.91)	
Endomorphic mesomorph	12(2.97)	9(2.33)	
Balanced mesomorph	68(16.83)	53(13.73)	
Ectomorphic mesomorph	58(14.36)	6(1.55)	
Mesomorph-ectomorph	139(34.41)	49(12.69)	
Mesomorphic ectomorph	82(20.30)	31(8.03)	
Balanced ectomorph	22(5.45)	39(10.10)	232.06*, df=11
Endomorphic ectomorph	0 (0.00)	4(1.04)	
Endomorph-ectomorph	0 (0.00)	18(4.66)	
Ectomorphic endomorph	0 (0.00)	0 (0.00)	

*Significant at 0.05 levels, χ^2= chi-square, df=degree of freedom.

Table 5: Comparison of mean somatotype components within BMI classification in boys and girls.

BMI	N	Endomorphy		Mesomorphy		Ectomorphy	
		Mean	SD	Mean	SD	Mean	SD
Boys							
Underweight	127	1.57	0.51	3.41	0.66	4.62	0.82
Normal	270	1.95	0.69	4.05	0.76	3.28	0.93
Overweight	7	4.06	1.34	5.23	1.20	1.18	1.18
ANOVA F-test		54.70*, df=2		44.88*, df=2		121.76*, df=2	
Girls							
Underweight	97	2.28	0.81	2.92	0.70	4.48	0.85
Normal	277	3.33	1.16	3.64	0.75	2.73	0.92
Overweight	12	4.84	0.75	5.03	0.87	0.31	0.45
ANOVA F-test		50.06*, df=2		60.15*, df=2		197.80*, df=2	

*Significant at 0.05 levels, df=degree of freedom, SD=Standard Deviation, N=Number of sample size; BMI=Body Mass Index.

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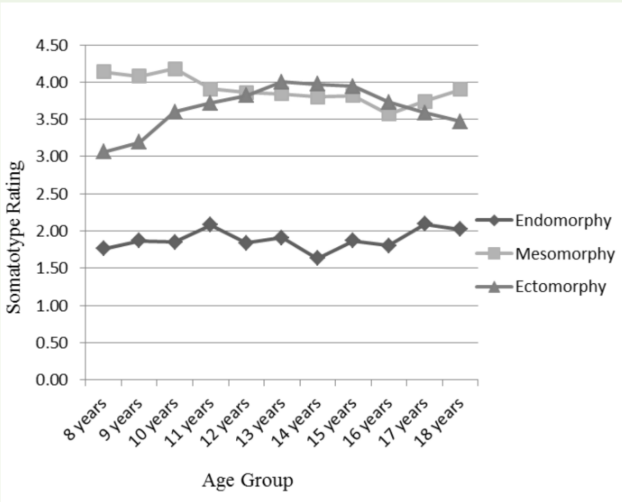

Figure 1: Age-wise mean somatotype component variation in boys.

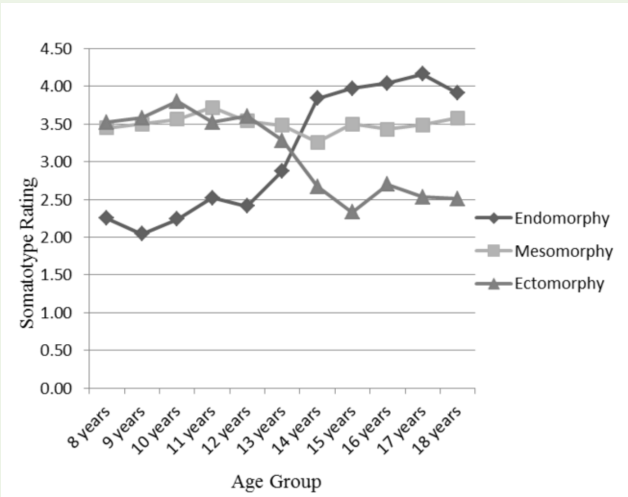

Figure 2: Age-wise mean somatotype component variation in girls.

Table 5 presents the comparison of mean somatotype components within BMI classification (underweight, normal weight, and overweight). It was noticed that, among both boys and girls, endomorphy and mesomorphy components were found to be significantly higher among those with the prevalence of overweight, and significantly lower among the underweight children. Ectomorphy, on the other hand, was found to be significantly higher among those with the prevalence of underweight, and lower among overweight children. From this table, we can prove that, there is a significant association between somatotype components and BMI among children.

Discussion

The present study showed a clear age-related change of mean somatotype components among Ao girls, and only minor changes were evident among the boys. This finding was in consonance with various other studies conducted in different parts of the country [13,14]. Endomorphy and ectomorphy components contributed in girls, more so through endomorphy component in the present study, where, endomorphy was found to be higher among the older age groups and increased as the age advanced in a slight fluctuation. Ectomorphy component, on the other hand, tended to decrease among the older children. The decrease of the third component (ectomorphy) in late adolescence may be related not only to the development and widening of the skeleton, but also to the increase in fat that takes place at these ages [15]. Furthermore, in the present study, there was a gradual decrease in the mesomorphic component with the advancement of age, and the younger boys had higher mesomorphic component than the older boys. The higher mesomorphy component among the younger age groups did not mean that the younger ones were more muscular than the older ones, but partly because of the fact that mesomorphy was adjusted for height [13].

The remarkable sexual dimorphism revealed in the present study with regard to somatotype components was in consonance with several other studies [16-18]. The Ao boys presented a higher

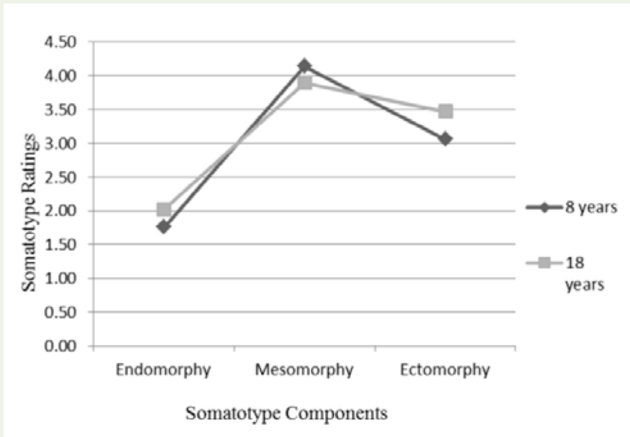

Figure 3: Age changes (8&18 years) in mean somatotype component ratings in boys.

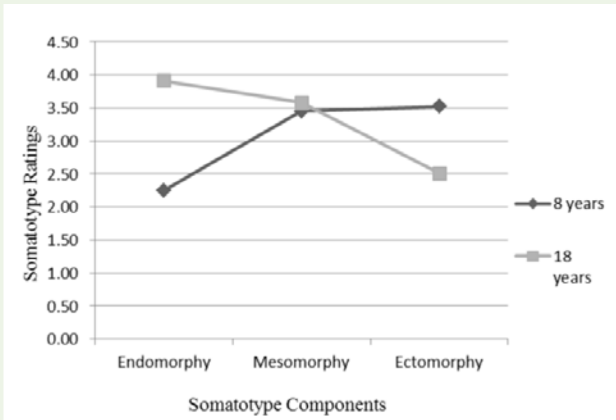

Figure 4: Age changes (8&18 years) in mean somatotype component ratings in girls.

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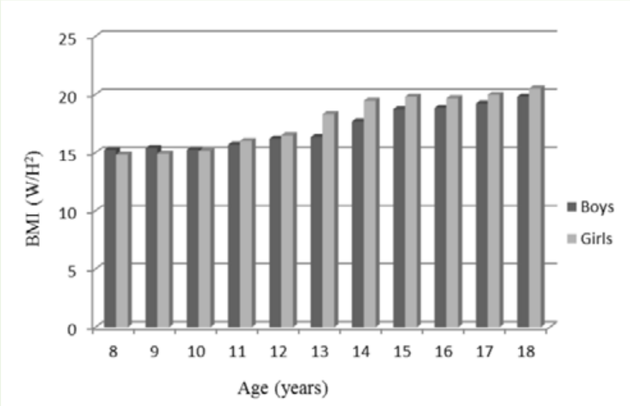

Figure 5: Mean of BMI according to age in boys and girls.

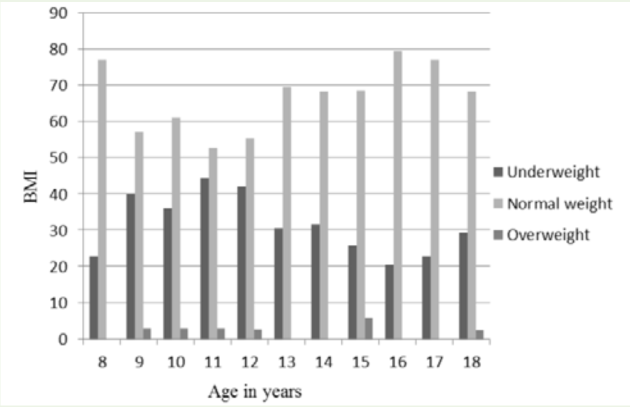

Figure 6: Distribution of BMI classification by age in boys.

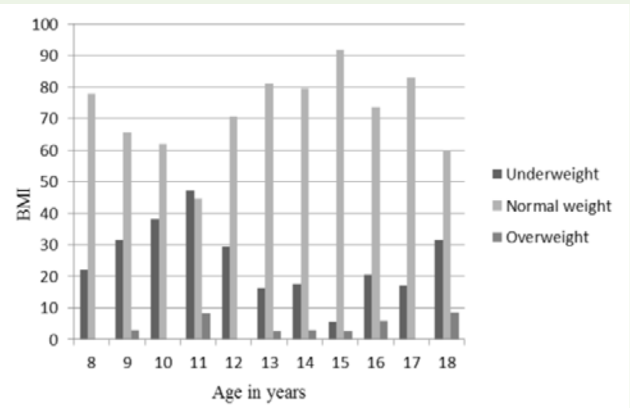

Figure 7: Distribution of BMI classification by age in girls.

value in mesomorphy component than girls, which showed a greater musculo-skeletal development of boys. According to Carter and Heath, girls were more endomorphic and less mesomorphic than boys, because of the hormonal changes that brought about an increase of subcutaneous fat in girls. And though there may also be an increase in fatness among boys, secretion of androgens stimulates musculoskeletal development and, consequently, the mesomorphy increases [1990]. The significantly higher mean ectomorphy in Ao boys during the older age groups delineates that boys had more linear physique than girls during the older age groups. Succinctly, the Ao boys had lower mean endomorphy, and higher mean mesomorphy and ectomorphy than their female counterparts.

The distribution of somatotype categories revealed a dominant muscular component with only marginally lower linear component among the Ao boys. The girls, on the other hand, had all the three components well distributed with slight muscular component dominant. The slightly higher mesomorphic ratings among the Ao children could be attributed to physical activity including householdchores, which was found to be very common among this population. Various other studies confirm the present study, where,a positive association was noticed between mesomorphic component and physical activity [19,20].

BMI, which was used to assess the nutritional status of the children in the present study revealed that both underweight and overweight coexisted, although the prevalence of underweight was significantly higher. Under nutrition among children and adolescents is a serious public health problem internationally, especially in developing countries [21]. The high prevalence of underweight among children in the present study could be due to the imbalance between diet needed for proper growth and regular energy expenditure through physical activity. Other studies also showed that low-fat diets and regular physical activity contributed to weight loss and weight maintenance [22]. Also, the high prevalence of underweight among Ao children could be attributed to family income group, where, most of the children belonged to low income group (51.73% in boys and 59.07% in girls), without proper nutrients required for a proper body growth. Poor environmental conditions such as poor housing and hygienic conditions, unsafe drinking water, heavy workloads, lack of preventive and control measures of locally endemic diseases and infections, have been found to be the causes of under nutrition in various other studies, which were the common characteristics of population groups belonging to low socio-economic strata of the society especially in developing countries [23,24]. On the other hand, the prevalence of overweight among children in the present study could be attributed to the reduction in energy expenditure accompanied by an increase in energy intake, which was in agreement with several other studies [25,26].

The significantly higher prevalence of overweight among Ao children with higher endomorphy and mesomorphy components depicts that, increase in endomorphy and mesomorphy components were a risk factor having predisposition toward certain diseases.The significant positive association between somatotype components and BMI was also found in various other studies [27,28].

Conclusion

The present study clearly shows that the somatotype components changed significantly with age among girls, and there were remarkable sex differences with regard to all the three components, more so within the endomorphy and ectomorphy components. There was also significant association between somatotype components and BMI,

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depicting that increase in endomorphy and mesomorphy was a risk factor having predisposition toward certain diseases. It is well known that, in the recent times,the prevalence of overweight and obesity are increasing rapidly in both developed and developing countries, and that the situation is becoming more serious in developing countries, where the proportion of overweight and obese people now co-exist with those who are underweight. A similar result has been identified among the Ao children, although the prevalence of underweight was significantly higher.

It is therefore recommended that, preventive measures should be taken early in life to avoid diseases associated with malnutrition. It is important to educate children on health related issues, where inactive living and unhealthy diet are increasing rapidly as an impact of urbanization, industrialization, and expansion of food markets, especially in developing societies. On the other hand, the high prevalence of underweight among the Ao children is a major concern that should be taken into consideration. Poverty has been the greatest challenge related to health problem, particularly undernourishment, in a country like India. Various intervention programs are required to eradicate under nutrition, especially among the urban poor. As children spend a high percentage of their time at school, schools can become the key environment to educate and improve their knowledge, attitude, and behavior towards health and lifestyle for the well being of the individual and society as a whole.

Acknowledgement

This article is a part of my Ph.D. thesis. I am grateful for the financial support I received from University Grant Commission (UGC) Rajiv Gandhi National fellowship that helped me in the completion of the thesis.

References

1. Heath BH (1963) Need for modification of somatotyping methodology. Am J Phys Anthropol 21:227-233.
2. Heath BH, Carter JEL (1967) A modified somatotype method. Am J Phys Anthropol 27: 57-74.
3. Sheldon WH, Stevens SS, Tucker WB (1940) The Varieties of Human Physique. New York: Harper Brothers.
4. Carter JEL, Heath BH (1990) Somatotyping. Development and Applications. Cambridge, UK, Cambridge University Press.
5. Herrera H, Rebato E, Hernandez R, Hernandez-Valera Y, Alfonso-Sanchez MA (2004) Relationship between somatotype and blood pressure in a group of institutionalized Venezuelan elders. Gerontology 50: 223-229.
6. Kalichman L, Livshits G, Kobyliansky E (2004) Association between somatotypes and blood pressure in an adult Chuvasha population. Ann Hum Biol 31: 466-476.
7. Janssen I, Katzmarzyk PT, Srinivasan SR, Chen W, Malina RM, et al. (2005) Combined influence of body mass index and waist circumference on coronary artery disease risk factors among children and adolescents. Pediatrics 115: 1623-1630.
8. Census of India (2011) Provisional population totals: Nagaland.
9. Snedecor GW, Cochran WG (1967) Statistical Methods. Iowa: The Iowa State University Press.
10. Weiner JS, Lourie JA (1981) Practical Human Biology. London: Academic Press.
11. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH (2000) Establishing a standard definition for child overweight and obesity worldwide: International survey. BMJ 320: 1240-1243.
12. Cole TJ, Flegal KM, Nicholls D, Jackson AA(2007) Body Mass Index cut offs to define thinness in children and adolescents: international survey. BMJ 335: 194-197.
13. Gakhar I, Malik SL (2002) Age changes and sex differences in somatotypes among the Jats of Delhi. Anthropologist (Special Issue) 1: 115-125.
14. Singh LD (2011) Somatotypes of the Affluent and Non-affluent Meitei Boys of Manipur, India. Anthropologist 13: 9-16.
15. Claessens AL, Beunen G, Simon J (1986) Stability of anthroposcopic and anthropometric estimates of physique in Belgian boys followed longitudinally from 13 to 18 years of age. Ann Hum Biol 13: 235-244.
16. Bhasin MK, Jain S (2007) Biology of the tribal groups of Rajasthan, India: Age changes in somatotype. Anthropologist 9: 257-265.
17. Saranga SPJ, Prista A, Nhantumbo L, Beunen G, Rocha J, et al. (2008) Heritabilities of Somatotype Components in a Population from Rural Mozambique. Am J Hum Biol 20: 642-646.
18. Vivek KS, Senthil KS, Vinayathan A, Krishnakumar R, Rajendran R (2016) Somatotyping in Adolescents: Stratified by Sex and Physical Activity. Int J Anat Appl Physiol 2: 32-38.
19. Malik SL, Eiben OG, Prakash M, Mittal M (1986) Impact of high altitude on body shape. Anthropologiai kozlemenyek 30: 203-208.
20. Ozener B, Duyar I (2008) The effect of labour on somatotype of males during the adolescent growth period. Homo 59:161-172.
21. Pelletier DL, Frongillo EA (2003) Changes in child survival are strongly associated with changes in malnutrition in developing countries. J Nutr 133: 107-119.
22. Bouchard C (2000) Introduction. In: Physical activity and obesity. Champaign, IL: Human Kinetics. p 3-19.
23. Khongsdier R (2002) Body mass index and morbidity in adult males of the War Khasi in Northeast India. Eur J Clin Nutr 56: 484-489.
24. De Onis M, Frongillo EA, Blossner M (2000) Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. Bull World Health Organ78:1222-1233.
25. Bodzsar EB, Zsakai A, Jakab K, Toth KB (2005) Body fatness and sexual maturation status. Anthropological Notebooks (Szlovenia)X(1): 12-17.
26. Laxmaiah A, Nagalla B, Vijayaraghavan K, Nair M (2007) Factors affecting prevalence of overweight among 12 to 17 year old urban adolescents in Hyderabad, India. Obesity 15: 1384-1390.
27. Nikolova M, Akabaliev V, Sivkov S, Mladenova S (2005) Body composition of children and adolescents from Plovdiv. In: Gruev B, Nikolova M, Donev A editors. Proceedings of the Balkan Scientific Conference of Biology in Plovdiv (Bulgaria) from 19th till 21st of May 2005. p 150-158.
28. Widiyani T, Suryobroto B, Budiarti S, Hartana A (2011) The growth of body size and somatotype of Javanese children age 4 to 20 years. HAYATI Journal of Biosciences 18: 182-192.

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