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Studies on Comparison of Body Mass Index (BMI) of School Going Children Having Different Blood Groups (A, B, Ab and O) of Sargodha District

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Abstract: Body mass index (BMI) of 149 male and female children, classified into three age groups (5-9, 10-14 and 15-18 years) having four different blood groups (A, B, AB and O), was estimated from different schools situated in Sargodha district. The highest BMI was found in boys of age 15-18 years, whereas the lowest BMI was observed in the students with 5-9 years age. Many male and female subjects from all age groups were found underweight but BMI values of group A and O subjects were found close to the normal values. Female subjects having AB blood group were found to have the highest BMI whereas subjects from blood group "A" exhibited the lowest BMI values. Female subjects with others two blood group (B and O) were found to have normal BMI values. Overall, the students of 5-18 years (male and female) belonging to different blood groups were found to have low BMI than the recommended values. It has been found that BMI of "O" subjects was better as compared to blood group A and B.

Key words: Body mass index (BMI), children obesity, age, blood groups

INTRODUCTION

Blood groups are being used as biological markers by researchers and anthropologists in search for humanity's imprint on our distant past. Due to various environmental factors, variations, strength, weakness of each blood group can be found as a part of humanity's continual process of acclimating (Peter and Catherine, 2000).

Distribution of blood groups is variable in the world. The highest percentage of blood group "A" is present in western Europeans. It is also found in considerable amounts around whole Mediterranean Sea, mainly in Corsica, Sardinia, Spain, Balkans and Turkey. Blood group A comes from Caucasian people and blood group B from Mongolians (Borecki *et al*., 1985). AB blood group has resulted from combination of two blood groups i.e. A and B. Pakistan has blood groups population as "B" 36, "O" 33, "A" 21 and "AB" 9% (Anees and Shabir, 2005). Similarly in other regions of the world, various blood distributions have been reported (D'Adamo, 2006).

The anthropometric is a term which refers to proportional measurements of a person's body. These measurements are length, weight, weight-for-length, height and head circumference which help to assess growth and development of a person (James, 2011). The body mass index (BMI) is included in anthropometric measurements. It is the ratio of weight (kg) to the square of height (cm^2). It is used to describe nutritional status of a person. It gives information about "fatness" or "thinness" of a person's body.

Body mass index offers a reasonable measure to assess fatness in children and adolescents. High reliability of measurements of height and weight suggests that a variant of weight-for-height provides a more reliable measure of adiposity that can be used to compare adiposity within populations. The BMI is thus an index of weight adjusted for stature. It is a useful tool for diagnosing obesity or malnutrition; however, such diagnosis should take into account a person's age, gender, fitness and ethnicity (D'Adamo, 2006)

So far, no study has been conducted regarding BMI of school going children having different blood groups (A, B, AB and O). Hence, the objectives of this research were to compare BMI of school going children, on the basis of gender and age, having different blood groups.

MATERIALS AND METHODS

The research work was conducted in different schools of Sargodha to study the BMI of school going children having blood groups A, B, AB and O. The BMI was calculated to check the status of subjects (obese, overweight, normal and under weight). The detail of study design used and methodology employed during this study has been given below:

Selection of sample: Data was collected from eleven different schools by selecting 149 children (including male and female) from 5-18 years who knew their blood groups. Subjects were used to calculate BMI according to age. Out of 149, 51 students had blood group O, 47 had B, 43 had A and 8 belonged to AB.

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Personal information: According to guidelines of World Health Organization for anthropometric measurements name, sex, age, contact number, E-mail address, postal address, consent and other necessary information of subjects were taken and recorded for further inquiry (WHO, 1995).

Data collection techniques: The tools selected and implied in conducting research were BMI calculator for children.

Body mass index: The body mass index was calculated from an individual's weight taken in Kg and height in cm by using the body mass index calculator for children. The BMI values were recorded as described by Nelson (1996). Height and weight measurements were made using standard procedures and using calibrated devices.

Preparation of the children for measurements: The children were instructed to remove as much outwears as possible and jewelry items. Children were asked to remove the shoes, empty the pockets and hands.

Measurement order: Weight and height measurements of the child at every school were taken with the assistance of chairperson and measuring assistant. The data was recorded on assessment form. One measurement of weight and duplicate measurements of height were taken to reduce error and to obtain accurate results.

Statistical analyses: The data obtained for each parameter was subjected to statistical analysis to determine the level of significance. The results were analyzed by t-test, one way ANOVA technique as well as descriptive analysis to make the comparison of BMI of different age group children (including male and female) having blood groups (A, B, AB and O).

RESULTS AND DISCUSSION

Table 1 shows the recommended ranges of BMI along with status of subjects.

Table 1: Recommended ranges of BMI along with status of subjects, adapted from WHO (2004)

Status	BMI	Status	BMI
Underweight	< 18.5	Obese-I	30.0-34.9
Severe thinness	< 16.0	Obese-II	35.0-39.9
Moderate thinness	16.0-16.95	Obese-III	>40.0
Mild thinness	17.0-18.49	Morbid obesity	40.0-44.9
Normal weight	18.5-24.9	Super obesity	45.0-50.0
Overweight	25.0-29.9	-	-

BMI of male students belonging to different blood groups: Male students were categorized into 3 groups as function of age (Table 2). No male subject among all the three categories of age group had normal BMI except blood group O. The male subjects, having blood group B and AB at the age of 15-18 years, showed severe thinness. The highest BMI was found in boys of 15-18 years whereas the lowest was observed in 5-9 years students. Boys of 5-9 years from all the blood groups were found underweight. Similar results were found in a study in China in which male and female subjects at the age 6-9 years were found underweight (Ji and Beijing, 2006; Ji, 2005). In another study conducted in Pakistan, BMI of affluent school girls and boys of Karachi, Lahore and Quetta (cities of Pakistan) were measured and it was found that the average BMI of 5-9 years subjects belonging to Karachi, Lahore and Quetta was below the recommended BMI for normal range (Table 1) (Aziz *et al*., 2010). But, in a study conducted in Sweden, both male and female subjects of Swedish School-Sports-Health were found to have their BMI >18 at the age of 10 years (Örjan *et al*., 2005). In another study carried in India, it was found that the mean BMI and prevalence of thinness (<5th percentile) among both female and male subjects having age 10-14 years, were lower than the recommended BMI for normal range (Mondal and Sen, 2010). This might be due to the fact that boys after age of 14 years show good height and after the age of 16 become heavier. It has been confirmed from many studies that the Europeans have higher BMI compared to Asian. Therefore, on the basis of scientific evidences, world health organization (WHO) expert consultation suggested that there should be different associations between BMI, percentage of body fat and health risks of Asian populations compared to European populations (WHO expert consultation, 2004). The reasons behind this suggestion might be the differences in the height, socio-economic status, life style, diet and genetic factors of Europeans and Asians.

Moreover, during the age period of 15-18 years, onset of puberty and level of activity may also affect the BMI. Among 15-18 years of boys, O group subjects were found normal. No boy with AB blood group could be found in this age group. Among 10-14 years of boys, A and O group subjects were found normal. While, all subjects of others blood groups were observed under weight. Overall, highest BMI was found in subjects of O group, whereas those from AB exhibited the lowest BMI. Male subjects from all the groups were found underweight but the BMI values of group A and O subjects, within the age 10-18 years, were found close to the normal values. The findings are in contradiction with the results obtained for female students.

BMI of female students belonging to different blood groups: The BMI of 37 female students was measured to find out correlation of BMI with blood groups (Table 2). Female students were also categorized into 3 groups as a function of age. The normal BMI was seen in the female subjects (10-14 years) having blood group B and

Table 2. Body mass index (BMI) of Male and Female students belonging to different Blood Groups.

Age group	Sex	Blood type	BMI (Mean±SD)	Total for Male	Total for Female
5-9 y	M (n = 4)	A	14.85±1.37	15.77±3.11 (n = 15)	15.98±3.30 (n = 8)
	F (n = 3)		14.80±1.85	-	-
	M (n = 7)	B	16.16±4.51	-	-
	F (n = 4)		17.38±4.20	-	-
	M (n = 4)	O	16.00±0.98	-	-
	F (n = 1)		13.90±0.00	-	-
	M (n = 0)	AB	-	-	-
	F (n = 0)		-	-	-
10-14 y	M (n=27)	A	18.61±3.34	17.98±3.07 (n = 80)	18.72±3.90 (n = 20)
	F (n = 4)		16.33±1.91	-	-
	M (n = 22)	B	17.22±2.75	-	-
	F (n = 8)		19.60±5.24	-	-
	M (n = 29)	O	18.06±3.10	-	-
	F (n = 5)		17.60±0.44	-	-
	M (n = 2)	AB	16.75±0.21	-	-
	F (n = 3)		21.43±3.67	-	-
15-18 y	M (n = 5)	A	18.16±1.50	18.02±3.73 (n = 17)	19.56±2.12 (n = 9)
	F (n = 0)		-	-	-
	M (n = 3)	B	15.13±1.62	-	-
	F (n = 3)		17.40±0.82	-	-
	M (n = 7)	O	20.17±4.34	-	-
	F (n = 5)		21.02±1.53	-	-
	M (n = 2)	AB	14.50±3.54	-	-
	F (n = 1)		18.70±0.00	-	-

AB. At this age, no female subject with blood group A could be observed for BMI. Only female subjects (10-14 years) of O and AB blood groups were observed to have their BMI in normal range. The highest BMI was found in girls of 15-18 years while the lowest was seen in 5-9 years students. Our results about the lower BMI in 5-9 years were in agreement with the findings of another study conducted in China in which the observed BMI of 6-9 years school children were lower than recommended BMI for normal range (Ji and Beijing, 2006; Ji, 2005). Overall, the highest BMI was found in subjects of AB group having age 10-14 years, whereas those from A exhibited the lowest BMI. Except subjects of A group having age 10-14 years, all others were found normal, though marginally. The findings are in contradiction with the results obtained for male students according to blood group. Therefore, it may also be attributed to some hormonal changes associated with blood groups.

Comparison between male and female students regarding BMI: BMI of blood group B and AB of female subjects were higher than the BMI of male subjects with same blood groups within the age 10-18 years whereas the female subjects of blood group A and O (only 10-14 years) had lower BMI compared to male subjects having same blood groups. Most female as well as male subjects, at the age of 5-9 years having blood groups A and O, showed prevalence of thinness regarding BMI. In general, female subjects in all the age groups had higher BMI than male subjects. Our results are concurrent with a study conducted in Swedish School-Sports-Health where it was found that the girls (21.9) at the age of 16 years had higher values of BMI than boys (21.4) (Örjan *et al*., 2010). In a report on Childhood Obesity in China, BMI of Chinese boys (Percentile 85-95th) was found to be higher (7-9 y: 17-18.4 (male) verses 16.4-17.7 (female); 10-14 y: 19.4-22.8 (male) verses 18.4-21.9 (female); 15-18 y: 23.5-24.8 (male) verses 22.9-24.2 (female)) compared to BMI of girls (Ji, 2005). Similarly, BMI (Percentile >95th) of US male children and adolescents having 6-19 years was higher than the female (Ogden *et al*., 2012). In the present study, higher weight status of female subjects compared to male subjects might be due to less physical activity as they remain at home most of the time after returning back from school.

Another study conducted by Haris *et al*. (2014) revealed that the subjects having Blood Group "O" were found to be less obese than of "B" Blood Group and more obese as compared to subjects having Blood Group "A". Besides this, it may also be attributed to hormonal differences among both the genders. Among other factors, socioeconomic factors are also important; high inflation does not warrant consumption of foods with high nutritional profile for the poor population of third world countries like Pakistan.

Comparison of BMI among different blood groups: The differences among blood groups regarding BMI were non-significant ($p>0.05$) (Table 3). In order to see that which blood group subjects have better BMI, we found coefficient of variation for each blood group subjects. The blood group subject with minimum value of coefficient of variation was considered as the best. The coefficient of variation had the lowest value for blood group O subjects so the BMI of the blood group O subjects was better as compared to other groups.

Table 3: Overall comparison of BMI among different Blood Groups (including male and female)

Groups	Count	Average	CV
O	51	18.35±3.17[a]	17.26
B	47	17.36±3.61[a]	20.77
A	43	17.73±3.13[a]	17.63
AB	8	18.19±3.83[a]	21.05

Following blood group O subjects, BMI for blood group A and B was better. While value of coefficient of variation for BMI of AB subjects was the highest which revealed poor BMI among all the blood group subjects.

To date, no literature has been found regarding measurements of BMI of individuals having different blood groups. Hence, a further study needs to be carried out in order to investigate the reasons of the lower BMI of children than the recommended and further elucidation of our results.

Conclusion: The highest BMI was found in boys of age 15-18 years, whereas the lowest BMI was observed in the students with 5-9 years age. Even though, lower BMI than recommended, of all the students of 5-18 years (male and female) belonging to different blood groups were observed but in general, BMI of “O” subjects was considered better as compared to blood group A, B and AB.

REFERENCES

Anees, M. and M.S. Mirza, 2005. Distribution of ABO Group alleles in Gujrat region of Punjab, Pakistan. Proc. Pak. Acad. Sci., 4: 233-238.

Aziz, S., U.E. Rubab, N.U.A. Wajeeha, R. Majid, K. Hosain, I.A. Siddiqui and S. Manzoor, 2010. Dietary Pattern, Height, Weight Centile and BMI of Affluent School Children and Adolescents from Three Major Cities of Pakistan. J. Coll. Phys. Surg. Pak., 20: 10-16.

Borecki, I.B., R.C. Elston, P.A. Rosenbaum, S.R. Srinivasan and G.S. Berenson, 1985. ABO associations with blood pressure, serum lipids and lipoproteins and anthropometric measures. Hum. Hered., 35: 161-170.

D'Adamo, P., 2006. Arthritis: Fight it with the Blood Type Diet. Berkley Books, p: 300. ISBN 9780425207406.

Haris, A., S. Hussain, T.M. Qureshi, M. Nadeem and M.U. Nasir, 2014. Surveillance of blood group "O" human with reference to iodine. Sci. Int. (Lahore), 26: 311-316.

Ji, C.Y. and J.L.S. Beijing, 2006. Regional and population variability of body mass index among Chinese schoolchildren and adolescents. W.J. Pedi., 2: 29-34.

Ji, C.Y., 2005. Report on Childhood Obesity in China (1) Body Mass Index Reference for Screening Overweight and Obesity in Chinese School-age Children. Biomed. Environ. Sci., 18: 390-400.

James, D.C.S., 2011. Anthropometric measurements. http://www.faqs.org/nutrition/A-Ap/Anthropometric-Measurements.html, accessed on 2011 July 13th.

Mondal, N. and J. Sen, 2010. Prevalence of stunting and thinness among rural adolescents of Darjeeling district, West Bengal, India. Ital. J. Pub. Health, 7: 54-61.

Nelson, W.E., R.E. Behrman, R.M. Kliefman and A.M. Arvin, 1996. Assessment of Growth. 15th ed. W.B. Saunders Company. Nelson Textbook of Pediatrics. pp: 63-67.

Ogden, C.L., D.M.R.P. Margaret, Carroll, MSPH, K. Brian, Kit, M.P.H. Katherine and M. Flegal, 2012. Prevalence of Obesity and Trends in Body Mass Index among US Children and Adolescents, 1999-2010. Am. Med. Assoc. JAMA, 307: 483-490.

Örjan, E., O. Kristjan and E. Björn, 2005. Physical performance and body mass index in Swedish children and adolescents. Scand. J. Nutri., 49: 172-179.

Peter, J.D.A. and W. Catherine, 2000. Live Right 4 Your Type-4 blood types, 4-programmes for a healthy life. Scotland, UK.

WHO, 1995. Physical Status, the Use and Interpretation of Anthropometry. Report of a WHO Expert Committee. WHO Technical Report Series 854. Geneva, Switzarland.

WHO expert consultation, 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet, 363: 157-63.