

## Head Circumference in Maharashtra School Children and Socio-economic Status

Santosh V. Shinde\*, A.D. Kundalkar\*\*, B.R. Zambare\*\*\*, Sudhir E.Pawar\*\*\*\*

### Abstract

**Aim:** Head circumference - one of the most significant findings in physical examination and diagnosis of neurological disorders. This parameter is an useful anthropometric tool. Keeping in purview the point that no literature is available regarding Maharashtra population, this study was undertaken where Head circumference was compared with socio-economic status of 9-12 aged school children.

**Material and Method:** A cross-sectional study including 623 subjects (312 male, 311 female) of 9-12 yrs was undertaken. The study group is further divided into high income group (HIG) and low income group (LIG) for which sardar dasture high school, municipal school no. 7, were taken respectively. Anthropometric measurements of Head circumference subjects who are all normal and healthy children, judged by criteria established by Gill *et al*, were taken.

**Results:** 1) Values of head circumference is higher in high group as compared to those of low socio-economic group.

2) It is observed that growth spurt in head circumferences is at a latter date between 11-12 yrs in female in both socio-economic groups, while in males, growth spurt is earlier between 10-11 yrs of age.

3) It is observed that all populations in the world are undergoing temporal changes with reference to body measurement.

4) Mean values have shown a drop towards higher income group in some age cohorts.

5) Growth spurt is revealed through data which clearly shows that HIG children attained such spurts much earlier than those of LIG.

**Conclusion:** With latest trend of globalization, world is coming closer and people are travelling far and wide. Although there exists few studies on adolescent growth, no serious attempts have been made in respect to population.

**Keywords:** Head circumference; Cross sectional analysis; Anthropometry; High income group (HIG); Low income group (LIG).

### Introduction

Head Circumference is one of the most significant findings in physical examination of children, especially in the evaluation of the

development and early diagnosis of neurological disorders.[1,2] There is a rapid increase in Head Circumference and marked histological changes in the brain in early infancy.[3,4] Therefore early recognition of deviation from normal growth is important.

Reference data for a large age range allow the follow-up of children and recognition of the catch-up growth in Head Circumference that can occur up to about 5 years, when cranial sutures interlock.[5,6,7] Head Circumference of school aged children may prove a useful anthropometric tool in deciding early nutritional history.[8,9] Any significant reduction in Head circumference found in malnourished children may have serious

**Authors affiliation:** \*Assistant Professor, \*\*Professor, Dept of Anatomy, Kashibai Navale Dental College, Sihegad, Pune (Maharashtra), \*\*\*Professor and Head, \*\*\*\*Professor - Dept of Anatomy, PDVVPF'S Medical College and Hospital, Ahmednagar ( Maharashtra).

**Reprints requests:** Dr. Santosh V. Shinde, Assistant Professor, Dept. of Anatomy, P.D.V.V.P.F's Medical College & Hospital, Ahmednagar 414111.

E-mail: santoshwshinde@rediffmail.com

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implication for their future performance and achievement.[10]

In Maharashtra, there is no standard values for Head Circumference of children, that can be used as one of the standard charts for developmental evolution. Our objective was to construct standard Head Circumference and relative Head Circumference for each sex of Maharashtrian children from 9 to 12 years of age, and compare our data with socio-economic status.

### Material and Methods

This was a cross-sectional study, including 623 subject (312 male and 311 female ) of age 9-12 years. The study group is further divided in to Higher income group (HLG) and Lower income group (LIG). Two schools were selected according to socio-economic status, Sardar Dastur High school for high income group and Municipal school no.7 for low income group. Those children studying in Municipal school are from low income group (LIG), are in contrast with their counterparts who are with the predominantly English medium school, where high income (HIG) are found. The Anthropometric measurement of Head circumference of each child was obtained and studied by cross sectional analysis along with socio-economic status.

The subjects were all normal and healthy school going children belonging to Higher income Group and Lower income Group. The subject were judged to be normal and healthy based on the criteria recommended by Gill *et al*. [4] The selection of subjects was on the basis of random sampling.

The age of the subjects was determined from their dates of birth recorded in the school register. The age was rounded off to the nearest whole number. The subject were divided in to the three age groups *i.e.* 9-10, 10-11 and 11-12. All the subjects came from the same environment.

For head circumference the male and female subjects were asked to sit in correct and comfortable position. For female subjects,

objects likes hair pins were removed and plaits were lifted up. Then the measurements from glabella around to the opisthocranium, maximum projection of the occiput was taken in centimeters. Then the mean is calculated, then compared with socio-economic status in all age groups among both sexes.

### *Socio-Economic groups*

Ideally it is necessary to assess objectively the economic status of each subject. However, it is extremely difficult to carry out such a survey as subjects for this study were not in a position to give their family income correctly. Thus it was decided to select those schools (corporation / Municipal school), where the student are belonging to the lower economic status (LIG), generally opt to enroll. The English medium schools, especially run by the Christian Missionaries, on the contrary have a majority of the students (more than 95 %) belonging to the upper and higher class families (HIG), where the income is quite high. Thus the present study purposely selected such school which provided students who belonged to these two opposite economic grades or status also indicating their levels of nutritional intake among these contrasting groups.

### Observation and Result

The study was carried out on a total 623 subject of both the sexes from the age group of 9 – 12 years and were considered separately for both the higher (HIG) and lower (LIG) as well as for sex differences.

It is observed that values of the head circumference is higher in higher socio-economic group as compared to those of low socio-economic group. The analysis is as follows:

### *Head circumference (cm)*

It is observed that growth spurt in head circumference is at a latter date between 11-

**Table 1: Mean and standard deviation of Head circumference**

Age Group (yrs)	High Socio-economic status (HIG)				Low Socio-economic status (LIG)			
	Male		Female		Male		Female	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
9-10	52.28	1.77	53.49	1.72	54.44	1.12	50.84	1.76
10-11	53.54	1.47	53.38	1.31	51.80	1.75	50.80	2.36
11-12	52.80	2.01	54.26	1.94	51.70	1.43	51.60	2.31

12 years in females of both socio-economic groups, while in males, growth spurt is earlier between 10-11 years of age.

The dropping of values in parameters at age 11-12 years in male of higher socio-economic group can be explained on the basis that the studies were cross sectional, where such differences could be possible. It is observed that the head circumference does not grow appreciably much after the early childhood. Thus it may be stated that this measurement is not a good parameter to be considered in such studies on growth.

## Discussion

It is believed that good fertile and properly maintained soil produces good crop. Likewise, healthy children of today would be the better citizens and parents of tomorrow. Hence, this pre-pubertal age group should be well attended for and looked after.

For the same, WHO is also stressing upon the health program of pre-pubertal and adolescent girls. This data will assist in preparing various health programs.

Bhandari B. *et al*[11], in 1972 had also done the same work as follows:

### *Head circumferences*

The above table shows the increase in head circumference in 9-12 years is negligible and same is observed in Bhandari *et al*[11] study though the value is lower in general.

The study, as mentioned earlier has been undertaken with the view to comprehend the dynamics of measurements of head circumference among the LIG and HIG and also to understand the sexual dimorphism presented by the measurements.

The study also provides a comparative picture with those similar studies under taken from Bhandari B. *et al*[11] in 1972 and Zaki M. E. *et al* in 2008.[12] It is now well established that all populations in the world are undergoing temporal changes with reference to body measurements mainly caused by the lifestyle changes and better nutritional food intake.

There also appears to be conscious changes brought about by exercise and food regulation for specific and desired body dimensions, specifically along the higher income group children in the urban area.

Comparing the values for the measurements, in all the three age groups considered here and across the genders and income groups of various previous studies clearly shows that these temporal changes and their impact on the measurements.

Although this general principle could be applicable when we compare all these studies, we have to be careful in providing interpretation of the obvious differences amongst these studies. This is mainly due to the fact that there is wide heterogeneity observed amongst the Indian population across the length and breadth of the country, as well as between the rural urban population divide.

**Table 2: Comparison of Head Circumference with other similar studies**

Age Group (yrs.)	Present Study				Bhandari B. <i>et al.</i> (1972)			
	HIG		LIG		HIG		LIG	
	M	F	M	F	M	F	M	F
9-10	52.28	53.49	54.44	50.84	48.4	---	---	---
10-11	53.54	53.38	51.80	50.80	48.9	---	---	---
11-12	52.80	54.26	51.70	51.60	49.0	---	---	---

The mean values have shown a drop towards the higher age group in some age cohorts. We have to keep in mind that the selection of these cohorts is based on only one criteria that is income. However, within the same age group cohorts, there can be children belonging to different caste or religious groups, who would represent different body dimensions. The fluctuation which we observe here between age cohorts thus could be introduced by this sampling error.

### Summary and Conclusion

With the latest trend of globalization, the world is coming closer and people are traveling far and wide. So, India with its present mode of acceleration on developmental process, also hope to level the economic disparities amongst people. It is said that national development is intimately integrated with the population of adolescents and youngsters of the nation as their strong burning desires and agile minds can make or break the nation. Hence, reproductive child health is its prime concern. Although there exists a few studies on adolescent growth and its dynamics, no serious attempt has been made to analyze the growth pattern amongst the pre-pubertals, especially in Pune. The present study attempts to fill this gap, with a view to understand the growth variations between sexes, belonging to two distinguishable economic categories.

The result clearly divide these two groups LIG and HIG as reflected through their anthropometric parameter.

Head circumference increases at a later date between 11-12 years in females and both socio-economic groups, while in males, growth spurt is earlier between 10 - 11 years of age.

The growth spurt is revealed through the data which clearly shows that HIG children attained such spurts much earlier than those who belong to LIG, who exhibited delayed spurt in head circumference.

The data would be quite useful not only to understand the underlying cause (genetic as well as environmental) for such variation, but also the factors which affect the growth of pre-pubertal individuals.

### References

1. Karabiber H *et al*. Head circumference measurement of urban children aged between 6-12 in Malatya, Turkey. *Brain and Development*. 2001; 23: 801-804.
2. Sanna E *et al*. The need of specific standards for head dimensions of urban sardinian boys. *Anthropologischer Anzeiger*. 2003; 61: 245-251.
3. Rabinowicz T. The differentiate maturation of the human cerebral cortex. In: Falkner F, Tanner JM, eds. *Human growth*, 2<sup>nd</sup> ed. New York: Plenum Press. 1986; 2: 385-410.
4. Luo ZC *et al*. Growth in early life and its relation to pubertal growth. *Epidemiology*. 2003; 14: 65-73.
5. Roche AF. Possible catch-up growth of the brain in man. *Acta Medica Auxologica*. 1980; 12: 165-179.
6. Laron Z. and Galatzer A. Effect of hGH on head circumference and IQ in isolated growth hormone deficiency. *Early Human Development*. 1981; 5: 211-214.
7. Al-Mazrou Y *et al*. Standardized national growth chart of 0-5 years old Saudi children. *Journal of Tropical Pediatrics*. 2000; 46: 212-218.
8. Spurr GB, Reina JC and Barac-Nieto M. Marginal malnutrition in school aged Colombian boys: Anthropometry and maturation. *American Journal of Clinical Nutrition*; 1983; 37: 119-132.
9. Anzo M *et al*. The cross sectional head circumference growth curves for Japanese from birth to 18 years of age: the 1990 and 1992-1994 survey data. *Annals of Human Biology*. 2002; 29: 373-388.
10. Oyedeji GA *et al*. Head circumference of rural Nigerian children - the effect of malnutrition

- on brain growth. *Central African Journal of Medicine*. 1997; 43: 264-268.
11. Bhandari B, Jain AM, Karna P, Mathur A and Sharma VK. Nutritional Anthropometry of rural school children of Udaipur district. *Indian J Pediatrics*. 1972; 59: 1.
  12. Zaki ME, Hassan NE and El-Masry SA. Head circumference reference data for Egyptian children and adolescents. *Eastern Mediterranean Health Journal*. 2008; 14: 1-13.