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Growth in head circumference from birth to 3 years in Jat Sikh and Bania males

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ABSTRACT

Head size attract particular attention in infancy. Head circumference (HC) is one of the anthropometric parameters included in physical examination of infant and toddler. This measure of cranial growth gives a global indication of growth and development of the brain. Normally at birth, head circumference is larger than chest circumference. By the age of four months, the head circumference equals the chest circumference and later the chest circumference is larger than head circumference except in the presence of malnutrition. The present study is longitudinal study based upon children of two endogamous groups i.e. Jat sikh and Bania. A total 160 male children (80 each group) ranging in age from birth to 3 years were measured anthropometrically at the interval of 3 months in first 2 years and then after 6 months up to the age of 3 years. The head growth is most rapid within the first three years of life, primarily owing to the development of brain. Finding of the present study shows the general pattern of growth is characterized by a period of rapid initial increase from birth to 9 months followed by period of slower increment during 9 to 12 months and 18 to 21 months.

Key words – *Head circumference (HC), longitudinal study, age, anthropometric data.*

INTRODUCTION

Head size attract particular attention in infancy (Hussain; 2010). Head circumference (HC) is one of the anthropometric parameters included in physical examination of infant and toddler. This measure of cranial growth gives a global indication of growth and development of the brain (Geraedts et al; 2011). Human embryo goes through tremendous alteration during pregnancy from tiny zygote to full developed infant in just nine months. After being born, infants' size is measured to evaluate retrospectively growth in prenatal period and intrauterine environment, but size at birth has also implications for long-time growth and development, mortality and morbidity. Measuring size at birth is important for monitoring of individuals growth and development and for public health in efforts to improve neonatal and maternal morbidity and mortality (Jenni; 2014).

Length/height, weight and head circumferences or occipito frontal circumferences comprise the most commonly used anthropometric measurements in assessment of growth. Birth weight, height and head circumference comprise the intrauterine nutritional status (Elmali et al; 2012). A routine measurement of head circumference is intended to aid in detection of two groups of disorders characterized by a large head and by a small head. This is an important measurement and is suggested to be performed and recorded carefully and regularly (Ayatollahi; 2001). The measurement of maximum circumference of the head is a part of routine physical examination of any body, just as much as examination of heart, chest and abdomen (Illingworth and Lutz; 1995).

Size at birth can be estimated with multiple anthropometric parameters, depending on measuring equipment available in the situation. Each parameter has different implications to infants' health and wellbeing. The most used parameter of size at birth globally is birth weight, which is easy and precisely measurable, weight scales being available commonly in health facilities in most parts of the world. Birth length, head circumference are used less globally, but in most developed countries. Chest circumference, mid-upper arm circumference (MUAC) and abdominal circumference can be used as substitutes for weight measuring if scales are not available. Combining anthropometric parameters with information about gestational age provides more reliable method for evaluating growth and development of new born. However, in many developing societies gestational age cannot be accurately determined (Jenni; 2014).

Head circumference as a single measure has been associated with labour complications, such as caesarean section, vacuum-assisted and forceps-assisted vaginal delivery and maternal and fetal distress (Elvander et al, 2012; Kennelly et al, 2003; Mujugira et al, 2013). The average

size differs between populations depending upon intricate combination of genetic and environmental factors and is continuously in transition stage. In better of societies environmental conditions favour fetal growth and size at birth is on average bigger than in developing societies. However there has not been historically very large variation in anthropometric parameters. Average birth weight varies globally between 3200 to 3700 grams; birth length is close to 50 centimetres and head circumference close to 35 centimetres. Lack of reliable and comprehensive data, especially from developing world hinders the comparison of size at birth globally.

Infant attains optimal size at birth if fetal intrinsic or maternal or uteroplacental extrinsic factors allow foetus to grow according to her/his genetic potential and if space of time spent in uterus is optimal for the development. Foetuses' genetic or chromosomal abnormalities or infections, mothers' diseases, substance use, parity or inappropriate nutrition or malfunctioning uterus or placenta may have an impact on fetal growth or gestational age and thus affect infants' size at birth. The exact optimal size at birth has not been determined, since there is always variation in size at birth due to genetic background and environmental conditions. However many different classification systems are at use to classify infants' size as optimal, small or large.

Size at birth has been associated with various health outcomes in short and long term. Small size at birth, usually measured by birth weight, has been associated with adverse birth outcome, death and increased risk for later morbidity. Also associations between large size at birth and morbidity and mortality have been found in many studies. It is not known, whether size at birth directly causes these adverse health consequences or whether mortality and morbidity are caused by some other factors that cause also size at birth deviate from optimal.

However, anthropometric measurements provide important information and are well grounded indicators for health and wellbeing ((Jenni; 2014).

We present below longitudinal data on head circumference measured every after 3 months during birth to 24 months and then after 6 months from 24 to 36 months, based on a constant sample size amongst Jat sikh and Bania male children.

MATERIAL AND METHODS

The present study has been conducted with a view to highlight the trends in head circumference in Jat sikh & Bania male children randing in age from 0 to 3 years. A total 160 children from endogamous group population of Jat- Sikhs (80) and Banias (80) were selected and studied for certain growth parameters in a longitudinal growth study. The measurement

was taken with non-stretchable, non-elastic tape by passing over glabella anteriorly and posteriorly at the most prominent part of the occiput. The head circumference was measured at birth and ages 3 months, 6 months, 9 months, 1 year, 1 year 3 months, 1 year 6 months, 1 year 9 months, 2 year, 2 year 6 months and 3 year. Data collection has been done from the various urban and rural areas of Bathinda district of Punjab during 2011 to 2015.

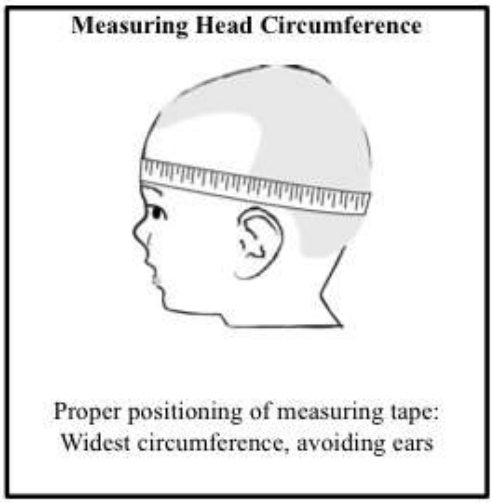

Figure 1

RESULTS

Growth charts for head circumference were constructed from longitudinal observations carried out on 160 male (80bania male & 80 Jat male).The mean size of HC and the standard deviation values at different ages in the male children ageing from birth to 36 months of age are illustrated in table 1.

Table 1 & Figure 2 shows a steady increase in head circumference with the advancement of age. Maximum increment of head circumference occur up to the age of 9 months. However, the rate of increase noticeably lowers in second year of life and diminution in increment was seen in 9 to 12 months then between 18 to 21 months.

Furthermore, in a visual comparison with the other Punjabi and ICMR Punjabi reference, it was realized that the findings were following a similar pattern. It is also noteworthy that at all ages, our subjects were found to have a lower HC size compared to the international studies. (Table 2)

At the age of 12 months children of Amritsar had lower values of HC than the present study while the children of Chandigarh take a lead in all the children of Punjab but the similar values seen in children of Patiala & Ludhiana. (Table 2)

Table 1: Head Circumference Measurements of Jat Sikh and Bania Males.

Age Group	N	Head Circumference (cm)		t-value
		Jat Sikh	Bania	
		Mean ± SD	Mean ± SD	
At Birth	80	34.78±1.23	34.96±2.52	0.581
3rd Month	80	40.38±1.36	40.36±1.37	-0.115
6th Month	80	42.72±1.13	42.68±1.11	-0.218
9th Month	80	44.08±0.94	43.98±0.83	-0.753
12th Month	80	44.82±0.97	44.78±0.84	-0.260
15th Month	80	45.49±0.97	45.47±0.81	-0.132
18th Month	80	46.14±1.01	46.05±0.90	-0.577
21st Month	80	46.64±1.01	46.45±0.95	0.991
24th Month	80	47.34±1.08	47.21±0.99	-0.797
30th Month	80	48.00±1.10	48.01±0.99	0.038
36th Month	80	48.68±1.27	48.79±1.17	0.555

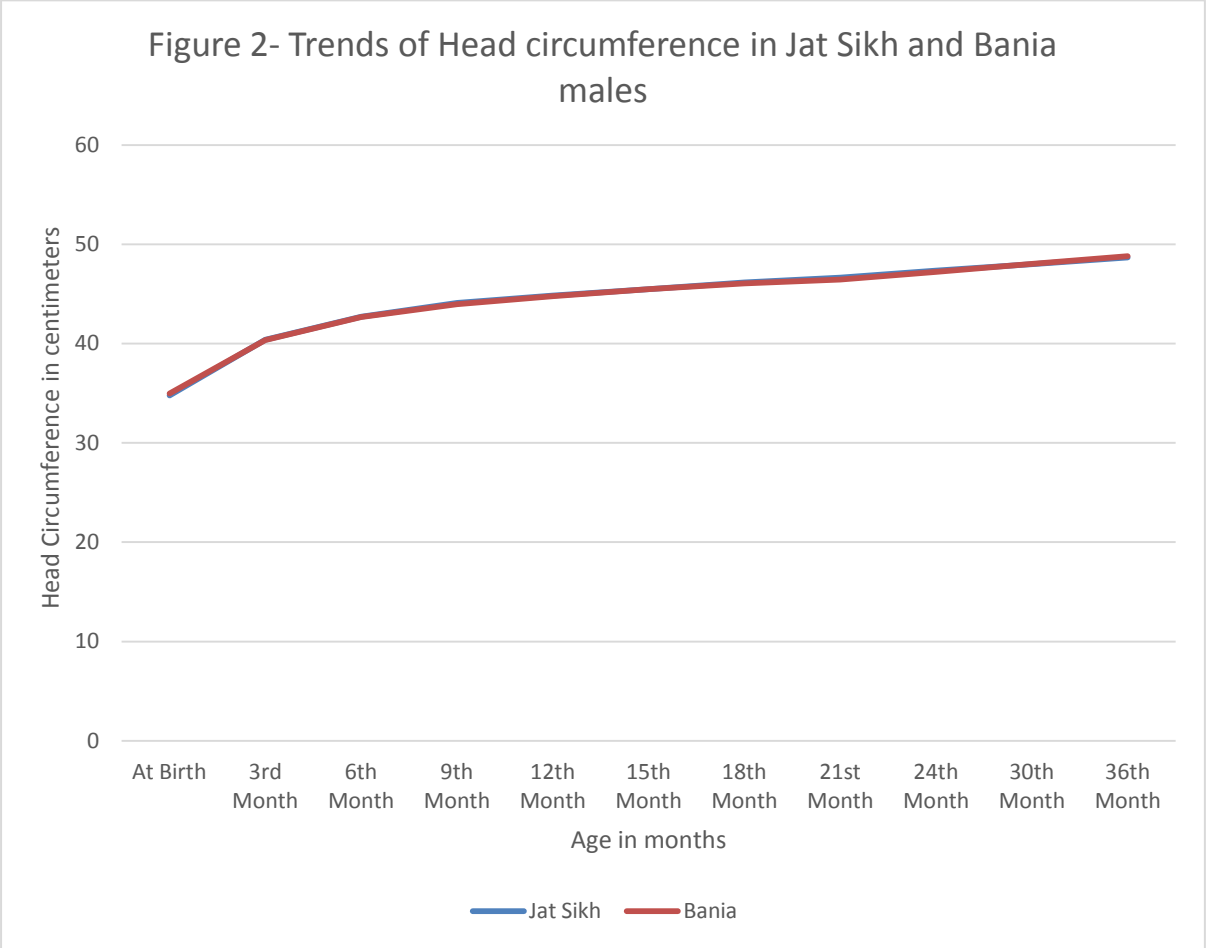

TABLE 2- COMPARISON OF HEAD CIRCUMFERENCE WITH OTHER PUBLIHED STUDIES OF MALE CHILDREN AGED 0-3 YEARS

Age Group (in months)	Present study		National references					International references			
	Jat Sikh	Bania	Harleen Kaur et al (2003)	Prabhjot & ShardaSidhu (2003)	AK Bhalla (1993)	DK Agarwal &KN Agarwal (1994)		Ounsted M et al (1985)	Ayatollani SMT (2001)	(2007)	Esmaeili M et al (2015)
			Patiala	Amritsar	Chandigarh	Ludhiana	ICMR	Oxford	Shiraz	WHO	Iran
At birth	34.78	34.96	-	-	33.98	34.33	-	35.25	34.9	34.46	35.13
3	40.38	40.36	40.78	39.2	39.64	39.38	40.8	-	40.0	40.51	-
6	42.72	42.68	42.42	41.0	42.64	42.17	42.6	44.37	43.1	43.33	45.04
9	44.08	43.98	43.67	42.5	44.20	43.67	43.0	-	-	44.99	45.96
12	44.82	44.78	44.50	43.7	45.39	44.89	45.5	47.57	46.3	46.06	46.90
15	45.49	45.47	44.99	-	-	-	-	-	47.0	46.80	47.30
18	46.14	46.05	44.91	-	-	46.89	-	48.98	47.7	47.37	47.6
21	46.64	46.45	46.47	-	-	-	-	-	48.0	47.84	-
24	47.34	47.21	46.71	-	-	47.52	47.1	50.14	48.5	48.25	48.5
30	48.00	48.01	47.40	-	-	48.29	-	-	-	48.93	-
36	48.68	48.79	47.67	-	-	49.02	48.2	51.39	-	49.46	-

DISCUSSION

Head growth is a dynamic process and plotting serial measurements of HC over a period of time could provide useful information in this regard (Mujugira et al; 2013) . Several recent studies have attempted to demonstrate the difference in the size of HC in various countries as well as between successive generations within the same country (Ishikawa et al; 1987, Dale and Maurer; 1983). The standard growth charts are based on data collected by WHO (2007) and ICMR (1972).

In present study Jat sikh and Bania children shared almost the same value of head circumference. It is evident from Table 2 that head circumference of males of both endogamous groups of present study were lower than those of studied in Ludhiana by Agarwal & Agarwal (1994). The present figures for head circumference tally with Punjabi males reported by ICMR (1977) at all the age groups.

It was seen that (Table 2) the head circumference figures of Indian children in the present study are considerably lower than those of English (Ounsted et al; 1985) and Iranian (Ayatollahi; 2001 & Esmaeili; 2015).

In other study conducted in Japan indicated a significant difference in the HC size between Japanese and Caucasian children which was correlated with the overall smaller stature of Japanese.

In another study, Hoey and Cox (1990) claimed that the mean of HC size in Irish children was larger than the british standard produced by Tanner and Nellhaus while it was smaller than Ounsted data from Oxford.

At all the age intervals the children of the present study had increments (table 1). The highest increment in the present study was seen during the first year.

From the available data (Table 2), it is clear that head circumference was highest in English reported by Ounsted M et al; 1985.

According to the finding of current research, which are similar to the previous studies in Punjab. Such studies need to be performed periodically in every population in different regions of the world.

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