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Growth in Head Circumference from Birth to Three years in Jat-Sikh and Bania Females- A Longitudinal Study

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Abstract
The measure of cranial growth gives a global indication of the growth and development of the brain. The head circumference is very important measurement because it is related to intracranial volume and permits an estimation of rate of brain growth. Earlier reported work indicates that socioeconomic and nutritional status affects the growth even within the ethnic group. The present study is longitudinal study based upon female children of two endogamous groups of Punjab i.e. Jat-Sikh and Bania. A total of 160 female children (80 each group) ranging in age from birth to 3years were measured anthropometrically at the interval of 3 months in first 2 years and thereafter 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. It was observed that head circumference was statistically non-significant (p > 0.05) amongst Jat Sikh and Bania females.
Keywords: *Head circumference (HC), longitudinal study, age, anthropometric data.*

Introduction

Head size attract particular attention in infancy[1]. The head circumference is very important measurement because it is related to intracranial volume and permits an estimation of rate of brain growth[2].Human embryo goes through tremendous alteration during pregnancy from tiny zygote to fully developed infant in just nine months. After being born, infant's 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[3]. 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 andregularly[4]. 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[5].

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[6-8]. The average size differs between populations depending upon intricate combination of genetic and environmental factors and is continuously in transition stage[3]. Every state of India differ in cultural, economic and nutritional factors which affect the growth patterns[9].

The present longitudinal study has been undertaken to compare the ethnic variations in head circumference in endogamous groups of Jat-Sikh and Bania females.

Materials and Methods

The present study has been conducted with a view to highlight the trends in head circumference in Jat-Sikh & Bania female children ranging in age from 0 to 3 years. A total 160children from the endogamous group population of Jat-Sikhs (80) and Banias (80) were selected and examined 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, 12 months, 15 months, 18 months, 21 months, 24 months, 30 months and 36months. Data collection had been done from the various urban and rural areas of Bathinda district of Punjab during 2011 to 2015. All metric measurements were done in centimetres (cm). Means and standard deviations were computed and comparisons of groups were made by using t' test.

Results

Mean head circumference of Jat-Sikh females were greater than that of Bania at all the age groups except at 3rdand 6thmonths. The head circumference steadily increased from birth to the age of 3 years (Table 1). The highest increment in the present study was seen during the first year. In terms of statistics, the differences were non-significant ($p > 0.05$) amongst Jat-Sikhs and Banias females for head circumference.

Table 1: Head Circumference Measurements of Jat Sikh and Bania Females

Age Group	N	Head Circumference (cm)		t-value
		Jat Sikh	Bania	
		Mean ± SD	Mean ± SD	
At Birth	80	34.88±1.47	34.66±1.40	-0.957
3rd Month	80	40.14±1.60	40.19±1.26	0.219
6th Month	80	42.56±1.17	42.61±1.01	0.273
9th Month	80	43.94±0.97	43.86±0.83	-0.567
12th Month	80	44.76±0.98	44.66±0.78	-0.712
15th Month	80	45.41±0.96	45.20±0.80	-1.497
18th Month	80	46.45±1.00	45.81±0.85	-1.058
21st Month	80	46.64±1.13	46.29±0.90	-2.133
24th Month	80	47.27±1.15	46.90±0.95	-2.209
30th Month	80	47.99±1.16	47.75±0.91	-1.445
36th Month	80	48.61±1.28	48.57±1.01	-0.178

Head circumference of females of both endogamous groups of present study (Table 2) have higher values of head circumference than those of children studied in Ludhiana at the age of 3rd and 6th months, but after that they shared nearly the same values up to 36th months[10].The present figures for head circumference are very close to those of head circumference of Jat-Sikh and Bania females of Punjab at birth, 6th, 9th and 12th months.[11] Results of females of the present study are almost same as in Calcutta & Delhi up to age of 36th months[10] and in Chandigarh up to age of 1 year[12].

In Table 3 the data of present study is compared with other foreign populations. It is seen from Table 3 that the head circumference figures of the present study are considerably lower than those of English [13,14] and Iranian [4,15]. A comparison of all foreign data reveals that head circumference at the age of 36th month is highest in English children.

Table: 2 Comparison of Female Head Circumference (in cms) with other Punjabi & Indian Populations

Age Group (months)	FEMALES																						
	Present study																						
	Jat Sikh	Bania	Kaur, Bhatnagar& Singal (2003) Patiala	Prabjot& Sidhu (2003) Amritsar	Mathur et al (1994) Gorakhpur	Bhalla, Kumar & Kaul (1987) Chandigarh	Agarwal& Agarwal (1994) Ludhiana	Varanasi	Calcutta	Delhi	Bangalore	ICMR (1984) Andhra Pradesh	Delhi	Jammu Kashmir	Kerala	Madhya Pradesh	Madras	Nagpur	Poona	Orissa	Punjab	Rajasthan	UP
At birth	34.88	34.66	-	-	32.6	33.72	34.54	34.12	34.73	34.74	34.59	-	-	-	-	-	-	-	-	-	-	-	-
3	40.14	40.19	39.82	38.6	38.8	38.94	38.93	39.71	39.95	39.50	38.97	39.9	-	40.0	38.9	39.0	38.4	37.7	39.9	39.7	40.8	40.7	37.5
6	42.56	42.61	40.80	40.8	42.1	41.74	41.76	42.24	42.56	42.26	41.54	41.8	-	41.8	40.4	39.6	40.2	40.1	41.4	40.3	42.5	41.9	41.9
9	43.94	43.86	42.56	42.3	-	43.32	43.50	43.67	44.17	44.08	43.57	41.9	-	42.2	41.9	41.2	41.3	41.6	42.5	41.4	42.5	42.1	42.2
12	44.76	44.66	43.88	43.4	-	44.36	44.55	44.96	45.38	45.22	45.02	43.7	44.0	44.4	44.0	43.6	43.4	43.3	43.8	43.2	44.6	43.2	43.8
15	45.41	45.20	43.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	46.45	45.81	44.70	-	-	-	46.22	46.29	46.79	46.41	46.87	-	-	-	-	-	-	-	-	-	-	-	-
21	46.64	46.29	44.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	47.27	46.90	45.45	-	-	-	47.13	46.93	47.58	47.00	47.57	45.0	44.8	46.4	45.5	45.6	44.7	44.5	45.3	44.2	45.8	45.4	45.2
30	47.99	47.75	46.74	-	-	-	47.86	47.39	47.98	48.24	47.39	-	-	-	-	-	-	-	-	-	-	-	-
36	48.61	48.57	46.87	-	-	-	48.72	47.69	48.03	48.46	47.54	46.3	46.3	47.3	46.5	47.2	45.4	45.7	46.5	46.5	46.7	46.1	46.1

Table: 3 Comparison of Head Circumference with other Published Studies of Female Children aged 0-3 years

Age Group (months)	FEMALES									
	Present study		Illingworth &Lutz (1965)	Kurniewicz-Witeczakowa et al (1983)	Ounsted et al (1985)	Paul (1986)		Ayatollahi (2001)	WHO (2007)	Esmaeili et al (2015)
	Jat Sikh	Bania	Poland		Oxford	Cambridge		Shiraz	Iran	
0	34.88	34.66	35.0	34.3	34.60	-		34.2	33.87	34.36
3	40.14	40.19	-	40.0	-	40.2		38.9	39.53	-
6	42.56	42.61	43.2	43.2	43.02	43.0		42.0	42.19	42.70
9	43.94	43.86		45.3	-	45.0		-	43.83	45.14
12	44.76	44.66		46.	46.09	46.3		45.1	44.89	45.60
15	45.41	45.20		-	-	-		45.8	45.65	46.00
18	46.45	45.81		47.3	47.59	-		46.4	46.24	48.16
21	46.64	46.29		-	-	-		46.8	46.73	-
24	47.27	46.90		-	48.63	-		47.2	47.18	48.2
30	47.99	47.75		-	-	-		-	47.93	-
36	48.61	48.57		-	49.82	-		-	48.50	-

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