

Anthropometric measurements of Sri Lankan newborns

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Summary

A study was conducted with the aim of establishing the mean birth weight, crown-heel length and head circumference for Sri Lankan newborns. A total of 1325 normal, singleton babies (993 Sinhalese and 332 Moor) with ultrasonically confirmed period of gestation, born at the Maternity Unit of the Base Hospital Kegalle, were selected. Means and standard deviations for the above measurements of the Sinhalese and Moor babies were established. Since the number of babies belonging to the Tamil ethnic group was small for statistical analysis, they were excluded from the study. For all three measurements, the mean values of male newborns were higher than those of the female newborns. When compared with the Sinhalese, the Moor males and females had highly significant higher values for birth weight, crown-heel length and head circumference ($P < 0.001$). Simple linear regression analyses were carried out between the baby's weight and maternal measures such as height, weight, age and parity. A significant relationship was observed between the baby's weight and mother's weight.

Key words – Anthropometry, Newborn, Gestational age, Reference standards, Ethnicity.

Introduction

The anthropometric parameters at birth are considered to be of great value when assessing intrauterine growth. Comparison of these birth measurements with established standards provides a reliable and a simple method of identifying the infant that deviates from the normal, and is at risk of early postnatal morbidity.

There are numerous studies on anthropometric standards at birth from other parts of the world

(1, 2, 3, 4, 5, 6). The studies available for the Sri Lankan newborns have been conducted mainly to establish the birth weight (7, 8, 9, 10 & 11) and to find out the factors affecting the birth weight (10, 11). The study conducted by Amarasinghe (12) has established the values for the head circumference of males and females at birth, and Ratnayake, Wikramanayake and Godawatte (13) reported values for several anthropometric characteristics of the newborn.

At present, the physical growth of a newborn is evaluated by comparing body measurements such as weight, crown-heel length and head circumference, with standards established in Western countries. These reference standards have a limited international comparative value, as they are obtained from white Caucasian populations.

The present study was undertaken with the aim of establishing norms for birth weight, crown-heel length and head circumference of the Sri Lankan newborn. The influence of socio-economic status, ethnicity, gestational age, parity, baby's sex, mother's weight and height, on these parameters was also investigated.

Materials and Methods

A total of 1325 normal, singleton babies, 993 Sinhalese and 332 Moor, born at the Maternity Unit of the Kegalle Base hospital were selected for this study. On an average, there are 6000 deliveries taking place per year at this hospital.

Only those infants whose mother's date of the last menstrual period (LMP) was certain, and the duration of gestation, calculated from the LMP was consistent with the one obtained by ultrasound examination, were included. Babies

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of diabetic and hypertensive mothers, and those with clinically evident congenital malformations were excluded from the study.

Data regarding the mother's age, occupation, ethnicity, weight, height, parity and the husband's occupation, were obtained from the hospital records, and also by personal interview.

Birth weight, crown-heel length, and head circumference, were measured soon after birth. All babies were weighed on a metric scale which allowed readings to the nearest 100 grams. The scale was periodically checked for zero error. The crown-heel length was measured keeping the baby in the supine position on a measuring board. The head circumference was measured around the largest occipito-frontal circumference using a non-stretchable plastic measuring tape.

The gestational age was calculated to the nearest week, counting from the first day of the last menstrual period (LMP). The socio-economic status of a newborn was identified on the basis of the parents' occupation and the educational level. The newborns included in the study belonged either to the low or middle socio-economic status.

The means and standard deviations were calculated for the male and female Sinhalese and

Sri Lankan Moor newborns. As the number of babies belonging to the Tamil ethnic group was small, they were excluded from the study.

Results

Table 1 shows the mean anthropometric values in the two ethnic groups, for males and females separately, and males and females combined. For all three measurements, the mean values of the male newborns are greater than those of the female newborns. Statistically significant differences ($P < 0.01$) are observed between the Moor males and the females with regard to the head circumference and the birth weight, and also between the Sinhalese males and females with regard to the head circumference.

The Moor male and female newborns as compared to the Sinhalese male and females, are heavier, taller and have greater head circumference values. These differences are statistically significant ($P < 0.001$).

Tables 2 and 3 present the mean values of weight, length and head circumference of the Sinhalese and Moor male and female newborns against gestational age. The values for the intrauterine growth in weight, length and head circumference increase as the gestational age increases.

Table 1
Mean birth weight, length and head circumference of Sinhalese and Moor newborns

	Sinhalese						Moor					
	Male		Female		Male & Female Combined		Male		Female		Male & Female Combined	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Birth Weight (g)	2869.57	467.47	2831.45	435.35	2852.45	467.05	3116.88	356.64	2980.00	365.31	3061.11	366.42
Crown-heel Length (cm)	50.73	3.81	50.37	3.69	50.56	3.76	51.84	2.69	51.50	3.75	51.70	3.17
Head Circumference (cm)	33.02	1.80	32.72	1.84	32.88	1.83	34.13	1.54	33.14	1.42	33.72	1.57

Table 2
Mean birth weight, length and head circumference by sex and gestational age of the Sinhalese newborns

Gestational age (weeks)	Male						Female							
	N	Birth weight (g)		Length (cm)		Head circumference (cm)		N	Birth weight (g)		Length (cm)		Head circumference (cm)	
		Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD
34	14	2450.30	335.41	48.25	2.95	33.50	4.72	11	2261.43	962.09	47.04	5.73	32.01	3.31
35	11	2447.66	111.16	46.33	1.70	33.00	1.11	13	2250.25	250.01	46.50	0.61	31.50	0.50
36	21	2658.16	286.35	48.61	7.51	33.21	1.41	31	2490.01	335.26	48.20	2.64	31.80	1.60
37	34	2613.89	428.64	48.78	2.57	32.78	2.10	38	2591.67	416.36	48.07	3.73	32.03	1.69
38	72	2861.39	387.93	50.56	2.58	32.72	1.48	69	2585.94	439.68	48.91	3.74	32.19	2.01
39	132	2891.74	410.22	50.82	3.45	32.88	1.53	104	2892.21	405.18	50.48	4.05	33.06	1.65
40	126	2970.79	466.19	50.43	4.12	33.21	1.62	112	2958.30	429.42	51.34	2.52	32.93	1.77
41	84	3050.40	550.02	52.52	3.59	33.24	1.68	53	2890.00	326.61	50.96	2.42	33.08	1.26
42	32	3080.63	316.03	52.00	3.24	34.13	2.47	37	2999.17	585.79	50.20	5.06	32.30	1.55
All gestational ages	526	2869.57	467.47	50.73	3.81	33.02	1.80	467	2831.45	435.35	50.37	3.69	32.72	1.84

Table 3
Mean birth weight, length and head circumference by sex and gestational age of the Moor newborns

Gestational age (weeks)	Male						Female							
	N	Birth weight (g)		Length (cm)		Head circumference (cm)		N	Birth weight (g)		Length (cm)		Head circumference (cm)	
		Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD
34	8	2410.16	330.91	49.97	1.96	33.96	3.36	6	2612.14	370.54	48.91	1.87	31.65	3.21
35	6	2643.70	398.43	49.01	3.67	32.36	2.11	-	-	-	-	-	-	-
36	17	2716.55	436.76	49.84	2.61	33.16	1.79	13	2621.90	419.22	50.18	3.01	31.08	3.14
37	16	2693.41	990.11	51.24	3.31	32.91	2.18	17	2516.74	361.50	50.74	2.41	32.44	2.13
38	31	3096.00	417.93	50.20	2.56	34.01	1.49	33	3103.33	277.23	50.33	1.80	32.13	1.96
39	34	2961.11	366.49	50.67	4.27	32.94	2.31	28	2805.71	364.57	49.57	5.15	32.80	1.29
40	39	2978.46	254.07	52.08	2.13	34.08	0.92	37	2950.71	498.00	52.60	2.42	33.71	1.94
41	12	3362.50	443.53	53.25	2.78	35.01	2.24	16	3237.50	216.15	52.25	1.48	34.50	0.87
42	10	3036.19	341.54	51.91	3.01	33.17	2.68	9	3005.06	374.17	50.33	2.05	32.67	1.25
All gestational ages	173	3116.88	356.64	51.84	2.69	34.13	1.54	159	2980.00	365.31	51.50	3.75	33.14	1.42

Simple linear regression analyses were carried out to find out the relationships between the birth weight of the infant and maternal measures such as pre-pregnancy weight, height, age and parity. A positive, significant correlation ($r=0.65$) was seen between the baby's weight and mother's weight. The relationships between the baby's weight and the mother's height, age or parity, are non-significant.

Discussion

The sample studied included infants of socio-economically similar mothers belonging to two ethnic groups, the Sinhalese and Moor. The two ethnic groups were considered separately when establishing the mean values for birth weight, crown-heel length and head circumference, as the ethnicity or race is known to influence these parameters (2, 5).

All anthropometric measurements differed significantly between the two ethnic groups. This is not surprising as race-specific anthropometric measurements have been described in adults (7).

Socio-economically the Moor community was not significantly different from the Sinhalese. However, traditionally the Moor are known to place more emphasis on their health, especially of their women. This leads to more medical consultations, better nutrition and better health care for pregnant mothers. This could lead to the production of healthier babies. The fact that most Moor women are not employed, may lead to their getting the required rest, especially in the afternoon hours. This could have led to the increase in the birth weight. Most Moor also live amongst extended families, where other members of the family share the burden of house-hold duties, thus relieving the pregnant woman of much toil. Such social, cultural and dietary habits, prevalent in the Moor community, may contribute in some form to the healthier state of the babies born to these mothers.

Numerous studies have shown that male babies are larger than the female babies (6, 9, 10, 13).

The findings of the present study are consistent with these observations.

When comparing birth weight or other physical parameters, attention should be given to ethnic, social, economic and geographic variation. Therefore, it is difficult to compare our results with those already published for other population groups.

The mean birth weight of 2852.45g, established for the Sinhalese newborn in this study is very close to the value reported by Abeyratne and Fonseka (9) which is 2895.4g. In the studies conducted by Collumbine (10), and Ratnayake and Wikramanayake (13), the mean birth weights reported are 2795.8g and 2940.0g. The mean birth weight of 3061.11g of the Moor newborn is greater than the values reported in previous studies on the Sri Lankan newborn.

The mean crown-heel length of 48.2 cm in a series of 100 full-term babies, established by Gomes in 1935 (14) is much lower than the values of 50.56 cm and 51.70 cm, established for the Sinhalese and Moor new borns in the present study. Ratnayake and Wikramanayake (12) in a study of 230 neonates reported a value of 50.33 cm for the crown-heel length. The ethnicity of the newborn is not specified in either of these studies.

The mean head circumference of 32.88 cm established in the present series is very close to the value of 32.79 cm reported by Ratnayake and Wikramanayake (13) in 1991. In a series of 813 newborns belonging to four ethnically distinct communities, Amarainshge (12) reported a value of 33.5 cm for the head circumference. The mean head circumference of 33.72 cm of the Moor newborn in the present series is higher than the values reported previously for this parameter.

The mother's weight exerts definite influence on the birth weight of the baby. Similar relationships have been reported by many earlier investigators (5, 6, 10, 11). However in the present series, maternal measures such as height, age and parity did not show any significant influence on the baby's weight.

The mean values of weight, crown-heel length and head circumference, based on measurements of infants born alive at various confirmed gestational ages, may be useful when assessing whether a newborn infant is within the normal limits of growth for his/her gestational age.

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References

1. Lubchenco L, Hansman C, Dressler M, Boyd E. Intrauterine growth as estimated from liveborn birthweight data at 24 to 42 weeks of gestation. *Paediatrics*. 1963; 32:793.
2. Shiono PH, Klebanoff MA, Graubard BI, Berendes HW, Rhoads GG. Birth weight among women of different ethnic groups. *Journal of the American Medical Association*. 1986; 255:48-52.
3. Bhat JG, Mukelabai K, Caster GNU, Taming HAND. Anthropometric parameters of Zambian infants at birth. *Journal of Tropical Paediatrics*. 1989; 35:100-103.
4. Diaferia A, Agostino GD, Ceci O, Locorotendo V, Tartangi M, Loizzi P. Bari district birth weight study: Comparison with the Bristol perinatal growth chart. *International Journal of Obstetrics and Gynaecology*, 1989; 29:227-231.
5. Goldenberg RM, Cliver SP, Cutter GR, Hoffman FJ, Cassady G, Davisa RO, Nelson KG. Black-White differences in newborn anthropometric measurements. *Obstetrics and Gynaecology*. 1991; 78:782-787.
6. Rehan NE, Taffida DS. Birthweight of Hausa infants in Northern Nigeria. *British Journal of Obstetrics and Gynaecology* 1979; 86:437-441.
7. Das Gupta BC. A study of neonatal record cards with special reference to the weight of the child at birth. *Transactions of Society of Medical Officers of Health: Ceylon*. 1935; 4, 79.
8. Nicholls L. A nutritional survey of the poorer classes in Ceylon. *Ceylon Journal of Science* 1936; (D) 4(1):1-70.
9. Abhayaratne OER, de Fonseka TEJ. Birth weight of Ceylonese babies-1. *Ceylon Journal of Medical Science* 1961;(D) 10:19-24.
10. Cullumbine H. Some factors which influence birth weight. *Ceylon Journal of Medical Science* 1950; 8(D), 19-29.
11. De Silva LVK, Dissanayake S, Wikramanayake T W. The relationship between birth weight and maternal weight. *Ceylon Journal of Medical Science* 1978; 23:71-74.
12. Amarasingha AAW. Head circumference of the newborn Ceylonese baby. *Archives of Diseases of Childhood*. 1966; 41:556-557.
13. Ratnayake A, Wikramanayake TW, Godawatte R. Size at birth of Sri Lankans. *Ceylon Journal of Medical Science*. 1991; 34:41-56.
14. Gomes WJ. Some studies in the Newborn. *Ceylon Journal of Child Health* 1965; 3:67-71.
15. Zillikens MC, Conway JM. Anthropometry in Blacks: Applicability of generalised skinfold equations and differences in fat patterning between blacks and whites. *American Journal of Clinical Nutrition* 1990; 52:45-51.
16. Carr-Hill RA, Pritchard CW. Reviewing birth weight standards. *British Journal of Obstetrics and Gynaecology*. 1983; 90:718-725.
17. Sedaghatian MR, Shayegan, J, Barkhorder J. Intrauterine growth pattern of live-born infants of Southern Iran compared with Western norms. *Journal of Tropical*