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Research Article

Anthropometric measurements of newborns

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ABSTRACT

Background: Aims and objectives of the study were to record the anthropometric measurements of the new-borns (i) Birth weight (ii) Crown heel length, (iii) Head circumference, (v) Chest circumference, (vi) Ponderal index.
Methods: This observational study includes a total no. of 2050 consecutive live singleton infants born between 28 to 42 weeks gestation in a 1 year period. Anthropometric parameters such as birth weight, crown heel length, head circumference, chest circumference and Ponderal index were recorded.
Results: At term, mean birth weight and lengths were 2800 gm and 50 cm respectively. Similarly mean head circumference and chest circumference were 33.3cms and 31.2cms respectively. As per the study, Ponderal index was 2.2 at term.
Conclusions: Anthropometric measurements obtained provide useful references for the care of new-born in our population. This would ultimately lead to identifying at risk new-borns and help in better management.

Keywords: Anthropometry, New-born, Ponderal index

INTRODUCTION

Anthropometry is the science which deals with the measurements. This provides single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of human body. It reflects health, nutritional status and predicts performance, future health and survival.[1]

Newborn anthropometry is the most important from paediatrician's point of view and also for centers involved in perinatal care. Though perinatal risk assessment can be done by weight percentile criteria, other anthropometric measurements such as crown heel length, head circumference, chest circumstance and ponderal index help in identifying at risk new borns.[2] There is no such measurement for universal use because it is dependent on racial, ethnic and geographic factors.[3] So this study was done to establish norms for anthropometric measurements for our newborns.

METHODS

Source of data: This observational study includes a total no. of 2050 consecutive live singleton infants born between 28 to 42 weeks of gestation in two government hospitals and one private hospital between November 1st 2002 to October 31st 2003.

Babies with congenital malformations and those born to mothers with hypertension (diastolic BP >90 mmHg on 2 determinations), diabetes and any other chronic illnesses were excluded.

The data was collected between the time of birth to the day of discharge.

Anthropometry

i. Birth weight: Birth weight of the new born was recorded in grams by electronic balance with a difference of ±10 gm within 12 hours of birth.

ii. Crown-heel length: crown heel length was recorded to the nearest of 0.1 cm with an infantometer with the baby being supine, knees fully extended and soles of feet held firmly against the foot board and head touching fixed board.

iii. Head circumference: The head circumference was measured by passing a non-elastic tape over the occipital protuberance on the back and supraorbital ridges in front.

iv. Chest circumference: It was measured at the level of nipple with same non elastic tape.

v. Ponderal index: It was calculated using the formula:

$$PI = \frac{\text{Weight (gm)}}{\text{Length}^3\ \text{(cm)}} \times 100$$

Gestational age assessment was done by new Ballard scoring system.

Statistical methods: Mean, standard deviation and percentiles were determined for various gestational age groups for different anthropometric parameters.

RESULTS

Total number of newborns studied = 2050

Number of males = 1033 (50.46%)

Number of females = 1017 (49.53%)

As per the Table 1, mean birth weight was 2800 gm at term (Figure 1).

In the present study, 5th and 95th centiles for weight (Table 2) were 2250 gms and 3500 gms for gestational age >37 weeks respectively (Figure 2).

Table 1: Distribution of new born babies according to weight for gestational age.

Gestational age	Birth weight (gm)		
	Mean -2SD	Mean	Mean +2SD
28-32 weeks	1100	1600	2100
33-37 weeks	1700	2300	3000
>37 weeks	2000	2800	3600

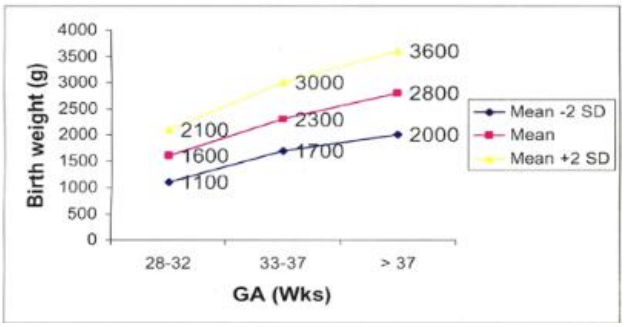

Figure 1: Intrauterine growth curve for weight with two standard deviations.

Table 2: Percentile values for weight.

Gestational age	Percentiles for weight (gm)				
	5th	10th	50th	90th	95th
28-32 weeks	1200	1300	1680	1900	1910
33-37 weeks	2000	2000	8270	2600	3300
>37 weeks	2250	2400	2750	3340	3500

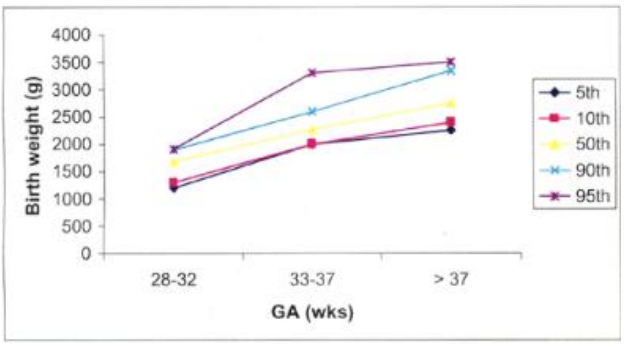

Figure 2: Percentile curve for weight including 5th and 95th centile.

As per Table 3, mean length was 50 cm at term (Figure 3). In the present study, 5th and 95th centiles for length (Table 4) were 46.1 cm and 52.8 cm for gestational age >37 weeks respectively (Figure 4).

Table 3: Distribution of newborn babies according to length for gestational age.

Gestational age	Length (cm)		
	Mean -2SD	Mean	Mean +2SD
28-32 weeks	37	41.5	45.9
33-37 weeks	42.7	45.7	48.7
>37 weeks	46	50	54

Table 4: Percentile values for length.

Gestational age	Percentiles for length (cm)				
	5th	10th	50th	90th	95th
28-32 weeks	37.80	38.6	42	43.6	44.2
33-37 weeks	44.5	44.5	46	47	47.5
>37 weeks	46.1	47.4	50.3	52	52.8

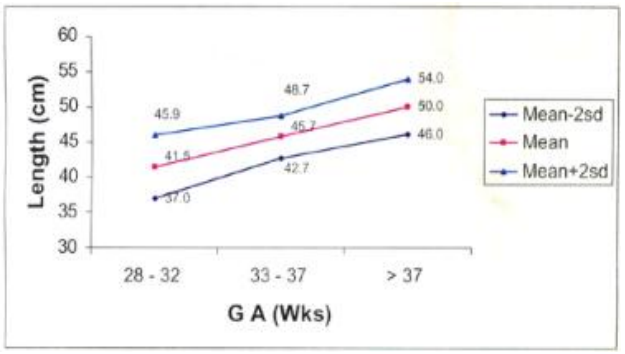

Figure 3: Intrauterine growth curve for length with two standard deviations.

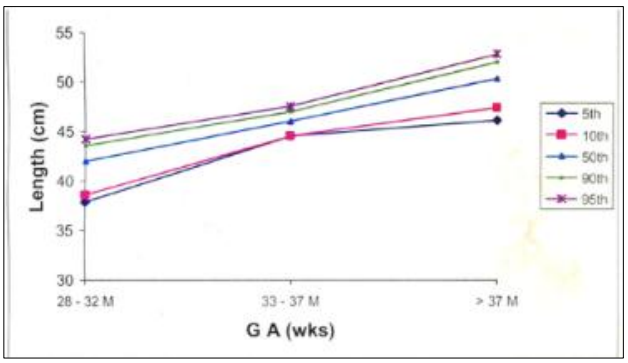

Figure 4: Percentile curve for length including 5th and 95th centile.

As per Table 5, mean head circumference was 33.3 cm at term (Figure 5). In the present study, 5th and 95th centiles for head circumference (Table 6) were 30.7 cm and 35 cm for gestational age >37 weeks respectively (Figure 6).

Table 5: Distribution of new born babies according to head circumference for gestational age.

Gestational age	Head circumference (cm)		
	Mean -2SD	Mean	Mean +2SD
28-32 weeks	23	26.8	30.6
33-37 weeks	27.8	31.1	34.5
>37 weeks	30.7	33.3	36

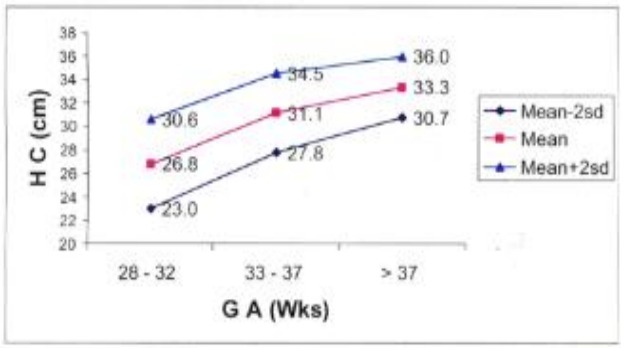

Figure 5: Intrauterine growth curve for head circumference with two standard deviations.

Table 6: Percentile values for head circumference.

Gestational age	Percentiles for head circumference (cm)				
	5th	10th	50th	90th	95th
28-32 weeks	23.6	24.3	27.2	28.6	29.1
33-37 weeks	29.3	29.3	31	32.8	33.5
>37 weeks	30.7	31.5	33.5	34.8	35

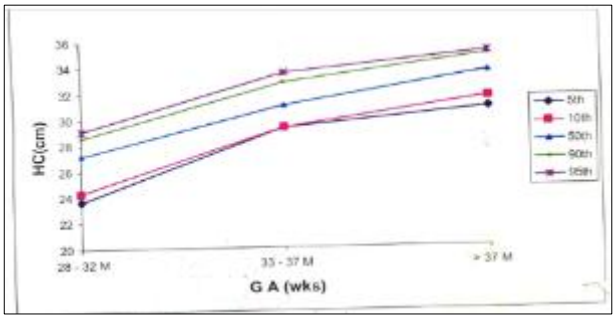

Figure 6: Percentile curve for head circumference including 5th and 95th centile.

As per Table 7, mean chest circumference was 31.2 cm at term (Figure 7). In the present study, 5th and 95th centiles for chest circumference (Table 8) were 23.8 cm and 33.1 cm for gestational age >37 weeks respectively (Figure 8).

Table 7: Distribution of new born babies according to chest circumference for gestational age.

Gestational age	Chest circumference (cm)		
	Mean -2SD	Mean	Mean +2SD
28-32 weeks	23.2	25.8	28.4
33-37 weeks	26.3	29.3	32.2
>37 weeks	28.4	31.2	34.1

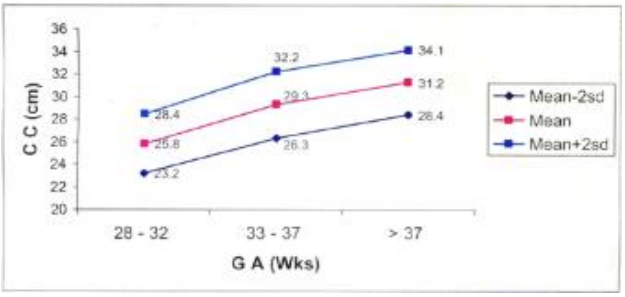

Figure 7: Intrauterine growth curve for chest circumference with two standard deviations.

Table 8: Percentile values for chest circumference.

Gestational age	Percentiles for chest circumference (cm)				
	5th	10th	50th	90th	95th
28-32 weeks	23.5	24.1	26.2	27.3	27.5
33-37 weeks	27.8	27.8	29.1	30.4	32
>37 weeks	28.8	29.4	31.5	33	33.1

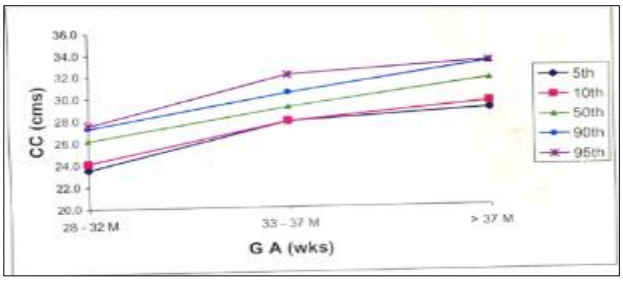

Figure 8: Percentile curve for chest circumference including 5th and 95th centile.

As per Table 9, mean Ponderal index was 2.2 at term (Figure 9). In the present study, 5th and 95th centiles for Ponderal index (Table 10) were 2.4 and 2.7 for gestational age >37 weeks respectively (Figure 10).

Table 9: Distribution of new born babies according to Ponderal index for gestational age.

Gestational age	Ponderal index		
	Mean -2SD	Mean	Mean +2SD
28-32 weeks	2	2.3	2.6
33-37 weeks	1.7	2.5	3.2
>37 weeks	1.8	2.2	2.7

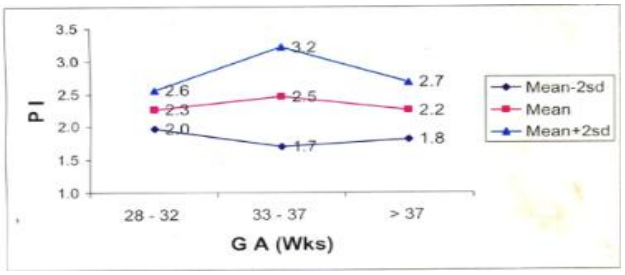

Figure 9: Intrauterine growth curve for Ponderal index with two standard deviations.

Table 10: Percentile values for Ponderal index.

Gestational age	Percentiles for Ponderal index				
	5th	10th	50th	90th	95th
28-32 weeks	2.13	2.23	2.29	2.30	2.30
33-37 weeks	2.22	2.22	2.27	2.93	3.2
>37 weeks	2.4	2.07	2.18	2.54	2.7

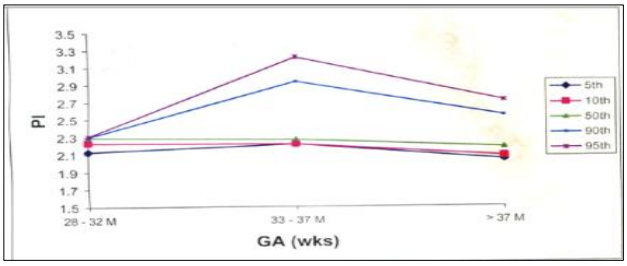

Figure 8: Percentile curve for Ponderal index including 5th and 95th centile.

DISCUSSION

The importance of developing empirical standard for growth parameters at birth for individual population has been stressed in the literature. So in this study we have tried to establish norms for our population.

Birth Weight: Birth weight not only a critical determinant of survival, growth and development of a baby but also a valuable indicator of health, nutrition and quality of antenatal services.[4] Birth weight has been studied by many authors in our country[5,6] (Table 11). As we have not studied maternal factors affecting birth weight like socioeconomic status, consanguinity, gravida status and paternal factors, it would be difficult to explain the difference in mean birth weights between studies. But lower values in our study could be due to maternal malnutrition which is one of the important determinants of birth-weight occurring in later part of pregnancy as evidenced by nutritional anemia in our mothers.

Table 11: Mean birth weight for the infants in the present study as compared with similar studies.

Gestational age	Parmar et al.	Manmohan et al.	Kalra et al.	Present study
28-32 weeks	1380	1440	-	1620
33-37 weeks	2530	2450	-	2340
>37 weeks	2850	2820	3060	2810

Length: Length is widely used for evaluation of prenatal growth and identification of infants requiring detailed assessment and close monitoring during neonatal period.[7] Crown heel length has been studied by many authors in our country (Table 12). From our study, we find that body length is less affected than body weight by intrauterine malnutrition and is a better guide to fetal age than the later as it has been said in the literature. It is probable that paternal height and maternal height have got more influence in determining infants' length.

Table 12: Mean length in the present study as compared with other similar studies.

Gestational age	Parmar et al.	Manmohan et al.	Kalra et al.	Present study
28-32 weeks	45.1	41	-	41.5
33-37 weeks	47.9	46.3	-	45.7
>37 weeks	48.7	48.3	48.5	50.0

Head circumference: As with the birth length, head circumference may give important diagnostic and prognostic information beyond that provided by birth weight alone.[8] Head circumference has been studied by many authors in our country (Table 13).

Chest circumference: It was observed the speed at which the circumference of the thorax of the fetus can be a rapid and reliable indicator of fetal and maternal pathology.[9]

Chest circumference has been studied by many authors in our country (Table 14).

Table 13: Mean head circumference in the present study as compared with other similar studies.

Gestational age	Parmar et al.	Manmohan et al.	Kalra et al.	Present study
28-32 weeks	28.1	29	-	26.8
33-37 weeks	32.8	32.1	-	31.1
>37 weeks	33.7	33.5	33.5	33.3

Table 14: Mean chest circumference in the present study as compared with other similar studies.

Gestational age	Parmar et al.	Kalra et al.	Present study
28-32 weeks	23.8	-	25.8
33-37 weeks	29.6	-	29.3
>37 weeks	31.3	31.1	31.2

Ponderal index: The Ponderal index can be used to classify intrauterine growth retardation. Ponderal index has also been studied by Parmar et al. (Table 15).

It is evident from the Table 15 that Ponderal index increases until term and then decreases. The decrease in values after 37wks reflects the effect of various factors on placental blood supply.

Table 15: Mean Ponderal index in the present study as compared with other similar study.

Gestational age	Parmars et al.	Present study
28-32 weeks	2.1	2.3
33-37 weeks	2.45	2.5
>37 weeks	2.49	2.2

Limitations of the study

This study had not looked into factors governing the birth weight and other parameters.

CONCLUSIONS

The results of five anthropometric parameters birth-weight, crown heel length, head circumference, chest circumference and Ponderal index provide references for the care of newborns. Anthropometric measurements are of both epidemiological and clinical use. The comparison of charts referring to different and clearly defined population living in the same country or indifferent countries is a way of measuring the extent of inequalities in health between populations or to monitor trends over time in response to public health policies. From a clinical view point, anthropometry is a tool to detect neonates at higher risk of neonatal and postnatal morbidity and growth improvement. A comprehensive evaluation of the neonate should consider anthropometric measurements at birth and also fetal ultrasound and Doppler velocimetry. At present, further clinical studies are needed to reach a consensus on how to combine neonatal and prenatal information to discriminate different neonates.

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