Gestational age specific anthropometric percentile charts of newborns at Kathmandu Medical College Teaching Hospital

Manandhar SR[1], Manandhar DS[2]

[1]Sunil Raja Manandhar, Assistant Professor; [2]Dharma Sharna Manandhar, Former Professor and Head; Department of Paediatrics, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal

ABSTRACT

Background: A gestational age specific birth weight, length and head circumference centile chart will help to identify intrauterine growth of a baby. Since the first published gestational age specific anthropometric study done in Nepal by Manandhar DS et al in 1993-94, there have been significant changes in socioeconomic conditions with improved health indicators. This study was done for identifying any changes in anthropometric measurements of the newborns born at Kathmandu Medical College Teaching Hospital (KMCTH).

Objectives: To produce gestational age specific birth weight, length and head circumference centile charts of the newborn babies born at KMCTH and to calculate incidence of low birth weight (LBW) babies at KMCTH.

Methods: This is a cross sectional observational study. Study was done at labour room, operation theatre, special care baby unit and postnatal wards of KMCTH. Study period was from 18th Aug 2011 to 28th Nov 2012 (15 months duration). Within 24 hours of birth, baby's weight, length and head circumference were measured by medical officers and post graduate Residents of the Paediatrics Department. Mother's weight, height and ethnicity were also recorded. Maturity of the baby was assessed by maternal history and corroborated by using modified Ballard score and Obstetric USG (Ultra sonogram) findings. Data were entered in excel database programme and later transferred into SPSS (Statistical package of social science) 16. Mean, standard deviation, range and percentiles values at different gestational age specific groups were calculated.

Results: A total of 2029 live babies without gross congenital malformations were included in this study, among which 57% (1154) were male. While analyzing maturity assessment, 89.1% (1808) were term, 8.7% (176) were preterm and 2.2 % (45) babies were post term. Mean birth weight at 40 weeks of gestation was 3.10 kg with Standard Deviation (SD) of 0.4 kg, mean head circumference was 34.0 cm (SD 1.2 cm) and mean length was 49.2 cm (SD 2.2 cm). Out of 2029 babies, 16.2% (328) babies were low birth weight (LBW) and 1.4% (28) babies weighed >4 kg.

Conclusion: Percentile charts of newborns will help to assess the intrauterine growth of babies. Further more studies of these percentile charts will help to produce national level percentile charts of newborns of Nepal.

Key words: Anthropometric measurements, Gestational age specific percentile charts

INTRODUCTION

In Nepal, more than 63% of the deliveries take place at home[1] where birth weight is often not recorded. In developing countries, low birth weight (LBW) <2500 g accounts for 60–80% of neonatal deaths[2]. Neonatal anthropometric parameters are significant predictive factors of neonatal morbidity and mortality. Birth weight is an important determinant of infant's survival and future development[3]. Prevalence of LBW in Nepal was reported as 27%[4]. A gestational age specific birth weight, length and head circumference centile chart will help to identify small for date babies and will also help in following the growth of a baby born before term[5]. So far, there are very few studies done in Nepal regarding gestational age specific birth weight, length and head circumference percentile charts of Nepalese babies.

A hospital based study at Paropakar Maternity hospital, Kathmandu, Nepal in 1997 by Manandhar DS et al[6] found low birth weight (< 2.5 kg) in 32% of the newborns, mean birth weight of 2660 g (standard deviation, SD 80 g) and mean head circumference 32.6 cm (SD 1.3 cm). A hospital based study done at Kathmandu Medical College Teaching Hospital (KMCTH), Kathmandu in 2003 by Manandhar K et al[3] found that the mean birth

Address for correspondence

Dr. Sunil Raja Manandhar
Assistant Professor
Department of Paediatrics
Kathmandu Medical College Teaching Hospital,
Kathmandu, Nepal
Email: drsunilraja@gmail.com

weight of term babies was 3050 g (SD 41 g), mean length 49 cm (SD 2.2 cm) and mean head circumference was 33.8 cm (SD 1.4 cm). Similarly, another hospital based study at Western Zonal Hospital, Pokhara, Nepal by Sreeramareddy CT et al[2] found that the mean birth weight was 3029 g (SD 438 g) and 8.5% newborns were low birth weight.

The objective of this study is to generate a gestational age specific birth weight, length and head circumference percentile charts of the babies born at KMCTH and to calculate incidence of low birth weight at KMCTH.

METHODS

This is a cross sectional study. The hospital permission was taken to carry out this research. Anthropometric measurements were taken at the labour room, operation theatre, special care baby unit and postnatal wards of Kathmandu Medical College Teaching Hospital (KMCTH). The study period was from 18th August 2011 to 30th November 2012 (15.5 months). A total of 2029 live newborn babies without gross congenital malformations were included. Within 24 hours of age, routine examination of newborn babies and birth weight, length and head circumference were measured by post graduate residents and medical officers of Paediatrics Department, KMCTH under close supervision by the principal author. Naked babies' weight were measured by an electronic weighing scale (Salter, UK) which has a sensitivity of 10 grams. Length was measured by two persons using a Kiddimeter (Child Growth Foundation, UK) which can read up to 10 mm. Head circumference was measured by non-stretchable paper measuring tape (Allegiance infant measuring tape, USA) which can read up to 1 mm. Maternal weight, height and ethnicity were also assessed. Maternal weight and height were measured by Stadiometer and maternal haemoglobin was obtained by Coulter machine. Data were entered in excel database programme and later transferredinto SPSS (Statistical package of social science) 16. Mean, median; mode, standard deviation, range and percentiles values at different gestational age specific groups were calculated. Percentiles values were obtained by using Tukey's Hinges method in statistical analysis SPSS 16

version. 10th, 50th and 90th centile values were obtained for different gestational age groups.

Preterm baby is defined as any neonate born before 37 weeks (<259 days) of pregnancy irrespective of birth weight. Similarly term is defined as any neonate born between 37 weeks and <42 weeks (259 – 293 days) of pregnancy irrespective of birth weight, whereas post-term baby is defined as a neonate born at gestation age of 42 weeks or more (294 days or more) irrespective of the birth weight[7].

Stillbirths, multiple births, gross congenital malformation and hydrops were excluded. Maturity of the baby was assessed by maternal history and corroborated by using modified Ballard score, and Obstetric USG findings.

RESULTS

Total of 2029 live born babies without gross congenital malformations were included in this study. Among those, 57% (1154) were male and 43% (875) were female, which is shown in table 1. While analyzing maturity assessment, 89.1% (1808) were term, 8.7% (176) were preterm and 2.2% (45) babies were post-term. Mean birth weight (50th centile) at 40 wks gestation was (mean ± SD) 3.10 ± 0.46 kg, mean head circumference was 34.16 ± 1.29 cm and mean length was 49.33 ± 2.26 cm. Out of 2029 babies, 82.5% (1673) babies were of normal weight, 16.1% (328) babies were low birth weight and 1.4% (28) babies weighed >4 kg.

Percentile charts of 10th, 50th and 90th centile for birth weight, length and head circumference according to gestational age were generated. According to this centile chart, at 40 weeks gestational age, mean birth weight was 3.1 kg, HC was 34 cm and length was 49.2 cm which are depicted in Table 2, 3 and 4 respectively. Since number of newborn babies was small in each of 25 to 32 weeks and 43 weeks gestational age groups (Table 1), percentile values were not calculated for these groups. While analyzing maternal characteristics, mother's mean weight was 59.73 ± 8.3 kg, mean BMI was 25.37 ± 3.85 kg/m^2 and mean Hb was 11.93 ± 1.34 gm/dl, which are shown in Table 5.

Table 1: **Distribution of newborns babies according gestational age and sex.**

Gestation age (weeks)	Female	Male	Total
25	2	0	2
26	0	1	1
28	0	5	5
29	1	3	4
30	1	2	3
31	1	2	3
32	4	8	12
33	4	15	19
34	17	17	34
35	18	16	34
36	15	44	59
37	77	128	205
38	182	266	448
39	186	273	459
40	285	298	583
41	59	54	113
42	18	17	35
43	5	5	10
Total	**875**	**1154**	**2029**

Table 2: **Percentile Chart: weight for age (kg)**

Gestation week (Observations)	33 (18)	34 (34)	35 (34)	36 (59)	37 (205)	38 (448)	39 (459)	40 (583)	41 (113)	42 (35)
10th centile	1.47	1.22	1.52	1.80	2.10	2.41	2.50	2.50	2.49	2.75
50th centile	1.82	1.97	2.27	2.54	2.75	3.00	3.00	3.10	3.15	3.20
90th centile	2.52	2.72	2.89	3.32	3.32	3.53	3.60	3.65	3.61	3.76

Table 3: Percentile Chart: Head Circumference for age (cm)

Gestation week (Observations)	33 (18)	34 (34)	35 (34)	36 (59)	37 (205)	38 (448)	39 (459)	40 (583)	41 (113)	42 (35)
10th centile	28.1	28.5	28.5	30.0	31.4	32.4	32.5	32.8	32.5	32.9
50th centile	30.5	31.0	32.0	33.0	34.0	34.0	34.0	34.0	34.0	34.0
90th centile	33.3	33.7	34.0	35.0	35.5	35.8	36.0	36.0	35.1	35.1

Table 4: Percentile Chart: Length for age (cm)

Gestation week (Observations)	33 (18)	34 (34)	35 (34)	36 (59)	37 (205)	38 (448)	39 (459)	40 (583)	41 (113)	42 (35)
10th centile	41.8	42.7	40.7	44.0	45.5	46.0	47.0	47.0	46.0	46.8
50th centile	45.0	46.0	46.5	48.0	48.9	49.0	49.0	49.2	49.0	49.7
90th centile	47.8	48.4	49.2	50.1	51.2	51.8	51.5	52.0	51.5	52.5

Table 5: Maternal Characteristics of this study

Variables	Mean ± SD	Range
Weight (kg)	59.73 ± 8.36	40 – 100 kg
Height (cm)	153.92 ± 6.5	120 - 177.5 cm
BMI (kg/m^2)	25.37 ± 3.85	14.2 – 48.6 kg/m^2
Hb (gm/dl)	11.93 ±1.34	9 – 17 gm/dl

Table 6: **Comparison of selected birth weight percentile among two studies.**

Study site	Sample size	33weeks			36 weeks			40 weeks		
		10th Centile	50th Centile	90th Centile	10th Centile	50th Centile	90th Centile	10th Centile	50th Centile	90th Centile
KMCTH 2011 (Present study)	2029	1.47	1.82	2.52	1.80	2.54	3.32	2.50	3.10	3.65
Paropakar Maternity Hospital 2010 By Aryal DR et al	9710	1.52	1.85	2.19	2.06	2.47	2.91	2.55	3.02	3.52

DISCUSSION

Prevalence of LBW in India was reported to be 30%[8] and incidence of LBW in tertiary centers of India 32.8%[9]. A study done by Yagnik CS et al[10] found that the mean birth weight of newborns in Pune, India was 2666 g. Matthai M et al[11] at Christian Medical College, Vellore, India postulated that birth weight of newborns was related to the height of the mother. They found that the mean birth weight of infants born to women with a height of 150-158 cm was 2945 ± 516 g as compared to 2847 SD ± 480 g to mothers with height <150 cm.

A study done in Bangladesh by Dhar B et al[12] in Public maternity hospital, Dhaka found that mean birth-weight was 2889 ± 468 gms and 15.1% babies were low-birth-weight. Male babies (2951 ± 471g) are slightly heavier than female babies (2813 ± 454 g) and also found that 42.7% babies are in between 2.5–3 kg. A similar study done by Haque F et al[13] in Bangladesh found that mean birth weight was 2679 ± 431 g and male babies (2692 ± 409 g) are slightly heavier than female (2665 ± 452 g).

A hospital based study done by Najmi SR[14] in Fatima Jinnah Medical College, Lahore reported mean birth weight of 2.91 kg. Among them, 19% were low birth weight, 78% babies were in between 2.5 to 4 kg and three percent of neonates weighed above 4 kg.

Following the first comprehensive anthropometric study done in Nepal about 18 years ago by DS Manandhar et al[5], there have been significant changes in socioeconomic conditions with better health indicators at urban areas of Nepal[1]. In this study, mean birth weight of the babyat 40 weeks (3100 gms) is higher than the national figure i.e. 2780 g[15] and is significantly higher than the first published gestational age specific birth weight percentile chart from the Paropakar Maternity Hospital, Kathmandu in 1993- 94 by Manandhar DS et al (2800 g)[5]. Maternal mean weight in that study[6] was 49.4 ± 6 kg and mean BMI was 21.31 kg/m^{2} where as in this study at KMCTH, mean maternal weight was 59.73 ± 8.36 kg and maternal mean BMI was 25.37 ± 3.85 kg/m^{2} showing a significant increase in maternal nutrition within these 20 year period. A recent study done at the same hospital in 2010 by Aryal DR et al[15] also showed increased birth weight (mean birth weight was 3023 gms), which are depicted in Table 6 showing comparison among two hospitals in birth weight at 33 weeks, 36 weeks and 40 weeks respectively.

Similarly, a hospital based study done at the western zonal hospital, Pokhara in Nepal by Sreeramareddy CT et al[2] also found a mean birth weight of 3029 ± 438 g.

Quite a significant number of mothers in the 1993-94 study at Paropakar Maternity Hospital were primi, young, undernourished poor carpet workers coming from outside Kathmandu valley where as in this study and the study reported by Aryal DR et al, most of the mothers are from urban regions of Kathmandu valley with better educational background and had received better antenatal care. Overall better anthropometric values seen in the newborns in the present study could be due to overall improvement in maternal nutrition in the country in general and particularly among mothers who delivered at KMCTH. This could be a reflection of better maternal nutrition and increase in maternal socio-economic condition in Kathmandu valley area.

Limitation of this study: As the newborn babies are few in numbers among 25 to 32 weeks and 43 weeks of gestational age, percentile values could not be reliably calculated for these groups.

CONCLUSION

This study showed a significant increase in birth weight, and decrease in the incidence of low birth weight at Kathmandu Medical College Teaching Hospital. These anthropometric percentile charts of newborn babies of Kathmandu Medical College will help to produce national level percentile charts of newborns of Nepal, if meta-analysis of anthropometric measurements from different regions of Nepal were done.

ACKNOWLEDGEMENT

REFERENCES

1. Population division, Ministry of Health and Population (MoHP), Government of Nepal. Infant and child mortality. In: New ERA and Macro International Inc. Nepal Demographic and Health Survey (NDHS) 2011. Kathmandu: Ministry of Health and Population, New ERA, and Macro International Inx: 2011. p 125.

2. Sreeramareddy CT, Chuni N, Patil R, Singh D, Shakya B. Anthropometric surrogates to identify low birth weight Nepalese newborns: a hospital-based study. BMC Pediatrics. 2008;8:16. doi:10.1186/1471-2431-8-16.

3. Manandhar K, Manandhar DS, Baral MR. One year follow up study of term babies born at Kathmandu Medical College Teaching Hospital. Kathmandu Univ Med J. 2004;4(8):286-90.

4. MIRA. Low Birth Weight prevalence and associated factors in four regions of Nepal. (A multi- hospital based study). UNICEF. 2000 Jun.

5. Manandhar DS, Osrin D, Malla K, Shrestha PS, Costello AM. Gestational age specific birth weight centiles in Nepal. J Nep Med Assoc. 1999;38:29-34.

6. Manandhar DS, Rajbhandari S, Pal D, Costello AM. Anthropometry of the term newborn and postnatal mother in Nepal. J Nep Med Assoc. 1997;35:150 -7.

7. Ghai OP, Gupta P. Newborn infants. In: Gupta P, Paul VK (editors). Ghai Essential Pediatrics, 7th ed. New Delhi (India): CBS Publications; 2010. pp 96-103.

8. United Nations Children's Fund (UNICEF). The State of the World's Children 2004. New York; UNICEF: 2003.

9. National Neonatology Forum of India. National Neonatal Perinatal Database-Report for year 2000. New Delhi: National Neonatology Forum, India; 2001.

10. Yajnik CS, Fall CHD, Coyaji KJ, Hirve SS, S Rao, Barker DJP, et al. Neonatal anthropometry: the thin–fat Indian baby, the Pune maternal nutrition study, India. Int J Obesity. 2003;27:173–80.

11. Mathai M, Jacob S, Karthikeyan NG. Birth weight standards for south Indian babies. Indian Pediatr. 1996 Mar;203(33):203-9.

12. Dhar B, Mowlah G, Nahar S, Islam N. Birth weight status of newborns and its relationship with other anthropometric parameters in a Public maternity hospital in Dhaka, Bangladesh. J Health Popul Nutr. 2002 Mar;20(1):36-41.

13. Haque F, Hussain AMZ. Detection of low birth weight new born babies by anthropometric measurements in Bangladesh. Indian J Pediatr. 1991;58:223-31.

14. Najmi SR. Distribution of Birth weights of Hospital Born Pakistani Infants. J Pakistan Med Assoc. 2000 Apr;50(4):121-4.

15. World Health Organization. Multicentre study on low birth weight and infant mortality in India, Nepal and Sri Lanka. New Delhi: Southeast Asia Regional Office, World Health Organization; 1994. 78 p.

16. Aryal DR, Gurung R, Misra S, Khanal P, Pradhan A, Gurubacharya SM. Intrauterine growth curves for singleton live babies in Paropakar maternity and women's hospital in Nepal. J Nepal Health Res Counc. 2012 Jan;10(20):160-6.