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Original Research Article

Assessment of gestational age using anthropometric parameters in newborns

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ABSTRACT

Background: Estimation of gestational age was needed for the measurement of intrauterine growth and associated conditions, such as whether infants with a low birth weight are preterm or growth-retarded, and identifying high-risk status for developmental delay. Menstrual history was unreliable in most of the cases and ultrasound was not feasible in low resource area, so in this study we were used anthropometric measurements as a simple tool for assessment of gestational age.
Methods: This study was a cross sectional observational study conducted in 380 babies born in January 2020-December 2022 in department of pediatrics, Rajah Muthiah Medical College and Hospital. The data were collected using semi-structured questionnaire and anthropometric assessment. The Epi info 7 software was used to analyse the data.
Results: The mean gestational age among neonates studied was 37.06±2.32 weeks, the mean head circumference was 33.48±1.01 cm and majority of them 141 babies had head circumference 33 cm, the mean chest circumference was 30.69±1.08 cm. and majority of the babies, had chest circumference of 30 cm, the mean foot length was 7.64±0.24 cm, the mean length of the babies was 47.9±1.26 cm.
Conclusions: Our study conclude that anthropometeric parameters in combination (head, chest circumference, length, foot length, birth weight) and as single parameters (foot length) was a simple and easy tool for assessing gestational age in low resource setting where we can make quick referral.

Keywords: Anthropometric parameters, Head and chest circumference, Length, Foot length

INTRODUCTION

Fetal growth is based on genetic, placental and maternal factors. Morbidity and mortality in newborns are directly related with gestational age and weight. An estimated 1 million babies die globally every year because of prematurity, of which about 375,000 neonatal deaths due to prematurity and low birth weight occur in India alone.[1,2] There are various methods for assessing gestational age and each has its own advantages and disadvantages, till now no gold standard method was available for gestational age assessment.

Early-pregnancy ultrasound is thought to be the gold standard for assessing Gestational age. Due to late antenatal care, problems with last normal menstrual period memory due to the use of hormonal contraceptives which is not reliable or due to maternal diseases, low literacy, and a lack of access to ultrasonography, and skilled personnel in using ballards scoring Gestational age estimation was problematic in low-resource settings.[3,4] Preterm birth contribute for 28% of all newborn deaths and is the second most common cause of death in children under the age of five.[5,6] The 15 million preterm births that occur annually around the world take

occurs in low- and middle-income nations, where the problem is most severe.[7]

The main purpose of this study was to design a simple method in assessment of gestational age in rural health centre done by low skilled personnel in low resource setting by using anthropometric parameters.

METHODS

This cross sectional observational study was carried out in 380 babies born in Department of Pediatrics, Rajah Muthiah Medical College Hospital, Annamalai University.

Study period

The study was conducted from January 2020-December 2022.

Inclusion criteria

All neonates appropriate for gestational age were included.

Exclusion criteria

Babies small for gestational age babies; large for gestational age babies; babies with congenital or skeletal abnormalities were excluded.

The babies were selected by simple random technique. The sociodemographic data were collected using semi structured questionnaire. All anthropometric measurements were measured as per "handbook of physical measures" by Hall et al for foot length comparison for gestational age Merz data was used, New ballards scoring system for assessment of gestational age was given in Figure 1 a and b (Table 1).[8]

Data analysis

The data collected were entered in excel and analysed using Epi info 7 version. The correlation of foot length and other anthropometric measurements were assessed using correlation coefficient and p value.

Ethical approval

The study was approved by Institutional ethical committee, Annamalai university, Chidambaram.

RESULTS

The mean gestational age among neonates studied is 37.06±2.32 weeks, around 2.9% were early preterm, 5.5% were moderate preterm, 22.1% were late preterm, 68.2% were term and 0.3% were post term (Table 2).

Table 1: Merz data.

Gestational age	Foot length in cm
<24	<44
24	44.1-45.9
25	46-48.9
26	49-51.9
27	52-53.9
28	54-55.9
29	56-58.9
30	59-60.9
31	61-63.9
32	64-65.9
33	66-68.8
34	69-70.9
35	71-72.9
36	73-75.9
37	76-77.9
38	78-80.9
39	82-82.9
40	83-84.9
41	>85

Table 2: Socio-demographic and obstetric data of new born studied.

Socio demographic data	N	%
Age in hours (mean±SD)	8.04±3.2	
Gender		
Male	201	52.9
Female	179	47.1
Gestational age in weeks (mean±SD)	37.06±2.32	
Term of birth		
Extreme preterm	4	1.1
Early preterm	11	2.9
Moderate preterm	21	5.5
Late preterm	84	22.1
Term	259	68.2
Ante natal risk factors		
Present	97	25.5
Absent	283	74.5

The mean birth weight is 2.54±0.522 kg in our study, the mean head circumference is 33.48±1.01 cm, and majority of them 141 babies had head circumference 33 cm (Table 3).

The mean chest circumference is 30.69±1.08 cm, and majority of the babies, had chest circumference of 30 cm and above, the mean foot length is 7.64±0.24 cm and the mean length of the babies is 47.9cm±1.26 (Table 3).

The correlation value (0.402) and p value 0.001 suggested there is positive correlation between increase in foot length and gestational age (Figure 2). The mean value of foot length as per term of delivery of baby shows

significant result. The foot length is 7.1 in extreme preterm, 7.29 cm in early preterm, 7.6 in late preterm and 7.7 cm in term and 7.8 cm in post term (Table 4).

There is positive correlation between foot length, head, chest circumference and length with gestational age at birth with p value of 0.001 and correlation coefficient of 0.497, 0.401 and 0.293 (Figure 3).

Table 3: Anthropometric measurements of newborn studied.

Measures	Head circumference in cm	Chest circumference in cm	Foot length in cm	Length in cm
Mean	33.48	30.69	7.648	47.92
Std. deviation	1.016	1.081	.2483	1.269
Minimum	32	29	7.0	46
Maximum	35	33	8.0	50

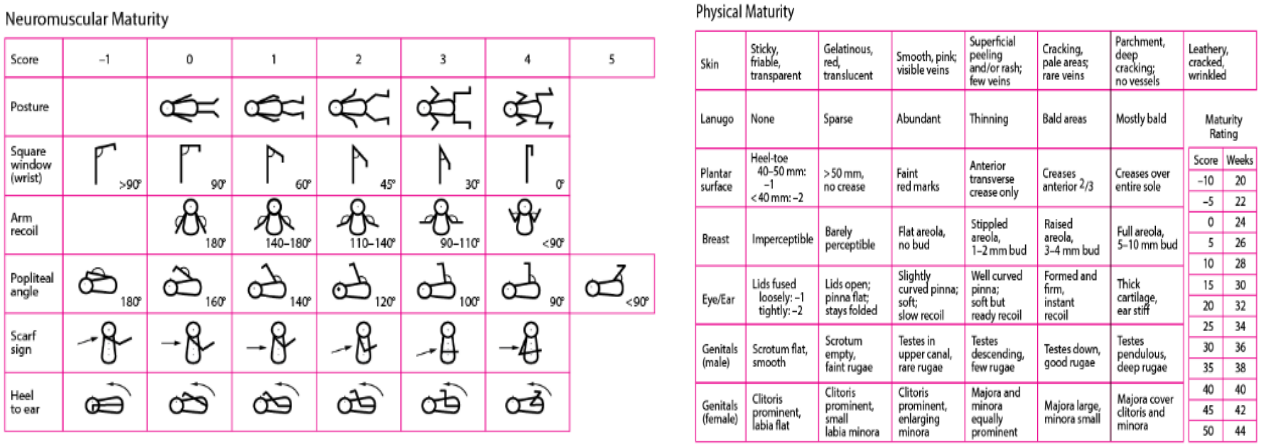

Figure 1: (a) Neuromuscular maturity scoring in new Ballards scoring; (b) physical maturity scoring in new Ballards scoring.

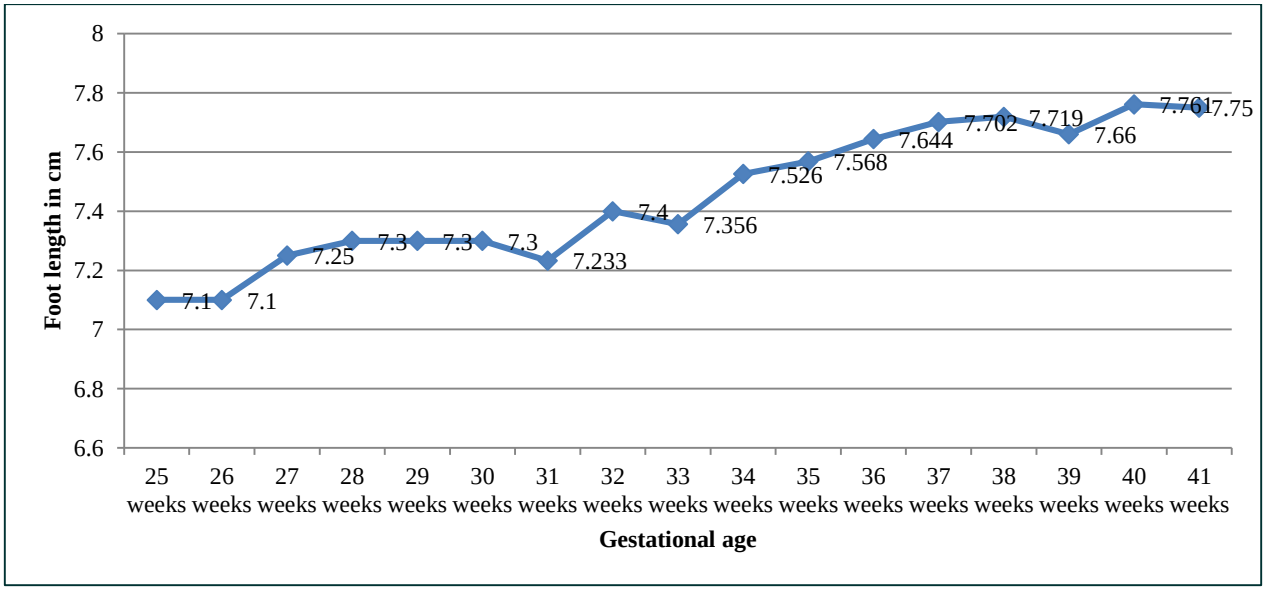

Figure 2: Correlation of gestational age with foot length.

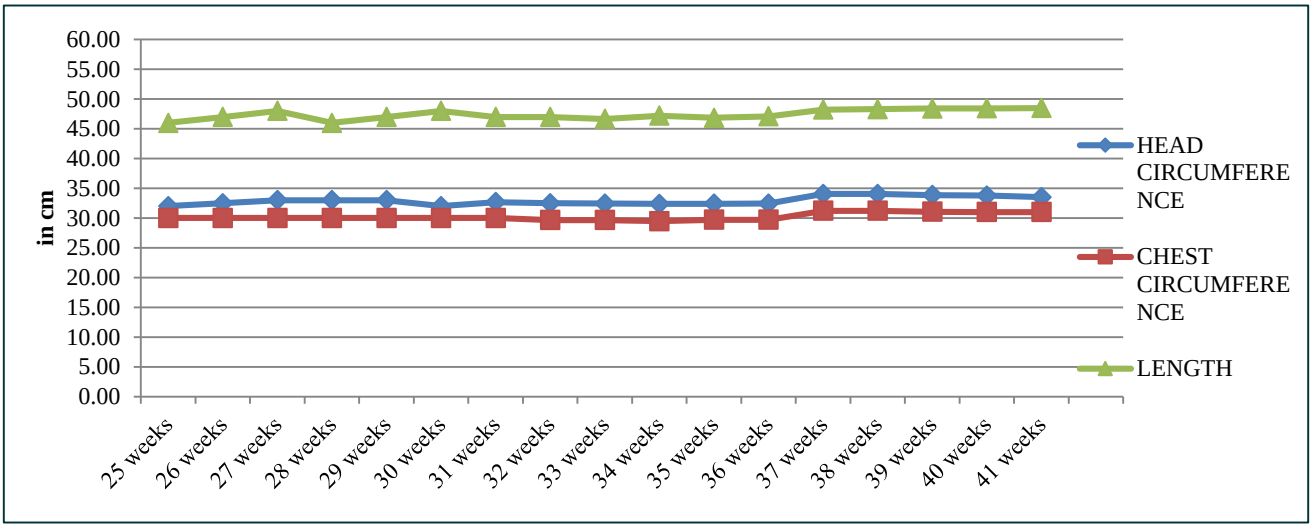

Figure 3: Correlation of GA with head, chest circumference and length.

Table 4: Association of foot length with birth weight.

Birth weight	Foot length	
	Mean	SD
ELBW	7.183	.0601
VLBW	7.329	.0747
LBW	7.574	.0263
Normal	7.700	.0131

DISCUSSION

A newborn's maturity level is important to identify postpartum morbidity and mortality since a baby with a very low maturity level had a high risk profile than one with a high birth weight, other neonatal issues like intraventricular hemorrhage, patent ductus arterious, and retinopathy of prematurity are also influenced by the baby's birth weight. It is difficult to distinguish between little for date and less mature babies when determining the baby's maturity accurately especially when the infant weighs little. A number of straightforward and quick procedures for determining maturity have been introduced as a result of some of the drawbacks of the methods, such as recalling the last day of menstruation and prenatal ultrasonography in low resource setting.

In order to be use in impoverished countries for the quick diagnosis of preterm neonates, for referral of preterm neonates, and the provision of potentially life-saving therapy, this study could be straightforward, economical, reliable, easy to use, and uniform. As a result, there may be a substantial correlation between some neonatal metrics and newborns' gestational ages such as head and chest circumference, foot length, length, birth weight. All of these infant traits can be evaluated using basic, easily accessible equipment like "measuring tape."

In our study, there was a significant correlation of gestational age with birth weight, length, foot length, head and chest circumference. Similar to our results, Das et al carried out a cross-sectional study with 530 continuously live-born infants between the ages of 28 and 41 in a tertiary care hospital, the study suggests that head circumference and Crown Heel Length can be used as simple methods for predicting Gestational age in babies when this is unknown. This can help identify high-risk newborns early without the use of imaging methods.[9] Between October 2019 and April 2020, Tiruneh conducted a cross-sectional study at Dessie Referral Hospital on 424 live births that was between 28 and 42 weeks gestation, the study showed the significant correlation of head circumference, crown heel length and birth weight with gestational age.[10]

In a research by Kumar et al 209 consecutive live births of singletons between 28 and 40 weeks of gestation was enrolled, foot length is a straightforward calculation, it can be used as a substitute for the New Ballard score.[11] Our study result was consistent with research done in India by Thawani et al.[12] A study by Yadav et al in India, which explained that birth weight, foot length, head circumference, and crown-heel length had a positive connection with gestational age, and this study, concurred on this point.[13]

The average foot length in the study by Kumar et al was 6.8 centimetres, or 34 weeks, a linear connection was seen when gestational age was plotted against mean foot length.[14]

Our study suggested that anthropometric measurements can be used in assessment of gestational age, foot length as an important marker among all anthropometric measures in gestational age measurement.

Strength

The study was conducted by single investigator so this might have avoided observer bias. Also larger sample

size and standard protocol follow up for data collection were major strength of our study.

Limitations

This was a cross sectional study. Further comparative study was recommended. This was hospital based single centric study. So the results may have varied based on the level of health care the babies were delivered. Role of confounding was also not ruled out in our study.

CONCLUSION

Our study concluded that anthropometeric parameters in combination and as single parameters was a simple and easy tool for assessing gestational age in low resource setting where we can make a quick referral.

Our study suggests the use of anthropometric measurements which is simple, easy, cheaper and less time consuming in assessment of gestational age at situations where other methods are less feasible. Combined parameters (head, chest circumference, length, foot length, birth weight) were best in assessing gestational age and have positive correlation and the best single parameters for analysing gestational age was foot length as compared to new Ballard's scoring which need skilled personnel.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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