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Mid upper arm circumference in pregnant women and its relationship with birth weight

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ABSTRACT

Introduction: Mid upper arm circumference (MUAC) is considered as a good indicator of maternal nutritional status in pregnant women. Very few studies have been done to establish a relationship between MUAC and birth weight of newborn. This study was carried out to analyze the relationship between MUAC and birth weight of newborn in a tertiary health care facility.

Materials and Methods: This cross sectional study was conducted in 240term pregnant women. MUAC was measured to the nearest millimeters using a non-stretchable tape at the midpoint between acromian process and olecranon process. Newborn baby weight was measured within 24 hrs of birth. The association between MUAC and birth weight was established by linear regression analysis.

Results: The mean of MUAC among pregnant women delivering LBW was 21.68±2.27 cm which was significantly low ($p<0.001$) compared to women delivering normal babies (23.47±2.56 cm). There wasa positive correlation($r=0.32$;$p<0.05$)between MUAC and birth weight of newborn.The cut off value of MUAC for the prediction of LBW in our study was found to be 22.59 cm with 62.77% sensitivity and 71.55% specificity.

Conclusion: Among the various maternal factors for the prediction of LBW, mid-upper arm circumference (MUAC) can be correlated with birth weight outcome effectively.

1. Introduction

Maternal nutrition is very important in determining the outcome of pregnancy especially the birth weight of the baby.[1] This is now a global concern and many physicians are trying to establish a definite relationship between maternal anthropometric parameters and baby birth weight.[2] Also, the maternal nutrition plays a major role in maternal and child health and it is an important nongenetic factor in gestational weight gain, fetal development and development of physiological function.

Poor maternal nutritional status is definitely related to adverse birth outcomes but their relationship is very complex and that depends upon many biologic, socioeconomic and demographic factors which vary widely in different populations.[3] So, there is wide variation in obtaining relationship between maternal anthropometric parameters and birth weight.[4] Once we establish this relationship we can modify birth outcomes and reduce neonatal mortality and morbidity as birth weight of an infant is the single most determinant of its chance of survival, healthy growth and development.

Maternal undernutrition is highly prevalent in resource poor settings (10-19%) and this range is very high in sub-Saharan Africa, south central and south eastern Asia and Yemen.[5] Each year around 15 million preterm babies are born (gestational age less than 37 weeks) and 20 million babies are born with low birth weight (birth weight less than

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2.5 kg). More than 95% of this low birth weight babies are born in resource poor setting countries.[6]

Among all anthropometric parameters MUAC is a good indicator of maternal nutritional status that is protein reserve of the body and it represents wasted lean body mass or malnutrition. MUAC is the circumference measured in the left arm at the midpoint between tips of acromion process to tip of olecranon process.

Till now lots of researches have been done to establish best relationship between different maternal anthropometric parameters and birth outcome (especially birth weight) but fewer of them have been able to predict best indicator of birth outcome with greater sensitivity, specificity and accuracy as this relationship varies in different geographical areas that is the cutoff value of different anthropometric parameters are different for developing and for developed countries. So, more studies and researches are needed to predict best indicator of birth outcomes.

So, this study has been taken up with an aim to establish relationship between maternal mid upper arm circumference and baby birth weight in healthy singleton term pregnant women who come for institutional delivery to the Department of O&G, M.K.C.G.Medical College, Berhampur, Odisha.

2. Objectives

1. To find out the relationship between mid-upper arm circumference of pregnant women and its effect on birth weight of their babies.
2. To measure the cut off value of MUAC for prediction of low birth weight among new born children.

3. Materials and Methods

The present study "Mid Upper Arm Circumference in Pregnant Women and its Relationship with Birth weight" was carried out from October 2018 to September 2020in the Department of Obstetrics and Gynaecology, MKCG Medical College, Berhampur.

3.1. Study design

Hospital based cross sectional study.

3.2. Study participants and Sampling

The prevalence of low birth weight children in Odisha is 19.2% (AHS Report).[7] By considering this prevalence, confidence level of 95%, absolute error of 5%, the samples size calculated was 239.

The samples were selected from the pregnant women who came for check-up or admission to the Department of O & G, M.K.C.G. Medical College & Hospital, Berhampur. Healthy term singleton pregnancies were selected for the study. All the healthy term pregnant women with singleton pregnancy at her third trimester and free from any medical or surgical illness, free from any obstetric complications and non-smoker and non-alcoholic were included in this study. Lady who did not give the informed consent, lady whose delivery was preterm, or baby was having any congenital malformation, hydrops foetalis or twin pregnancy were excluded from the study. Women with gestational diabetes, severe anaemia, preeclampsia, chronic hypertension, foetal anomaly, rheumatoid arthritis, thyroid and parathyroid disorders, and hepatic or renal or cardio- vascular diseases were excluded from the study.

3.3. Study procedure

Anthropometric indicators include maternal weight in kg, height in cm, and MUAC in cm. MUAC was measured in the right arm at the level, midway between acromion and olecranon processes in centimetres to the nearest decimal place.

The babies were examined within 24 hr of delivery, and BWs were recorded using the SECA weighing scales (to the nearest 1g). As per the WHO (1995) definition, new-borns weighing less than 2.5 kg were considered as LBW neonates.

3.4. Ethical clearance

Ethical clearance has been obtained from the Institutional Ethical Committee of M.K.C.G. Medical College and Hospital to conduct the study.

3.5. Data compilation and analysis

Both descriptive and inferential statistics were used to analyse the data. Results on continuation measurements were presented with mean and standard deviation (SD) and results on categorical measurements were present in number and percentage. Odds ratios were computed to assess the risk of LBW between various cut-off points of MUAC and 95% CIs were calculated. Adjusted odds ratios from multivariable regression models were also performed. Significance was assessed at 5% of the level of significance.

4. Results

A total of 240 participants were selected for the study. The mean age of the study participants was 25.47 (±3.63) years. Majority of the participants (55.83%) were of aged 19-25 years followed by 25-30 years (35.83%), 6(2.5%) participants in 30-35 years and 14(5.83%) were of aged >35 years.

The anthropometric measurement of study participants was done in term of measurement of height, weight and MUAC. The mean height of the pregnant women was 151.760 (±6.345) cm. The mean weight of the study participants was 51.747 (±8.038) kg and the mean mid-

upper-arm-circumference (MUAC) was 23.042 (±2.566) cm among the study participants (Table 1).

Table 1: Anthropometric measurements of the study participants

Anthropometric Measurements of Mother	Mean (SD)
Height (cm)	151.760 (±6.345)
Weight (Kg)	51.747 (±8.038)
Mid-Upper Arm Circumference (MUAC) (cm)	23.042 (±2.566)

Regarding distribution of MUAC among the study participants, more than one fourth (28.5%) of them had MUCA ranges from 21-23 cm, 66 (27.5%) of them had MUCA ranges form 21-23 cm, 52 (21.7%) had MUCA ranges from >25 cm and 13 (5.4%) of the participant had MUCA ranges from 17-19 cm (Figure 1).

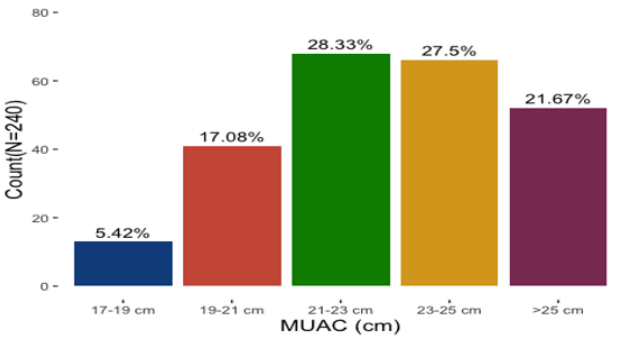

Fig. 1: Mid upper arm circumference of the study participants

Out of 240, 188(78.3%) children had birth weight >2.5 kg (Normal), 48(20.0%) had birth weight <2.5kg (Low birth weight) and only 4(1.7%) had very low birth weight (<1.5kg) (Table 2)

Table 2: Birth weight of the baby born of the study participants

Birth Weight (Kg)	Count (%)
VLBW (<1.5kg)	4 (1.7%)
LBW (<2.5kg)	48 (20.0%)
Normal (>2.5kg)	188 (78.3%)

The mean MUAC of mother with normal birth weight of baby was 23.41 (+2.27) cm and for those with LBW baby it was 21.68 (+2.27) cm. This difference of MUAC in relation of birth weight of the baby was found statistically significant (p <0.001). Linear regression between MUAC and Birth weight among the study participants was performed and it was found a significant (p<0.05) linear positive correlation with correlation coefficient of 0.32 (Figure 2).

The prevalence of LBW with various MUAC group showed a higher proportion (61.54%) of LBW among participants with lower MUAC (17-19cm) as compared to those with MUAC range between 19-21cm (24.39%) and

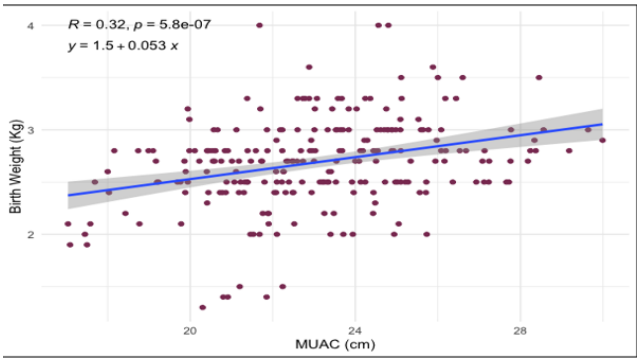

Fig. 2: Linear regression between MUAC and birth weight showing positive correlation

with 21.23cm (29.41%). The proportion of LBW babies was lowest (7.69%) among those having MUAC >25 cm (Table 3)

To determine the cutoff value for prediction of LBW among the children with respect to MUAC value, ROC curve was plotted. ROC curve measured the optimal cut off point for prediction of LBW child form MUAC of the mother was 22.59 with area under the curve was 0.68 (Figure 3)

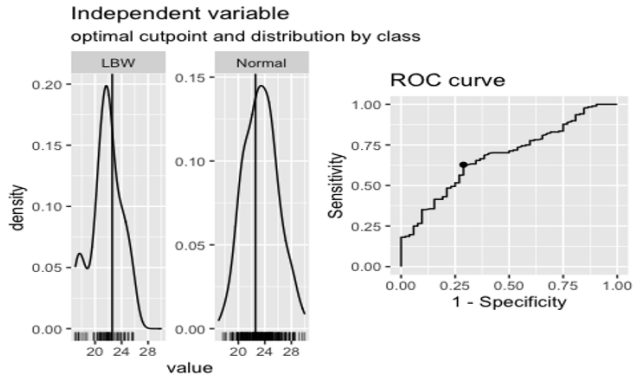

Fig. 3: ROC curve for estimation of cut off value to predict LBW form MUAC of Mother

With the cut-off value of MUAC of 22.59cm, the sensitivity table showed the true positivity was 34.26% and true negativity was 88.64%. Hence, the sensitivity for the cut-off value of 22.59 was 62.77% and specificity 71.55% (Table 4)

5. Discussion

In our study a significant association was observed between maternal MUAC and newborn birth weight (p <0.05). Similar study conducted by Ghosh et al. found a significant association between MUAC and birth weight of the babies with higher proportion of LBW among mothers with low MUAC.[8]

Table 3: Prevalence of LBW among various MUAC groups in the study participants

MUAC (cm)	LBW (N=52)	Normal (N=188)	Total (N=240)	p value
17-19 cm	8 (61.54%)	5 (38.46%)	13 (100.00%)	
19-21 cm	10 (24.39%)	31 (75.61%)	41 (100.00%)	
21-23 cm	20 (29.41%)	48 (70.59%)	68 (100.00%)	< 0.01
23-25 cm	10 (15.15%)	56 (84.85%)	66 (100.00%)	
>25 cm	4 (7.69%)	48 (92.31%)	52 (100.00%)	

Table 4: Specificity and sensitivity table for prediction of LBW

MUAC Values (Cut-off=22.59)	LBW (N=52)	Normal (N=188)	Total (N=240)	p value
<22.59cm	37 (34.26%)	71 (65.74%)	108 (100.00%)	**< 0.01**
>22.59cm	15 (11.36%)	117 (88.64%)	132 (100.00%)	

Our study showed a correlation coefficient of 0.32 between MUAC and birth weight of newborn. In an Asian study conducted by Tang et al.[9] found a significant positive correlation between MUAC and birth weight of the baby with correlation coefficient of 0.34, which are in accordance to this present study. However, study conducted by Mishra et al.[10] found the significant linear relation between MUAC and birth weight with correlation coefficient of 0.57 which is higher than our findings.

A study conducted by Ogbonna et al. for prediction of birth weight from MUAC of mother found that in each unit increase in maternal MUAC resulted in 36.1 gm increase in birth weight whereas in our study, linear equation showed in each unit increase of MUAC, there is increase of 1.55 gm birth weight of the baby which is much lower than previous finding.[11] Similar study conducted by Elshibly et al. found a high correlation (p<0.001) between MUAC of mother and birth weight of the baby.[12]

We found a cutoff value of MUAC of 22.59 whereas systematic review conducted by Tang et al. had found the optimum cut off value of MUAC for the prediction of LBW was 23 cm.[9] Study conducted by Thomas et al. among HIV positive pregnant women to find the association between MUAC and BW, the cut off value obtained for prediction of LBW was 22cm, which is lower than our study.[13] A study conducted by Assefa et al. at Ethiopia found MUAC of 23cm as the cut off value for prediction of LWB and a statistically significant association between LBW and MUAC of less than 23 cm.[14] Verver et al. recommended a cut off value of 23 cm a risk factor for predicting low birth weight babies.[15] WHO collaborative study (1997) showed a cutoff value of 23 cm have a significant risk of delivering LBW babies. (OR 1.9, 95% CI). Mohanty et al studied 395 singleton pregnancies and suggested MUAC cutoff value of 22.5 cm as the best predictor of LBW which was similar to our findings.[16]

6. Conclusion

In our study, among the various maternal factors for the prediction of LBW, the measurement of mid-upper arm circumference (MUAC) can be correlated with birth weight outcome effectively. The mean cut off value of MUAC for the prediction of LBW is of 22.5 cm in our study which falls with the other researches which ranges the cutoff values from 19 to 29. It can be taken as a proxy for the nutritional status of the mother and hence, useful for the prediction of birth weight of the baby. It can be used as an efficient and cost-effective screening tool for LBW.

7. Acknowledgement

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8. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

9. Source of Funding

None.

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