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Research Article

MID-ARM CIRCUMFERENCE AS AN ANTHROPOMETRIC ALTERNATIVE FOR PREDICTING LOW BIRTH WEIGHT AMONG FULL-TERM SINGLET:A PORT HARCOURT STUDY

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A B S T R A C T

Background: Withhigh patronage of unskilled and less trained birth attendants, particularly at rural areas, there is need to finda less expensive and faster technique to identify low birth weight (LBW) babies to ensure prompt intervention and close supervision to reduce post-natal developmental complications. **Aim and Objective:** This study evaluated the use of mid-arm circumference (MAC) as reliable alternative to identify LBW babies in Port Harcourt. **Materials and methods:** The study was a cross-sectional research involving direct linear measurement of the mid-arm circumference (MAC) and birth weight (BW) of 500 singleton babies, using standard procedures. All measurements were taken within 24 hours of delivery at two Tertiary Health Facilities in Port Harcourt from February to November 2014.The obtained data were analysed using Minitab® 2013 (version 17.1.0) Statistical Software. Pearson's correlation analysis evaluated the strength of the relationship between birth weight and MAC, with the regression equation used to determine the cut-off value. **Results:** 19 out of 500 (3.8%) infants had BWless than 2.5kg. The mean weight and MAC of the babies were3.33±0.51kg (males; 3.38±0.52kg, and females; 3.27±0.50kg) and 11.11±0.92cm (males; 11.17±0.88cm, and females; 11.03±0.97cm) respectively. MAC had a significant strong (+ve) correlation with birth weight in both sexes (male; r=0.877and females; r= 0.868). From the generalised regression equation [Birth weight (kg) = -2.04 + 0.483 (MAC)], MACof 9.5cm corresponded to 2.5kg birth weight 'cut-off' value. **Conclusion:** Nigerian babies with MAC <9.5cm can be said to have LBW. MAC is one anthropometric parameters thathas proven to be a reliable alternative for identifying LBW babies and therefore recommended for use, as it does not require any professional skill.

INTRODUCTION

The birth state of an infant can determine the developmental pattern; as babies born with LBW (that is Birth Weight [BW] <2.5kg) are more likely to have poorer outcomes when compared to babies with normal BW.[1,2] Therefore, early identification of LBW babies will create room for proper and effective care,[1,2] to ensure survival and normal development. However, in rural communities of developing countries where local health facilities and delivery is fairly common, it may difficult to measure birth weight due to unavailability of adequate equipment;[3-5] as well as untrained health staff.[1,3,4] This has made the prevalence of LBW common and on the increase.

In bid to discover reliable and less expensive anthropometric parameter which may not require any professional skill that could serve as a surrogate for predicting LBW, researchers found BW could be predicted using,chest circumference [CHC],[3-11] Head circumference,[11,12] mid-arm circumference [MAC],[3,6,7,10] calf circumference [CC],[8,12] and Foot length.[4,11] However, the cut-off obtained from the various studies were region specific with varying values.In view of the above, this study investigated the reliability of MAC as a surrogate to BW, and cut-off for MAC that represented the 2.5kg LBW value for Nigerian babies in Port Harcourt.

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MATERIALS AND METHOD

This study was a cross-sectional analytical research, involving anthropometric measurement of 500new-borns (263 males and 237 females) full-term singleton live births at University of Port Harcourt Teaching Hospital (UPTH) and Braithwaite Memorial Specialist Hospital (BMSH) Port Harcourt, Rivers State for a period of 40 weeks (10months), from February to November 2014.

All measurements were obtained within the first 24hrs of delivery. Birth weight (Fig. 1) and mid-arm circumference

(Fig. 2) were measured using standard methods as described by WHO.[17] Birth weight was taken with the measuring scales currently available in the hospital soon after birth with the neonate naked in a supine position. The Mid arm circumference of the arm was also measured using a non-stretchable plastic-coated measuring tapes, with the newborn lying with arm lateral to the trunk of the body. The position of the mid arm was identified by measuring the length of the infant's left arm from the top of the shoulder to the tip of the elbow; this measurement was then divided into 2 and the midpoint gotten. The circumference was then measured at the midpoint in centimetres. Two consecutive (repeated) measurements were taken for each variable and the mean value calculated to the nearest 0.01kg for BW and 0.01cm for MAC. Newborns with major congenital abnormalities or IUGR were excluded from the study. Ethical clearance from both Hospitals and Written and signed consents were sought and obtained from the parents of the newborns.

The obtained data were analysed using Minitab® 2013 (version 17.1.0) Statistical Software. Pearson's correlation analysis evaluated the strength of the relationship between birth weight and MAC among the sexes. From the general regression equation, the cut-off value was determined.

Fig 1 Baby Weight taken with the baby lying in a supine position

Fig 2 The arm placed lateral to the trunk and the mid arm circumference measured

RESULTS

The mean (±S.D) BW of the infants was 3.33±0.51kg, while the mean MAC of the infants was 11.11±0.92cm; males=11.17±0.88cm and females=11.03±0.97cm (Table 1). The correlation between BW and MAC was positively strong and statistically significant (r=0.870, p<0.01) (r=0.877 for males [Fig. 1] and r=0.868 for females [Fig. 2]).

Table 1 Descriptive characteristics of measured parameters

Parameter	Total (n=500)	Range (min-max)	Male (n=263)	Female (n=237)
BW (kg)	3.33±0.51	1.70 - 5.00	3.38±0.52	3.27±0.50
MAC (cm)	11.11±0.92	7.00 - 14.00	11.17±0.88	11.03±0.97

Note: *n=distribution, Max=Maximum, Min=Minimum, BW=Birth Weight, MAC=Mid-Arm Circumference.*

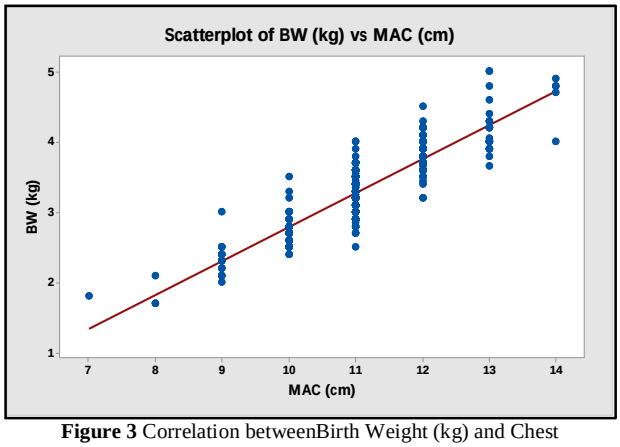

Figure 3 Correlation betweenBirth Weight (kg) and Chest Circumference (cm) for total neonates (**r= 0.870)**

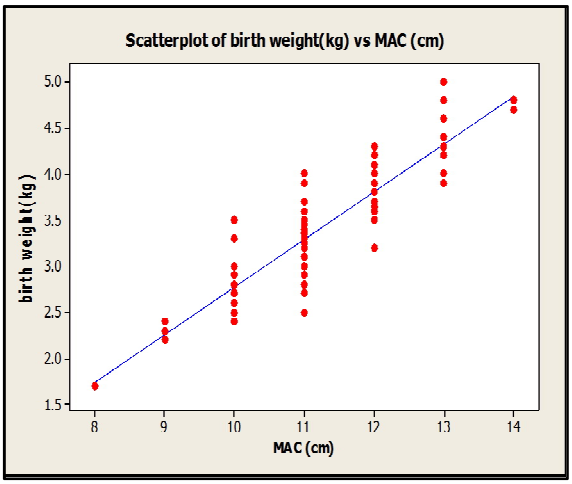

Fig 4 a Correlation betweenBW (kg) and MAC (cm) **r= 0.877**for males

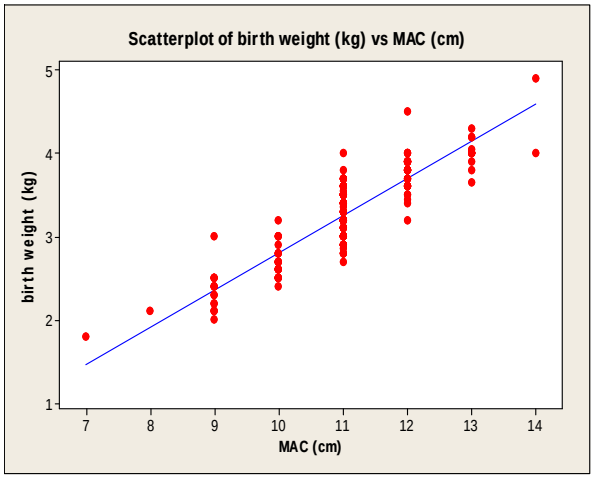

Fig 4 b Correlation betweenBW (kg) and MAC (cm) **r= 0.868** for females

From the generalised regression equation [BW = -2.04 + 0.483 (MAC)], when the birth weight of 2.5kg was substituted to achieve the correspondingvalue for MAC, 9.5cm was the obtained as the cut-off value.

DISCUSSION

In this study, the prevalence of low birth weight (LBW) was 3.8%; with a greater proportion among females (54.8%) when compared to males (22.8%). Higher percentage of LBW in female babies have been reported.[11-13] The mean birth weight (3.33±0.51kg) for the Nigerian babies in Port Harcourt was greater than the values in Ethiopia (2807 ± 691.82g),[11] and India (2348 ± 505gm).[12]

Studies on alternative to the skill-required birth weight (BW) have continued to draw attention in developing countries with limited standard health care facilities and train staff. Head circumference, chest circumference, mid-arm circumference [MAC], and calf circumference [CC], Thigh and Foot length [TC and FC] [4-14] have all been reported to significantly predict LBW; however the debate on which is the most reliable remains unending. In this study, MAC was significantly positively correlated with BW (r=0.870, P<0.01) and the corresponding cut-off value for LBW was 9.5cm. The correlation values and cut-offs vary with different populations; India (r=0.792, cut-off=9.0cm),[3]Ethiopia (r=0.842, cut-off=8.9cm),[3] and Bangladesh (r=0.792, cut-off =9.0cm),[14] but same cut-off valueof 9.5cm for Tanzania.[15]The higher cut-off value for the Nigerian babies could be attributed to greater weight, associated with difference in bone sizeandmuscle mass distribution, which are influenced by the developmental (intrauterine) environment before birth.

For this study, MAC<9.5cm could be regarded as the Anthropometric Risk Indicator (ARI) for LBW.Earlier works has shown that MAC is easier to record, reliable and effective and its application in community situation do not require the attention of a professional healthcare giver.[10,14-17]The use of this parameter would be of great assistance for timely identification of LBW newborns; in order to ensure prompt intervention to prevent post-natal morbidity and mortality.

CONCLUSION

Nigerian babies with MAC <9.5cm can be said to have LBW. MAC is one anthropometric parameter that has proven to be a reliable alternative for identifying LBW babies and therefore recommended for use communities with limited health care professionals.

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