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Intrapartum symphysio-fundal height measurement as a predictor of low birth weight in a low resource setting

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ABSTRACT

Background: Low birth weight (LBW) increases the risk of perinatal morbidity and mortality and of the long term neurologic and developmental disorders. Early identification of LBW is necessary to decrease complications and enhance the survival of the newborn. **Aim:** To determine the usefulness of symphysio-fundal height as a predictor of low birth weight in a low resource setting. **Methods:** This was a prospective cross-sectional study of consecutive 214 parturients who presented in early labour to the Central Hospital Warri (CHW) from November 1, 2013 to February 28, 2014. Their demographic characteristics were obtained using a structured proforma. Three measurements of the symphysio-fundal height (SFH) were taken using a non-elastic tape and the mean of the three readings were calculated to the nearest centimeter. The data obtained were analyzed using statistical package SPSS version-21. **Results:** Two hundred and fourteen parturients delivered during the period. The mean age and parity were 29.45±4.75years and 1.59±1.56 respectively. Twenty of the parturients (9.3%) delivered before 37weeks, 165 (77.1%) delivered at 37-40weeks while the remaining 29 parturients (13.5%) delivered at 41weeks gestation and beyond. The mean birth weight was 3184±502g. SFH measurement of 29-35 cm had a low sensitivity (3.7-37%) but a high specificity, positive and negative predictive values for low birth weight. There was a high sensitivity, specificity, positive and negative predictive values for both normal and macrosomic babies. **Conclusion:** Symphysio-fundal height measurement is a simple, cheap and effective screening test to predict newborn with low birth weight.

Key words: Intrapartum, symphysio-fundal height (SFH), low birth weight, safe delivery, maternal and childhood morbidity and mortality, obstetric care

INTRODUCTION

Low birth weight (LBW) is a major public health problem, contributing substantially both to infant morbidity and mortality. The principal determinants of LBW are duration of gestation and intrauterine growth rate.[1] Low birth weight (LBW) is defined by World Health Organization as a birth weight less than 2500g.[2] Below this value, birth weight specific infant mortality begins to rise rapidly.[2] Birth weight from 1000g to 1499g are very low birth weight, while birth weight from 500g to 999g are extreme low birth weight.[2] Birth weight is governed by two major processes; duration of gestation and intrauterine growth rate. LBW is therefore caused by either a short gestation period or a restricted intrauterine growth or a combination of both. The major determinants of LBW babies in developing countries are poor gestational nutrition, low pre-pregnancy weight, short maternal stature and malaria.[3,4] In developed countries, the most important single factor is cigarette smoking, followed by poor pre-pregnancy weight, prior history of prematurity or spontaneous abortion.[3,4] Worldwide, about 18 million babies are estimated to be born with LBW every year, half of these is in South Asia.[5] Although these LBW babies constitute only 14% of children born, they account for 60-80% of neonatal deaths.6 In Nigeria, the average incidence of LBW babies is 14%.[7] Low birth weight babies have an increased risk of developing cerebral palsy, hyaline membrane disease, apnoea, intra-cranial haemorrhage, sepsis and retro-lental fibroplasia.[8] Intrautering growth restriction (IUGR) babies are far more likely to exhibit growth deficiencies, which appears to be permanent. Such babies remain a burden on government expense in developed countries and a permanent problem for their families in developing countries.[8] Therefore, establishing the foetal weight prior to delivery is very important in resource poor countries because many centers do not have neonatal intensive care units (NICU) to take care of LBW babies, they have to be referred to centers that have such facilities which is often too late. Identifying these LBW babies before delivery will help to increase their chances of survival. Ultrasonography, clinical palpation, gestational age-derived birth weight centiles, maternal self-estimation and symphysio-fundal height measurement remain the main methods of birth weight estimation and each of these methods have varying degrees of accuracy and limitations.[9-11] In developing countries, ultrasonography is not readily available in most health facilities especially in rural areas. Even when available, prohibitive cost prevents access to this tool. Clinical palpation depends on experience, which may be lacking in many obstetric care personnel in these countries. Additionally, approximately 20% of the rural obstetric population in these countries are unsure of their dates.[12] Gestational age-derived birth weights are also unsuitable for these women with unsure dates who cannot afford or access ultrasonography. Symphysio-fundal height (SFH) is defined as the distance in centimetres from the upper border of the symphysis pubis to the top of the curvature of the fundus.[13,14] While it can be measured both ultrasonically and manually, manual measurements of SFH have been shown to be as accurate as ultrasonic assessment and an effective method of determining foetal growth rate and well-being.[13,14] The measurement of SFH is simple, reliable, safe and quick to perform, non-invasive and an inexpensive test to screen low-risk populations, especially in low resource settings where ultrasound facilities may not be available in most small hospitals and clinics.[15] In addition, other health workers can be trained on its use, allowing for early detection of foetal growth anomalies and prompt referral to higher levels of care.[15] SFH measurement with a tape is a reproducible technique that is easily learntand the easy availability of the non-elastic tape makes it attractive for use in foetal weight estimation particularly in developing countries.[16-18] Despite these advantages, it still presents problems with conversion of a measurement to foetal weight estimate. This study sought to determine the use of this non-elastic tape in estimating intra-partum foetal weight and also to provide a chart for conversion of such measurements to foetal weight, especially in resource poor resource areas.

METHODOLOGY

Study site

This study was carried out at the obstetric unit of the Central Hospital Warri (CHW), Delta state. Central Hospital, Warri is a low resource centre. It is a 200-bed hospital in Delta State, South South Nigeria. It functions at the three levels of health care delivery. The average attendance at the antenatal clinic is one hundred and forty (140) to one hundred and eighty (180) patients per clinic visit and one hundred and twenty (120) new patients are booked each week.

Methods

This was a prospective cross-sectional study. Ethical clearance was obtained from the ethical review board of the hospital. The sample size of 214 parturients was determined using the Kish formular. The purpose of the study was duly explained to parturients in the labour ward and an informed written consent obtained. Their socio-demographic characteristics were obtained and documented in the proforma designed for this purpose. Patients with polyhydramnios, oligohydramnios, foetal anomalies, unsure dates, multiple pregnancies, obesity (weight ≥ 90kg), antepartum haemorrhage, eclampsia, ruptured foetal membranes, clinical or ultrasound evidence of uterine fibroids and descent below 2/5th were all excluded from the study. Every woman who presented in labour during the working hours was selected for the study if they met the criteria and gave consent to participate in the study. As soon as the parturients were admitted for vaginal delivery in early active phase of labour (cervical dilatation of 4-5cm), the measurements were taken. The most reliable method of measurement in a supine position with an empty bladder, between uterine contractions was used. The highest point on the fundus was determined by placing a single finger transversely over that point, not necessarily in the midline. The finger was depressed gently, just enough to determine the upper limit of the uterine fundus. The measurement was then taken with a non-flexible tape measure from the skin directly above the upper edge of the pubic symphysis to the marked point at the fundal height. No attempt was made to correct the foetal lie to be perfectly longitudinal. The tape had its markings on the reverse side, so as to reduce the potential for observer bias and digit preference. Three measurements were taken. The mean of the three measurements was obtained to the nearest centimeter. The birth weight of the baby was measured in grams to the nearest 50g by the attending midwives within 30mins of delivery using a functional analogs weighing scale. Frequent checks were made during the study to ensure that the scales were correctly calibrated. Findings were recorded in the structured proforma.

Statistical analysis

The Statistical package SPSS version 21 was used for data analysis. The mean birth weight for each symphysio-fundal height was estimated by fitting a polynomial regression model to the data. The observed birth weight was plotted against symphysio-fundal height to show if and how the variability changes with symphysio-fundal height. The standard deviation (SD) of the birth weights for each SFH was calculated and modeled as a function of SFH. The results are represented in simple percentages, tables and scatter plots.

RESULTS

Two hundred and fourteen of the women who delivered during the study period under review met the inclusion criteria and their data were analyzed. The mean maternal age was 29.45±4.75 years (18 - 44years). The mean parity was 1.59±1.56. The mean gestational age was 37 weeks (30 to 45 weeks). Twenty parturients (9.3%) delivered before 37weeks, 165 (77.1%) delivered at 37-40weeks and the remaining 29 (13.5%) delivered at 41weeks gestation and above. This is shown in table 1.

Table 2 showed that the mean birth weight in this study was 3184 ± 502g (1600 to 4300g). Twenty seven babies (12.6%) weighed <2500g, 176 babies (82.2%) weighed 2500 to 3999g, while 11 (5.1%) weighed 4000g or more. The correlation between SFH and mean birth weight is shown in table 3. SFH of 30 cm had the least standard deviation in birth weight of 311g while 38cm had the highest standard deviation in birth weight of 456g.

The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of birth weights are shown in table 4. For low birth weights, the specificity, PPV and NPV were high (about 100%) but the sensitivity were low (3.7-37%). For normal birth weight infants, all the parameters are high (sensitivity, specificity, PPV and NPV). Predicting high birth weight from SFH >= 40cm, showed a moderate sensitivity (45.5%), high specificity (91.1%), low PPV (21.7%) and high NPV (92%).

Figure 1 showed a positive correlation between SFH and birth weight and Figure 2, showed a scatter plot of mean birth weight against SFH with a linear line showing the appropriate correlation between SFH and birth weight. The birth weight prediction table derived from the scatter plots in figures 1 and 2 are shown in table 5. From the table, the birth weight for SFH 29-45cm can be predicted.

Table 1: Socio-demographic characteristics

Variables	Frequency	Percentage (%)
Age (in years)		
18-25	23	10.7
25-34	15.7	73.4
≥ 35	34	15.9
Parity		
0	61	28.5
1	59	27.6
2-4	83	38.8
≥ 5	11	5.1
GA at delivery		
< 37 weeks	20	9.3
37-40 weeks	165	77.1
≥ 41 weeks	29	13.5

Table 2: Birth weight distribution

Birth weight (grams)	Frequency	Percentage (%)
<2500	27	12.6
2500-3999	176	82.2
≥ 4000	11	5.1
Total	**214**	**100**

Table 3: Symphysio-fundal height (SFH) and mean birth weight

SFH (cm)	Frequency	Mean birth weight (g)	Standard deviation
29	2	1900	424
30	4	2250	311
31	3	2500	436
32	3	2500	400
33	1	2200	421
34	9	2800	447
35	13	2800	400
36	33	3100	490
37	41	3115	378
38	51	3325	456
39	31	3400	375
40	20	3600	321
41	1	3900	
42	1	4000	
43	1	4000	

Table 4: Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of birth weights

SFH (cm)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
29	7.4	100	100	88.2
30	14.8	100	100	89.0
31	11.1	100	100	88.6
32	11.1	100	100	88.6
33	3.7	100	100	87.8
34	18.5	93.1	27.7	93.5
35	3.7	88.2	31.3	90.7
36	92.6	100	100	74.5
37	76.1	68.4	91.7	38.2
38	52.3	73.7	90.2	25.0
39	27.3	97.4	98.0	22.4
40	45.5	91.1	21.7	92.0

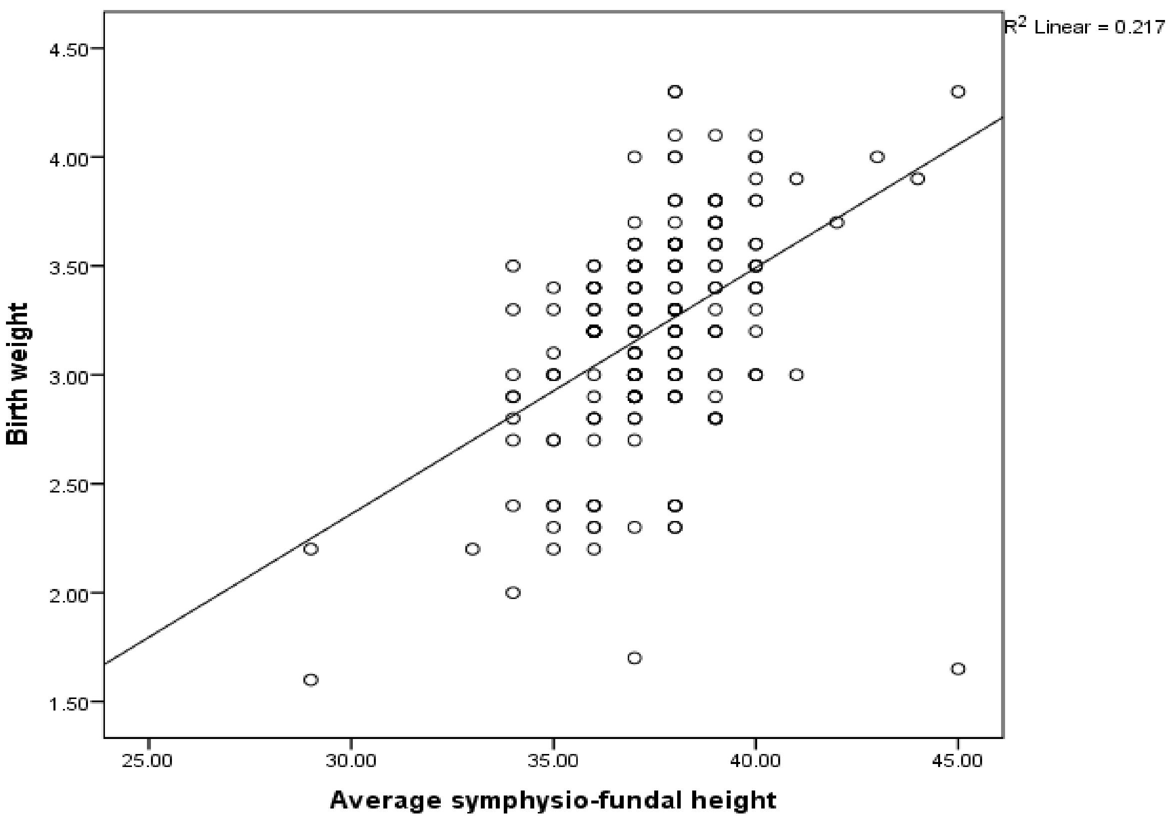

Figure 1: correlation between birth weight and SFH

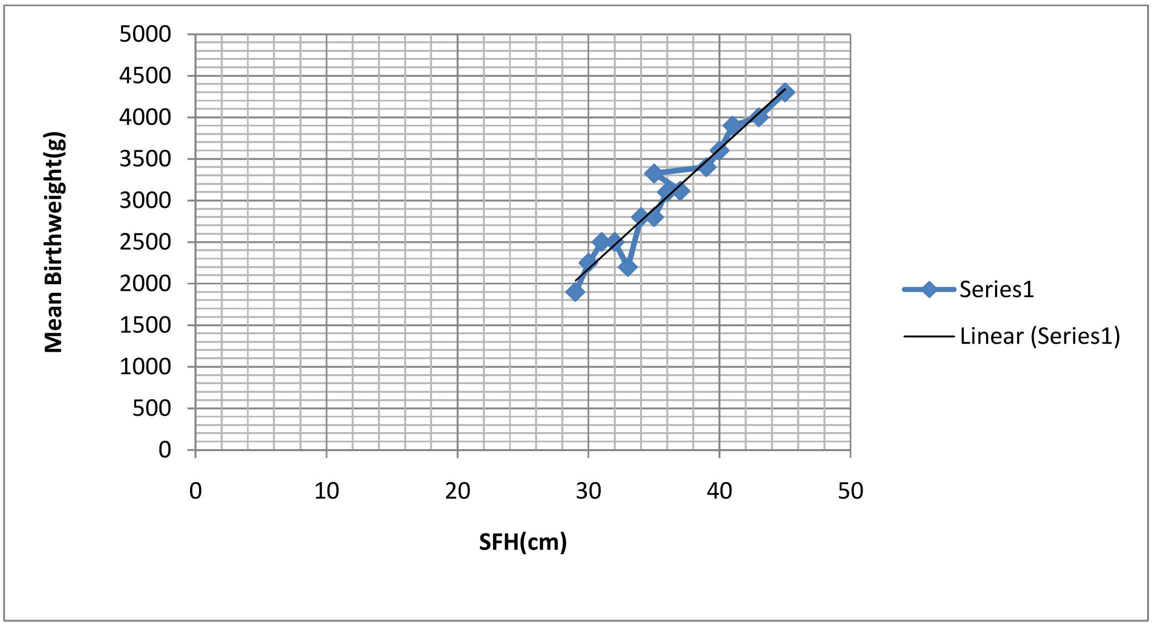

Figure 2: correlation between mean birth weight and symphysio-fundal height

Table 5: Predicted birth weight from SFH using the scatter plot

Symphysio-fundal height (SFH) in cm	Predicted Birth weight(g)
29	2000
30	2200
31	2400
32	2500
33	2600
34	2700
35	2900
36	3100
37	3200
38	3300
39	3400
40	3600
41	3800
42	3900
43	4100
44	4200
45	4400

DISCUSSION

Both foetal macrosomia and intrauterine growth restriction (IUGR) increase the risk of perinatal morbidity and mortality and of long term neurologic and developmental disorders.[19] Identification of IUGR after 37 weeks of gestation is an indication for delivery to reduce the risk of foetal mortality.[19] Accurate prediction of foetal weight has been of great interest in obstetrics. As foetal weight cannot be directly measured, it must be estimated from foetal and maternal anatomical characteristics such as the symphysio-fundal height (SFH) measurement. Estimation of birth weight by symphysio-fundal height measurement is a useful alternative where ultrasonography is not available. The SFH derived birth weight will be found more useful in clinical situations where knowledge of the minimum, maximum and approximate foetal weight are all required for clinical decision-making.

The average standard deviation of 502g for birth weight (BW) gotten in this study is close to that of 450g for clinical palpation and biparietal diameter (sonography) reported by other researchers.[12,20,21] It was also noted that the standard deviation (SD) for low birth weight (LBW)was similar to the SD for normal weight babies. This study showed that prediction of low birth weight with SFH had a low sensitivity but a high specificity, PPV and NPV. These findings corroborate the results by earlier workers.[10,12,22,23] However, this is at variance with other studies that showed a high sensitivity for prediction of low birth weight.[16,21] This difference may also be due to differences in population, number of samples and duration of data collection. This showed that low birth weight infants can be predicted from SFH and the sensitivity can be improved with larger sample sizes. The prediction of normal birth weight infants had a high sensitivity, high specificity, high PPV and also a high NPV. This finding is similar to all the previous studies reviewed.[10,12,16,21] This may be because normal weight infants constituted the majority in all of these studies. Also, the prediction of high birth weight infants had moderate sensitivity, similar to previous reports.[10,12,16,21] The correlation coefficient revealed a good correlation of SFH with BW as with previous reports from earlier studies.[10,12,21,23] The birth weight prediction table derived from this study will be found most useful in clinical scenarios where knowledge of the average BW is required to make clinical decisions. This is because the average birth weight can be read off the table if the SFH is measured. Therefore, a woman with a previous difficult delivery of a 4000g baby but with SFH measurement of 37cm at term in the index pregnancy may be allowed a vaginal delivery. Also, based on the chart, a SFH measurement of 29cm will produce an average BW of 2000g, therefore the parturient can be counseled on the need for a paediatrician and possible referral to a center with neonatal care. This study has shown positive correlation between SFH and BW. It has also shown that SFH can predict LBW as well as normal BW. A chart for the prediction of BW from SFH was developed from the study. So, in resource poor settings and centers where ultrasound scan is not available for women in labour, this chart becomes very useful in estimating birth weight.

Limitations

The study was done within a limited time frame thereby limiting the sample size, a larger sample size may have improved the sensitivity. Also, the height of the parturient was not taken into consideration which may have an effect on the birth weight.

CONCLUSION

This study has shown that SFH can predict birth weight even for low birth weight infants and is a useful alternative to ultrasonography. The birth weight prediction table derived can be applied in primary health care centers or hospitals that do not have either ultrasonography or experienced personnel.

RECOMMENDATION

SFH measurement holds a great promise for use in developing countries. It is a cheap, simple and easily applicable method of predicting birth weight especially in low resource settings. However, to accept it as a screening method for foetal weight estimation, future research with a larger sample size is recommended.

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