# PARTURIENT SYMPHYSIO-FUNDAL HEIGHT AND ABDOMINAL GIRTH MEASUREMENTS TO PREDICT BIRTH WEIGHT AT MUHIMBILI MEDICAL CENTRE, DAR-ES-SALAAM, TANZANIA

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## Summary

**Birth weight is known to influence morbidity and mortality. Simple measures to predict birth weight before delivery would therefore be useful in order to plan a delivery. Maternal parturient symphysio-fundal height has been used to detect Low Birth Weight. This study aims at predicting the fetal weight using the maternal symphysio-fundal height and abdominal girth.**

**A prospective study was done on 600 pregnant women admitted in labor. A detail anthropometric measurement was done and correlated with birth weight after delivery. Symphysio-fundal height and abdominal girth measured to the nearest centimeter positively correlated with birth weight. The coefficient of correlation was 0.74 and 0.69 respectively with a significance of p<0.001. Gestational age had a poor correlation with birth weight (Coefficient of correlation 0.01 and p >0.295). A formula was derived for the estimation of birth weight using these two parameters viz: Birth weight = Bo + B1 (Abdominal girth) + B2 (symphysio-fundal height) where B0 is a constant =2.61, B1 (partial regression coefficient) = 0.32 (Standard deviation 0.002) and B2 (partial regression coefficient) = 0.081 (Standard deviation 0.004).**

**The sensitivity in detecting birth weight below 2 kg was 88.2% and the specificity was 84.3%. While the specificity for detecting birth weight above 3.8kg was 83.3% and a specificity of 68%. The Symphysio-fundal height and abdominal girth could predict the birth weight more closely than the gestational age.**

**Key words:** Symphysio-fundal height, abdominal girth, parturient, prediction, birth weight.

## Introduction

Birth weight is known to influence perinatal mortality. In a study reported by Manji et al 1998, it was noted that LBW carried a 3 fold increased risk of mortality and a 7 fold increased risk of morbidity.(1) Simple techniques for estimation of fetal weight can be useful in developing countries for various reasons. First, these are simple methods; secondly they can be used in anticipation of LBW delivery and therefore can be transferred in-utero to institutes where special care is available for the neonates.

Surrogate measurements to predict fetal weight or neonatal weight have been used in various circumstances in Tanzania. Ngowi J in 1990 used neonatal anthropometry for estimation of birth weight.(2) Ramaiya in 1994 used newborn's arm circumference as a screening tool for Low Birth Weight and correlated this with maternal anthropometry (nutritional status).(3) Walraven et al in 1995 developed a symphysio-fundal height chart for estimating fetal weight and found that the use of Cardiff chart may not be applicable in Tanzanian setting.(4)

This study therefore was done to find out if we could use maternal anthropometry in terms of abdominal girth and sympysio-fundal height in the estimation of fetal weight in our setting.

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## Methodology

This prospective study was done in the labor ward of Muhimbili Medical ceentre for 3 consecutive months. This is a tertiary referral hospital in Dar-es-Salaam, Tanzania. It provides specialized care, has research activities and teaching of Medical students. The population of Dar-es-salaam is 3.0m and the annual number of deliveries is 30,000-32,000 per annum. The common causes of referral is anemia, false labor, hypertension and other problems such as antepartum hemorrhage, twin pregnancy and bad obstetric history.

## Study population

Patients admitted in the labor ward with labor pains.
Exclusion criteria:

1. Polyhydramnious (On clinical as well as Ultrasonographic diagnosis)
2. Multiple pregnancy (Mostly on clinical examination and/or records of antenatal card)
3. Obese ( Defined as body weight above 20% of the normal for age and BMI above the 97$^{th}$ centile)
4. Parturient with engaged presenting part ( This was assessed by the author and an experienced midwife)

Sample size was calculated using the EPI info version-6 program.

## Selection of patients

Parturient in labor who verbally consented to have measurement s done during labor and satisfied the entry criteria were recruited into the study. Detail history included parity, antenatal history, marital status, education and so on. Physical examination was done by the Obstetrician and author, and included weight, height, systemic examination and fundal palpation. Emphasis was paid on the menstrual history and this was used as basis for calculating the expected date of delivery. Congruancy was established using fundal height.. After emptying the bladder, the symphysio-fundal height was taken using a non-elastic, non-stretchable tape calibrated in centimeters. This was done from the midpoint of the upper border of symphysis-pubis to the heighest point on the uterine fundus.

The abdominal girth was taken at the greatest enlargement of the abdominal girth, usually just above the umbilicus. Since those with polyhydramnious, obesity and multiple pregancny were excluded already, there was no control for these factors.

The birth weight of the baby was recorded after the initial stabilization period using a seca scale to the nearest of 10 grams. The gestational age was also estimated using the Dubowitz criteria after delivery, by an experienced Pediatrician.(5)

**Data analysis**

The Social Sciences package (SPSS PC+) and the STATA program was used. Various variables were tabulated and statistics calculated. The Coefficient of correlation was also calculated. An equation was derived form the associations and this was furthering tested with another 100 sample of mothers. The specificity and sensitivity of this was also calculated.

**Results**

Six hundred parturient mothers were enrolled for the study. The age ranged from 15-40 years. There were 72 in the age range 15-19 (12% and 51 (8.5%) between 35-40 years. The rest were between 20-34 years age. The parity of 81.7% of the mothers was between 1-3, while the rest had higher parities. The highest was in one who had parity 8. The mean parity was 2.4.

The majority of the women were at term (92%), while only 43 (8%) were below 37 weeks. The mean gestation age was 40 weeks, and range was 30-42 weeks. The distribution of gestational age and mean birth weight in each group is indicated in table 1.There was no correlation (coefficient of correlation r= 0.01) between the gestation age from obstetric calculation and the birth weight. Among those with preterm delivery ( which included all infants from 30-36 weeks in this study), 60% had a birth weight below 3 kgs.

Table 1. The distribution of birth weight and mean gestational weight.

| Gestational age n weeks (no.) | Mean birth weight (kgs) | Std.D |
|---|---|---|
| 30-32 (n=11) | 2.9786 | 0.5957 |
| 33-34 (n=11) | 2.6429 | 0.4429 |
| 35-36 (n=21) | 2.9353 | 0.6151 |
| 37-38 (n=164) | 3.0947 | 0.4566 |
| 39-40 (n=221) | 3.0987 | 0.5000 |
| 41-42 (n=172) | 3.0976 | 0.494 |

r=0.01, (p>0.295)
Std. D = Standard deviation

The symphysio-fundal height and mean birth weight distribution is indicated in table 2 and figure 2. There was a good correlation (coefficient of correlation r= 0.74). The mean symphysio-fundal height was 34.5cm (standard deviation 3.25) with a range of 27-45 centimeter. The majority of women in the study group (69.5%) had a symphysio-fundal height ranging from 31.3-37 cm with a mean birth weight of 3.036 kg. The percentage of women with babies of birth weight less than 2.5kgs decreases from 97% to 6% as symphysio-fundal height increases from 27-29cm to 37.1-39cm respectively.

Table 2. Symphysio-fundal height and birth weight.

| Symphysio-fundal height in centimeter (no) | Mean birth weight in kgs | Std.D |
|---|---|---|
| 27-29 (n=34) | 2.4074 | 0.2646 |
| 29.1-31 (n=39) | 2.66367 | 0.3674 |
| 31.1-33 (n=140) | 2.8336 | 0.3044 |
| 33.1-35 (n=138) | 3.0076 | 0.3174 |
| 35.1-37 (n=139) | 3.2673 | 0.3673 |
| 37.1-39 (n=50) | 3.54 | 0.3904 |
| 39.1-41 (n=38) | 3.6987 | 0.3293 |
| 41.1-43 (n=5) | 4.000 | 0.3937 |
| 43.1-45 (n=7) | 4.2071 | 0.4188 |

Std D= Standard deviation.

Figure 1 indicates the graph, which shows a significant linear correlation between the symphysio-fundal height and the birth weight. The formula for the predicting the weight with symphysio-fundal height is indicated.

The mean abdominal girth for the entire study group was 90.6cm (SD 6.6) with a range of 73-105cm. The mean birth weight increased with corresponding increase in abdominal girth. The percentage of babies with birth weight below 2.5 kg decreased from 100% to 3.9% as the girth increased from 73-77 to 101.1-105cm respectively. Table 3 and Figure 2 indicate the relation of the abdominal girth and birth weight.

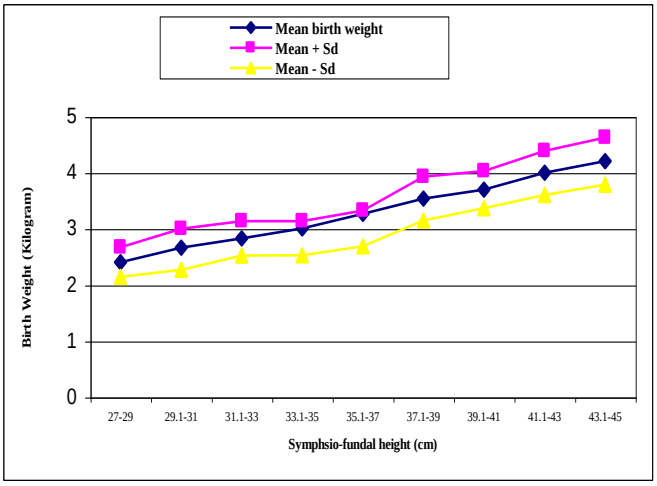
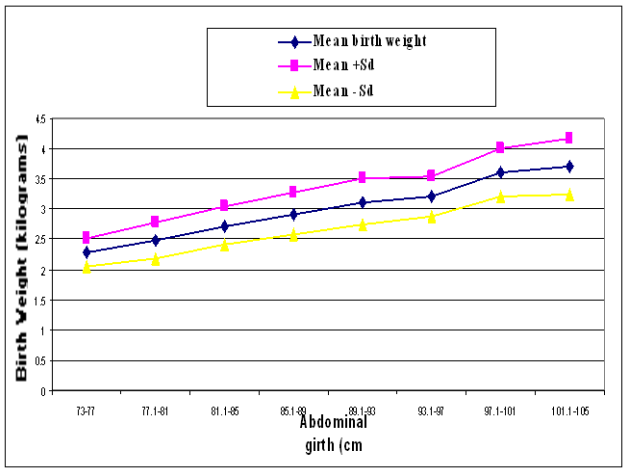



Figure 1. Symphsio-fundal height and birth weight

Table 3. The abdominal girth and mean birth weights

| Abdominal girth in cm | Mean birth weight in kg | Std D |
|---|---|---|
| 73-77 | 2.875 | 0.2416 |
| 77.1-81 | 2.4793 | 0.2858 |
| 81.1-85 | 2.7226 | 0.3164 |
| 85.1-89 | 2.9246 | 0.3591 |
| 89.1-93 | 3.1164 | 0.3749 |
| 93.1-97 | 3.2115 | 0.3169 |
| 97.1-101 | 3.613 | 0.421 |
| 101.1-105 | 3.7137 | 0.4689 |

Coefficient of correlation r= 0.69, Std D= Standard deviation




Birth Weight =BO + B1 (Abdominal girth)
BO (constant) = 1.54
B1 (Regression Coefficient) = 0.51 (Std error 0.002)

Figure 2. Abdominal Girth and Birth Weight

Table 4. Correlation between the birth weight, gestational age, symphysio-fundal height and abdominal girth.

| Parameters | Coefficient of correlation (r) |
|---|---|
| Birth weight : Symphysio-fundal height | 0.74* |
| Birth weight : Abdoinminal girth | 0.69* |
| Birth weight : Gestational age | 0.01 |
| Symphysio-fundal height: Abdominal girth | 0.48* |
| Symphysio-fundal height: Gestational age | 0.04 |
| Abdominal girth: Gestational age | 0.03 |

*r = significant at a level of p<0.001

The correlation between the birth weight, gestational age, symphysio-fundal height and abdominal girth showed the relation as indicated in Table 4. A multiple regression analysis with birth weight as dependant variable and symphysio-fundal height and abdominal girth and independent variables was done. The best weight was best correlated with symphysio-fundal height and then with abdominal girth.

The best fit with the use of the symphysio-fundal height was: Birth weight = B0 + B1 (symphysio-fundal height), where B0 is a constant with a value of -0.81+/-0.143, and B1 is the regression coefficient with a value of 0.112+/-0.004. Similarly, the best fit for the use of abdominal girth was: Birth weight = B0 + B1 (abdominal girth), where B0 is a constant with a value of -1.54, and B1 is the regression coefficient with a value of 0.51 +/-0.002.

When using both the anthropometric measurements, the best fit obtained was: Birth weight = B0+ B1 (Abdominal girth) + B2 (symphysio-fundal height) where B0 is a constant =2.61, B1 (partial regression coefficient) = 0.32 (+/- 0.002) and B2 (partial regression coefficient) = 0.081 (+/- 0.004).

This formula was then validated to obtain the sensitivity and specificity for birth weights of less than 2 kgs and those with birth weight above 3.8 kgs as indicated in the table 5.

Table 5. Sensitivity and specificity of the formula for deriving birth weights below 2.0kgs and above 3.8 kgs.

| Observed birth weight | Calculated birth weight (kg) | | | | Sensitivity | Specificity |
|---|---|---|---|---|---|---|
| | ≤2 | >2 | <3.8 | ≥3.8 | | |
| ≤2kg | 15 | 2 | - | - | 88.2% | 84.3% |
| >2kg | 13 | 70 | - | - | | |
| <3.8kg | - | - | 60 | 88 | 83.3% | 68.18% |
| ≥3.8kg | - | - | 2 | 12 | | |

## Discussion

This study has attempted to evolve a simple technique using 2 anthropometric measurements in parturient mothers. The technique is simple and takes less than five minutes to record. Maternal symphysio-fundal height and abdominal girth before the presenting part engaged showed a good correlation with expected birth weight. The coefficient of correlation was 0.74 and 0.69 respectively as indicated in tables 2&3 and figures 1&2.

Several studies elsewhere have indicated similar findings. Walvaren et al in 1995 studied 1509 women who had singleton delivery with data available on birth weight and symphisio-fundal height. They found that fundal height was superior in predicting the birth weight than maternal height, pre-delivery weight or mid-upper arm circumference. This study further showed that at a cut-off point of 30cm for symphysio-fundal height, the detection rate of low birth weight babies and those below 2000grams was 66% and 68%, while at a cut-off point of 38 cm, the detection rate of large for date (>4 kilograms) or twin delivery was 76%.[4] In our study the prediction of a birth weight below 2 kilograms using both the measurements was 88.2%, while for predicting the weight of more than 3.8 kg, the sensitivity is 83.3% (Table 5)

Similarly, Mohanty et al in 1998 showed a coefficient of correlation of 0.74 with a prediction rate of 77% using a cut-off point of 30 cm for low birth weight.[6] Studies have been done to increase the sensitivity and specificity of anthropometric measurement. These studies include the use of biparietal diameter, gestational age, fetal abdominal circumference, maternal nutritional status and so on.7-11 All these studies have indicated that the use of symphysio-fundal height can be the most useful measurement. However, this study uses the combination of symphysio-fundal height and abdominal girth, both of which have been found to augment the sensitivity and specificity. Gestational age from the history was not a good predictor of birth weight as seen in table 1 and table 4. This could be due to several reasons. First, it could be due to difficulty in obtaining correct dates from the mothers. Secondly, some women conceive during the lactation amennorhoea period, thus dates may not be accurate. There is also a high incidence of intra-uterine growth retardation and therefore in these situations gestational age is not a useful predictor. [12]

While after delivery, assessment of gestational age can be done on the baby with fair accuracy using the Dubowitz method and has been correlated with birth weight (Manji et al 1998) this is not ideal since transporting a Low Birth Neonate from place of delivery to a specialized care center may be hazardous.[1]

This study therefore provides a simple measure of parturient anthropometry for estimation of birth weight. The use of simplified charts such as that suggested by Mathai et al 1987,Mohanty et al 1998, and Thompson et al 1999 should be considered.[6,7,9]

## Conclusion

It is possible to derive the birth weight using simple techniques of maternal anthropometric measurements in resource poor settings. Symphysio-fundal height and Abdominal girth can both be used to increase the efficiency of predicting the birth weight.

## Recommendation

There is a need to have a meta-anlaysis of all the available studies and standardize a simplified formula for use in resource poor settings.

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