Symphysis Fundus Height Measurements during Labour: A Prospective, Descriptive Study

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ABSTRACT

This study was conducted to determine the correlation between symphysis fundus height (SFH) measurements and infant weight. It was also to examine whether descent of the fetus or rupture of the membranes affects the relationship and to calculate a simple formula for estimation of fetal weight. A descriptive prospective study design was used. The setting was the teaching hospitals in Johannesburg. Results show that there is a good correlation between SF measurements and birthweight (r = 0.56) and also between the product of SF measurements and abdominal girth (r = 0.57). The correlation of abdominal girth alone and birthweight was less significant (r = 0.47). Rupture of the membranes has minimal effect on the measurements. The correlation of SF measurements with birthweight was highest when subtracting engagement of the head (in fifths above the pelvic brim) from the SF measurement (r = 0.64). In conclusion, fundal height among women with similar size fetuses varies widely. The formula created from the observations was not sufficiently accurate to be clinically useful. The primary value of SF measurements is to assess fetal growth over time by repeated measurements in individual pregnancies. (*Afr J Reprod Health;* 4[1]:48-55)

RÉSUMÉ

Les mesures de la hauteur du fond de la symphyse pendant l'accouchement: étude perspective descriptive. Cette étude avait pour but de déterminer la corrélation entre les mesures de la hauteur du fond de la symphyse (HFS) et le poids infantile. L'étude se donnait aussi la tâche d'établir si la descente du foetus ou la rupture de membranes a un effet sur les rapports et de calculer une simple formule pour l'estimation du poids de foetus. Une organisation de l'étude perspective descriptive a été utilisée dans ce travail encadré dans des Centres Hospitaliers Universitaires à Johannesbourg. Les résultats démontrent qu'il existe une bonne corrélation entre les mesures FS et le poids de naissance (r = 0.56) et aussi entre le produit de mesures FS et le volume de l'abdomen (r = 0.57). La corrélation du volume de l'abdomen seulement et le poids de naissance était moins significative (r = 0.47). La rupture de membranes n' a que d'effets minimaux sur les mesures. La corrélation des mesures FS avec le poids de naissance était plus élevée au moment de soustraire l'engagement de la tête (en cinquièmes au-dessus du bord pelvien) de la mesure FS (r = 0.64). En conclusion, la hauteur fundique varie beaucoup parmi les femmes qui ont les foetus de même taille. La valeur primaire de mesures FS est d'évaluer la croissance foetale au cours d'une période à travers des mesures répétées de grossesses individuelles. (*Rev Afr Santé Reprod* 2000; 4 [1]:48-55).

KEY WORDS: *Symphysis fundus height, labour, fetal growth*

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Introduction

Identification of the at-risk fetus represents one of the main problems in modern obstetrics, in spite of a wide range of clinical, biochemical and ultrasonographic techniques available.[1] Ultrasonographic measurement including biparietal diameter, head circumference, abdominal circumference and femur length, are reasonably sensitive for diagnosing impaired fetal growth, detecting about 85% of low birthweight babies,[2] but it is not readily available as a screening method in many hospitals, particularly in developing countries.

Clinical estimation of fetal weight by external palpation has been found to give errors exceeding 800g in about 50% of cases,[2] and in term pregnancies to be as inaccurate as guess work.[3-6] Measurements of symphysis fundal height (SFH) with a tape along the anterior abdominal curvature have met with varying degrees of success in estimating fetal size. Some authors found graphic presentation of symphysis fundal height measurements to monitor fetal growth during pregnancy very accurate and useful,[5,8-14] whereas other authors found this method not sensitive and specific enough.[15-18] The predictive effect is said to be maximum at around 32 weeks of pregnancy.[7,19,20] Measurements of maternal abdominal circumference have also been used by several authors,[21,22] but these measurements are influenced by biological variations such as skin fold thickness and maternal weight.[3,23] Walraven et al[24] compared the value of different maternal anthropometric indices for predicting birthweight and found symphysis fundal height a better predictor than maternal height, pre-delivery weight or mid-upper arm circumference.

Intrapartum birthweight estimation is often needed to give an indication of viability, the need for referral to a centre with neonatal facilities, the method of delivery for breech presentations or the risk of shoulder dystocia.[10,25] The purpose of this study was to evaluate the extent to which variables that change during the course of labour influence symphysis fundal height measurements and whether it is possible to derive a correction factor for estimation of birthweight, taking these changes into account.

Materials and Methods

A descriptive prospective study was designed. After approval by the Committee for Research on Human Subjects of the University of the Witwatersrand, 248 patients admitted to Coronation, JG Strijdom and Baragwanath Hospitals for labour and delivery were recruited. Patient selection criteria were age >18 years, singleton pregnancy, live fetus, longitudinal lie, no major congenital abnormality, established labour and no immediate indication for caesarean section. During routine admission, baseline data were recorded for age, parity, gravidity, period of amenorrhoea, gestational age by sonar (if done antenatally), weight, height and possible antenatal complications. Women who fulfilled the criteria were then asked to participate in the study. After verbal consent was obtained, the following findings were recorded: time of admission examination; symphysis fundus height (SFH) measurement; abdominal girth; engagement of the head; cervical dilatation and effacement; station of the head (in fifths above the pelvic brim); membranes intact or ruptured and a subjective assessment of the women's general appearance made (thin – average – obese).

Uterine height measurements were taken with a metric tape made of non-elastic material. The measurements were taken from the upper border of the symphysis pubis to the highest point of the uterine fundus lying in contact with the abdominal wall. The fundus was defined by gentle pressure exerted in a plane at right angles to the abdominal wall. Measurements were recorded to the nearest 0.5cm. No correction for the status of the bladder was made. The measurements of abdominal girth were also taken with a non-elastic metric tape at the level of the umbilicus at the end of a normal expiration. The patients were re-examined approximately every two hours until delivery, for change in SFH measurements, engagement of the head, cervical dilatation and status of the membranes. After delivery, records were made of mode of delivery, birthweight of the baby, sex, Apgar scores, head circumference and length.

Linear regression analysis was performed between symphysis fundus height measurements and birthweight, taking into account factors that might influence these measurements. Spearman's rank correlation was used as a measure of correlation between SFH and birthweight, the product of SFH and abdominal circumference and birthweight, and abdominal circumference and birthweight. *Statgraphics Version 7.1* statistical package (Statistical

Graphics Corporation 1993) was used for the analysis.

Results

Baseline data were obtained from 248 patients, 191 patients had a re-examination after a mean of 158mins and in 50 patients another reassessment was possible (mean 160mins later). Most of the patients delivered before a second reassessment was due.

Table 1 shows the clinical characteristics of the women. The median weight was 63kg. Abdominal girth was within normal range with a median of 96cm. The birthweight ranged from 800 to 4415g with an average weight of 2900g and a median of 3075g (Table 2). The data for symphysis fundus height, cervical dilatation and engagement at each consecutive examination are given in Table 3.

Table 1 **Maternal Baseline Characteristics**

	Median	Range
Age (yr.)	24	19–42
Parity	1	0–6
Gestational age (dates)	39	27–44
Gestational age (sonar)	39	25–42
Weight (kg)	63	45–99
Height (cm)	157	145–176
Abdominal birth (cm)	96	78–123

Table 2 **Neonatal Outcome Variables**

	Median	Range
Birthweight (g)	3075	800–4415
Apgar (1min.)	8	0–10
Apgar (5min.)	9	0–10
Head circumference (cm)	34	24–48
Length (cm)	50	31–61

Table 3 **Assessments**

	Baseline	1st Assessment (158min)	2nd Assessment (160min)
n	248	191	50
SFH	33 (23–44)	32 (23–43)	32 (26–43)
Cervix (cm)	5.2 (0–10)	7.3 (2–10)	7.4 (4–10)
Engagement	2.9 (0–5	2.2 (0–5)	2.2 (1–4)

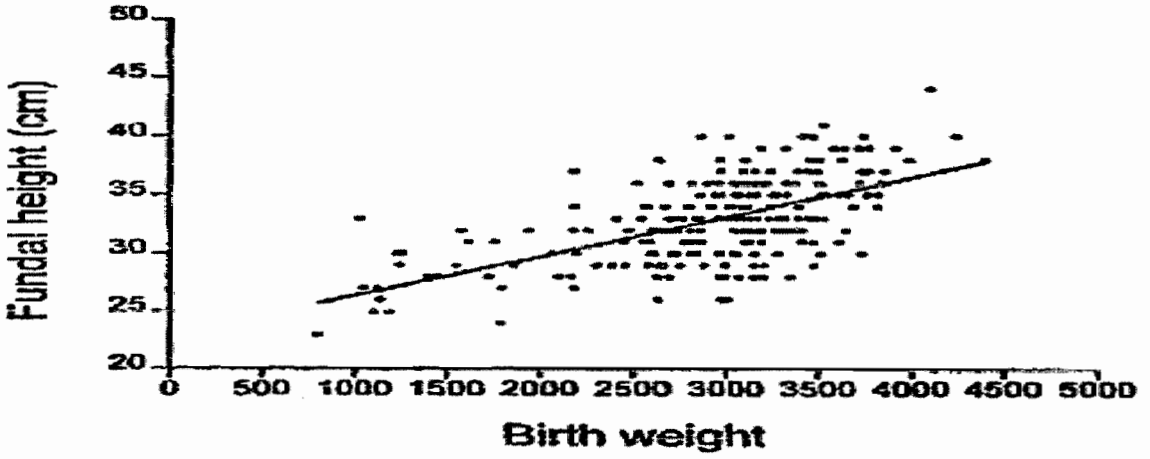

Figure 1 **Correlation between Symphsis Fundus Height and Birth Weight**

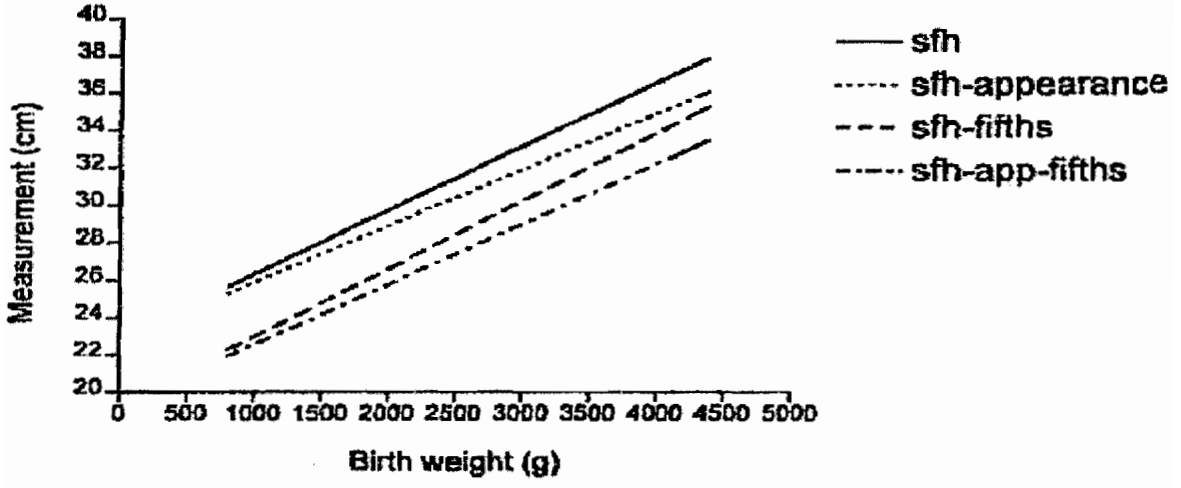

Figure 2 **Sysphysis Fundus Height — Fifths Measurements and Correlation to Birth Weight**

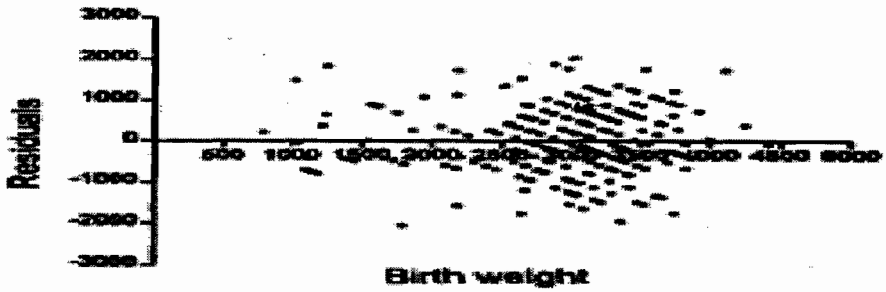

Figure 3 **Residuals Showing the Deviation of the Estimated from the Actual Birth Weight**

Correlation between symphysis fundus height measurements and birthweight was highly significant ($r = 0.56$ and $p = 0.000$ [Figure 1]). The product of SFH and abdominal girth correlated well with birthweight as well ($r = 0.57$, $p = 0.000$). Abdominal girth alone and birthweight correlated less well ($r = 0.47$, $p=0.000$). Values obtained by subtracting engagement of the head in fifths from the SFH measurement showed a higher correlation with birth weight than SFH alone ($r = 0.64$, $p = 0.0000$ [Figure 2]). From the linear regression equation, a formula was created to estimate the birth weight from the measurements obtained by subtracting 20 as the y-intercept and engagement in fifths, then multiplying the value by the factor 300 for 1/slope (estimated birth weight = (SFH – fifths – 20×300). Figure 3 is a graph of residuals showing the deviation of the estimated from the actual birth weight.

Discussion

Prematurity and low birthweight are major causes of perinatal morbidity and mortality in developing countries, the incidence being around 40%,[5,7,26] compared with around 6% in developed countries. Antenatal estimation of birthweight is known to be difficult and inaccurate. On the other hand, birthweight correlates well with perinatal outcome.[26] Ultrasonographic weight estimation to detect the fetus at risk is usually not available in peripheral hospitals and midwives' units. Even if ultrasound is available, measurements are likely to be more inaccurate during labour, especially if the membranes are ruptured and the presenting part is engaged into the pelvis, because these factors make ultrasound visualisation difficult.

Clinical estimation of fundal height is practised widely to predict birthweight, although proven un-

reliable.[5,7,27,28] Symphysis fundus height measurement with a tape seems a simple clinical method, because it is cheap, readily available, non-invasive and acceptable to patients.[8,29,30]

Growth charts have been developed for different population groups, considering the influence of race, weight and height on symphysis to fundal height, and used successfully during the antenatal period to detect fetal growth abnormalities by different authors,[31-35] although some questioned their usefullness.[4,15,16,36] Others found them accurate only if the period of amenorrhoea was known,[5,37] or when measurements were combined with an ultrasound examination.[7,12]

Intrauterine death in small for gestational age babies occurs mainly in the last two to three weeks of pregnancy. Maternal risk anamnesis and early detection of pregnancy complications are important aspects in decision-making and should be used in combination with a standard growth chart.[38-40] There are only a few studies which consider the patient presenting in labour.[25,30,41,42] Very often one is confronted with a patient in whom delivery of a premature baby might be imminent. The decision to transfer a patient to a secondary or tertiary care centre and the mode of delivery are to a large extent determined by estimated fetal weight. We tried to assess whether SFH measurement on a patient in labour would predict birth weight more accurately by including variables such as the women's appearance, status of the membranes, engagement of the head, etc. The results of our study do not confirm the findings of Hoelscher et al[41] that a SFH measurement of 29cm reasonably predicts babies with a birthweight less than 2.0kg.

The results show wide variation in fundal height between women with similar size fetuses, which was influenced by the general physical appearance of the patient. As in Belizan's study,[7] there was no variation in the distribution of SFH measurements due to the status of the membranes, but unlike Belizan[7] and Indira,[43] engagement of the head was found to be an important factor. These findings agree with the studies of Lindhard[36] and Westin.[34] Engstrom examined the effect of bladder volume on fundal height measurements. According to this study, the prevoid fundal height measurements were significantly higher than the postvoid fundal height measurements, but the differences were significantly smaller in women who had voided within 30mins before measurements were obtained.[30] We neither recorded bladder volume nor did we correct the measurements for it, but certainly this point should be taken into account as it seems to influence measurements as much as does engagement of the head. As have others, we found a good correlation between SFH measurement and birthweight.[23,27] The correlation between the product of SFH and abdominal girth was slightly better,[20,23] whereas abdominal girth measurements alone showed poorer correlation with birth weight. These findings have been described before.[27,43] Abdominal girth is more influenced by maternal weight and skinfold-thickness than is fundal height measurement.

We found that engagement of the fetal head was associated with a reduction in symphysis fundus measurements on average of about 1cm per fifth of head above the brim from 4 fifth to 1 fifth. Measurements in obese women exceeded those in thin women by about 4 to 5cm, relative to fetal weight. Unfortunately, our attempts to combine additional factors such as engagement of the head with the symphysis fundus measurements did not reduce the error in weight estimation to a level which would be clinically useful. The main value of symphysis fundus measurements is likely to remain its serial use to monitor fetal growth in individual pregnancies rather than absolute weight estimation. For growth monitoring, factors such as maternal obesity and anatomical differences remain relatively constant. It is important to keep in mind the importance of always doing the measurement with an empty bladder. Our findings suggest that towards term, engagement of the fetal head may account for a decrease in SF measurements of about 1 cm per fifth of head. Correction of serial SF measurements for changes in engagement of the head from one measurement to the next may reduce the chance of falsely diagnosing poor growth. The practical usefulness of this principle will need to be evaluated in a longitudinal study.

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REFERENCES

1. Pschera H and Soederberg G. Estimation of foetal weight by external abdominal measurements. *Acta Obstet Gynecol Scand* 1984; 63: 175–179.
2. Pearce M and Campbell S. A comparison of symphysis fundal height and ultrasound as screening test for light-for-gestational age infants. *Br J Obstet Gynaecol* 1987; 94:100–104.
3. Muylder de X, Somer de ML and Bouckaert A. Early labour symphysis-fundus height as a predictor of birthweight. *Am Soc Belge Trop* 1988; 68:61–65.
4. Persson B, Stangenberg M, Lunell NO, Brodin U, Holmberg NG and Vaclavinkova V. Prediction of size of infants at birth by measurement of symphysis fundus height. *Br J Obstet Gynaecol* 1986; 93: 206–211.
5. Munjanja SP, Masona D, Maxwell M and Mahomed K. A Symphysial-fundal height nomogram for Central Africa. *Centr Afr J Med* 1987; 33: 29–32.
6. Grover V, Usha R, Kalra S and Sachdeva S. Altered fetal growth: antenatal diagnosis by symphysis-fundal height in India and comparison with western charts. *Int J Obstet Gynaecol* 1991; 35: 231–234.
7. Belizan JM, Villar J, Nardin J, Malamud J and Sainz De Vicuna L. Diagnosis of intrauterine growth retardation by a simple clinical method: measurement of uterine height. *Am J Obstet Gynaecol* 1978; 131: 643–646.
8. Azziz R, Smith S and Fabro S. The development and use of a standard symphysial-fundal height growth curve in the prediction of small for gestational age neonates. *Int J Gynecol Obstet* 1988; 26: 81–87.
9. Pattinson RC. Antenatal detection of small-for-gestational-age babies. *SAMJ* 1988; 74: 282–283.
10. Kennedy I. Symphysis-fundus graphs revisited. Proceedings of the Tenth Conference on Priorities in Perinatal Care in South Africa, 1991.
11. Kennedy I. The symphysis-fundus height graph and fetal growth retardation: gimmick or useful clinical tool? *J Trop Ped* 1990; 36: 4–9.
12. Rosendahl H, Kivinen S. Detection of small for gestational age fetuses by the combination of clinical risk factors and ultrasonography. *Eur J Obstet Gynecol & Repro Biol* 1991; 39:7–11.
13. Royburt M and Seidman DS. Fundal height – can we trust the umbilicus? *The Lancet* 1991; 338: 891–892.
14. Villar J and Belizan JM. The evaluation of the methods used in the diagnosis of intrauterine growth retardation. *Obstet Gynecol Survey* 1986; 41: 187–197.
15. Bailey SM, Sarmandal P and Grant JM. A comparison of three methods of assessing interobserver variation applied to measurement of the symphysis-fundal height. *Br J Obstet Gynaecol* 1989; 96: 1266–1271.
16. Rosenberg K, Grant JM and Hepburn M. Antenatal detection of growth retardation: actual practice in a large maternity hospital. *Br J Obstet Gynaecol* 1982; 89: 12–15.
17. Rosenberg K, Grant JM, Tweedie I, Aitchison T and Gallagher F. Measurement of fundal height as a screening test for fetal growth retardation. *Br. J Obstet Gynaecol* 1982; 89: 447–450.
18. Secher NJ, Lundbye-Christensen S, Qvist I and Bagger P. An evaluation of clinical estimation of fetal weight and symphysis fundal distance for detection of SGA infants. *Eur Obstet Gynecol & Repro Biol* 1990; 38: 91–96.
19. Cnattingius S, Axelsson O and Lindmark G. Symphysis-fundus measurements and intrauterine growth retardation. *Acta Obstet Gynecol Scand* 1984; 63: 335–340.
20. Quaranta P, Currell R, Redman CWG and Robinson JS. Prediction of small-for-dates infants by measurement of symphysial-fundal-height. *Br J Obstet Gynaecol* 1981; 88: 115–119.
21. Faustin D. Percentage of maternal abdominal length for detecting accelerated uterine growth from a twin gestation. *J Reprod Med* 1991; 24: 141–142.
22. Geirsson RT. Prediction of size of infants at birth by measurement of symphysis fundus height. *Br. J Obstet Gynaecol* 1987; 94: 277–283.
23. Dare FO, Ademowore AS, Ifaturoti OO and Nganwuchu A. The value of symphysio-fundal height/abdominal girth measurements in predicting fetal weight. *Int J Gynecol Obstet* 1990; 31: 243–248.
24. Walraven GEL, Mkanje RJB, van Roosmalen J, van Dongen PWJ, van Asten HAGH and Dolmans WMV. Single pre-delivery symphysis-fundal height measurement as a predictor of birthweight and multiple pregnancy. *Br J Obstet Gynaecol* 1995; 102: 525–529.
25. Bergstrom S and Liljestrand J. Parturient fundal height and its relation to fetal weight. *J Trop Ped* 1989; 35:27–30.
26. Belizan JM, Lechtig A and Villar J. Distribution of low-birth weight babies in developing countries. *Am J Obstet Gynaecol* 1978; 132: 704–705.
27. Mathai M, Jairaj P and Muthurathnam S. Screening for light-for-gestational age infants: a comparison of three simple measurements. *Br J Obstet Gynaecol* 1987; 94: 217–221.
28. Taylor P, Coulthard AC and Robinson JS. Symphysial-fundal height from 12 weeks' gestation. *Aust NZ J Obstet Gynaecol* 1984; 24: 189–191.
29. Calvert JP, Crean EE, Newcombe RG and Pearson JF. Antenatal screening by measurement of symphysis-fundus height. *Br Med J* 1982; 285: 846–849.

30. Engstrom JL, Ostrenga KG, Plass RV and Work BA. The effect of maternal bladder volume on fundal height measurements. *Br. J Obstet Gynaecol* 1989; 96: 987–991.

31. Stabile I and Grudzinskas JG. Effect of race on maternal symphysis to fundal height, and weight. *Br J Obstet Gynaecol* 1986; 93: 890.

32. Tjon A Ten WE, Kusin JA and With de C. Fundal height measurement as an antenatal screening method. *J Trop Ped* 1985; 31: 249–252.

33. Usher R and McLean F. Intrauterine growth of live-born Caucasian infants at sea level: standards obtained from measurements in 7 dimensions of infants born between 25 and 44 weeks of gestation. *J Ped* 1969; 74: 901–910.

34. Westin B. Gravidogram and fetal growth. *Acta Obstet Gynaecol Scand* 1977; 56: 273–282.

35. Brenner WE, Edelman DA and Hendricks CH. A standard of fetal growth for the United States of America. *Am J Obstet Gynaecol* 1976; 126: 555–564.

36. Lindhard A, Nielsen PV, Mouritsen LA, Zachariassen V, Sorensen HU and Roseno H. The implications of introducing the symphyseal-fundal height-measurement. A prospective randomized controlled trial. *Br J Obstet. Gynaecol* 1990; 97: 675–680.

37. Wallin A, Gyllenswaerd A and Westin B. Symphysis-fundus measurement in prediction of fetal growth disturbances. *Acta Obstet Gynecol Scand* 1981; 60: 317–323.

38. Tejani N, Mann LI and Weiss RR. Antenatal diagnosis and management of the small-for-gestational-age fetus. *Obstet and Gynaecol* 1976; 47: 31–36.

39. Theron GB and Greyling KG. Do we need to be concerned about light for gestational age babies with normal symphysis-fundus growth? Proceedings of the Tenth Conference on Priorities in Perinatal Care in South Africa, 1991.

40. Wennergren M, Karlsson K and Olsson T. A scoring system for antenatal identification of fetal growth retardation. *Br J Obstet Gynaecol* 1982; 89: 520–524.

41. Hoelscher HJ, Quintelier J, Makin J and Pattinson RC. Critical intra-partum symphysis-fundus measurements. Proceedings of the Twelfth Conference on Priorities in Perinatal Care in South Africa, 1993.

42. Ong HC and Sen DK. Clinical estimation of fetal weight. *Am J Obstet Gynaecol* 1972; 112: 877–880.

43. Indira R, Oumachigui A, Narayan KA, Rajaram P and Ramalingam G. Symphysis-fundal height measurement – a reliable parameter for assessment of fetal growth. *Int J Obstet Gynecol* 1990; 33: 1–5.