

# Usefulness of symphysis-fundal height in predicting fetal weight in healthy term pregnant women

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## Summary

**Background:** There are some works reporting that the measurement of the symphysis-fundal height (SFH) of a full-term uterus is a simple method for estimating the fetal weight. **Aim:** Evaluating the goodness of distance between the symphysis and uterine fundus in predicting both low-weight fetuses and high-weight fetuses, comparing it with the third quarter ultrasound estimation of fetal weight and then assessing the clinical effectivity of symphysis-fundal measurement associated with third quarter echography in predicting birth weight. **Methods:** A prospective study was carried out on 96 single physiologically full-term pregnancies. The diagnostic accuracy of the SFH, echographic fetal growth estimated between the 32<sup>nd</sup> and the 35<sup>th</sup> week (expressed in percentiles), and of both was expressed as sensitivity, specificity, predictive positive and negative value, likelihood ratios and compared. **Results:** There was a correlation between the SFH and fetal birth weight. A SFH below 33 cm is predictive of a fetus whose weight is less than 3,100 g whereas a SFH above 34 cm is predictive of a fetus whose weight is more than or equal to 4,000 g. The diagnostic effectiveness of the SFH was not significantly higher than the ultrasound scanning evaluation of fetal weight in the third quarter and could be slightly improved if it is taken into account along with the ultrasound scanning data. **Conclusions:** The measurement of the SFH at term may be helpful in foretelling the fetal birth weight and may improve the diagnostic accuracy of the third quarter echographic estimation of birth weight.

**Key words:** Symphysis-fundal height (SFH); Fetal birth weight; Diagnosis.

## Introduction

Already in 1957, Johnson *et al.* [1] developed a formula for calculating fetal weight starting from the measurement of the height of the uterine fundus. More recently it was reported [2] that the clinical evaluation of the fetal weight starting from such measurement is neither more nor less accurate than the one carried out by ultrasound scanning. Moreover, some articles illustrate the practicality of the measurement of the distance between the pubic symphysis and the fundus of the uterus [3-6], in case an ultrasound scan cannot be executed, while some others suggest that it can be used as a screening method of fetuses with intrauterine growth restriction (IUGR) [7-9]. On the other hand, some authors [6, 10] have also reported that the symphysis-fundal height (SFH) can be used to identify large babies at birth. The aim of this work was to verify the usefulness of the SFH in diagnoses of both low-weight fetuses and large-weight fetuses at birth in full-term pregnancies, and to compare it with the ultrasound estimation of fetal weight, executed at the third quarter echography. Additionally, the clinical effectivity of symphysis-fundal measurement associated with third quarter echography in predicting birthweight was assessed.

## Patients and Methods

The study was carried out in accordance with the ethical standards stated in the Declaration of Helsinki. All patients gave consent for measuring the distance between the symphysis and

the fundus of the uterus. Such measurements were carried out on 96 women with single full-term physiological pregnancies and with the fetus in cephalic presentation. The measurements were carried out by means of an inelastic tape graduated in centimeters, from the upper edge of the pubic symphysis up to the higher part of the fundus of the uterus, placing the patient in the gynecological position. Distances were recorded in centimeters and approximated to 0.5 cm. The 3-cm distance of the fetal vertex from an ideal plane passing through the ischial spine and the lower edge of the pubic symphysis was considered as a strict criterion of inclusion. Such distance was evaluated during the obstetric examination, immediately before the symphysis-fundal measurement. Further inclusion criteria were that all the recruited pregnant women had to be submitted to an obstetric ultrasound (US) scan between the 32<sup>nd</sup> and the 35<sup>th</sup> week of pregnancy estimating the fetal weight through the Hadlock equation [11], were not obese (pregravidic body mass index less than 29.9), and did not have polyhydramnios or oligohydramnios (excluded with US examination of the amniotic fluid, executed at the time of the symphysis-fundal measurements).

Four classes of fetal weight at birth were arbitrarily considered: < 3,100 g, from 3,100 g - 3,699 g, 3,700 g - 3,999 g, and  $\geq$  4,000 g. For each of these the diagnostic accuracy (sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), likelihood ratios for a positive and negative test) of the following groups of measurements of the SFH were calculated first:  $\leq$  33 cm; from 33 cm - 34 cm, and  $>$  34 cm. Then the diagnostic accuracy of fetal growth, expressed in percentiles, estimated according to the US executed in the third quarter was calculated for the following limits: < 50<sup>th</sup> percentile, in the 50<sup>th</sup> percentile,  $>$  50<sup>th</sup> percentile. Finally, the diagnostic accuracy of the measurements of the SFH and the fetal growth estimated according to the US combined together was calculated.

Revised manuscript accepted for publication February 19, 2008

Table 1. — Accuracy of the symphysis-fundal height measurements.

	≤ 33 cm	< 3,100 g < 50 <sup>th</sup> percentile	≤ 33 cm and < 50 <sup>th</sup> percentile	≤ 33 cm	3,100-3,699 g < 50 <sup>th</sup> percentile	≤ 33 cm and < 50 <sup>th</sup> percentile	≤ 33 cm	3,700-3,999 g < 50 <sup>th</sup> percentile	≤ 33 cm and < 50 <sup>th</sup> percentile	≤ 33 cm	≥ 4,000 g < 50 <sup>th</sup> percentile	≤ 33 cm and < 50 <sup>th</sup> percentile
Sens.	82.3%*	17.6%*	17.6%*	31.2%**	12.5%	4.2%**	6.2%	12.5%	—	6.7%	—	—
Spec.	78.5%	89.9%	97.4%	66.7%	89.6%	93.7%	62.5%	88.7%	93.7%	63%	86.4%	93.8%
PPV	45.2%	27.3%	60%	48.4%	54.5%	40%	3.3%	18.2%	—	3.3%	—	—
NPV	95.4%	83.5%	98.7%	49.2%	50.5%	69.2%	76.9%	83.5%	92.6%	78.5%	82.3%	86.3%
LR+	3.8	1.7	6.7	0.9	1.2	0.7	0.2	1.1	—	0.2	—	—
LR–	0.2	0.9	0.8	1.0	1.0	1.0	1.5	1.0	1.1	1.5	1.1	1.1
	33-34 cm	50 <sup>th</sup> percentile	33-34 cm and 50 <sup>th</sup> percentile	33-34 cm	50 <sup>th</sup> percentile	33-34 cm and 50 <sup>th</sup> percentile	33-34 cm	50 <sup>th</sup> percentile	33-34 cm and 50 <sup>th</sup> percentile	33-34 cm	50 <sup>th</sup> percentile	33-34 cm and 50 <sup>th</sup> percentile
Sens.	11.8%	52.9%	—	43.7%	56.2%	29.2%	50%	31.2%	12.5%	6.7%	13.3%	—
Spec.	62%	57%	79.7%	77.1%	66.7%	95.8%	70%	52.5%	82.5%	61.7%	49.4%	93.8%
PPV	6.2%	20.9%	—	65.6%	62.8%	87.5%	25%	69.8%	12.5%	3.1%	4.6%	—
NPV	76.6%	84.9%	94.0%	57.8%	60.4%	85.2%	87.5%	79.2%	92.6%	78.1%	75.5%	86.4%
LR+	0.3	1.2	—	1.9	1.7	6.9	1.7	0.6	0.7	0.2	0.3	—
LR–	1.4	0.8	1.2	0.7	0.6	0.7	0.7	1.3	0.8	1.5	1.8	1.1
	> 34 cm	> 50 <sup>th</sup> percentile	> 34 cm and > 50 <sup>th</sup> percentile	> 34 cm	> 50 <sup>th</sup> percentile	> 34 cm and > 50 <sup>th</sup> percentile	> 34 cm	> 50 <sup>th</sup> percentile	> 34 cm and > 50 <sup>th</sup> percentile	> 34 cm	> 50 <sup>th</sup> percentile	> 34 cm and > 50 <sup>th</sup> percentile
Sens.	5.9%	29.4%	5.9%	25%	31.2%	12.5%	43.7%	56.2%	25%	86.7%	86.7%	80%
Spec.	59.5%	53.2%	72.1%	56.2%	43.7%	64.6%	67.5%	58.7%	76.2%	75.3%	64.2%	86.4%
PPV	3%	11.9%	4.3%	36.4%	35.7%	26.1%	21.2%	21.4%	17.4%	39.4%	30.9%	52.2%
NPV	74.6%	77.8%	95%	42.8%	38.9%	65.9%	85.7%	87%	96.8%	96.8%	100%	100%
LR+	0.1	0.6	0.2	0.6	0.5	0.3	1.3	1.4	1.0	3.5	2.4	5.9
LR–	0.9	1.3	1.3	1.3	1.6	1.3	0.8	0.7	1.0	0.2	0.2	0.1

\*p 0.035; \*\*p 0.008.

The values of sensitivity (Sens.), specificity (Spec.), positive predictive value (PPV), negative predictive value (NPV), likelihood ratio for a positive test (LR+) and likelihood ratio for a negative test (LR–) are described for each cutoff of symphysis fundal height, percentile value and both. \*p = 0.035 is the level of significance for the comparison between 82.3 % and 17.6 % sensitivity values; \*\*p = 0.008 is the level of significance for the comparison between 31.2 % and 4.2 % sensitivity values. All the other comparisons do not reach significance.

To verify a possible correlation between the distance between the symphysis and the fundus and the fetal weight at birth, and between the third quarter echographic growth and the fetal weight at birth, the Spearman and Kendall correlation coefficients were calculated. Such non parametric tests correct the need of approximation to 0.5 cm of the SFH measurement. Sensitivity, specificity, PPV, and NPV were compared through the chi-square test and Fisher's exact test, considering a minimum value of significance of  $p < 0.05$ .

## Results

The distances between the symphysis and the fundus were as follows: 38 cm (1 case, 1%); 37 cm (3 cases, 3.1%); 36 cm (13 cases, 13.5%); 35.5 cm (1 case, 1%); 35 cm (15 cases, 15.6%); 34.5 cm (1 case, 1 %); 34 cm (31 cases, 32.3%); 33 cm (14 cases, 14.6%); 32.5 cm (2 cases, 2.1%); 32 cm (8 cases, 8.3%); 31 cm (3 cases, 3.1%); 30 cm (4 cases, 4.2%). The average distance between the symphysis and the fundus was 34 cm (standard deviation 1.6 cm). The fetuses with growth estimated < 50<sup>th</sup> percentile resulted as 11 (11.4%), in the 50<sup>th</sup> percentile as 43 (44.8%), and > 50<sup>th</sup> percentile as 42 (43.7%). The fetal birth weight turned out to be between 2,550 g and 4,900 g (average 3,520 g, SD 432 g). Newborns weighing < 3,100 g resulted to be 17 (17.7%), from 3,100 g - 3,699 g 48 (50%), 3,700 - 3,999 16 (16.7%), and those weighing ≥ 4,000 g 15 (15.6%).

Both the Spearman and the Kendall coefficients

showed a scanty correlation between the distance from the symphysis to the fundus and fetal birth weight (0.571 and 0.445,  $p < 0.00001$ , respectively). They showed an even less significant correlation between the fetal growth estimated according to the US executed in the third quarter and fetal weight at birth (0.434 and 0.327;  $p < 0.001$ , respectively).

Table 1 shows the sensitivity, specificity, PPV, NPV and likelihood ratios of the SFH, estimated fetal growth (as regards the 50<sup>th</sup> percentile) and both for each class of fetal weight considered.

Although the correlation between the SFH and fetal birth weight was stronger in comparison with the estimated parameter of fetal growth, no significant differences of frequency were found in the values of positive and negative predictability, specificity and sensitivity (except for the sensitivities of measurements below 33 cm for fetuses weighing less than 3,100 g). Likewise, when taken together, the SFH and the estimated fetal growth did not significantly improve the diagnostic accuracy. However, values of 33 cm or lower of the SFH in fetuses with growth below the 50<sup>th</sup> percentile seemed to be more predictive than fetuses whose weight was lower than 3,100 g at birth; SFH between 33 and 34 cm and growth in the 50<sup>th</sup> percentile seemed to be more predictive than fetuses whose weight was between 3,100 g and 3,699 g; SFH beyond 34 cm and growth above the 50<sup>th</sup> percentile seemed to be more predictive than fetuses whose weight was higher than or equal to 4,000 g.

## Discussion

The need to know the fetal weight in a single full-term physiological pregnancy seems to be useful only for the management of labor and delivery due to the risk of dystocia or fetal suffering in connection with the fetal weight [12-14]. Usually, in healthy term pregnant women, the fetus weight is not assessed with an echographic scan executed near to the labor date. Therefore, the routine third quarter echographic scan and the clinical evaluation of fetal growth are the only tools to evaluate birth weight. Fetuses weighing less than 2,500 g and more than 4,500 g are very uncommon in a population of healthy pregnant women, thus the usefulness of measuring the distance between the symphysis and the fundus would seem more necessary in the few cases of pregnant women who are not monitored during their pregnancy, in particular with US in the third quarter. In fact, despite the correlation found in this study (similar to the one reported by Bothner *et al.* [12]), an accurate weight of the baby cannot be obtained from the symphysis-fundal measurement. Moreover, this is in agreement with what was found over 50 years ago by Johnson *et al.* [1]. We can roughly state that a full-term uterus over 34 cm in length can contain a fetus weighing 4,000 g or more (likelihood ratio 2.4), while a full-term uterus less than 33 cm in length can contain a fetus weighing less than 3,100 g (likelihood ratio 3.8). The first measurement is in accord with what was reported by Winkström *et al.* [8], while the second is in accord with what was found by Rondó *et al.* [3]. From a larger case series reported by Walraven *et al.* [6], we can also understand that the more such cutoffs are increased and decreased, respectively, the more the probability that fetuses with IUGR and macrosomia will be diagnosed.

It may happen that a routine third quarter US scan will find fetal growth under the 50<sup>th</sup> percentile. Although this is not a pathological finding, it may be a sign of some fetuses that are developing late growth restriction. Since there is no need to repeat the US scan under such conditions, the SFH may be helpful in determining those rare IUGR cases. As far as the results of this study are concerned, the diagnostic accuracy of the SFH is slightly improved when associated with the value in percentiles of the fetal growth estimated by means of the US scan executed in the third quarter, i.e. relating to the low birth-weight fetuses. In any case, there is a fair ratio of large fetuses (3,700 - 3,999 g) which could be more at risk of dystocia and which cannot be easily detected either by US or clinically [14-16].

Barnhard *et al.* [13] reported that the distance between the symphysis and the fundus can predict a cesarean section for labor arrest. This eventuality can also occur in the absence of very large fetuses. Therefore, in light of what has been reported in this study, it would be interesting to evaluate how much the SFH and US evaluation of the growth together can predict dystocia during labor rather than determining the fetal weight, with a doubtless usefulness for the management of the labor and delivery.

A Cochrane systematic review [17], reports that there is not enough evidence to evaluate the use of symphysis-fundal measurement during antenatal care. However, as suggested by this study, SFH at term may be considered as an easy tool to improve the echographically estimated fetal weight between the 32<sup>nd</sup> and the 35<sup>th</sup> week of pregnancy, and may be useful in the management of labor.

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