OPEN ACCESS
Scholars International Journal of Obstetrics and Gynecology
Abbreviated Key Title: Sch Int J Obstet Gynec
ISSN 2616-8235 (Print) |ISSN 2617-3492 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Ultrasonographic Evaluation of Fetal Sacral Length: Correlation with Gestational Age

Parvin S. S[1*], Khatun M[2], Banu S[3], Mohiuddin A. S[4], Ahmed A. U[5]

[1]Dr. Salma Shahnawaz Parvin, Assistant Professor, Department of Radiology and Imaging, Bangabandhu Sheikh Mujib Medical College, Faridpur, Bangladesh
[2]Dr. Maksuda Khatun, Assistant Professor, Department Radiology & Imagining, Bangabandhu Sheikh Mujib Medical College Faridpur, Bangladesh
[3]Dr. Syeeda Banu, Assistant Professor, Department of Obstetrics and Gynaecology, Rangpur Medical College & Hospital, Rangpur, Bangladesh
[4]Professor AS Mohiuddin, Head of the Department (Rtd), Radiology and Imaging, BIRRDEM, Dhaka, Bangladesh
[5]Professor Akhtar Uddin Ahmed, Head of the Department (Rtd), Radiology and Imaging, BIRRDEM General Hospital, Dhaka, Bangladesh

DOI: 10.36348/sijog.2022.v05i04.005 | **Received:** 06.03.2022 | **Accepted:** 06.04.2022 | **Published:** 12.04.2022

***Corresponding author:** Parvin S. S
Assistant Professor, Department of Radiology and Imaging, Bangabandhu Sheikh Mujib Medical College, Faridpur, Bangladesh

Abstract

Introduction: Obstetricians need an accurate estimate of gestational age to decide when to terminate the pregnancy and how to deliver the baby. When unreliable menstrual history cannot be used to determine gestational age, ultrasonography comes in handy. Ultrasonography has been used to determine gestational age using a variety of parameters. However, all of these parameters are only reliable in the first and second trimesters of pregnancy. They become less reliable as the pregnancy progresses, due to a variety of factors, with a maximum variability of about 3 to 3.5 weeks in the third trimester. ***Methods:*** A total of 200 pregnant women participated in this prospective observational study at the Department of Radiology and Imaging, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine, and Metabolic Disorders. The research was carried out between January 2001 and December 2002. ***Result:*** The participants' average age was 24.54 years. Only 3% of the participants were in the oldest age range of 36-40 years, with 38 percent of the participants being between the ages of 21 and 25. The average height of the participants was 150-154 cm in 52 percent of the cases. The mean SD height and weight were 152.40±3.44 cm and 54.80±4.45 kg, respectively. There is a strong positive relationship between fetal sacral length and gestational age, according to BPD and FL. The relationship between gestational age and fetal sacral length was demonstrated to be statistically significant. There was no statistically significant relationship between fetal sacral length and maternal height. ***Conclusion:*** Fetal sacral length is well related to gestational age. If sacral length is measured accurately with a high-resolution ultrasound scanner, it can be used reliably as an additional parameter throughout pregnancy in conjunction with other established parameters.

Keywords: Ultrasound, Sonography, Gestational.

INTRODUCTION

The ability to determine gestational age is critical for providing the best obstetric care. Reliable gestational age estimation has long been a challenge for all those who care for pregnant women, especially in high-risk pregnancy cases where early termination is recommended. Clinical parameters are inconsistent, which makes it difficult to provide proper perinatal care. Fetal age and growth can now be determined with a high degree of accuracy thanks to recent advances in diagnostic imaging [1]. Clinical, radiological, or ultrasonographic dating can be used to determine gestational age [2]. If the gestational age is mistaken, it increases the possibility of iatrogenic preterm delivery before the viable age of the fetus. On the other hand, the baby may die in the uterus beyond term and all the complications of post-term pregnancy may occur as well if the gestational age is unknown. Abnormalities of

fetal growth like large-for-date or intrauterine growth retardation are also declared by assessing the gestational age. Symmetry or asymmetry of growth is also decided to depend upon several fetal parameters. Prior to the availability of ultrasonography, the gestational age was determined by obstetrician recollecting the first day of last menstruation of the subject and clinical findings like fetal height, Fetal heart sound, and perception of first quickening Because of faulty memory, variability in menstrual cycle length, implantation hemorrhage, and use of oral contraceptives within 3 months of conception or conceived while nursing, this method of determining gestational age may be inaccurate [3]. The introduction of ultrasonography ushers in a new era in the field of obstetrics. It is crucial in determining gestational age. The measurement of gestational age has become an essential part of obstetric ultrasonography. The procedure is based on fetal part measurements. Any variable that changes with increasing gestational age can be used as a parameter in ultrasonography to determine gestational age [4]. Gestational sac diameter (GSD), crown-rump length (CRL), biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femoral length, and other parameters are commonly used to determine gestational age [5]. GSD and CRL are used during the first trimester, while others are used during the second and third trimesters. The accuracy of predicting gestational age varies within a narrow range during the first and second trimesters of pregnancy. Because all of the parameters in the third trimester of pregnancy are affected by multiple factors, these measurements become less reliable as the pregnancy progresses. There are no single fetal parameters that can be used to estimate gestational age in the third trimester. For all pregnancies beyond 20 weeks, the composite age dating method, which employs multiple parameters to reduce variability, is recommended [6]. Ultrasonography is a noninvasive, inexpensive, simple, and widely available technique. Ultrasound measurements of a variety of fetal osseous structures have been linked to gestational age. Measurements for BPD, HC, and FL have been established to aid in the diagnosis of normal and abnormal fetal growth and skeletal abnormalities. Other fetal organic structures have also been studied. A kidney length study found a strong correlation between kidney length and gestational age [7-9]. The goal of this study was to sonographically evaluate fetal sacral length in order to consider it as a new parameter for determining gestational age throughout pregnancy when the mother's LMP is unknown or other routine methods produce contradictory results. The purpose of this study was to use a real-time ultrasonogram to correlate fetal sacral length with gestational age in a Bangladeshi population.

OBJECTIVE

General Objective

- To determine the normal length of the fetal sacrum at different ages of gestation throughout pregnancy

Specific Objectives

- To find out the role of ultrasonographic measured fetal sacral length as a parameter for determination of gestational age, based on the fetal sacral length throughout pregnancy.

METHODS

The Department of Radiology and Imaging at the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine, and Metabolic Disorders conducted this prospective observational study. From January 2001 to December 2002, the study lasted two years. For the purposes of this study, 200 pregnant women with apparently normal fetuses, aged 15 to 40 weeks, were referred to the radiology and imaging department of the study hospital. Consecutive sample selection was carried out in accordance with the study's inclusion and exclusion criteria. Initially, all subjects were evaluated using a detailed history and clinical examinations, with a focus on obstetrics. The fetal sacral length was sonographically measured, and gestational age was calculated using Biparietal Diameter (BPD), Femur Length (FL), and an average of these two measurements. The parameters were related to gestational age, which was calculated based on the last menstrual period (LMP). A link was discovered between gestational age and fetal sacral length. Each participant provided informed written consent, and the study hospital's ethical review committee granted ethical approval.

Inclusion Criteria

- Women with a normal pregnancy with reliable LMP
- Regular menstrual history
- Early-onset of perinatal care
- Complete visualization of the sacrum
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Multiple pregnancies
- Oligo and polyhydramnios
- Intra-uterine growth retardation
- Exclude those affected with other chronic diseases etc.

RESULTS

The mean age of the participants was 24.5±4.48 years. 38% of the participants were aged between 21-25 years, and only 3% of participants were from the oldest age group of 36-40 years. 52% of the participants had a height between 150-154 cm. The Mean ± SD height was 152.40±3.44 cm, and the Mean

± SD weight was 54.80±4.45 kg. Fetal sacral length and gestational age were found to have a strong positive correlation as predicted by BPD and FL. The correlation between gestational age and mean fetal sacral length was found to be highly significant. There was no statistically significant relationship between fetal sacral length and maternal height observed.

Table 1: Age distribution of the participants (n=200)

Age group (Years)	Frequency	Percentage (%)	Mean age ± SD (years)
16-20	40	20	24.5±4.48
21-25	76	38	
26-30	58	29	
31-35	20	10	
36-40	6	3	

This study involved 100 percent of women between 15 to 40 weeks of gestation. The age range was from 16 to 40 years and the mean age of the participants was 24.5±4.48 years. 38% of the participants were aged between 21-25 years, and only 3% of participants were from the oldest age group of 36-40 years.

Table 2: Height distribution of subjects (N=200)

Height group(cm)	Number of subjects	Percentage (%)	Mean ± SD height (cm)
<150	40	20%	152.40±3.44
150	104	52%	
>154	56	28%	

Out of the 200 subjects, most of the participants (52%) belonged to the 150-154 cm height group, followed by 28% from the height group of >154cm, and the remaining belonging to <150 cm (20%). The mean height of the subjects was 152.40 ± 3.44 cm.

Table 3: Weight Distribution of the participants (N=200)

Weight group (kg)	Frequency	Percentage (%)	Mean ± SD weight (KG)
45-49	18	9	54.80±4.45
50-54	80	40	
55-59	82	41	
60-64	12	4	
>64	8	4	

Among the participants, the majority (41%) were from the weight group of 55-59 kg, while 40% weighed 50-54 kg. 9% of the participants had very low weight, between 45-49 kg, 4% had weight between 60-64 kg, and the remaining % weighed over 64 kg.

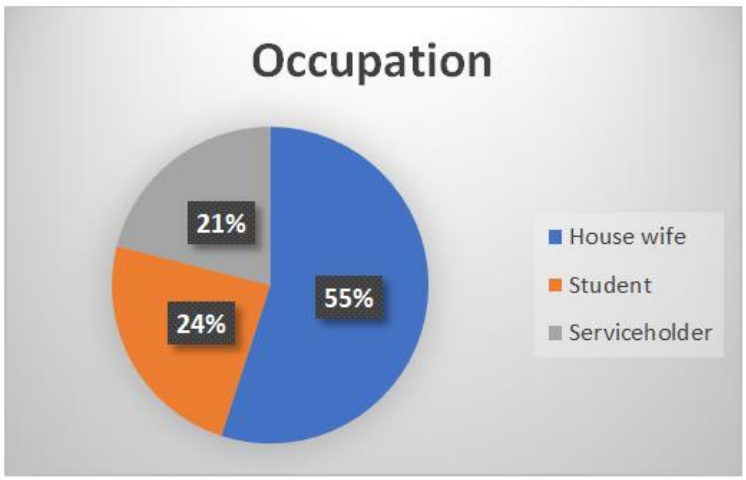

Figure 1: Occupation distribution of subjects (N=200)

Over half (55%) of the participants were housewives, while 24% were students and 21% were service holders.

Table 4: Relationship of fetal sacral length with gestational age as predicted by BPD, FL, and average of these two

Predicted Gestational Age	Fetal sacral length (mm)	
	Number	*P*-Value
predicted by BPD	200	<0.001
predicted by FL	200	<0.001
predicted by an average of BPD & FL	200	<0.001

The sacral length was presented in millimeters and gestational age was expressed in weeks. A strong positive correlation was found between fetal sacral length and gestational age as predicted by BPD and FL. These results had high statistical significance (p<0.001).

Table 5: Mean fetal sacral length at various gestational age (15-40 weeks) (n=200)

Gestational age(weeks)	Number of observation(n)	Mean±SD fetal sacral length(mm)	95% Confidence interval	
			Lower	Upper
15	12	14 ±0.89	13	15
16	10	15 ± 0.81	14	16
17	6	16 ±.61	15	17
18	8	17 ±0.84	16	181
19	10	181 ±0.84	17	19
20	10	19 ±0.81	181	20
21	10	20 ±0.81	19	21
22	8	21 ±0.84	20	22
23	8	22 ±0.92	21	23
24	8	23 ±0.92	22	24
25	6	24 ±0.89	23	25
26	10	25 ±0.88	24	26
27	6	26 ±0.89	25	27
28	8	27 ±0.92	26	28
29	6	28 ±0.89	27	29
30	6	29 ±0.63	28	30
31	10	31 ±0.94	29	33
32	6	32 ±0.77	30	34
33	6	33 ±0.64	31	35
34	6	34 ±0.63	32	36
35	8	35 ±0.84	33	37
36	6	36 ±0.77	34	38
37	8	37 ±0.75	35	39
38	6	38 ±0. 63	36	40
39	6	39 ±0.63	37	41
40	6	40 ±0.77	38	42

The observed values were grouped according to gestational age determined by an average of BPD and FL. Mean fetal sacral length, their standard deviation, and 95% confidence intervals were presented for each week of gestation. The fetal sacral length increases linearly corresponding to gestational age from a mean of 14 mm ± 0.89 SD at 15 weeks to 40 mm ± 0.77 SD at 40 weeks of gestation. The relationship between gestational age and the mean fetal sacral length was highly significant (p<0.001)

Table 6: Relation of fetal sacral length with maternal height and weight (n=200)

Variables	Number	Pearson's Correlation	*P*-Value
Maternal height	200	.64	>0.05
Maternal weight	200	.07	>0.05

There was no statistically significant correlation observed between the fetal sacral length with maternal height (r=0.64, p>0.05) or with maternal weight (r=0.07, p>0.05).

DISCUSSION

Diagnostic ultrasonogram is now widely used as a tool to evaluate fetal anatomy, and technological advancements in this field have made it possible to examine fetal organs in the early stages of their development in great detail, thus increasing our knowledge of normal and abnormal anatomy of the fetus. This is certainly true for the fetal spine. Evaluation of the fetal spine is an important component of the screening sonographic examination. An accurate length of the normal fetal sacrum is necessary for the early diagnosis of fetal spinal anomalies. The purpose of this study was to discover a new reliable parameter for determining gestational age throughout pregnancy by establishing a correlation between fetal sacral length

and gestational age. The fetal sacral length grows longer as the pregnancy progresses. By 15 weeks of gestation, the sacrum appears to be ossifying on ultrasonography [10]. The fetal sacrum is well seen in the longitudinal section of the caudal fetal spine as ossified the last five vertebral bodies. The coccyx is ossified after birth so it is the sacrum that represents these caudal most vertebral bodies. In the third trimester, the sacrum is easier to measure and the coccyx is different in echogenicity from that of the ossified sacrum. Technical error or maternal obesity may result in poor scans and prevent the identification of the sacrum. Exact measurements continue to be hindered by the uncertainty of the sacral endpoints, especially the lower one if it is obscured by limb bones. These sorts of problems were also faced in a few cases. This prospective study was carried out on 200 pregnant women between 15 to 40 weeks of gestational age. The sacral length of the fetuses was measured in millimeters. The caudal most five vertebrae were measured. The current study's findings are consistent with other studies that found a strong correlation between fetal sacral length and gestational age. The fetal sacral length and gestational age predicted by BPD, as well as the average of these two, were found to have a strong positive correlation. The fetal sacrum's mean length increased linearly from 14 mm at 15 weeks to 40 mm at 40 weeks of gestation. There was no correlation between sacral length and maternal height, or between sacral length and maternal weight. Karabulut *et al*., compared the data obtained by ultrasonography and dissection to determine the value of prenatal ultrasonographic measurements of the sacrum as a predictor of in utero development and gestational age [11]. They had a prospective study on 186 pregnant women from14 to 40 weeks. Their study showed that there is a linear correlation between sacral length and gestational age (r =.93), the FL (r =.93), and the BPD (r =.93). They also dissected sacral bones of 101 spontaneously aborted fetuses between 13 to 39 weeks and found that the sacral bones obtained by dissection were similar to those of ultrasonogram [11].

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The Fetal sacral length is well related to gestational age. If sacral length is measured accurately with a high-resolution ultrasound scanner, it can be used reliably as an additional parameter throughout pregnancy in conjunction with other established parameters.

Funding: No funding sources.

Conflict of interest: None declared.

Ethical approval: The study was approved by the Institutional Ethics Committee.

REFERENCES

1. Rosenberg Chervenak.ext book of diagnostic ultrasonogaphy. 4th edition. Hagen- Ansert Sandra L. Churchill Livingstone; pp 833-945.
2. DeCherney, A. H., & Pernol, M. L. Normal Pregnency and Prenatal Care. In: Current Obstetrics & Gynecological Diagnosis and Treatment, 6th edition. East Norwalk: Appalation and Lange, pp. 183–201.
3. Curet, L. B. (1979). Determination of gestational age. *Wisconsin Med J*, 78, 43-44.
4. Pearce, J. M., & Chazal, R. D. (1993). Establishing gestational age. In: Dewbury, K., Meire, H., Cosgrove, D. (editors). Ulfrasound in Obstetrics and Gynaecology. 1 st ed. Edinburgh: Churchill Livingstone, 211-221.
5. Benson, C. B., & Doubilet, P. M. (1998). Fetal measurements: Normal and Abnormal fetal growth. In: Rumark, C. M., Wilson, S. R., & Charboneau, J. W. (editors). Diagnostic ultrasound 2nd ed. New York: Mosby Year book Inc, (2), 1013-131.
6. Hadlock, F. P., Deter, R. L., Harrist, R. B., & Park, S. K. (1983). The use of ultrasound to determine fetal age-a review. *Medical Ultrasound*, *7*(3), 95-103.
7. Bertagnoli, L., Lalatta, F., Gallicchio, R., Fantuzzi, M., Rusca, M., Zorzoli, A., & Deter, R. L. (1983). Quantitative characterization of the growth of the fetal kidney. *Journal of clinical ultrasound*, *11*(7), 349-356.
8. Cohen, H. L., Cooper, J., Eisenberg, P., Mandel, F. S., Gross, B. R., Goldman, M. A., ... & Rawlinson, K. F. (1991). Normal length of fetal kidneys: sonographic study in 397 obstetric patients. *AJR. American journal of roentgenology*, *157*(3), 545-548.
9. Ansari, S. M., Saha, M., Paul, A. K., Mia, S. R., Sohel, A., & Karim, R. (1997). Ultrasonographic study of 793 foetuses: measurement of normal foetal kidney lengths in Bangladesh. *Australasian radiology*, *41*(1), 3-5.
10. Willams, L. H., Berry, M., Collins, P., Dyson, M., Dussek, J. E., & Ferguson, M. W. J. (1995). Gray's Anatomy -38th ed. New York: ELBS with Churchill Livingstone, pp1815-1826.
11. Karabulut, A. K., Köylüoğlu, B., & Uysal, İ. (2001). Human foetal sacral length measurement for the assessment of foetal growth and development by ultrasonography and dissection. *Anatomia, Histologia, Embryologia*, *30*(3), 141-146.