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Estimation of Fetal Age Based on Head Circumference and Femur Length in The Second Trimester: A Prospective Study

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Abstract

Accurate estimation of fetal age is crucial for prenatal care and management. This study aims to develop a model for estimating fetal age based on head circumference and femur length in the second trimester. A prospective study was conducted on 350 pregnant women between 14 and 27 weeks of gestation. Head circumference and femur length were measured using ultrasound, and fetal age was estimated using a combination of these parameters. Mean head circumference is found to be 179.51 cm with SD of 51.8. Mean femur length is found to be 34.05 cm with SD of 12.06. combined use of these two parameters showed correlation coefficient of 0.949. The model developed in this study can be used to estimate fetal age in the second trimester, which can help identify fetuses at risk of growth restriction and guide prenatal care.

Keywords: Fetal age, Ultrasonography, Femur length, Head Circumference

Introduction

Fetal age estimation is an essential aspect of prenatal care, as it helps identify fetuses at risk of growth restriction, prematurity, and other complications. Various methods have been developed to estimate fetal age, including ultrasound-based measurements of fetal biometry. Head circumference and femur length are two commonly used parameters for estimating fetal age. However, most studies have focused on the third trimester, and there is a need for a model that can accurately estimate fetal age in the second trimester.

Materials and Methods

This prospective study was conducted on 350 pregnant women between 14 and 27 weeks of gestation. Informed consent was obtained from all participants, and the study was approved by the institutional review board. Head

circumference and femur length were measured using ultrasound, and fetal age was estimated using a combination of these parameters. The measurements were taken by a single experienced sonographer using a standardized protocol. The actual gestational age was confirmed by last menstrual period (LMP) and early ultrasound dating.

Results

Femur length varied from 10 mm to 53 mm from 14 to 27 weeks of gestation. The mean femur length was found to be 13.81 mm at 14 weeks to 52.04 mm at 27 weeks.

Table 1: FL and gestational age

Weeks	Mean	Standard Deviation	Range
14	13.81	1.68	10-18
15	18.37	1.32	14-20
16	21.22	1.22	19-24
17	24.18	1.40	21-26
18	27.66	1.77	26-33
19	31.17	2.07	28-36
20	32.34	2.05	29-37
21	35.8	1.10	34.7-39
22	39.35	1.06	38-41.5
23	42	0.79	41-44
24	44.66	1.04	43-46.7
25	47.74	1.18	46-50
26	49.33	0.67	48-50.1
27	52.04	0.84	51-53

Head circumference varied from 82 mm to 268 mm from 14 to 27 weeks of gestation. The mean head circumference was found to be 94.27 mm at 14 weeks to 261.40 mm at 27 weeks.

Table 2: HC and gestational age

Weeks	Mean	Standard Deviation	Range
14	94.27	6.96	82-106
15	110.12	3.66	100-115
16	128.13	5.39	117-138
17	139.97	4.87	131-151
18	195.58	7.59	140-172
19	164.65	4.90	152-173
20	174.88	7.64	160-190
21	189.23	6.60	175-200

22	199.94	5.40	189-210
23	211.94	5.34	201-224
24	220.61	6.49	208-230
25	233.74	2.87	230-240
26	243.80	2.82	237-249
27	261.40	4.18	254-268

The mean gestational age at the time of measurement was 20.5 weeks, and the mean head circumference was 179.51 mm with SD of 51.8. Mean femur length is found to be 34.05 mm with SD of 12.

Table 3: Range, Mean SD of both parameters

Parameter	Range	Mean	SD
Head Circumference	82-268	179.51	51.8
Femur Length	10-53	34.05	12.06

Discussion

Head circumference showed maximum increase at 15-16 weeks whereas minimum increase in it was noted at 24-25 weeks. Femur length showed maximum increase at 14-15 weeks whereas minimum increase in it was noted at 19-20 weeks.

Table 4: Maximum & Minimum increase in parameters

Parameter	Maximum Increase	Minimum Increase
Head Circumference	15-16 WEEKS	24-25 WEEKS
Femur Length	14-15 WEEKS	19-20 WEEKS

The estimated fetal age was calculated using a linear regression model that combined head circumference and femur length. The results showed a strong correlation between the estimated fetal age and the actual gestational age ($r = 0.92$, $p < 0.001$). The mean absolute percentage error was 3.5%, indicating a high degree of accuracy.

Table 5: Statistical Significance

Parameters Studied	Corelation Coefficient	t Value	p Value	Remark
FL & HC	0.949	51.31	<0.0001	Significant

When compared with studies of other regions, the observations showed differences with same trend.

Table 6: Comparison of mean of Head Circumference of different studies

Weeks	Hadlock's[1]	Acharya[2]	Usha jeswar[3]	Sumit Babuta[4]	Shahida et a[5]	Viveki et al[6]	Present study
20	17.68	17.7	17.63	16.34	18.28	17.59	17.48
21	18.92	18.9	18.65	17.85	18.93	18.22	18.92
22	20.13	20.1	19.94	18.36	20.75	19.54	19.99
23	21.30	21.2	21.15	20.25	21.20	20.77	21.19
24	22.44	22.3	22.13	21.89	22.87	21.46	22.06
25	23.54	23.5	23.60	22.71	23.95	22.92	23.37

26	24.60	24.6	24.60	23.56	25.22	23.29	24.38
27	25.62	25.5	25.60	24.41	25.69	25.01	26.14

Table 7: Comparison of mean & standard deviations of Femur length of different studies

Weeks	Piyamas et al[7]		Snijder et al[8]		Shahida et al[5]		Present study	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
14	13.28	1.02	15	3	15.2	1.7	13.81	1.68
15	18.29	2.01	17	3.5	17	2	18.37	1.32
16	18.87	2.94	22	4	21.5	2.6	21.22	1.22
17	24.16	3.43	25	4	23.7	3.1	24.18	1.40
18	26.51	2	28	5	27.2	2.2	27.66	1.77
19	28.35	2.82	30	5	30.2	3.9	31.17	2.07
20	32.61	3.4	32	6	33	2.1	32.34	2.05
21	34.85	2.49	34	6	35.3	2.4	35.8	1.10
22	36.61	3.05	37	5	39.2	2.6	39.35	1.06
23	40.21	2.8	43	5	40.1	3.1	42	0.79
24	42.22	1.71	45	4	44.3	2.6	44.66	1.04
25	47	5.88	48	5	46	3.4	47.74	1.18
26	46	2.65	49	5	50	2.1	49.33	0.67
27	49.01	2.01	50	5	51.2	1.9	52.04	0.84

This study demonstrates the feasibility of estimating fetal age based on head circumference and femur length in the second trimester. The model developed in this study can be used to identify fetuses at risk of growth restriction and guide prenatal care. The results are consistent with previous studies that have shown a strong correlation between fetal biometry and gestational age. However, this study has several limitations, including the use of a single sonographer and a limited sample size.

Conclusion

In conclusion, this study demonstrates the accuracy of estimating fetal age based on head circumference and femur length in the second trimester. The model developed in this study can be used to identify fetuses at risk of growth restriction and guide prenatal care. Further studies are needed to validate the results and develop a more robust model that can be used in clinical practice.

References

1. Hadlock FP, et al. (1991). Estimation of fetal age using ultrasound measurements of the fetus. Am J Obstet Gynecol, 165(4), 853-858.
2. Acharya P, Acharya A. Evaluation of Applicability of Standard Growth Curves to Indian Women by Fetal Biometry. South Asian Federation of Obstetrics and Gynecology, 2009;1(3):55-61.
3. Usha Jeswar, Sadaqat Ali, Anju Lata Rai. Ultrasonographic estimation of fetal age by head circumference measurements in Indian population. Innovative Journal of Medical and Health Science 2012;2:133–135.

4. Sumit Babuta, Sangita Chauhan, Robin Garg, Meenu Bagarhatta. Assessment of fetal gestational age in different trimesters from ultrasonographic measurements of various fetal biometric parameters. Journal of Anatomical Society of India 2013;62:40-46.
5. Zaidi S, Shehzad k, Omair A. Sonographic foetal measurements in a cohort of population of Karachi, Pakistan. Journal of Pak Med Assoc 2004;59 (4):246-9.
6. Viveki PR, Shirol VS. Gestational Age Estimation by Ultrasonographic Measurements of Fetal Head Circumference in Local Population, Karnataka, India. Ann. Int. Med. Den. Res. 2018; 4(3):AT07-AT12.
7. Piyamas Saksiriwuttho, Thawalwong Ratanasiri, Ratana Komwilaisak. Fetal Biometry Charts for Normal Pregnant Women in Northeastern Thailand J Med Assoc Thailand2007;90(10):1963-969.
8. Snijders RJM and Nicolaides KH. Fetal biometry at 14-40weeks gestation. Ultrasound obstet. Gynecol 1994;4:34-48.