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COMPARATIVE STUDY OF GESTATIONAL AGE USING MEAN FETAL KIDNEY LENGTH AND OTHER SONOGRAPHIC FETAL PARAMETERS IN SINGLETON PREGNANCY AFTER 24 WEEKS

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ABSTRACT

INTRODUCTION: To accurately estimate the fetus age and follow up on the growth of different fetal organs, it is vital to know the accurate date of birth. It also helps to prevent prenatal and postnatal complications for the newborn. It is common for antenatal mothers to be unaware of last menstrual period (LMP). In such situations, it would be difficult to calculate the delivery date. According to various studies, up to 30% of women were not sure of their LMP. The treating obstetricians would have to be very careful when the exact LMP is unknown in order to prevent post maturity and prematurity deliveries.

MATERIAL AND METHODS: The present study is prospective comparative study of Department of Obstetrics and Gynaecology in Guntur Medical College and Hospital, Andhra Pradesh, India. After 24 weeks of gestational age are included who are at age between 20-35 yrs which is of 200 sample size in the year 2020-21. Clinical assessment of gestational age was done by palpating the fundal height of the patient. Following this using ultrasound, meam fetal kidney length (FKL) along with other fetal parameters were calculated.

RESULT: In the present study, BPD ranged from 28-40 wks, whereas the mean BPD was 35.25+2.67 HC ranged between 27-40 and the mean BPD was 35.35+2.88 MKL ranged between 27-41 and the mean MKL was 35.93+3.49. Upon the composite of multiple parameters GA ranged between 27.8-39.6 and the mean was 3.5.36+2.7.

CONCLUSION: The FKL is very much useful in assessing the gestational age. From our study we state that there is a significant correlation between fatal kidney length and the gestational age. Hence fetal kidney is appropriate in estimation of gestational age.

Keywords: Gestational age, usg, fetal kidney, femur length.

INTRODUCTION:

It is critical to have a precise date of birth in order to calculate the foetal age and monitor the development of its various organs. Additionally, it aids in the newborn's postnatal and prenatal problems prevention. In many impoverished nations, it is typical for expectant

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moms to be uninformed of the last menstrual period (LMP). Calculating the delivery date would be challenging in such circumstances. Up to 30% of women, according to several studies, were unsure of their LMP. When the precise LMP is unknown, the treating obstetricians must exercise extreme caution. To solve this issue, foetus biometry, which measures foetuses' numerous bodily parts, is used [1,2]. Although there are numerous factors that can be used to estimate gestational age, ultrasonography has not yet been able to pinpoint a single precise factor. To get around this issue, many characteristics can be utilised indirectly to determine the age of the foetus. The biparietal diameter, abdominal circumference, and the lengths of long bones such the femur and humerus are the few measurements that can be used to determine gestational age.

It's important to get the gestational age right for high-risk pregnancies, especially when the foetus is mature and an early termination is necessary. It is essential to accurately predict gestational age in order to prepare for an operative birth, manage multiple issues, and monitor the growth and development of the foetus. Learning how to run different tests and analyse the findings is essential. Traditionally, the duration of a pregnancy was calculated as the last menstrual period multiplied by 9 months and 7 days, or 280 days. Most women now receive two separate estimations that could be different. One is based on the latest menstrual period (LMP), while the other is determined by ultrasound measures of well-known foetal traits. Gestational age determination by last menstrual period (LMP): This method, which has been used for generations, is incredibly dependable and easy to understand. The estimated delivery date is determined by multiplying the first day of your last period by nine months plus seven days [2,3]. Ovulation can be delayed by factors including oligo ovulation or hormone therapy, which could result in incorrect dates. This strategy has disadvantages, just like any other approach. Gestational age determination using clinical methods: Looking at the Pelvis, According to their research, the most reliable method would be to date based on gestational age and rely on accurate menstrual records and pelvic examinations throughout the first trimester. Within the first 12 weeks of pregnancy, ultrasound measurements of the crown rump length are more accurate than a clinical evaluation by an experienced obstetrician. A skilled obstetrician can, however, obtain precise results during this time period by an abdominal examination [3,4].

After 24 weeks, the Symphysiofundal height (in cms) is roughly the same as the gestational age. Multiple gestations, IUGR, and diabetes pregnancy are a few conditions that could affect the measurement, though Symphysiofundal height has a 90% confidence level of accuracy within 6 weeks when related with gestational age. The application of medical ultrasound during pregnancy is known as obstetric ultrasound [4,5].

Since it was first used in obstetrics in the late 1950s, ultrasonography has developed into a very helpful diagnostic tool. Prenatal ultrasound examinations are now secure, noninvasive, precise, and economical. The term "SONAR," that means "sound navigation and ranging," is used to describe the SONAR principle. An inverse piezoelectric action is what causes ultrasound waves. The phenomenon known as the piezoelectric effect occurs when pressure is applied to crystals (piezoelectric materials), and the mechanical pressure results in the generation of an electric current. Contrarily, a mechanical wave is produced when an electric pulse is supplied to a piezoelectric material; this mechanical wave is an

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ultrasonic beam. A transducer that is in touch with the mother's abdomen and is adjusted to examine at any specific uterine material emits sound waves. These waves are reflected back to the transducer at the point where they encounter a tissue interface, where they are processed into the ultrasonic image that is seen on the monitor [6,7].

According to recent research, the kidney length of the foetus plays a significant role in estimating gestational age. This is especially true for the time frame encompassing weeks 24 through 38. Femur length and bi-parietal dimension are more significant pre-36 weeks than head circumference. In the past, FKL measures were used to identify foetal kidney malformations. Later, the link with gestational age was discovered using FKL measurements. The advantage of FKL measures is that intrauterine foetal growth retardation has no impact on them. Even in cases of foetal growth retardation, the renal length (FKL) has been reported to exhibit a constant rise of 1.7 mm every 15 days during the whole pregnancy [7,8].

The goal of the current study was to use the mean foetal kidney length and its comparison to other sonographic parameters to estimate the gestational age of a foetus beyond 24 weeks.

MATERIAL AND METHODS:

After receiving approval from the institution's ethical committee, the current prospective comparison study was carried out between 2020 and 2021 at the Department of Obstetrics and Gynaecology in the Guntur Medical College and Hospital, Andhra Pradesh, India. After 24 weeks of gestation, 200 healthy pregnant women who are between the ages of 20 and 35 and whose BMIs range from 18 to 25 kg/m2 are included. Following the receipt of written informed permission, each patient had a full medical history taken, and each one had their fundal height palpated to determine their gestational age. The mean foetal kidney length, head circumference, femur length, abdominal circumference, and biparietal diameter were then determined using ultrasound technology.

The whole length of the kidney and the renal pelvis are visible when measuring the length in the sagittal plane. Each single foetal kidney is evaluated at least three times from the upper pole to the lower pole for its greatest length, and the mean of the readings is computed.

Inclusion Criteria:

1.Pregnant mothers with singleton pregnancies after 24 weeks.

2.Antenatal mothers who are sure of their dates of last menstrual period.

3.Normal antenatal patients with no associated risk factors.

Exclusion Criteria:

1.Fetal Anomaly

2.Antental mothers with unknown dates.

3.Multiple gestation,

4.Associated risk factors such as Diabetes, Preeclampsia, eclampsia, chronic renal diseases

5.Obscure adrenal and renal borders or margins.

6.Abnormal renal morphology.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

RESULTS:

Table 1: Age distribution is depicted in the below table

Age (yrs)	N	Minimum	Maximum	Mean	SD
	200	20	35	24.41	3.79

Participants in my study ranged in age from 20 to 35 years old, with a mean age of 24.41 3.79 years.

Table 2: Frequency of Distribution according to GA

GA LMP	Frequency	Percent
< 32	28	14.0
33 – 37	77	38.5
38 – 42	95	47.5
Total	200	100.0

Table 3: Frequency of distribution according to Parity

Parity	Frequency	Percent
Primi	114	57.0
Multi	86	43.0
Total	200	100.0

In my study, 57% of women were primiparous and 43% were multiparous.

Table 4: Pregnancy confirmation

Pregnancy confirmation	Frequency	Percent
UPT	145	72.5
USG	55	27.5
Total	200	100.0

In the current study, 27.5% of women who were pregnant received USG confirmation,

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

while 72.5% received UPT confirmation.

Table 5: Presentation

Presentation	Frequency	Percent
Breech	15	7.5
Cephalic	183	91.5
Transverse	2	1.0
Total	200	100.0

Breech presentation occurred in 7.5% of the patients, cephalic presentation in 91.5%, and transverse lay in 1% of the cases.

Table 6: Comparision of mean gestational age

	N	Minimum	Maximum	Mean	SD
LMP GA	200	28	41	36.51	3.20
BPD	200	28	40	35.25	2.67
HC	200	27	40	35.35	2.88
AC	200	27.0	41.0	35.05	3.07
FL	200	28	40	35.25	2.99
MKL	200	27	41	35.93	3.49
Multiple parameters	200	27.80	39.60	35.36	2.72

In this, the mean age observed was 36.5±13.20 weeks, and the gestational age based on LMP ranged from 28 to 41 weeks. BPD varied from 28 to 40, with a mean of 35.25±2.67; HC ranged from 27 to 40, with a mean of 35.35±2.88. Between 27 and 41, Ac ranged, with a mean of 35.05±3.07; FL between 28 and 40, with a mean of 35.25±2.99; and MKL between 27 and 41, with a mean of 35.93±3.49. GA varied from 27.8 to 39.6 on the composite of several factors, and the mean was 35.36±2.72.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Table 7: Correlation between different parameters with gestational age

		BPD	HC	AC	FL	MKL	POG WITH MP
LMP GA	r - value	0.778	0.791	0.79	0.759	0.746	0.857
	P- value	0.000	0.000	0.000	0.064	0.000	0.000
	N	200	200	200	200	200	200

Table 8: Regression equations

	R	R Square	Constants		Equation
			A	B	
BPD GA	0.778	0.61	11.570	0.65	11.57 +0.65 * LMP GA
HC GA	0.791	0.626	9.42	0.71	9.42 + 0.71 * LMP GA
AC GA	0.79	0.624	7.38	0.76	7.38 + 0.76 * LMP GA
FL GA	0.759	0.576	9.39	0.71	9.39 + 0.71 * LMP GA
MKL GA	0.746	0.557	6.23	0.81	6.23 + 0.81 * LMP GA
ML GA	0.776	0.603	8.92	0.73	8.92 + 0.73 * LMP GA

Table 9: Correlation of different parameters with Gestational age was shown inbelow table

	< 32			33 – 37			38 – 41		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
LMP GA	34	31.91	2.84	123	36.85	2.36	43	39.16	1.17
BPD	34	30.94	1.37	123	35.26	1.35	43	38.60	0.66
HC	34	30.91	1.56	123	35.50	1.87	43	38.42	1.20
AC	34	30.76	1.60	123	35.12	2.37	43	38.23	1.09
FL	34	30.94	1.35	123	35.29	2.22	43	38.51	0.80

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

MKL	34	32.50	3.79	123	35.99	2.92	43	38.44	2.38
Multiple parameters	34	31.21	1.63	123	35.56	2.35	43	38.47	0.74

Table 10: Correlation in subgroups of gestational age – LMP derived gestational agewith BPD

GA		Mean	SD	P-value
< 32	LMP GA	30.68	1.28	0.018*
	POG BPD	31.07	1.94	
33 - 37	LMP GA	35.29	1.47	0.0002*
	POG BPD	34.71	1.61	
38 - 42	LMP GA	39.21	0.89	0.0001*
	POG BPD	36.91	1.92	
Overall	LMP GA	36.51	3.20	0.0001*
	POG BPD	35.25	2.67	

In my study, the mean LMP GA observed during the first 32 weeks was 30.68±1.28 and the mean POG BPD observed during the next 33–37 weeks was 35.29±1.47 and the mean POG BPD observed during the next 38–42 weeks was 36.51±3.20 and the mean POG BPD observed during the last 38–42 weeks was 35.25±2.67. Across the four research pregnancy trimesters, both metrics revealed a statistically significant connection.

Table 11: Correlation in subgroups of gestational age – LMP derived gestational age with HC

GA		Mean	SD	P-value
< 32	LMP GA	30.68	1.28	0.28
	POG HC	30.86	1.99	
	LMP GA	35.29	1.47	

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

33 - 37	POG HC	34.78	1.89	0.0028
38 - 42	LMP GA	39.21	0.89	0.0001*
	POG HC	37.13	2.00	
Overall	LMP GA	36.51	3.20	0.0002*
	POG HC	35.35	2.88	

In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28 and the POG HC was 30.86+1.99; during the following 33–37 weeks, the LMP GA observed was 35.29+1.47 and the mean POG HC observed was 34.781.89; and during the following 38–42 weeks, the mean LMP GA observed was 36.51+3.20 and the POG HC was 35.35+2.88. In the current investigation, the mean age observed during the first 32 weeks of pregnancy did not differ statistically substantially from that observed later in the pregnancy, when the mean age calculated based on the HC changed significantly from that estimated based on the LMP GA.

Table 12: Correlation in subgroups of gestational age – LMP derived gestational age with AC

GA		Mean	SD	P-value
< 32	LMP GA	30.68	1.28	0.35
	POG AC	30.54	1.67	
33 – 37	LMP GA	35.29	1.47	0.0001*
	POG AC	34.13	2.10	
38 - 42	LMP GA	39.21	0.89	0.0001*
	POG AC	37.13	2.13	
Overall	LMP GA	36.51	3.20	0.0001*
	POG AC	35.05	3.07	

In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28 and the mean POG AC seen during the next 33–37 weeks was 35.29+1.47, and the mean POG AC observed during the next 38–42 weeks was 39.21+0.89. Overall, the LMP GA was 36.51+3.20 and the POG AC was 35.05+3.07. In the current investigation, there was no statistically significant difference between the mean age determined using AC during the first 32 weeks of pregnancy and the mean age determined using AC towards the end of the pregnancy when compared to the mean age determined using LMP GA.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Table 13: Correlation in subgroups of gestational age – LMP derived gestational agewith FL

GA		Mean	SD	P-value
<32	LMP GA	30.68	1.28	0.10
	POG FL	30.93	1.74	
33 - 37	LMP GA	35.29	1.47	0.0002*
	POG FL	34.55	2.33	
38 - 42	LMP GA	39.21	0.89	0.0001*
	POG FL	37.08	2.07	
Overall	LMP GA	36.51	3.20	0.0001*
	POG FL	35.25	2.99	

In my study, the mean LMP GA observed during the first 32 weeks was 30.68±1.28 and the mean POG FL observed during the following 33–37 weeks was 35.29±1.47 and the mean POG FL observed during the following 38–42 weeks was 39.21±0.89 and the POG FL was 37.08±2.07; overall, the LMP GA was 36.51±3.20 and the POG AC was 35.25±2.99. In the current investigation, there was no statistically significant difference between the mean age determined using FL during the first 32 weeks of pregnancy and the mean age determined later in pregnancy when compared to the mean age determined using LMP GA.

Table 14: Correlation in subgroups of gestational age – LMP derived gestational agewith Mean kidney length (MKL)

GA		Mean	SD	P-value
< 32	LMP GA	30.68	1.28	0.0011*
	POG MKL	31.54	3.48	
33 - 37	LMP GA	35.29	1.47	0.0016*
	POG MKL	34.74	1.96	
38 - 42	LMP GA	39.21	0.89	0.0001*
	POG MKL	38.18	2.68	

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Overall	LMP GA	36.51	3.20	0.084
	POG MKL	35.93	3.49	

In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28 and the POG MKL was 31.54+3.48. During the following 33–37 weeks, the LMP GA observed was 35.29+1.47 and the mean POG MKL observed was 34.741.96. Finally, during the following 38–42 weeks, the mean LMP GA observed was 39.21+0.89 and the POG MKL was 38.18+2.68, In my investigation, it was shown that the mean gestational age estimated using the MKL and the gestational age estimated using the LMP differed statistically significantly.

Table 15: Correlation in subgroups of gestational age – LMP derived gestational agewith Multiple parameters (MP)

GA		Mean	SD	P-value
< 32	LMP GA	30.68	1.28	0.043*
	POG MP	30.99	1.75	
33 - 37	LMP GA	35.29	1.47	0.0391*
	POG MP	34.84	2.70	
38 - 42	LMP GA	39.21	0.89	0.0001*
	POG MP	37.25	1.65	
Overall	LMP GA	36.51	3.20	0.0007*
	POG MP	35.45	2.99	

In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28 and the POG MP was 30.99+1.75; during the following 33–37 weeks, the LMP GA observed was 35.29+1.47 and the mean POG MP observed was 34.84+2.70; and during the following 38–42 weeks, the mean LMP GA observed was 39.21+0.89 and the POG MKL was 37.25+1.65; overall, the LMP GA In the current investigation, it was found that the mean gestational age assessed using the MKL and the gestational age estimated using the LMP differed statistically significantly.

DISCUSSION:

For clinical care, particularly for high-risk pregnancies, a precise estimate of the foetal gestational age is essential. Pregnancies with preeclampsia and eclampsia are high-risk. When the foetus reaches maturity, pregnancy termination may be necessary in circumstances of unforeseen difficulties. The bulk of biochemical, serological, and

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ultrasound-based screening tests are carried out during a particular gestational stage[7,8]. There are certain restrictions when utilising the last menstrual cycle to determine the anticipated delivery date [9,10]. Due to poor menstrual history, pregnancy during lactational amenorrhea, first trimester vaginal bleeding, and irregular monthly cycles, this can result in estimations that are erroneous. For Symphysio fundal height, the gestational age in centimetres is between 24 and 36 weeks. However, a variety of circumstances, including gestational diabetes mellitus (GDM), multiple pregnancies, intrauterine growth retardation, transverse foetal lie, gestational ages between 24 and 36 weeks, can affect how it is measured. Hadlock-based composite gestational ages assessments are the most popular biometric indices for assessing foetal gestation. This is calculated using the biparietal diameter, head, abdomen, and femur height measurements (FL). Despite being the most prevalent, these biometric indices might be impacted by underlying medical disorders including intrauterine growth retardation [11,12]. Additionally, they indicate possible discrepancies, particularly when estimating gestational ages in the third trimester. In circumstances like IUGR, the embryonic kidney length varies somewhat in terms of its width and antero-posterior dimensions. Additionally, no other medical issue has a substantial impact on how long it is. Throughout pregnancy, the kidney of the foetus grows continuously at 1.7mm, untouched or impacted by any growth anomalies. The current study, titled Comparative investigation of gestational age estimation using mean foetal kidney length and other sonographic foetal parameters in singleton pregnancies after 24 weeks, was conducted with the aim of estimating the gestational age of the foetus beyond 24 weeks using mean foetal kidney length due to a lack of data across the trimesters [12].

Participants in my study ranged in age from 20 to 35 years old, with a mean age of 24.41 + 3.79 years. Pregnancy-related findings: Of the participants in this study, 43% were multiparous and 57% were primiparous. In my study, 27.5% of women who were pregnant received USG confirmation, while 72.5% received UPT confirmation. Breech presentation occurred in 7.5% of the patients, cephalic presentation in 91.5%, and transverse lay in 1% of the cases. Based on several criteria, the mean GA was observed: It is crucial to understand the precise foetal gestational age (GA) in order to manage obstetric patients, and this cannot be emphasised enough [12,13]. To make an informed choice on obstetric care, it is critical to understand the actual age of pregnancy. An accurate FGA calculation enables necessary planning for the delivery mode and postpartum care of the new born. Additionally, it aids in the assessment and diagnosis of intrauterine growth retardation as well as counselling expectant mothers who are at a high risk of premature birth (IUGR).

Unknown gestational age has been associated with a poor pregnancy outcome, including low birth weight, spontaneous premature labours, and perinatal death rates. Haines emphasised that the foetus is at risk when there is a hazy LMP date combined with any obstetrically high-risk circumstance (such as placenta previa and pregnancy-induced hypertension (IUGR) due to the challenge of selecting when to deliver the baby). The last menstrual period (LMP), ovulation date, conception date (in cases of artificial insemination), quickening, ultrasonography, and symphysis fundal height are some of the techniques used to calculate FGA. The use of ultrasound in obstetrics practise and FGA estimate are both essential. Sonographic estimates of gestational ages are made using

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

calculations based on foetal measures. This acts as a supplementary indicator [13]. In order to establish the correlation between foetal biometric data, numerous equations have been constructed. They are a legitimate and impartial method of determining FGA. These biometric measurements include: Femur length, Head circumference, Abdominal circumference, Biparietal diameter, Crown rump length, and Gestational sac (FL). When it comes to precisely determining FGA with ultrasound, especially as the pregnancy gets closer to term, obstetricians confront significant challenges [13,14]. This issue is frequently made worse as the pregnancy proceeds since there is an increase in biological variety in the foetal DNA. Maternal age, parity, and pregnancy weight are only a few examples of the variables that may contribute to these variances. Technical aspects like interobserver error or various measuring procedures can potentially increase foetal variability as pregnancy nears term.

This conclusion was reinforced by Benson et al., who highlighted that as the pregnancy progresses into the third trimester, the precision of these conventional predictors of FGA (GS, CRL, BPD, HC, AC and FL) declines. Butt & Konje et al advocated combining different biometric parameters for FGA determination in the third trimester rather than relying on a single biometric parameter. Ansari et al. and Konje et al. discovered that the foetal kidney length (FKL) is a more precise method of predicting gestational age than the other foetal biometric indices based on BPD, HC, FL, and AC between 24 and 38 weeks of gestation [14,15,16]. The foetal kidney can be reliably measured between weeks 14 and 17 of pregnancy using transvaginal sonography (TVS), and starting at week 18 using transabdominal ultrasonography. Ansari et al. discovered a little variation in Asian embryonic kidney length compared to earlier studies on Caucasians. This may show the ethnic diversity of the study population, which may help to explain why Degan advised evaluating a wide range of epidemiological factors related to prenatal development and using specific charts for various populations wherever they were available. According to Kurtz et al., although there are many well-known charts that have been in use for a long time, significant demographic disparities occasionally cause researchers to develop a nomogram for other races, which makes the need for this study necessary.

The mean age observed in the current study was 36.51±3.20 weeks, while the gestational age based on LMP ranged from 28 to 41 weeks. On the basis of a composite of several factors, GA had a range of 27.8–39.6 and a mean of 35.36±2.72. Comparability between GA and LMP GA based on several parameters: In my study, the mean LMP GA observed during the first 32 weeks was 30.68±1.28, and the mean POG BPD seen during the following 33–37 weeks was 35.29±1.47, and the mean POG BPD observed during the following 38–42 weeks was 36.51±3.20. Across the four research pregnancy trimesters, both metrics revealed a statistically significant connection. In the current study, the mean LMP GA observed during the first 32 weeks was 30.68±1.28, and the mean POG HC observed during the next 33–37 weeks was 35.29±1.47, and the mean POG HC observed during the next 38–42 weeks was 36.51±3.20, and the mean POG HC was 35.35±2.88. Overall, the LMP GA was 36.51±3.20, and the POG HC was 35.35±2.88. The mean age seen during the first 32 weeks of the study was not statistically different from the mean age calculated later in the pregnancy based on the HC, which differed considerably from the

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

mean age estimated based on LMP GA [15,16]. In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28, and the mean POG AC observed during the following 33–37 weeks was 35.29+1.47, and the mean POG AC observed during the following 38–42 weeks was 39.21+0.89. Overall, the LMP GA was 36.51+3.20, and the POG AC was 35.05+3.07. In the current investigation, there was no statistically significant difference between the mean age determined using AC during the first 32 weeks of pregnancy and the mean age determined using AC towards the end of the pregnancy when compared to the mean age determined using LMP GA. In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28, and the mean POG FL observed during the following 33–37 weeks was 35.29+1.47, and the mean POG FL observed during the following 38–42 weeks was 39.21+0.89, and the POG FL was 37.08+2.07. Overall, the LMP GA was 36.51+3.20, and the POG AC was 35.25+2.99 [17,18].

In the current investigation, there was no statistically significant difference between the mean age determined using FL during the first 32 weeks of pregnancy and the mean age determined later in pregnancy when compared to the mean age determined using LMP GA. In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28 and the POG MKL was 31.54+3.48. During the following 33–37 weeks, the LMP GA observed was 35.29+1.47 and the mean POG MKL observed was 34.74+1.96. Finally, during the following 38–42 weeks, the mean LMP GA observed was 39.21+0.89 and the POG MKL was 38.18+2.68, In the current investigation, it was found that the mean gestational age assessed using the MKL and the gestational age estimated using the LMP differed statistically significantly [18,19]. In the current study, the mean LMP GA observed during the first 32 weeks was 30.68+1.28, and the mean POG MP observed during the following 33–37 weeks was 35.29+1.47, and the mean POG MP observed during the following 38–42 weeks was 39.21+0.89, and the POG MKL was 37.25+1.65. Overall, the LMP GA was 36.51+3.20, and the POG AC was 35.45+2.99. In the current investigation, it was found that the mean gestational age assessed using the MKL and the gestational age estimated using the LMP differed statistically significantly. The search for the most precise biometric measure that can predict gestational age has increased as the pregnancy gets closer to term. Campbell's condition that FGA be estimated with minimum biological variation, simple measurement, and high reliability must be met by this biometric parameter. The unborn kidney can be seen and measured with ease [18,19,20].

The right FKL exhibited a very good concordance correlation between sonographers, with a coefficient of 0.977 between sonographers and a coefficient value of 0.977 within sonographers, according to the pilot investigation to demonstrate inter rater reliability. While the left FKL had a concordance coefficient of 0.995 and 0.990, respectively, between sonographers. It is 0.996 for the interclass correlation coefficient. This indicates that measurements of the embryonic kidneys satisfy the Campbell criteria for strong intra- and inter-rater consistency. To further support the discovery, the intraclass correlation was assessed using the ANOVA model. The result was a coefficient of 0.989, which is excellent enough to be applied therapeutically. The Bland Altman plot shows that the measurements are also strongly distant from zero. The results show that when FGA grows,

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

both FKLs rise linearly. While the left FKL grows from 2.100.37 cm at 20 weeks of pregnancy to 4.750.29 cm at 40 weeks, the right FKL expands from 2.040.38 cm to 4.740.26 cm at that point in the pregnancy. This is in line with earlier research63, which showed that FKL also rises as FGA does. The fact that FKL and FGA have a positive connection suggests that FKL is a reliable indicator of FGA at the third trimester [18,19]. According to Konje et al., FKL is a more accurate method of determining FGA than the biometric indices of BPD, HC, FL, and AC between 24 and 38 weeks of gestation. This may also account for the fact that both FKLs show a weak but positive connection with other biometric measurements whose effectiveness decreases as pregnancy approaches term. The left FKL correlates with FL (0.379, p 0.01), BPD (0.343, p 0.01), AC (0.396, p 0.01), and HC (0.311, P 0.01) but not with other biometric parameters (0.360, p 0.1), BPD (0.323, p 0.01), AC (0.379, p 0.01), or HC (0.311, P 0.01). (0.331, p 0.01). Gestational age is crucial in establishing the anticipated delivery date in the first trimester and assessing the development of the foetus in the second and third trimesters. The variability in FKL-based gestational age estimation has previously been the subject of several research. They found a linear connection between the gestational age in weeks and the foetal kidney length in mm.

We conducted this investigation to look for any variations in the Indian population. There are several ways to determine gestational age, including using the LMP and crown rump length in the first trimester. Biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femoral length (FL) have become well-accepted foetal biometric measures for estimating gestation age globally as the pregnancy advances. However, the margin of error for these parameters widens as the gestation develops, especially in the third trimester, and these parameters may not be correct. The calculation of gestational age has also been proposed using additional parameters such as foetal foot length and foetal kidney length. Numerous studies concluded that the mean foetal kidney length was the metric that best represented or accurately correlated gestational age. They believe that foetal sacral length can be utilised to date labour due to the strong correlation between GA and sacral length that Ozat et al discovered. Moreover, additional research discovered that factors including BPD, HC, AC, and FL are strongly correlated with GA, although determining these parameters required highly developed ultrasonography expertise.

In the current study, we discovered that the FKL parameter was the most accurate for estimating gestational age. These findings are supported by a study by Kansaria et al. that demonstrated how utilising the FKL parameter improved labour dating. The kidney's length can be used as an accurate measure to estimate the gestational age, according to a study by Das et al. As shown in the table above, we compared the intercept and regression coefficient (slope) between the current study and a few earlier investigations.

In contrast to earlier studies, the current finding demonstrated a positive Pearson's correlation and regression coefficient between kidney length and gestational age. Sonographically measuring the appropriate lengths of foetal kidneys during pregnancy was done in the Cohen et al. study. The gestational ages were calculated using biometry and the most recent menstrual cycle. The relationship between gestational age and renal length is

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

quite significant (r = 0.82). Biparietal dimension, femoral size, and abdominal circumference were used to determine this. These three measures were combined to create an average. There was no discernible difference in right and left renal lengths in foetuses whose kidneys were scanned. Between gestational ages, the typical renal lengths fluctuate dramatically (p less than 0.001). The goal of Konje et al. was to assess the accuracy of kidney length measurement when used to estimate gestational age between the 24th and 38th weeks of pregnancy and to compare it to other foetal biometric markers [17,18,19]. Between 24 and 38 weeks of gestation, 73 singleton, uncomplicated pregnancies underwent conventional ultrasonography foetal biometry and kidney length assessments every 2 weeks. The most accurate models for calculating gestational ages in late pregnancy included elements including kidney length, biparietal dimension, head circumference, and femur circumference. The model had a standard error of 8.48 days and correctly predicted gestational ages. When the model took into consideration the kidney length, biparietal dimension, head circumference, and femur height, the standard error for gestational age prediction was 8.57 days. These models performed marginally better than those derived from biparietal size, head circumference, and femur height (+- 9.87), biparietal dimension, head circumference, and femur diameter (9.45), and biparietal and femur sizes (9.9), respectively, biometric indices. Using simple linear regression models, the kidney length and femur size had the best accuracy in predicting gestational age (10.29 and 10.96 days, respectively), whereas the abdominal circumference had the worst accuracy (14.54 day).

The goal of Toosi and Rezaie-investigation Delu's was to identify the typical length of the developing kidney (KL) and how it relates to GA. 92 pregnant women who were between the eighth and tenth weeks along in a typical singleton pregnancy underwent cross-sectional studies. The women had typical foetal biometry ultrasounds and measures of kidney length. A multivariate and univariate linear regression analysis was carried out to determine GA on KL and other fetobiometry parameters. GA and KL had a substantial (r = 0.83) association. The most accurate way to predict GA was to combine head circumference, foetal biparietal diameter, and femur length. Together with a standard error (SE) of about 14.2 days. These findings demonstrated that KL measures could provide a more precise estimation of the gestational age when combined with other foetal biometric parameters. In a study by Shivalingaiah et al., it was discovered that foetal kidney length highly correlated (r = 0.85) with gestational age in the late trimesters, even in IUGR foetuses [19,20,21]. The study looked at how kidney size affected the gestational age. 60 pregnant women between the ages of 24 and 36 weeks participated in the study. Early dating scans provided reliable prenatal dating. The kidney that was the closest was measured in millimetres. In addition, it was assessed four times each week along with other biometric measurements. According to the observations, KL has the lowest overall departure from gestational age. This demonstrates that all other ultrasonography biometric factors and the observed kidney length were nearly identical [20,21].

The goal of the Chatterjee et al study was to assess the foetal kidney length as a measure for estimating gestational age during pregnancy using ultrasound. 100 pregnant women of various ages and due dates participated in this study. According to the findings, KL has the

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lowest week-to-week variation from the gestational ages. The findings demonstrated that all other ultrasonography biometric measures and kidney length were essentially equal.

CONCLUSION: The study came to the conclusion that the kidney length might be utilised to predict gestational age on its own, especially in the later trimesters when biometric indicators might not be as accurate. The calculation of gestational age using the foetal kidney proved valuable.

Ethics committee approval and consent to participate: Taken

Availability of data and material: All required data is available

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CONFLICT OF INTEREST: None

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