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DETERMINATION OF ACCURACY OF ULTRASONOGRAPHY IN 1st TRIMESTER OF PREGNANCY IN DETECTION OF DATE OF DELIVERY.

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ABSTRACT

INTRODUCTION: The estimated date of delivery carries significant medical, social, and personal importance for pregnant women and serves as a critical reference for physicians responsible for ensuring a safe birth. Accurate determination of gestational age is essential in obstetric care. Precise pregnancy dating enables obstetricians to counsel women at risk of preterm birth (delivery before 37 weeks) regarding potential neonatal outcomes. Earlier evidence has shown that first-trimester ultrasound using CRL provides more accurate estimation of gestational age compared to later assessments. **OBJECTIVE:** To determine the accuracy of Ultrasonography in 1st trimester of pregnancy in detection of date of delivery. **METHODS:** this descriptive cross sectional study was conducted at Obstetrics and Gynaecology department-2 of Bahawal Victoria Hospital, Bahawalpur from 2022-2023. Al the women aged 18 to 44 years either parity and booking status, presented with singleton intrauterine pregnancy with presence of participant had a first-trimester ultrasound (7 to 13+6 weeks) with crown–rump length–based dating performed by experienced sonographer and ultrasound with available records estimated date of delivery (EDD) and the actual date of delivery were included. The accuracy of ultrasonography in the 1st trimester was considered positive if the actual date of delivery occurred on the date estimated by the ultrasound performed during early pregnancy. Data were analyzed using SPSS version 26. **RESULTS:** Overall mean age of women was 32.56±6.11 years. The mean gestational age at first-trimester ultrasound being 10.15±0.86 weeks and at delivery was 38.87+2.40 weeks**.** Accuracy of first-trimester ultrasound in predicting the date of delivery was found to be high, with 83.6% (92 out of 110) of cases accurately matching the estimated and actual delivery dates, while 16.4% (18 out of 110) were inaccurate. Maternal age, mode of delivery, and parity showed no statistically significant differences in accuracy p->0.05**.** **CONCLUSION:** 1st trimester ultrasonography is a reliable method for estimating the expected date of delivery, with crown–rump length being the most accurate parameter for early gestational dating, while due few significant limitation of the study further large-scale studies is recommended to validate these findings and to establish robust evidence for routine clinical use in clinical practice.

KEY WORDS: US, Gestational Age Accuracy, estimation. EDD

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INTRODUCTION

Estimating gestational age (GA) is essential for evaluating newborn maturity and plays a vital role in obstetric care and medical decision-making,[1] as it directly influences clinical judgment and guides the formulation of appropriate management strategies throughout pregnancy. Accuratepregnancy dating may assist obstetricians in appropriately counseling women who are at risk of a preterm delivery (Delivery of fetus before 37 weeks) about likely neonatal outcomes and is also essential in the evaluation of fetal growth and the detection of intrauterine growth restriction.[2] Approximately 70% of women in the United States undergo ultrasound during pregnancy to estimate the expected date of delivery.[2] Therefore, accurate determination of gestational age is essential for monitoring fetal development throughout pregnancy and ensuring optimal management in relation to the delivery date.

However the early ultrasound measurement provides the highest precision for determining pregnancy duration during the initial trimester, since differences in fetal growth are very small at this stage.[3] According to previous studies reported that the ultrasound has been shown to be effective for estimating GA during the first and second trimesters; however, its precision declines in the third trimester due to biological factors such as ethnic differences in fetal growth patterns and variability across populations.[4,5] Therefore, age and gestation in early months remains reliable within an error margin of 3–5 days.[3] Several studies have explored the significance of crown–rump length (CRL) in estimating fetal growth indicators such as birth weight, small for gestational age, and large for gestational age, all of which are strongly linked to health outcomes during fetal life, infancy, and later adulthood.[6,7] Evidence indicates that SGA increases the likelihood of cerebral palsy, mental health problems, and reduced cognitive ability in term as well as moderate-to-late preterm newborns,[6] while LGA is associated with long-term metabolic consequences, particularly a higher risk of childhood obesity and metabolic syndrome later in life.[6,8] As per study conducted in 2014, in the third trimester, biparietal diameter (BPD) becomes less reliable and may lose accuracy beyond 30 weeks of gestation.[5] Therefore, when used in later trimesters, BPD should be interpreted alongside other biometric parameters to better assess fetal growth and minimize the risk of erroneous ultrasound measurements.[5]

However there is a variation in methodological approaches exists among studies that formulate equations for gestational age estimation, as a recent study developed and validated a formula to estimate GA using CRL measurements in Chinese fetuses between 11 and 14 weeks of pregnancy.[1] Another study demonstrated a strong association between first-trimester crown–rump length and gestational age,[3] while other reported that the TCD is a reliable marker for estimating gestational age, as its measurements closely align with gestational age calculated from the last menstrual period and it found to be a superior predictor compared to other parameters, particularly between 14 and 22 weeks of pregnancy.[9] On the other hand revealed that the TCD, BPD, FL head circumference and abdominal circumference has the strongest correlation with gestational age during 2nd and third trimester.[10] Based on the above contradictory findings and previous research on the reliability of first-trimester ultrasound, along with the limited current evidence, this study was conducted to evaluate the accuracy of first-trimester ultrasound in estimating GA, which may help strengthen earlier evidence regarding the reliability of first-trimester ultrasound and contribute to the prevention of SGA

and large for gestational age outcomes.

MATERIALS AND METHODS

This descriptive cross sectional study was conducted at obstetrics and Gynaecology department-2of Bahawal Victoria Hospital, Bahawalpur from January 2022 December 2022. Non probability consecutive sampling technique was used. Al the women aged 18 to 44 years either parity and booking status, presented with singleton intrauterine pregnancy with presence of participant had a first-trimester ultrasound (7 to 13+6 weeks) with crown–rump length–based dating performed by experienced sonographer and ultrasound with available records estimated date of delivery (EDD) and the actual date of delivery were included. Women with multiple gestations, nonviable pregnancies, diagnosed fetal anomalies, or ectopic/molar pregnancies, women with elective/planned early delivery, medically indicated preterm/post-term delivery due to severe placenta previa, pre-eclampsia, abruption placenta or any other medical condition and women without complete medical record were excluded. Study was done after obtaining approval from the ethical review committee, patients were informed about the study procedure and its purpose in brief, and written informed consent was obtained. Subsequently a detailed clinical history and examination were performed, followed by a first-trimester ultrasound using for gestational age estimation and calculation of the expected date of delivery. All the patients were then followed prospectively throughout pregnancy with routine antenatal visits, and maternal and fetal complications, if any, were recorded in structured case record forms. Subsequently at the time of delivery, the actual date of delivery (ADD) was documented from hospital records, and mode of delivery was noted. The accuracy of first-trimester ultrasonography was determined by comparing the ADD with the EDD derived from the ultrasound. Subsequently the difference of **±7 to 10 days** between EDD and ADD was generally considered as accurate.

RESULTS

Overall 110 pregnant women were enrolled with mean age of 32.56±6.11 years. Majority of the participants were nulliparous (41.8%), followed by 2.7% women had parity 4 and reaming all women were with parity of 1-3. The majority of deliveries occurred at term (84.5%), while 12.7% were preterm and 2.7% were post-term. Vaginal delivery was slightly more common (54.5%) compared to cesarean section (45.5%). The mean gestational age at first-trimester ultrasound being 10.15±0.86 weeks and at delivery was 38.87+2.40 weeks. The overall mean difference between the ultrasound-estimated date of delivery and the actual delivery date was -7.90±16.82 days. **Table: 1.**

Based on the findings the accuracy of first-trimester ultrasound in predicting the date of delivery was found to be high, with 83.6% (92 out of 110) of cases accurately matching the estimated and actual delivery dates, while 16.4% (18 out of 110) were inaccurate. **Fig: 1**

Based on the stratification by maternal age, mode of delivery, and parity showed no statistically significant differences in accuracy p->0.05 as shown in table **2.**

Table: 1. Clinical and demographic informative variables n=110

Variables		Frequency	Percent
Parity	**0**	46	41.8
	1	30	27.3
	2	18	16.4
	3	13	11.8
	4	3	2.7
	Total	110	100.0
	LSCS	50	45.5
Mode of	**Vaginal**	60	54.5
delivery	**Total**	110	100.0
	Post-	3	2.7
Term	**term**		
category	**Preterm**	14	12.7
	Term	93	84.5
	Total	110	100.0
Mean maternal age		32.56±6.11	years
Mean gestational age		10.15±0.86	weeks

at first trimester	
Mean gestational age at delivery	38.87+2.40 weeks
Overall mean difference between EDD and delivery date	-7.90±16.82 days

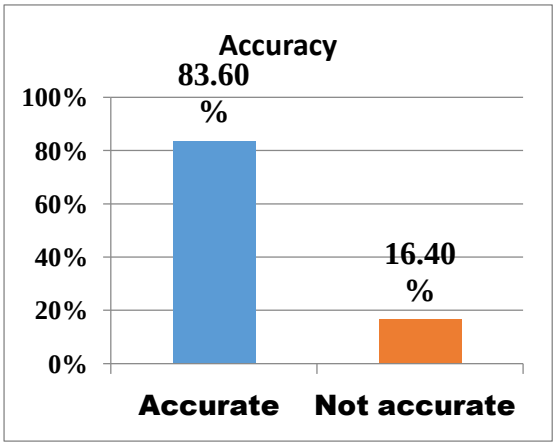

Fig: 1: Accuracy of first trimester US for gestational age and delivery n=110

Table: 2. Stratification based on maternal age, MOD and parity n=110

Variables		Accuracy		Total	p-value
		Yes	No		
Age Groups	**18-30 years**	8	36	44	0.732
		7.3%	32.7 %	40.0 %	
	31-45 years	10	56	66	
		9.1%	50.9 %	60.0 %	
Mode of delivery	**C-section**	7	43	50	0.541
		6.4%	39.1 %	45.5 %	
	SND	11	49	60	
		10.0 %	44.5 %	54.5 %	
Parity	**Primiparous**	7	33	40	0.721
		6.7%	31.7 %	38.5 %	
	Parity 1-3	10	51	61	
		9.6%	49.0 %	58.7 %	
	Parity>3	0	3	3	
		0.0%	2.9%	2.9%	

DISCUSSION

The estimation of the expected date of delivery (EDD) carries significant importance in obstetric practice, as it not only ensures appropriate clinical management but also provides psychological satisfaction and preparedness for the expectant mother.[11] The accurate calculation of EDD in the early trimester and its documentation in the antenatal record are essential components of maternal care. This study has been done to assess the accuracy of Ultrasonography in 1st trimester of pregnancy in detection of date of delivery on 110 women with an overall mean age of 32.56±6.11 years and mean gestational age at first trimester ultrasound 10.55±2.01 weeks with overall mean CRL of 31.80±11.92 mm.

These findings are comparable to those reported by Agarwal P et al[12] who observed an age range of 18 to 42 years, with a mean of 24.98 years, and the majority of women between 21 and 30 years. Consistently, Zhang Y et al[1] documented an overall mean age of 29.4 ± 3.7 years, with an average gestational age of 88.7 ± 4.5 days and a mean crown-rump length (CRL) of 63.48 ± 8.70 mm at the time of diagnosis by ultrasound. Additionally, Hassan MM et al[13] also reported comparable demographic characteristics. However, some variations observed across studies may due to the differences in studies populations and sample selection criteria.

In this study based on the findings the accuracy of first-trimester ultrasound in predicting the date of delivery was found to be high, with 83.6% (92 out of 110) of cases accurately matching the estimated and actual delivery dates. In the comparison of this study Thurlbeck WM et al[14] reported the successive calculation of CRL mean diameter of gestational sac using the proposed method demonstrated accuracies of 60% and 70%, respectively, based on a sample of 10 ultrasound images. In the favor of this study Sahota DS et al[15] reported that the CRL-based dating formula was developed for pregnancies between 6 and 15 weeks of

gestation, which showed no evident systematic prediction error and compared well with previously established CRL dating formulas. However, Gjessing HK Et al[16] compared BPD and CRL for late first-trimester pregnancy dating, finding that while CRL is the established standard, BPD may serve as a feasible alternative around 12 weeks when evaluated using the same population and statistical methods. In aligns to this study Yusrawati Y et al[17] demonstrated that the ultrasound examinations were performed on 400 pregnant women in their first trimester (4–13 weeks) for prenatal assessment, and Pearson correlation analysis revealed a strong association between CRL and gestational age based on the last menstrual period.[17] Consistently Rezaee H et al[18] observed that the no significant differences were found between Iranian and European parameters for CRL and mean gestational sac curves, while CRL between 6 and 12 weeks remains the most accurate parameter for first-trimester dating. Additionally, in the study by de la Fuente-Diez E et al[19] reported that the GA estimation shows low reproducibility when based on two CRL measurements; however, one equation achieved a GA difference within ±5 days in 97.1% of cases, outperforming all other equations.[19] Overall a few earlier studies have reported that first-trimester ultrasound is reliable for gestational age estimation, the current evidence remains insufficient to recommend its universal implementation. Additionally, present study also has certain limitations, including a relatively small sample size, the absence of comparisons with second- and third-trimester ultrasound findings, and the lack of follow-up on fetal outcomes. Hence further, larger-scale studies are recommended to validate these findings, incorporating bigger populations, comparisons across all trimesters, and correlation with neonatal outcomes to establish stronger evidence for clinical practice.

CONCLUSIONS

This study revealed that the 1st trimester ultrasonography is a reliable method for estimating the expected date of delivery, with crown–rump length being the most accurate parameter for early gestational dating, particularly between 6 and 12 weeks. However, due few significant limitation of the study including limited sample size and absence of comparisons with later trimesters or fetal outcomes, further large-scale studies are recommended to validate these findings and to establish robust evidence for routine clinical use in clinical practice.

ETHICS APPROVAL: The ERC gave ethical review approval. NO: 2244/DME/QAMC BAHAWALPUR DATED: 17/08/2023.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

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AUTHORS' CONTRIBUTIONS:

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared.

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