RESEARCH PAPER

Comparison Between Transcerebellar Diameter and Other Prenatal Diameters for Detection of Gestational Age

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ABSTRACT

Background: Reliable assessment of gestational age (GA) is critical for appropriate obstetric care, but many pregnant women, particularly in low-resource settings, present for ultrasound late in pregnancy without early dating scans or accurate last menstrual period (LMP) recall. Conventional biometric parameters like biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL) are often influenced by fetal growth abnormalities. Transcerebellar diameter (TCD) has emerged as a potentially more stable predictor of GA, yet limited data compare its efficacy against other parameters across wider gestational ages.

Objective: To evaluate efficacy of TCD among multiple measurements fetal age assessment in second and third trimester.

Methods: A cross-sectional study was conducted on 300 pregnant women between 13 and 40 weeks of gestation with confirmed LMP and first-trimester CRL data. Fetal biometric parameters (TCD, BPD, HC, AC, FL) were measured via obstetric ultrasound. Correlation and regression analyses assessed each parameter's relationship with gestational age, and predictive accuracy was evaluated within ±1 and ±2 weeks.

Results: All parameters showed strong correlation with gestational age (TCD: $r = 0.992$, $R^2 = 0.984$; BPD: $r = 0.993$, $R^2 = 0.987$). The combined model yielded the highest accuracy ($R^2 = 0.997$) and predicted GA within ±1 week in 100% of cases. TCD alone had the best single-parameter accuracy (88.3% within ±1 week).

Conclusions: TCD is a highly reliable parameter for second and third trimester gestational age estimation, outperforming other individual biometric indices. Its incorporation into routine ultrasound, particularly alongside other measurements, significantly enhances dating accuracy when early GA confirmation is unavailable.

Keywords: Transcerebellar diameter, gestational age, fetal biometry, second trimester, third trimester, obstetric ultrasound, biometric accuracy

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INTRODUCTION

Accurate estimation of gestational age (GA) is essential in obstetric care, guiding fetal growth assessment, delivery timing, and perinatal management. Although first-trimester crown–rump length (CRL) measurement is the most reliable dating method, many women—particularly in low-resource settings—present in the second or third trimester. In these cases, GA estimation depends on fetal biometry, which becomes increasingly variable as pregnancy advances due to genetic and environmental influences **(1).**

Conventional parameters such as biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL) are commonly used but may be affected by growth abnormalities like intrauterine growth restriction (IUGR) or macrosomia, resulting in inaccurate GA estimation. In contrast, transcerebellar diameter (TCD) demonstrates a consistent linear growth pattern in the second and third trimesters and is relatively resistant to growth disturbances, making it a potentially more stable parameter when CRL is unavailable **(3,4).**

However, TCD remains underutilized in clinical practice. Previous studies have been limited by small sample sizes, restricted gestational age ranges, and insufficient statistical comparisons with traditional biometric parameters using robust methods such as multivariate regression and error analysis **(5-7).** Given these

limitations and the frequent late presentation of pregnant women for ultrasound evaluation, there is a need to validate a more reliable GA estimation tool for later pregnancy. TCD shows promise, particularly in under-resourced settings where early scans and accurate menstrual histories may be lacking **(8-10).**

Therefore, this study aimed to assess the correlation between TCD and gestational age, compare its predictive accuracy with BPD, HC, AC, and FL in the second and third trimesters, and evaluate whether a combined measurement model could further enhance estimation accuracy.

PATIENTS AND METHODS

After obtaining approval from the Ethical Committee and written informed consent from all participants, this controlled cross-sectional observational study was conducted on 300 pregnant women attending the obstetrics and gynecology outpatient clinic at October 6 University Hospital, Giza, Egypt. The study was carried out between June 2024 and September 2025.

Study Population

Patients were enrolled consecutively from routine antenatal visits at the outpatient clinic.

Inclusion Criteria

- Pregnant women aged 18 to 45 years
- Singleton pregnancies (low-risk or high-risk)
- Documented first-trimester CRL measurement confirming gestational age

Exclusion Criteria

- Pregnancies in the first trimester at time of examination
- Fetal anomalies or malformations
- Absence of early first-trimester dating scan

Study Procedures: All participants were submitted to the following:

History Taking, Clinical Examination and investigations:

All participants underwent a structured clinical evaluation, including detailed history taking and physical examination. Recorded data included personal history (age, residence, occupation, marital status), menstrual history (last menstrual period and cycle regularity), obstetric history (parity, previous complications, miscarriage), contraceptive history, medical comorbidities (e.g., anemia, hypertension, diabetes), as well as relevant surgical and family history.

Routine antenatal investigations were performed according to standard protocols, including complete blood count (CBC), urine analysis, and blood group typing (ABO and Rh factor), to assess general health and screen for pregnancy-related complications.

Ultrasound Assessment

All ultrasound scans were performed by the primary investigator under the direct supervision of a senior radiologist to ensure consistency and minimize inter-observer variability. A standardized approach was adopted in accordance with ISUOG (International Society of Ultrasound in Obstetrics and Gynecology) guidelines **(10)** for fetal biometric assessment.

The measured fetal biometric parameters included transcerebellar diameter (TCD), biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL).

Measurement Techniques:

- **TCD:** Obtained by rotating the transducer slightly downward from the transthalamic view until the cerebellum appears in the posterior cranial fossa. The diameter was measured outer-to-outer across the widest transverse plane at a 90° angle to the cerebellar axis. This measurement avoids distortion from skull moulding and maintains accuracy even in growth-restricted fetuses.
- **BPD:** Measured in the trans-thalamic plane from the outer edge of the near parietal bone to the inner edge of the far parietal bone (outer-to-inner), ensuring a symmetrical view with visible cavum septum pellucidum.
- **HC:** Circumferential measurement along the outer perimeter of the skull in the same plane as BPD, using the ellipse tool.
- **AC:** Measured in a transverse section of the abdomen at the level of the stomach and portal sinus, avoiding rib shadowing.
- **FL:** Measurement taken from the greater trochanter to the distal metaphysis, excluding the femoral epiphysis if visualized. Care was taken to avoid spurious length due to limb angle or shadowing artifacts.

All biometric values were recorded in millimeters and stored digitally for later analysis. If fetal position hindered measurement, the mother was asked to ambulate or return for a re-scan.

Outcome Measures

The biometric measurements were compared to gestational age as calculated from the confirmed first-trimester CRL scan and LMP.

- **Primary outcomes** included correlation coefficients, regression values (R^2), and

gestational age deviation within ±1 and ±2 weeks for each biometric measurement.

- **Secondary outcomes** included comparison of TCD's performance with that of combined biometric models (e.g., TCD + BPD + FL + HC + AC).

Sample Size: A total of 300 pregnant women were included to ensure statistical strength and clinical representativeness. Although prior studies suggested that 50–60 participants would be sufficient to detect a strong correlation between TCD and gestational age ($r \geq 0.90$) at a 95% confidence level and 90% power, a larger sample was chosen to enhance subgroup analysis (second vs third trimester), improve the reliability of multivariate regression models, and increase generalizability. The sample size also enabled accurate assessment of deviation ranges (±1 and ±2 weeks), supporting evaluation of TCD's clinical predictive value.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this study.

Confidentiality of Data

All data were handled with strict confidentiality. Personal identifiers were removed, and anonymized codes were used for analysis. The data were stored securely and accessed only by the research team.

Statistical analysis: The collected data were coded, tabulated, and statistically analyzed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 18.0, IBM Corp., Chicago, USA, 2009. Descriptive statistics were done for qualitative data as number and percent, for quantitative data as minimum& maximum of the range as well as mean±SD (standard deviation). While correlations were done using Pearson correlation. Linear regression model was used to find out independent factors predicting gestational age. The level of significance was taken at p-value <0.050.

RESULTS

The results of the present study are demonstrated in the following tables.

Table 1: Demographic Characteristics

The study included 300 pregnant women with a mean age of 31.2 years. Most were multiparous (68.7%), rural residents (62%), and not working (74.7%). Anemia (40%) was the most common comorbidity. Blood groups were evenly distributed, and 30.3% were Rh-negative, which has clinical relevance.

Table (1): Demographic characteristics of the studied cases

Variable		Mean±SD / n	Range / %
Age (years)		31.2±4.8	18.0–42.0
Prity	**Primi**	94	31.3%
	Multi	206	68.7%
ABO	**A**	81	27.0
	B	80	26.7
	AB	80	26.7
	O	59	19.7
RH	**Positive**	209	69.7
	Negative	91	30.3
Comorbidites	**Anemia**	120	40.0
	Hypertension	5	1.7
	Diabetes mellitus	3	1.0
Resdidence	**Urban**	114	38.0
	Rural	186	62.0
Work	**Working**	76	25.3
	Not working	224	74.7

Total=300.

Table 2: Fetal Characteristics

The mean gestational age (GA) was 27.1 weeks, with an almost equal split between second and third trimesters. Fetal biometry showed average values such as TCD = 32.1 mm, BPD = 67.2 mm, HC = 243 mm, AC = 226.1 mm, and FL = 47.8 mm, reflecting normal fetal development.

Table (2): Fetal characteristics of the studied cases

Variable		Mean±SD / n	Range / %
Trimester	**Seconds**	155	51.7%
	Trimester	145	48.3%
Gestational age by LMP (week)		27.1±7.8	13.0±40.0
Transcerebellar diameter (mm)		32.1±11.6	13.9–53.9
Biparietal diameter (mm)		67.2±21.4	24.0–103.0
Head circumference (mm)		243.0±76.5	90.0–375.0
Abdominal circumference (mm)		226.1±84.4	60.0–381.0
Femur length (mm)		47.8±18.6	9.0–79.0

Total=300.

Table 3: Correlation with Gestational Age

All fetal measurements had strong, significant correlations with GA. The strongest were BPD (r = 0.993) and TCD (r = 0.992), suggesting they are reliable indicators for dating pregnancies.

Comparison between transcerebellar diameter and others prenatal diameter for detection gestational age

Table (3): Correlation between gestational age (LMP) and fetal measurements

Variable	r	p
Transcerebellar diameter (mm)	0.992	**<0.001***
Biparietal diameter (mm)	0.993	**<0.001***
Head circumference (mm)	0.991	**<0.001***
Abdominal circumference (mm)	0.988	**<0.001***
Femur length (mm)	0.990	**<0.001***

Total=300. Pearson correlation. *Significant

Table 4: Regression Analysis

Individually, TCD and BPD explained over 98% of GA variability. The combined model (all 5 measurements) showed the highest accuracy ($R^2 = 0.997$), confirming that using multiple parameters improves gestational age prediction.

Table (4): Regression analysis for gestational age (LMP) using fetal measures

Indices	Items	β	SE	p-value	95% CI	R^2
Transcerebellar diameter (mm)	**Constant**	5.692	0.167	**<0.001***	5.363 – 6.022	0.984
	TCD (mm)	0.666	0.005	**<0.001***	0.657 – 0.676	
Biparietal diameter (mm)	**Constant**	2.726	0.171	**<0.001***	2.388 – 3.063	0.987
	BPD (mm)	0.362	0.002	**<0.001***	0.357 – 0.367	
Head circumference (mm)	**Constant**	2.509	0.201	**<0.001***	2.113 – 2.905	0.982
	HC (mm)	0.101	0.001	**<0.001***	0.099 – 0.103	
Abdominal circumference (mm)	**Constant**	6.415	0.200	**<0.001***	6.021 – 6.809	0.976
	AC (mm)	0.091	0.001	**<0.001***	0.090 – 0.093	
Femur length (mm)	**Constant**	7.241	0.179	**<0.001***	6.888 – 7.594	0.979
	FL (mm)	0.414	0.003	**<0.001***	0.407 – 0.421	
Combined measurements	**Constant**	4.724	0.147	**<0.001***	4.435 – 5.012	0.997
	TCD (mm)	0.274	0.011	**<0.001***	0.252 – 0.296	
	BPD (mm)	0.072	0.010	**<0.001***	0.052 – 0.091	
	HC (mm)	0.013	0.002	**<0.001***	0.008 – 0.018	
	AC (mm)	0.008	0.002	**<0.001***	0.005 – 0.012	

	FL (mm)	0.076	0.010	**<0.001***	0.057 – 0.096	

Total=300. β: Regression coefficicent. SE: Standard error. CI: Confidence interval. *Significant. R^2: Coefficient of determination

Table 5: Deviation Accuracy

TCD had the best single-measure accuracy (88.3%) within ±1 week of actual GA. BPD followed closely. The combined model achieved 100% accuracy, making it the most reliable method for GA estimation.

Table (5): Deviations grades of different measures from gestational age of the studied cases

Models	**Deviation of actual gestational age**				
	-2 weeks	**-1 week**	**0 week**	**+1 week**	**+2 weeks**
TCD	15 (5.0%)	95 (31.7%)	94 (31.3%)	76 (25.3%)	20 (6.7%)
BPD	23 (7.7%)	63 (21.0%)	118 (39.3%)	83 (27.7%)	13 (4.3%)
HC	23 (7.7%)	72 (24.0%)	119 (39.7%)	61 (20.3%)	25 (8.3%)
AC	24 (8.0%)	67 (22.3%)	118 (39.3%)	59 (19.7%)	32 (10.7%)
FL	25 (8.3%)	72 (24.0%)	97 (32.3%)	81 (27.0%)	25 (8.3%)
Combined	0 (0.0%)	34 (11.3%)	234 (78.0%)	32 (10.7%)	0 (0.0%)

Total=300.

DISCUSSION

Accurate estimation of gestational age (GA) is fundamental in obstetric care, influencing fetal growth monitoring and timing of delivery. Although first-trimester crown–rump length (CRL) measurement is the gold standard, many women present in the second or third trimester, when biometric dating becomes less precise due to increasing biological variability **(11; 8).** Additionally, reliance on last menstrual period (LMP) may be unreliable because of recall bias, irregular cycles, or recent contraceptive use **(12).**

Conventional parameters such as biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL) may be affected by growth disturbances like intrauterine growth restriction (IUGR) or macrosomia, potentially leading to inaccurate GA estimation **(13; 14).** In contrast, transcerebellar diameter (TCD) demonstrates a consistent linear growth pattern and relative preservation in growth-restricted fetuses, making it a promising alternative marker in the second and third trimesters **(11; 14; 13).**

However, previous studies have been limited by small sample sizes, restricted gestational ranges, and limited robust comparative analyses **(12; 8).** Therefore, this study aimed to assess the correlation between TCD and gestational age and compare its predictive accuracy with conventional fetal biometric parameters.

Demographic and Clinical Profile of the Study Population, the current study included a total of 300 pregnant women ranging in age from 18 to 45 years, with a mean age of 31.2 ± 4.8 years. The majority of participants were multiparous (68.7%), while 31.3% were primiparous. The distribution of Rh factor was also notable, with 69.7% of women being Rh-positive and 30.3% Rh-negative. Comorbidities in our sample were dominated by anemia (40%), followed by hypertension (1.7%) and diabetes mellitus (1%). Additionally, the majority resided in rural areas (62%), and 74.7% were not engaged in employment.

In comparison, **Bekele and colleagues (15)** evaluated 104 women in Ethiopia, with a mean maternal age of 28 ± 4.66 years. Their cohort included a majority of multiparous women (60.6%) and a strong urban representation (68.3%). **Kumari and colleagues (7)** conducted their study on 114 Pakistani women with a slightly lower mean maternal age of 28.18 years. In their sample, the BMI averaged 23.58 ± 3.63 kg/m², and the median parity was gravida 2.0 (IQR 2), indicating a more balanced parity distribution. **Ofoegbu and colleagues (9)** included 110 Nigerian women, also with a mean maternal age of 31.5 ± 5.8 years, closely resembling our cohort in age distribution. On the other hand, **Bavini and colleagues (16)** studied 100 Indian women, mostly in the 21–30-year age group, with 77% being primigravida. **Singh and colleagues (17)** conducted a larger study with 500 women, where 47.2% were primigravida. Moreover, **Ali and colleagues (12)** also reported a similar trend of late antenatal visits and a high prevalence of anemia among participants. **Bakry and colleagues (13)** found a comparable average maternal age (25.3 ± 3.2 years), though their population skewed younger and mostly urban.

Fetal Characteristics and Gestational Age Estimation, in the current study, the gestational age based on last menstrual period (LMP) ranged from 13 to 40 weeks, with a mean of 27.1 ± 7.8 weeks, encompassing both second (51.7%) and third trimesters (48.3%). Biometric assessments revealed a mean transcerebellar diameter (TCD) of 32.1 ± 11.6 mm, biparietal diameter (BPD) of 67.2 ± 21.4 mm, head circumference (HC) of 243.0 ± 76.5 mm, abdominal circumference (AC) of 226.1 ± 84.4 mm, and femur length (FL) of 47.8 ± 18.6 mm.

Bekele and colleagues (15) restricted their study to third-trimester pregnancies (28–41 weeks) and reported a mean gestational age of 36.09 weeks (based on crown-rump length), with TCD-based estimation at 35.38 weeks and composite biometry at 34.99 weeks, showing a smaller margin of error for TCD. Similarly, **Kumari and colleagues (7)** found a mean gestational age of 33.84 ± 5.29 weeks by LMP, while TCD-based estimation was 31.51 ± 5.05 weeks, revealing a statistically significant underestimation ($p < 0.001$), although the correlation remained strong. In **Ofoegbu and colleagues (9)**, the gestational age at enrollment was 33.7 weeks, with measurements taken using both traditional biometric parameters and TCD. **Bavini and colleagues (16)** provided trimester-specific TCD values, with 35 ± 0.98 mm at 28–32 weeks, 40 ± 1.04 mm at 32–36 weeks, and 43 ± 0.88 mm at 36–40 weeks, consistent with our mean of 32.1 mm. **Singh and colleagues (17)** covered a wider gestational range (14–39 weeks) and established nomograms for each parameter.

Bakry and colleagues (13) reported similar biometric trends in third-trimester fetuses, emphasizing the superiority of TCD, which was accurate within 3 days of LMP in 55.5% of cases, compared to 31.5% for BPD. Their findings support our observation that TCD maintains greater stability in estimating gestational age during late pregnancy, especially in resource-limited settings.

Our results showed the TCD-based GA model having high reliability ($R^2 = 0.984$), further corroborating the findings of **George and colleagues (11)**, who emphasized that TCD is less affected by fetal growth anomalies compared to BPD or AC.

Correlation Between Fetal Biometric Measurements and Gestational Age, a central finding in the current study was the exceptionally strong positive correlation between gestational age and all biometric parameters. The correlation coefficients were: TCD ($r = 0.992$), BPD ($r = 0.993$), HC ($r = 0.991$), AC ($r = 0.988$), and FL ($r = 0.990$)—all statistically significant with $p < 0.001$. This reinforces the predictive strength of each measurement, especially TCD and BPD.

Singh and colleagues (17) reported similar findings with $R^2 = 0.979$ for TCD in normal pregnancies and $R^2 = 0.942$ in IUGR cases, confirming its robustness in both normal and compromised fetuses. **Bekele and colleagues (15)** emphasized TCD's consistency using Bland-Altman analysis, noting a lower mean bias of 0.65 weeks compared to 1.1 weeks for composite biometry, with tighter limits of agreement. **Kumari and colleagues (7)** reported 94.7% accuracy of TCD within a ±2 mm margin from LMP, and strong linear correlation ($p < 0.001$). **Ofoegbu and colleagues (9)** found TCD had the strongest correlation with gestational age ($r = 0.8837$) among all parameters. **Bavini and colleagues (16)** confirmed the highest correlation for TCD with $r = 0.979$, surpassing all traditional measures.

These correlations were remarkably consistent with findings from **Ali and colleagues (12)**, who reported that TCD showed strong correlation ($r > 0.98$) across second and third trimesters. Likewise, **Mandal and colleagues (8)** found a correlation coefficient of $r = 0.982$ for TCD and GA, underscoring its utility as a consistent predictor regardless of fetal anomalies or maternal recall bias.

Regression Analysis for Predicting Gestational Age, the current regression analysis confirmed that TCD is a strong predictor of gestational age. The simple linear model showed a regression coefficient $\beta = 0.666$, with a coefficient of determination $R^2 = 0.984$, meaning TCD alone explained 98.4% of gestational age variability. When combined with BPD, HC, AC, and FL in a multiple regression model, the R^2 increased to 0.997, demonstrating near-perfect prediction. The contribution of each variable in the combined model was: TCD ($\beta = 0.274$), BPD ($\beta = 0.072$), HC ($\beta = 0.013$), AC ($\beta = 0.008$), and FL ($\beta = 0.076$).

Bekele and colleagues (15) utilized Bland-Altman analysis, considered more accurate for comparing measurement methods. They concluded that TCD produced narrower limits of agreement (–3.56 to +2.25 weeks) than composite biometry (–4.73 to +2.53 weeks), emphasizing TCD's statistical superiority. **Singh and colleagues (17)** also found $R^2 = 0.958$ for TCD in regression analysis, while **Kumari and colleagues (7)** documented strong statistical significance in linear regression models using TCD. **Bavini and colleagues (16)** similarly found TCD to retain accuracy beyond 36 weeks, while traditional measures lost precision. **George and colleagues. (11)** used similar multivariate regression techniques and

also found TCD + FL models offered the most stable predictions. **Bakry and colleagues (13)** advocated for TCD as the primary biometric marker in the absence of early scans, particularly in under-resourced rural clinics.

Accuracy of Gestational Age Estimation Within Specific Deviations, a major strength of the current study was evaluating accuracy within ±1 and ±2 weeks of actual gestational age. Among single-parameter models, TCD achieved 88.3% accuracy within ±1 week, followed by BPD at 88.0%, FL at 86.3%, HC at 84.0%, and AC at 81.3%. The combined model achieved 100% accuracy within ±1 week, with no deviations beyond ±2 weeks.

Kumari and colleagues (7) reported that TCD matched LMP within 2 mm in 94.7% of cases, consistent with our findings. **Bekele and colleagues (15)** found TCD to have greater agreement with crown-rump length compared to composite biometry, especially in the third trimester, making it ideal for pregnancies lacking first-trimester dating. **Ofoegbu and colleagues (9)** observed TCD's predictive accuracy at 84.6% (±2 weeks)—lower than AC (86.4%) but still commendable. **Singh and colleagues (17)** further emphasized that TCD accuracy remains high even in IUGR, where other parameters underperform.

These findings mirror those of **Bakry and colleagues (13)**, who reported that TCD was accurate within ±1 week in 83% of cases, significantly outperforming BPD and AC. **Ali and colleagues (12)** also identified TCD as the most consistent parameter for third-trimester dating.

Mandal and colleagues (8) showed similar results, recommending TCD as a standalone dating parameter when early ultrasonography is unavailable. This aligns closely with our study's aim of offering a feasible GA estimation model in contexts where reliable LMP recall or early scans are not available.

Clinical Implications

The findings of our study underscore the significant clinical value of transcerebellar diameter (TCD) as a reliable biometric parameter for estimating gestational age, especially in the second and third trimesters. In resource-limited settings where early ultrasonography or accurate recall of the last menstrual period is often unavailable, TCD provides a consistent and dependable alternative for fetal dating. Its strong correlation with gestational age, minimal deviation, and high predictive accuracy suggest that TCD should be integrated routinely into obstetric ultrasound protocols. Additionally, the combination of TCD with other biometric measurements—such as BPD, FL, HC, and AC—further enhances the precision of gestational age estimation, which is vital for appropriate antenatal management, timely intervention, and improving perinatal outcomes.

Strength Points

A major strength of our study lies in its large sample size (n = 300), which enhances the statistical power and generalizability of the findings. The inclusion of women from both urban and rural backgrounds, as well as a wide gestational age range from 13 to 40 weeks, provides a diverse representation of the obstetric population. Another key strength is the comprehensive evaluation of five fetal biometric parameters individually and in combination, with robust correlation and regression analyses to assess their predictive capacity. The study's design allowed for direct comparison between individual and composite models, clearly demonstrating the superior performance of TCD and the additive value of using multiple biometric indices together.

Limitations

Despite its strengths, the study has some limitations. Firstly, the cross-sectional design precludes longitudinal tracking of biometric growth trends over time. Secondly, inter- and intra-observer variability in ultrasound measurement was not assessed, which could impact reproducibility. Additionally, while the study included a wide gestational range, first-trimester pregnancies were excluded, limiting the evaluation of TCD in early gestation. Finally, the findings may not be directly generalizable to populations with different ethnic or genetic fetal growth patterns.

CONCLUSION

The current study concludes that TCD is a highly reliable and accurate predictor of gestational age, demonstrating strong correlation and minimal deviation from LMP-based estimations in both the second and third trimesters. Among all individual biometric parameters evaluated, TCD showed the best performance in terms of both correlation coefficient and regression model fit. When combined with other parameters such as BPD, HC, AC, and FL, the model achieved near-perfect predictive accuracy ($R^2 = 0.997$). These findings support the routine clinical use of TCD, either alone or in combination, for fetal dating, particularly in settings where early dating scans are not available.

Based on the results of the current study, it is recommended that transcerebellar diameter be routinely included in standard obstetric ultrasound protocols for second and third trimester gestational age estimation. Clinicians should consider TCD especially in cases where traditional parameters may be

compromised, such as in growth-restricted fetuses or late bookers without early dating scans.

List of Abbreviations

- GA: Gestational Age
- TCD: Transcerebellar Diameter
- BPD: Biparietal Diameter
- HC: Head Circumference
- AC: Abdominal Circumference
- FL: Femur Length
- LMP: Last Menstrual Period
- CRL: Crown-Rump Length
- IUGR: Intrauterine Growth Restriction
- R^2: Coefficient of Determination
- SPSS: Statistical Package for the Social Sciences

Ethical Considerations

This study was conducted after obtaining approval from the Ethical Committee of the Faculty of Medicine, October 6 University (Approval Code: O6U-ERC-0013; Registration No.: SCCREIRB-MEDICIN6OCT-PU-001-121224-018. Written informed consent was obtained from all participants prior to enrollment

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