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ORIGINAL RESEARCH

Comparative evaluation of CANSCORE and birth weight for the assessment of fetal malnutrition in neonates: a prospective observational study

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ABSTRACT
Background: Fetal malnutrition, marked by inadequate in utero development of muscle and fat, remains a significant contributor to neonatal morbidity and mortality, particularly in low-resource settings. Conventional anthropometric measures like birth weight often fail to detect fetal malnutrition accurately. The Clinical Assessment of Nutritional Status Score (CANSCORE) provides a simple, bedside method for its evaluation.**Objective:** This study aimed to assess the effectiveness of CANSCORE in detecting fetal malnutrition compared to traditional birth weight measurements among preterm and term neonates.**Methods:** A prospective observational study was conducted from May 2023 to November 2024 at Rajshree Medical Research Institute, Bareilly. A total of 149 neonates were evaluated within 48 hours of birth. Gestational age was assessed using maternal history and the New Ballard Score. Birth weight and CANSCORE assessments were recorded, and fetal malnutrition was identified by a CANSCORE <25.**Results:** Of the 149 neonates, 53.02% were male and 46.98% female. The prevalence of fetal malnutrition based on CANSCORE was significantly higher among preterm neonates (23.49%) compared to term neonates (13.42%) (p=0.01). A positive correlation (r=0.72) was observed between birth weight and CANSCORE, although CANSCORE identified more cases of malnutrition that were otherwise missed by weight assessment alone.**Conclusion:** CANSCORE is a valuable and more sensitive tool compared to birth weight alone for the assessment of fetal malnutrition, especially in settings with limited healthcare resources. Its ease of use, without reliance on sophisticated equipment, makes it ideal for early identification and intervention to improve neonatal outcomes.

INTRODUCTION

Fetal malnutrition, first described by Scott and Usher in 1966, refers to inadequate muscle and fat development in utero, often resulting in soft tissue atrophy at birth. Fetal growth is influenced by the fetus's genetic potential, uterine nutrition, and placental efficiency, leading to a range of birth sizes (1). Fetal malnutrition typically arises from caloric, protein, and nutrient deficiencies and is characterized by loss of subcutaneous fat, muscle depletion, and loose skin in several body areas (1,2).Multiple factors contribute to fetal malnutrition, including inadequate maternal nutrition, impaired nutrient transfer through the placenta, increased fetal demand, maternal socioeconomic status, and placental health. It is a major contributor to neonatal morbidity and mortality, particularly in low-resource settings (2,3).

The WHO reports that malnutrition accounts for nearly half of all under-five deaths, and in India, up to 30% of neonates are low birth weight, predominantly due to fetal malnutrition rather than prematurity (4).J. Metcoff observed that the timing of malnutrition during pregnancy affects neonatal measurements: second-trimester malnutrition impacts length, head circumference (HC), and weight, whereas late thirdtrimester malnutrition mainly affects subcutaneous fat and weight, with normal length and HC (1,5).

Traditional anthropometric measures like birth weight are insufficient for detecting fetal malnutrition. To address this, Metcoff developed the CANSCORE

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(Clinical Assessment of Nutritional Status Score) in 1994, a simple, bedside clinical tool based on nine physical parameters (hair, neck, cheeks, chest, arms, abdomen, back, buttocks, legs). Each parameter scores from 1 (severe malnutrition) to 4 (normal nutrition), with a total range of 9 to 36. Scores below 25 indicate fetal malnutrition (6,7).

Research has shown that fetal malnutrition significantly increases the risk of neonatal complications, mortality, and long-term issues like cognitive impairments and learning difficulties. Babies malnourished in utero are at higher risk of developing cardiovascular, endocrine, and metabolic disorders later in life, regardless of whether they are classified as small (SGA) or appropriate (AGA) for gestational age (8).Given the simplicity and effectiveness of CANSCORE in identifying fetal malnutrition without sophisticated tools, its use is particularly advantageous in developing countries like India, where healthcare resources and trained personnel may be limited (9,10).

CANSCORE has proven more accurate than weight-based assessments, identifying malnourished infants who might otherwise be missed. It does not rely on special equipment, formulas, or measurements, making it ideal for resource-limited settings. Furthermore, it has been linked to predicting neurodevelopmental outcomes.In this study, we aim to evaluate the effectiveness of CANSCORE in assessing fetal nutritional status at birth compared to conventional anthropometric indices.

MATERIAL AND METHODS

This prospective observational comparative study was conducted in the Department of Pediatrics at Rajshree Medical Research Institute, Bareilly, from May 2023 to November 2024. The study aimed to evaluate fetal malnutrition (FM) in preterm and term neonates by comparing CANSCORE with birth weight. A total of 149 neonates delivered at the institute during the study period was included in this study.

Methodology

1. **Timing of Examination**: Each neonate was assessed within 48 hours of birth to ensure reliable anthropometric and nutritional evaluation, minimizing postnatal influences.
2. **Gestational Age Assessment**
3. **Naegele's Rule**: Used if the maternal Last Menstrual Period (LMP) was accurately known.
4. **New Ballard Score**: Used when LMP was unknown or uncertain.
5. **Data Collection**
6. Maternal and neonatal details were recorded systematically in a structured proforma, capturing:
7. **Sex**: To account for sex-based physiological differences.
8. **Age at Examination**: Documented in hours (within the first 48 hours).
9. **Birth Weight**: Measured using a digital infant weighing scale (recalibrated daily), and assessed using Olowe's weight-for-gestational-age chart.

Anthropometric Assessments

1. **Birth Weight Measurement**:
   - Neonates were weighed naked on a digital infant scale.
   - Daily recalibration and zero correction of the scale were ensured.
   - Normal birth weight boundaries were defined between the 3rd and 97th percentiles on the Olowe Chart.

2. **Derived Anthropometric Indices**:
   - **CANSCORE Assessment**: A non-invasive tool evaluating subcutaneous fat and muscle mass across 9 physical parameters.
   - Each parameter was scored from 1 (severe malnutrition) to 4 (good nourishment).
   - **Interpretation**: A total CANSCORE < 25 indicated fetal malnutrition.

Ethical Considerations

- Ethical approval was obtained from the Institutional Ethics Committee.
- Informed consent was collected from parents or legal guardians.
- Data confidentiality was maintained by anonymization and secure storage.
- The study followed ethical principles outlined in the Declaration of Helsinki, Indian Council of Medical Research (ICMR) guidelines, and National Neonatal Forum (NNF) recommendations.

RESULTS

Table1:Distributionof Gestational Age bySex

G.A. (Weeks)	uency (%)	Male n(%)	Female n(%)	Total n(%)	P value
32—34	20(13.42)	11 (7.38)	9(6.04)	20(13.42)	0.996
35—36	35(23.49)	18 (12.08)	17(11.41)	35(23.49)	
37—38	44(29.53)	23 (15.44)	21(14.09)	44(29.53)	
39—40	40(26.85)	22 (14.77)	18(12.08)	40(26.85)	
≥41	10(6.71)	5(3.36)	5(3.36)	10(6.71)	
Total	149(100)	79(53.02)	70(46.98)	149(100)	

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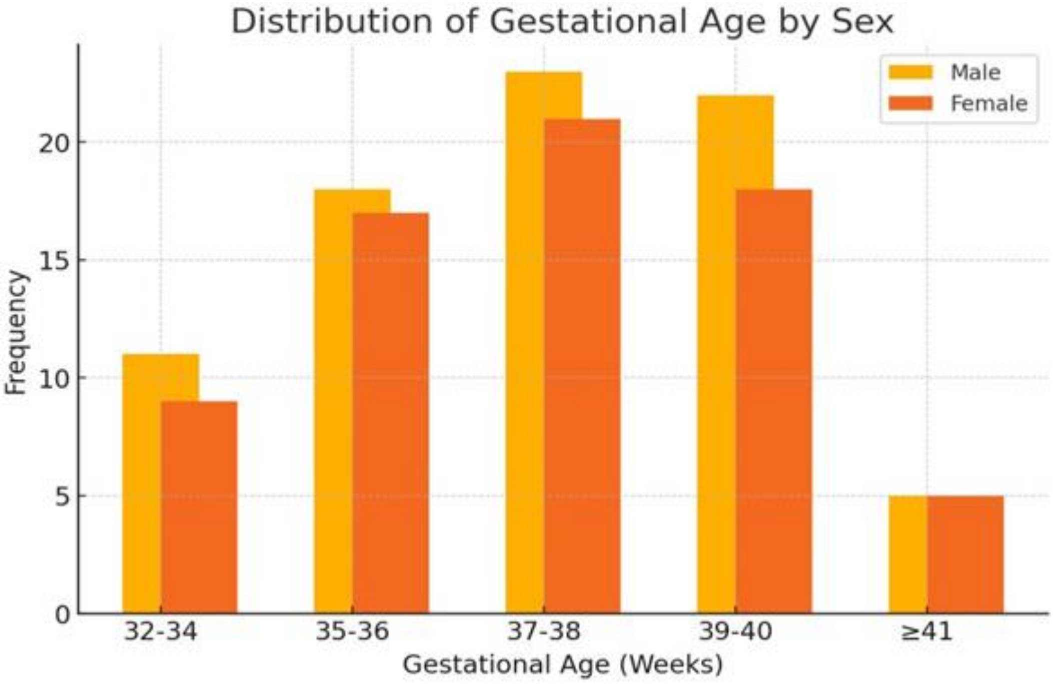

Figure 1: Distribution ofGestationalAgebySex

Table2: Mean Birth WeightbyGestational age andSex

G.A. (Weeks)	ean±SD (Total)	Male Mean ± SD	Female Mean ±SD	p-value
32—34	1650±250	1700±200	1600±250	0.02*
35—36	2300±400	2350±350	2250±400	0.15
37—38	3100±450	3150±400	3050±450	0.1
39—40	3300±500	3350±450	3250±500	0.08
≥41	3400±200	3450± 150	3350±200	0.12

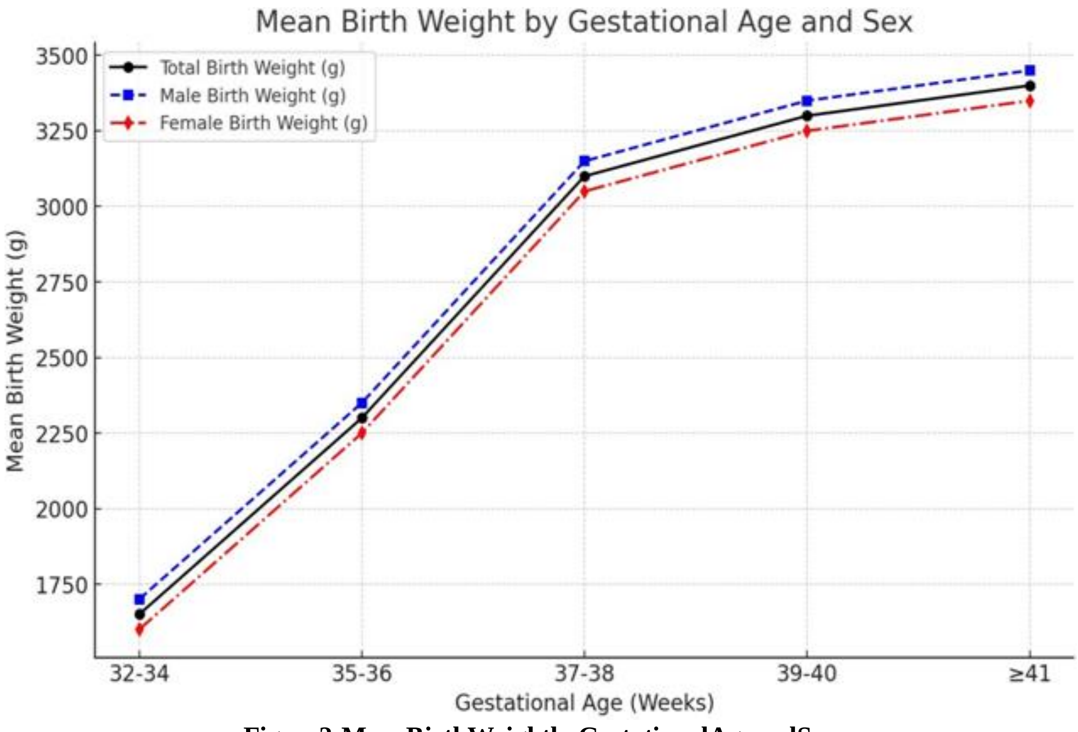

Figure2:MeanBirthWeightbyGestationalAgeandSex

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Table 3: MeanCANSCOREbyGestational AgeandSex

G.A (Weeks)	ean±SD (Total)	Male Mean ± SD	Female Mean ± SD	p-value
32—34	22.5±3.0	23.0±2.8	22.0±3.2	0.03*
35—36	24.8±3.5	25.0±3.2	24.5±3.8	0.25
37—38	27.5±4.0	27.8±3.8	27.2±4.2	0.18
39—40	27.8±4.2	28.0±4.0	27.5±4.5	0.22
≥41	28.0±4.0	28.5±3.8	27.5±4.2	0.3

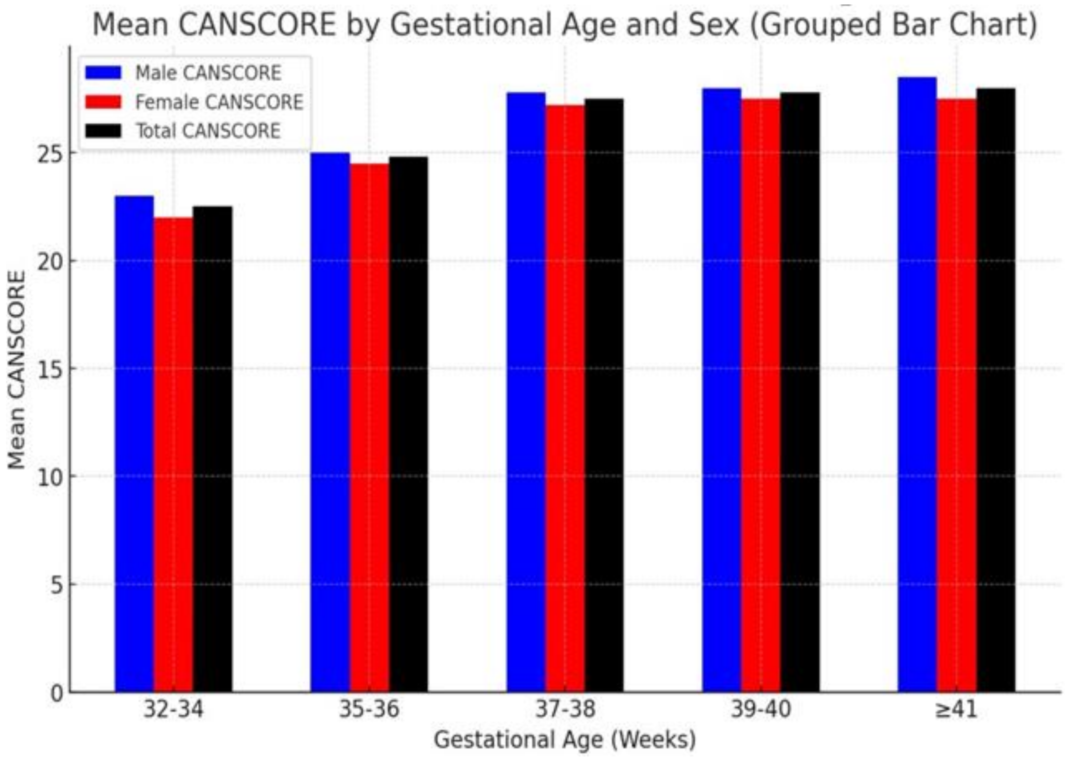

Figure3:MeanCANSCOREbyGestational AgeandSex

Table 4:PrevalenceofFetal Malnutrition inTermandPretermNewborns

AssessmentTool	Term n(%)	Preterm n(%)	p-value
CANSCORE<25	20(13.42)	35 (23.49)	0.01*

Table 5:CorrelationMatrixofAnthropometric IndicesandCANSCORE

Variable	CANSCORE	Birth Weight
CANSCORE	1	0.72*
BirthWeight	0.72*	1

DISCUSSION

The present study analyzed the distribution of gestational age by sex and birth weight categories across different gestational ages, comparing the findings with multiple Indian studies to evaluate fetal malnutrition using the CANSCORE index (9,10).

Among 149 neonates, 53.02% were male (n = 79) and 46.98% were female (n = 70). The highest proportion of neonates (29.53%) were born between 37–38 weeks of gestation, followed by 26.85% between 39–40 weeks. Preterm births (32–34 weeks) accounted for 13.42%, with a nearly equal male-to-female ratio, while post-term births (≥41 weeks) constituted 6.71%. The Chi-square test (p = 0.9963) indicated no significant association between gestational age and sex. In comparison, Madhunandanet al. (2021) reported a higher proportion of preterm births (18.2%) with 58% males, suggesting a greater male predisposition to preterm delivery (11). Similarly, Swati Singh et al. (2019) found that term neonates accounted for 76.4% of the cohort, with males comprising 54%, slightly higher than in our findings (12). Overall, these results suggest that while the distribution of gestational age is comparable across studies, variations in preterm and post-term neonate proportions may be attributed to regional maternal and fetal health factors.

The mean birth weight distribution across different gestational age groups in our study demonstrated a steady increase from 1650 ± 250 g at 32–34 weeks to

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3400 ± 200 g at ≥41 weeks, with male neonates consistently exhibiting higher birth weights compared to females. The most significant difference was noted in the preterm category (32–34 weeks), where males had a significantly higher mean birth weight (1700 ± 200 g) compared to females (1600 ± 250 g) ($p = 0.02$). In later gestational ages, however, the sex-based differences were statistically insignificant ($p > 0.05$). Similarly, Sethi et al. (2022) reported a mean birth weight of 1680 ± 230 g at 32–34 weeks and 3380 ± 180 g at ≥41 weeks, with a significant difference noted only among preterm neonates (13). Madhunandanet al. (2021) (11) also found mean birth weights of 1700 ± 260 g at 32–34 weeks and 3450 ± 250 g at ≥41 weeks, with significant sex-based differences only in preterms ($p = 0.03$). Lakhuteet al. (2016) reported comparable findings, with significant differences in preterm neonates ($p = 0.02$) but not in term neonates (14). Similarly, Singh et al. (2019) observed statistically significant sex-based differences predominantly among preterm neonates (12).

These consistent findings across studies reinforce the importance of CANSCORE as a sensitive and reliable tool for assessing fetal malnutrition, surpassing conventional weight-based indices in identifying at-risk neonates. The mean CANSCORE in our study increased progressively with advancing gestational age, from 22.5 ± 3.0 at 32–34 weeks to 28.0 ± 4.0 at ≥41 weeks, with males demonstrating slightly higher scores than females. A statistically significant sex-based difference was observed only among preterm neonates ($p = 0.03$). Sethi et al.(2022)(13) reported comparable trends, with a mean CANSCORE of 22.8 ± 3.1 at 32–34 weeks and 28.3 ± 3.9 at ≥41 weeks, noting significant sex-based differences among preterms ($p = 0.02$). Madhunandanet al. (2021) (11) reported similar findings, with significant differences among preterm neonates ($p = 0.03$). Lakhuteet al. (2016) (14) also found significant sex-based differences among preterm neonates ($p = 0.04$). Studies by Singh et al. (2019) (12) similarly observed that while CANSCORE values increased with gestational age, significant sex-based differences were limited to the preterm group.

With regard to nutritional status assessment among term neonates using CANSCORE, our study found that 13.42% had a CANSCORE of less than 25, indicating malnutrition. In comparison, Sethi et al. (2022) reported a higher prevalence of fetal malnutrition (35.4%) using CANSCORE (13). Similarly, Chelli et al. (2022) observed 41.5% malnutrition (15), while Madhunandanet al. (2021) reported 33.3%, all substantially higher than the rate observed in our study (11). Lakhuteet al. (2016) et al. found a malnutrition prevalence of 26% among neonates (14). Singh et al. (2019) similarly observed a high malnutrition rate of 66.4% using CANSCORE (12). These variations suggest that the prevalence of fetal malnutrition assessed by CANSCORE may vary significantly across different populations, possibly due to differences in maternal nutritional status, antenatal care, and socioeconomic factors. Among preterm neonates in our study, 23.49% were found to have a CANSCORE below 25, whereas Sethi et al. (2022) reported a malnutrition rate of 35.4% in a similar cohort, again higher than our findings (13).

The correlation matrix in our study revealed a strong positive correlation between CANSCORE and birth weight ($r=0.72$, $p<0.001$), suggesting that neonates with higherbirth weights and better proportionalityhad higher nutritionaladequacy. Lakhuteet al. (2016) reported a positive correlation between CANSCORE and birth weight ($r=0.68$), further validating our study (14).

CONCLUSION

The present study highlights a consistent increase in birth weight and CANSCORE with advancing gestational age, with minor sex-based differences predominantly observed among preterm neonates. The findings align closely with several Indian studies, though variations in the prevalence of fetal malnutrition were noted, likely reflecting regional differences in maternal and neonatal care. The CANSCORE index proved to be a sensitive and reliable tool for assessing fetal malnutrition, surpassing traditional weight-based parameters. Our results emphasize the need for early identification of at-risk neonates, particularly among preterms, to facilitate timely interventions and improve neonatal outcomes.

REFERENCES

1. Tesfa D, Teshome F, Ambaw B. Fetal Malnutrition and Associated Factors among Term Newborn Babies at Birth in South Gondar Zone Hospitals, Northwest Ethiopia. Int J Pediatr. 2021;2021:5005365.
2. Marshall NE, Abrams B, Barbour LA, Catalano P, Christian P, Friedman JE, et al. The importance of nutrition in pregnancy and lactation: lifelong consequences. Am J Obstet Gynecol. 2022;226(5):607-32.
3. Fall CH. Fetal malnutrition and long-term outcomes. Nestle NutrInst Workshop Ser. 2013;74:11-25.
4. India State-Level Disease Burden Initiative Malnutrition Collaborators. The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. Lancet Child Adolesc Health. 2019;3(12):855-70.
5. Janardhan AM, Alok S, Janardhan L. Detection of fetal malnutrition and its associated maternal factors in a rural setting. Int J ContempPediatr. 2020;7(9):1880-4.
6. Geetha M, Kiran B, Santosh S, Rangaiah V, Himabindu T, Pavan Raj, et al. CANScore – A boon to resource-limited settings. Int J Pediatr Res. 2019;6(4):189-93.
7. Kapoor A, Awasthi S, Yadav A, Tiwari S. Assessment of fetal malnutrition using CANScore and its comparison with various anthropometric parameters and proportionality indices. J Nepal Paediatr Soc. 2021;41(3):320-6.

DOI: 10.69605/ijlbpr_14.4.2025.206

8. Bhutta ZA, Berkley JA, Bandsma RHJ, Kerac M, Trehan I, Briend A. Severe childhood malnutrition. Nat Rev Dis Primers. 2017;3:17067.
9. Varahala AM, Chidugulla SK, Pathuri NK. Assessment of fetal malnutrition by CANScore and comparison with anthropometric attributes–a tertiary care centre experience. IOSR J Dent Med Sci. 2015;14(10):7-12.
10. ChoupaniDastgerdi R, Asgharzade A, Salehifard A, Farhat A, Khalili M. Assessment of fetal malnutrition based on the CANScore index and anthropometric indices. J Nutr Fast Health. 2022;10(1):1-6.
11. Madhunandan K, Archana TP, Chandan N, Pavan Kumar D. Assessment of fetal malnutrition by Clinical Assessment of Malnutrition Score (CANScore) – A cross-sectional study. J Res Med Dent Sci. 2021;9(8):400-10.
12. Singh S, Sharif M, Yadav V, Jafri N, Saxena A. CANScore versus other anthropometric indices to assess nutritional status in newborns. Glob Res Anal. 2019;8(1):21-4.
13. Sethi A, Gandhi DD, Patel SH, Presswala DK, Patel SB. CANScore – An important index for detection of fetal malnutrition at birth. Natl J Med Res. 2022;6(3):226-9.
14. Lakhute SV, Kendre VV, Dixit JV, Nagaonkar A, Chinte LT. Anthropometry in the assessment of fetal malnutrition at tertiary technology. Stat Person. 2016;18(2):316-9.
15. Chelli SB, Surekha SM, Pulluru UR, Prithiviraj E, Sumathy G. A comparative study between CANScore and Ponderal Index in identifying nutritional status of the neonate. Int J Health Sci. 2022;6(S6):3205-13.