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A comparative study between CAN score and Ponderal Index in identifying nutritional status of the neonate

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Abstract--Introduction: Inadequate supply of nutrients to the fetus results in fetal malnutrition. As a result, the fetus fails to grow resulting in intrauterine growth restriction (IUGR). Though Small for Gestational Age (SGA) is used synonymously for IUGR but the later shows evidence of malnutrition. To detect fetal malnutrition various methods are being used currently. CAN is clinical method to detect the nutritional status through physical examination. Detection of fetal malnutrition by CAN score and comparing with other methods was the aim of this study. Materials and methods: This hospital based prospective study was carried on 200 neonates delivered in district government hospital, Koppal. Nutritional status assessment was done using CAN score and is compared with ponderal index and birth weight for gestational age. Results: Incidence of fetal malnutrition was 41.5% using CAN score. 10.5% small for gestational age neonates were well nourished and 7% appropriate for gestational age neonates were malnourished when detected through CAN score. 14% neonates

showed malnutrition with $PI < 2.5$ but when detected through CAN score it was 8%. Well-nourished neonates with $PI > 2.5$ were 86% but after CAN score 33.5% showed malnutrition. When compared with CAN score PI had 19.27% sensitivity and 89.74% specificity while birth weight for gestational age had 83.13% sensitivity and 82.05% specificity. Conclusion: CAN score is best method to detect fetal malnutrition without use of any instrument. It can detect malnutrition which is missed by other commonly used methods.

Keywords--intrauterine growth restriction, fetal malnutrition, small for gestational age, appropriate for gestational age, CAN score.

Introduction

Intrauterine growth restriction (IUGR) is a clinical condition in which the fetus fails to grow during pregnancy. It is an adverse fetal condition that accounts for perinatal morbidity and mortality. Improper supply of nutrients with limited oxygen to the fetus from mother results in intrauterine growth restriction. Failure to acquire sufficient muscle mass and fat during intra uterine growth is known as fetal malnutrition (FM). This in-utero state of poor nutrition is a result of inadequate supply and or utilization of nutrients. The term fetal malnutrition was coined by Scott and Usher in 1966 to describe infants who showed evidence of soft tissue wasting at birth irrespective of specific etiology¹. Early detection of intrauterine growth restriction is important for the timely management of short- and long-term sequelae. The underlying mechanism to develop IUGR remained poorly understood though several risk factors were identified. IUGR influences about ~8 % of all pregnancies². Rate of fetal malnutrition proceeds to be tall in India at round 30% in differentiate to 5-7 % in developed countries. Many factors affect fetal growth, including nutritional state, habits of mother, state of placental function and genetic makeup of the fetus³.

Placental insufficiency, small for gestational age (SGA) and IUGR are the current term to describe intrauterine malnutrition. These terminologies are not synonymous with FM as none of these strategies survey the subcutaneous fat gathered. Additionally, newborns with ailing health in late third trimester may have a birth weight of over 2.5 kg and are misdiagnosed as typical in spite of being malnourished. The significance of tending to this issue of fetal malnutrition is emphasized due to serious sequelae of malnutrition on numerous organ framework. 39% of malnourished neonate had neurological and intellectual handicaps⁴. The purpose of this study was to assess the nutritional status of neonates using Clinical Assessment of Nutritional (CAN) score and compare with other methods in fetal malnutrition assessment.

Materials and Methods

This prospective study was carried out on 200 neonates, delivered at district government hospital, Koppal. This work was carried out after taking institutional ethical committee clearance. This work was carried out for a period of 3 months.

Inclusion criteria

- Maternal age between 18-35 years
- Gestation age between 34-42 weeks
- Singleton pregnancy
- Infants with no congenital anomalies

Exclusion criteria

- Multiple pregnancies
- Preterm neonates
- Unknown gestational age
- Neonates with congenital anomalies, intrauterine death and still birth
- Mother with gestational diabetes and cardiovascular disease.

Electronic weighing scale was used to record weight without any clothes wrapped around neonate. Infantometer was used to measure length. Neonates were classified based on weight and length that were plotted on intrauterine growth charts into small for gestational age (SGA), appropriate for gestational age (AGA)^{5,6,20}. Ponderal index (PI) = weight (gms) × 100/ length (cm)³. PI < 2.2 was considered as malnutrition^{7, 21}. Clinical assessment of Nutritional status (CAN) is a scoring framework described by Metcoff⁸ in 1994. It is based on nine superficial promptly distinguishable signs of malnutrition in neonates. Each sign is rated from 4 (no malnutrition) to 1 (malnourished). A CAN score < 25 indicated fetal malnutrition⁸. This score was taken within 48 hours of birth.

Statistical methods

The collected data was statistically analyzed using Microsoft Excel (Version 2003). Chi-square test was used. Sensitivity, specificity, positive predictive value and negative predictive values were calculated. The values were expressed as the percentage,

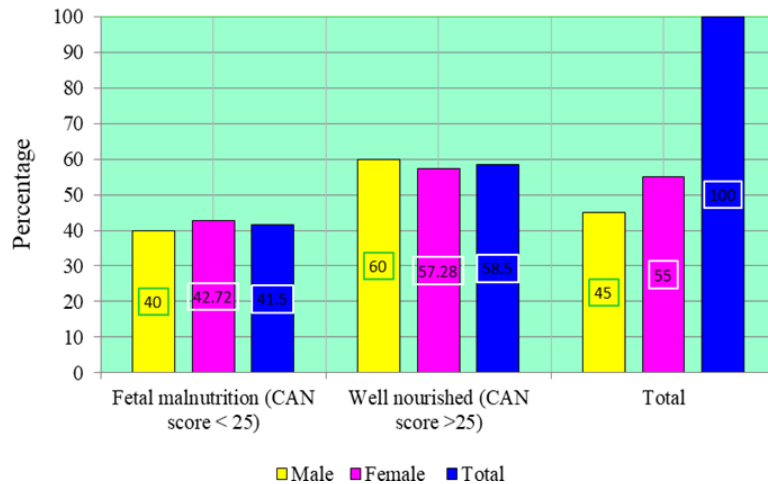
Results

This study was carried out in 200 neonates where 110 are females while 90 are males. Total incidence of FM was 41.5% which was observed through CAN score (Table -1). Incidence of FM between was equal in predisposition between female and male neonates (Graph – 1). We found 117 (58.5 %) well-nourished and 83 (41.5 %) malnourished neonates when detected through CAN score. We found 90 (45%) SGA neonates and 110 (55 %) AGA neonates when detected through weight for gestational age. FM was observed in 83 (41.5%) neonates while 117 (58.5%) were well nourished neonates (Table -2 & Graph – 2).

Table 1
Incidence of fetal malnutrition

Parameter	Male (%)	Female (%)	Total (%)
Fetal malnutrition (CAN score < 25)	36 (40%)	47 (42.72%)	83 (41.5%)
Well nourished (CAN score >25)	54 (60%)	63 (57.28 %)	117 (58.5%)
Total	90 (45%)	110(55%)	200 (100%)

Graph - 1. Incidence of fetal malnutrition

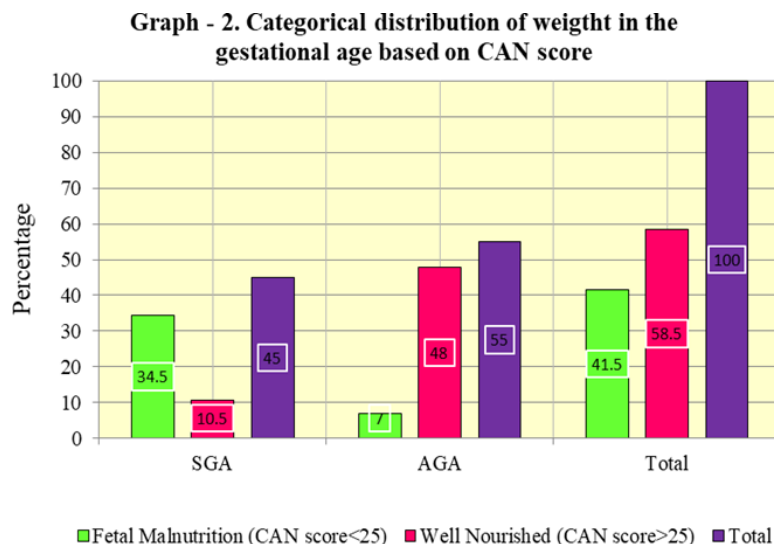


Graph 1 depicts incidence of fetal malnutrition in male and female neonates. Each vertical bar represents the percentage fetal malnutrition and well-nourished at <25 and >25 respectively.

Table 2
Categorical distribution of weight in the gestational age based on CAN score

Birth weightfor GA	Fetal Malnutrition (CAN score<25)	Well Nourished (CAN score>25)	Total
SGA	69 (34.5%)	21 (10.5%)	90 (45%)
AGA	14 (7%)	96(48 %)	110 (55%)
Total	83 (41.5%)	117 (58.5%)	200 (100 %)

GA: gestational age, SGA: small for gestational age, AGA: Appropriate for gestational age



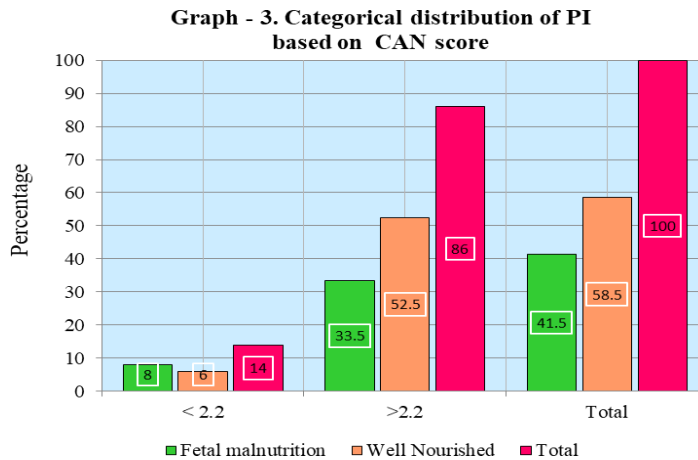
Graph 2 shows distribution of weight in the gestational age based on CAN score. Each bar represents the percentage. GA: gestational age, SGA: small for gestational age, AGA: Appropriate for gestational age.

Classification through Ponderal index (PI) showed 28 (14%) showed FM while 172 (86%) were well nourished. Overall, our study detected 83 FM out of 200 neonates. Out of 200 neonates CAN score detected 83 (41.5%) FM, while 28 (14%) were detected through PI. After applying CAN score 12 (6%) neonates were well nourished. Remaining well-nourished neonates with typical PI, 67 (33.5%) had significant malnutrition (Table -3 & Graph - 3).

Table 3
Categorical distribution of PI based on CAN score

PI	Fetal malnutrition	Well Nourished	Total
< 2.2	16 (8%)	12 (6%)	28 (14%)
>2.2	67 (33.5%)	105 (52.5%)	172 (86%)
Total	83 (41.5%)	117 (58.5%)	200 (100)

PI: ponderal index.

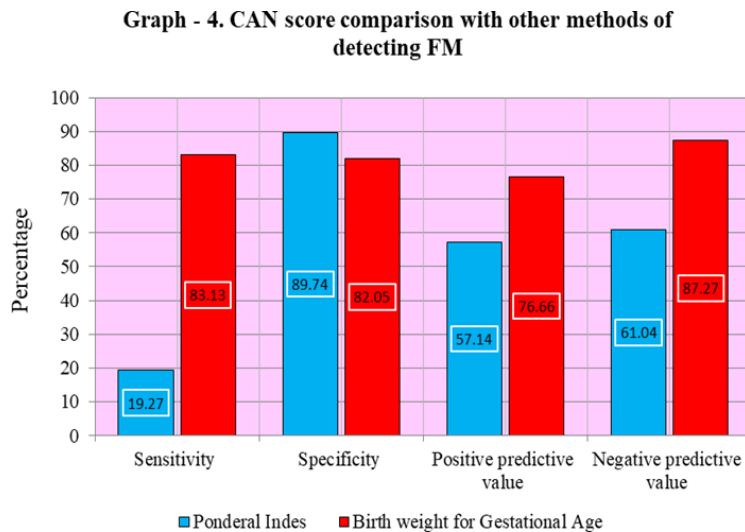


Graph 3 displays categorical distribution of Ponderal index (PI) in the neonates. Each bar denotes the percentage of the fetal malnutrition and well-nourished based on CAN score at <2.2 and >2.2.

Table 4
CAN score comparison with other methods of detecting FM

Value	PI	Birth weight for GA
Sensitivity (%)	19.27%	83.13%
Specificity (%)	89.74%	82.05%
Positive predictive value (%)	57.14%	76.66%
Negative predictive value (%)	61.04%	87.27%

PI: ponderal index; GA: gestational age.



Graph 4 exhibit comparison of CAN score with Ponderal index (PI) and Birth weight for gestational age to detect fetal malnutrition. Each value is expressed in

percentage. PI: ponderal index; GA: gestational age. Validity measures to detect FM are compared with CAN score (Table-4). When compared with CAN score PI showed low sensitivity of 19.27% with 89.74% specificity. It had 57.14 and 61.04% positive predictive and negative predictive value respectively. Birth weight for gestational age has a sensitivity of 83.13%, 82.05% specificity, 76.66% positive predictive value and 87.27% negative predictive value when compared with CAN score (Graph – 4).

Discussion

IUGR, SGA, placental insufficiency is a different terms used to detect neonatal nutritional deficiencies, but none are synonymous with FM⁹. Good indicator of fetal wellbeing is intrauterine growth. Low cost and effective method that has been extensively used to determine intrauterine growth is anthropometry¹⁰. In our study, incidence of FM was 41.5% which was more than values observed by Metoff (10%)⁸. Incidence of 24 % was reported by Soundarya M et al¹¹, 27.4% by Kumari¹², 27.97 % by Sankhyan et al¹³ and 28% by Rao¹⁴. Maternal poor nutritional status, rural area and low socio-economic status might be cause of higher incidence. Adebami et al¹⁵ reported 18.8% FM while 81.2% were well-nourished. We found 58.5% well-nourished and 41.5% FM based on CAN score with is coinciding with findings of Mehta et al¹⁶ where FM was 40.3% while 59.97% were well nourished.

In our study, when classified through weight per gestational age 55% were AGA while 45% were SGA. This is close to the findings of Rao et al¹⁴ with 58.3% AGA and 41.7% SGA. When detected through CAN score 7% AGA were having FM, while 10.5% SGA were well nourished in our study. These findings are close to the findings of Soundarya et al¹¹ where 77% were AGA, 23% were SGA, with 8.2% FM in AGA and 23% SGA were well nourished. In a study by Amarendra et al¹⁷ reported 83% FM out of 100 SGA neonates while 58.6% AGA neonates had FM. Intrauterine growth charts are the diagnostic tools for SGA hence FM was more in SGA. This classification may miss some neonates with FM who are not SGA.

On the basis of PI, 14% FM was detected out of which CAN showed 8% FM. Amarendra et al¹⁷ classified 61.6% neonates as FM. PI showed 29.19 % FM in a study conducted by Mehta et al¹⁶. In a study by Vikram Singhal et al¹⁸, PI detected 16 (8%) neonates with FM, out of which only 10 neonates were malnourished when CAN score was applied. In acute malnutrition at the expense of weight, length will be spared. PI may misclassify neonates with chronic insult in utero as length and weight may be affected in neonates^{3, 16, 18}. In our study using CAN score the sensitivity and specificity of birth weight for gestational age is 83.13% and 82.05% respectively which is lesser than Amarendra et al¹⁷(51% sensitivity and 21.5% specificity PI showed 19.27% sensitivity and 89.74% specificity using CAN score in our study while Amarendra et al¹⁷ reported 69.5% sensitivity and 55.6% specificity. In a study by Lakshmi et al¹⁹ observed a sensitivity of 15% and specificity 96.96% of using PI. These values are close our present study.

Conclusion

Major problem in developing countries is fetal malnutrition. Our study re-emphasizes Metcoff et al observations that fetal malnutrition is not synonymous with SGA and IUGR. Classification based on birth weight for gestational age into SGA and AGA showed well-nourished and malnourished neonates respectively in our study. Hence this may misdiagnose the neonates. To measure intrauterine malnutrition, PI is not suitable method due to its failure to adjust for all gestational weeks. CAN score is the best clinical marker to detect IUGR when compared to other methods. PI can be combined with CAN score to get best results than using PI alone. CAN score detects fetal malnutrition which are escaped by other methods. This simple and non-invasive method is a boon to primary health setup when adequate health professionals are not there. It is low cost and effective method to detect malnutrition in mainly in rural hospitals without any need of instruments. More studies should be conducted by CAN score in low socioeconomic, rural and semi-rural areas to study the prevalence.

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Conflict of interest: None

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