Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

DETECTION OF FETAL MALNUTRITION BY CLINICAL ASSESSMENT OF NUTRITIONAL STATUS SCORE (CAN SCORE) AT BIRTH AND ITS COMPARISON WITH OTHER METHODS OF DETERMINING INTRA UTERINE GROWTH AND STUDY OF GESTATIONAL AGE AND PARITY ASSOCIATED WITH FETAL MALNUTRION

Dr.Maddi Prakash Kumar[1], Dr.K.Aruna Jyothi[2], Dr K.Mahendra[3], Dr.M.Mallikarjuna[*]

[1]Associate Professor, Department of Pediatrics, Kurnool Medical College, Kurnool, AP.
[2]Associate Professor, Department of Pediatrics, Government Medical College, Nandyal, AP.
[3]Post Graduate, Department of Pediatrics, Kurnool Medical College, Kurnool, AP.
*Associate Professor, Department of Pediatrics, Kurnool Medical College, Kurnool, AP.
Corresponding Author: Dr.M.Mallikarjuna

Abstract

Introduction: The fundamental tenet of human development is nutrition, which is also one of the risk factors for rising new born morbidity and mortality. Fetal malnutrition is a serious condition marked by evident intrauterine loss or failure to acquire a typical amount of subcutaneous fat or muscle. It is a vital state that sets the stage for proper growth and neurodevelopment throughout life. India has received a score of 101out of 116 on the global hunger index for 2021 in developing nations.

Materials and Methods: Live born, singleton neonates with a gestational age of ≥34 weeks who were brought for a regular checkup immediately after birth in the outpatient department and neonates whose hospital stay exceeded 24 hours of birth in Government General Hospital were enrolled. A total of 50 neonates brought to Government General Hospital from January 2021 to December 2021 were studied. Interviews were conducted with the parents of the children who met the criteria for selection and who agreed to take part in the study, and information regarding the baby's sex, gestational age, time of delivery, and the mother's history of multiple pregnancies was gathered. The latest menstrual period (LMP) date was used to calculate the gestational age in accordance with clinical evaluation using New Ballard's Scoring and first trimester ultrasonography. Within 48 hours of the birth, all the infants underwent a protocol-required systematic examination.

Results: The CANSCORE ranged from 18 to 36, and the mean and median CANSCORE was 27.84±4.61and 28 (IQR 4.5), respectively. The PI ranged from 2 to 3, and the mean and median PI was2.44±0.26 and 2.36 (IQR 0.40), respectively. The MAC/HC ratio ranged from 0.23 to 0.33, and the mean and median MAC/HC ratio was 0.29±0.02 and 0.28 (IQR 0.03), respectively. In the present study, 76% of the neonates had CANSCORE of ≥25, and 24%had CANSCORE of <25. In the present study, 80% of the neonates had MAC/HC ratio of ≥0.27, and 20% had MAC/HC ratio of <0.27. In the present study, 68% of the neonates were boys, and 32% were girls. However, 66.67% of the boys had CANSCORE of <25 compared to 33.33% of the girls, and the difference was statistically not significant (p=0.586).

Conclusion: The present study reemphasizes that FM is a significant problem in the study area as the incidence of FM in the study area is as high as one in four newborns are likely to have FM based on CANSCORE. Further, the present study also reemphasizes that CANSCORE is a simple systematic method to identify fetal malnutrition. It does not require any sophisticated equipment or time-consuming calculations. Hence it is the method preferred for or ideal for screening malnourished babies. At the same time, MAC/HC ratio seems to be a more accurate index than PI as the diagnostic accuracy of PI is slightly less than MAC/HC ratio. This tool is very helpful in the periphery where the availability of qualified personnel is less and will help the health workers to identify FM easily in developing nations where the incidence of FM is high. However, these observations require further validation due to the potential limitations of the study.

Key Words: Morbidity, Mortality, CANSCORE, MAC/HC ratio, New Ballard's Scoring.

INTRODUCTION

The fundamental tenet of human development is nutrition, which is also one of the risk factors for rising new born morbidity and mortality. Fetal malnutrition is a serious condition marked by evident intrauterine loss or failure to acquire a typical amount of subcutaneous fat or muscle[1]. It is a vital state that sets the stage for proper growth and neurodevelopment throughout life. India has received a score of 101out of 116 on the global hunger index for 2021 in developing nations[2].

Prevalence of fetal malnutrition in India is 21.7%, infant mortality is currently at 27.6%, and infant mortality globally is 17 per 1000 live births.

In hyper-income nations like the United States and Australia, the frequency of foetal malnutrition is roughly 11%, and there is a substantial risk of mortality and morbidity throughout the newborn period and beyond[3,4]. The majority of infants were born SGA, with an estimated 34% in South Asia. According to data from 2014, the highest number of SGA births observed in South Asia account for an estimated 22% of neonatal deaths.

SGA or fetal malnutrition babies are more likely to develop sepsis, hypoglycemia, hyperthermia, polycythemia[5], high newborn mortality, modest cognitive deficits, hyperactivity, or attention deficit disorders at age of 5 years and a significant chance of developing metabolic syndrome as adults. Fetal malnutrition's consequences and long-term implications need for further research.

Fetal malnutrition and growth failure during the intrauterine period are caused by a variety of reasons. factors include short mothers, primi mothers, mothers who are between the ages of 20 and 35, Insufficient placenta in the user drug-related chronic illness, smoking, drug use, and chromosomal anomalies SGA babies have been seen in a lot of cases at our institute.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

Malnutrition is a manmade disease which is often start in a womb and ends inthe tomb.
Malnutrition is a manmade disease which is often start in a womb and ends inthe tomb.

AIMS AND OBJECTIVES

AIMS OF THE STUDY: This study was aimed to address the problem of feral malnutrition in aneffective way using CANSCORE and various other parameters.

OBJECTIVES OF THE STUDY

Primary objective: Compare the CANSCORE to anthropometric and proportionality indices andtheir accuracy in identifying fetal malnutrition

Secondary objective: Find out the incidence of fetal malnutrition. Find out whether combining CANSCORE and anthropometric indices to asses degree of fetal malnutrition.

Research question: I am identifying fetal malnutrition clues comparison of CANSCORE with anthropometric indices help in increasing the accuracy of diagnosis avoiding certified misdiagnosis.

MATERIALS AND METHODS

Source of data: Live born, singleton neonates with a gestational age of ≥34 weeks who were brought for a regular checkup immediately after birth in the outpatient department and neonates whose hospital stay exceeded 24 hours of birth in Government General Hospital were enrolled.

Sample size and sample size calculation: A total of 50 neonates brought to Government General Hospital from January 2021 to December 2021 were studied.

The sample size was calculated based on the prevalence of malnutrition using CANSCORE from previous study by Amarendra M et al. [76] (2017) and based on the following formula as below

$n = 4pq/L^2$ where n= sample size

p= Prevalence of malnutrition using CANSCORE from previous study by Amarendra M. et al.(2017) which was considered as 68.4%.q = (100 - p) = 100- 68.4 = 31.60

L =Allowable error 20% of p $Z\alpha$ at 0.05=1.96 (Approximately = 2)

Hence

n = 4x68.4x31.60/(20/100 x 68.4)2 = 8645.76/187.14 = 46.19 ≈ 47

Based on the above formula, the minimum effect size required was 47. Hence a total of 50 neonates were enrolled.

Selection Criteria

Inclusion Criteria

- Live born, singleton neonates with gestational age more than or equal to 34 weeks.
- Neonates whose hospital stay exceeds 24 hours of birth and neonates who arebrought for a regular checkup in outpatient department within 24 hours of birth.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

- Parents willing to give informed consent.

Exclusion criteria

- Neonates with congenital malformations.
- Twins and multiple gestations
- Neonates with cephalohematoma, sub galeal bleed.
- Neonates with unknown gestational age.
- Infant of diabetic mother

Ethical clearance: Prior to the commencement, the study was approved by the Ethical and Research Committee, Government General Hospital, Kurnool, Andhra Pradesh.

Informed Consent: All the parents/caregivers of the neonates fulfilling selection criteria were explained about the nature of the study, and a written informed consent was obtained prior to the enrollment.

Method of collection of data

Interviews were conducted with the parents of the children who met the criteria for selection and who agreed to take part in the study, and information regarding the baby's sex, gestational age, time of delivery, and the mother's history of multiple pregnancies was gathered. The latest menstrual period (LMP) date was used to calculate the gestational age in accordance with clinical evaluation using New Ballard's Scoring and first trimester ultrasonography. Within 48 hours of the birth, all the infants underwent a protocol-required systematic examination. The protocol included information on the baby's anthropometry, all of the CANSCORE characteristics as outlined by Metcoff10, and maternal data. To prevent subjectivity and bias, the researcher alone evaluated all the infants. A normal digital weighing scale, an infantometer, and fibre glass tape were the tools employed.

All newborns had their length, mid-arm circumference, and head circumference measured during the first 24 hours of life. Weight was also measured at birth.

Birth weight: Nude birth weight, measured to the nearest 10 grams using an electronic weighing scale.

Length: Length was measured to the nearest 0.1 cm using an Infantometer.

Head circumference: It was taken as the largest circumference of the skull using a flexible non stretchable tape to the nearest 0.1cm.

Mid Arm Circumference: It was measured in the left arm, at a point midway between tip of the acromion and the olecranon process using a flexible non-stretchable tape to the nearest 0.1 cm. All these examination findings were noted on a predesigned proforma.

Outcome variables

<u>CANSCORE</u>

Based on the nine clinical signs of malnutrition listed by Metcoff10, which include an examination of the hair and an assessment of the loss of subcutaneous tissues and muscles in the specified areas-cheeks, neck and chin, arms, back, buttocks, legs, chest, and abdomen-

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

CANSCORE was applied to each infant within 48 hours of birth. Each score might be anything between 1 and 4. Each parameter with no signs of malnutrition received a maximum score of 4, and the parameter with the strongest signs of malnutrition received the lowest value of 1. The overall rating resulting from the nine symptoms was used to calculate the neonates' CANSCORE, and foetal malnutrition was taken into account when the CANSCORE was 25.

Ponderal index (PI)

It was calculated using the following formula:

$PI = Weight\ (gms) \times 100 / Length\ (cms)^3$

Ponderal index < 2.2 gm/cm^3 was considered as an index of malnutrition**.**

Mid arm circumference/ head circumference Ratio

This study used the Mid Arm/ Head Circumference Ratio (MAC/HC) with acutoff value of 0.27 to determine malnutrition.

Statistical tests: The data obtained was coded and entered into a Microsoft Excel spread sheet (Annexure III), and master chart was prepared. The data was analyzed using SPSS statistical software version 20.0. Categorical data was expressed in terms of rates, ratios, and percentages and continuous variable were tested for normality using Shapiro Wilk test and parameters with normal distribution were expressed as mean ± standard deviation (SD) while the parameter which did not follow the normal distribution were expressed in terms of median and interquartile (IQR) range. The comparison of categorical data was done using the chi-square test or Fisher's exact test. The accuracy of CANSCORE, PI, and MAC/HC ratio in predicting fetal malnutrition was determined by calculating sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV), positive and negative likelihood ratios. The correlation between CANSCORE with length, birth weight, head circumference, and midarm circumference was determined by Spearman's correlation coefficient (ρ). All tests were two-tailed, and a p-value of less than 0.05 was considered significant.

RESULTS

The present one-year hospital-based, cross-sectional study with analytical components was conducted in the in the Government General Hospital, Kurnool, from January 2021 to December 2021. A total of 50 live born, singleton neonates with a gestational age of ≥34 weeks brought for regular checkup immediately after birth in the outpatient department and neonates whose hospital stay exceeded more than 24 hours of birth in Government General Hospital were studied. The data obtained was analyzed, and the final results were tabulated and interpreted as below.

Table 1. Clinical characteristics of the study population

Mean (n=952)					**Range**	
Parameters			**Median**	**IQR**		
	Mean	**SD**			**Min**	**Max**

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

Mother's age (Years)	24.00	3.56	23.00	3.25	19.00	37.00
Gestational age by Ballard score	37.68	1.53	38.00	2.00	34.00	40.00
Length (cms)	47.21	2.50	48.00	3.00	40.60	51.00
Birth weight (Kg)	2.60	0.52	2.55	0.74	1.50	3.90
Head circumference (cms)	32.77	1.54	33.00	1.85	29.00	35.50
Mid arm circumference (cms)	9.36	1.02	9.50	1.20	7.00	11.50
CANSCORE for Hair	3.22	0.71	3.00	1.00	2.00	4.00
CANSCORE for Cheeks	3.18	0.66	3.00	1.00	2.00	4.00
CANSCORE for Neck and chin	3.02	0.65	3.00	0.00	2.00	4.00
CANSCORE for Arms	2.84	0.55	3.00	0.00	2.00	4.00
CANSCORE for Legs	3.02	0.71	3.00	1.00	2.00	4.00
CANSCORE for Back	3.00	0.57	3.00	0.00	2.00	4.00
CANSCORE for Buttocks	3.00	0.61	3.00	0.00	2.00	4.00
CANSCORE for Chest	3.24	0.69	3.00	1.00	2.00	4.00
CANSCORE for Abdomen	3.32	0.68	3.00	1.00	2.00	4.00
CANSCORE	27.84	4.61	28.00	4.50	18.00	36.00
Ponderal index	2.44	0.26	2.36	0.40	2.00	3.00
MAC/HC	0.29	0.02	0.28	0.03	0.23	0.33

The clinical characteristics of the study population are as shown in table 1. The CANSCORE ranged from 18 to 36, and the mean and median CANSCORE was27.84±4.61and 28 (IQR 4.5), respectively. The PI ranged from 2 to 3, and the mean and median PI was2.44±0.26 and 2.36 (IQR 0.40), respectively. The MAC/HC ratioranged from 0.23 to 0.33, and the mean and

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

median MAC/HC ratio was 0.29±0.02 and 0.28 (IQR 0.03), respectively.

Table 2. Distribution of neonates according to the CANSCORE

CANSCORE		
	Number	**Percentage**
≥25	38	76.00
<25	12	24.00
Total	**50**	**100.00**

In the present study, 76% of the neonates had CANSCORE of ≥25,and 24%had CANSCORE of <25.

Table 3. Distribution of neonates according to the Ponderal index

Distribution (n=50)		
Ponderal index		
	Number	**Percentage**
≥2.25	40	80.00
<2.25	10	20.00
Total	**50**	**100.00**

In this study, 80% of the neonates had PI ≥2.25, and 20% had PI <2.25.

Table 4. Distribution of neonates according to the MAC/HC ratio

Distribution (n=50)		
MAC/HC		
	Number	**Percentage**
≥0.27	40	80.00
<0.27	10	20.00
Total	**50**	**100.00**

In the present study, 80% of the neonates had MAC/HC ratio of ≥0.27, and 20% had MAC/HC ratio of <0.27.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

In the present study, 68% of the neonates were boys, and 32% were girls. However,66.67% of the boys had CANSCORE of <25 compared to 33.33% of the girls, and the difference was statistically not significant (p=0.586).

Table 5. Distribution of neonates according to the Ballard score andits association with CANSCORE

Ballard score	**CANSCORE ≥25 (n=38)**		**CANSCORE < 25 (n=12)**		**Total (n=50)**	
	Number	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**
34	1	2.63	2	16.67	3	6.00
36	9	23.68	1	8.33	10	20.00
38	20	52.63	9	75.00	29	58.00
40	8	21.06	0	0.00	8	16.00
Total	**38**	**100.00**	**12**	**100.00**	**50**	**100.00**

P = 0.061

In this study, 58% of the neonates had a Ballard score of 38, and no association was found between CANSCORE and Ballard score (p=0.0**).**

In the present study, 74% of the neonates were term neonates, and 26% were preterm. However, 75% of the term neonates had CANSCORE of <25 compared to 25% of the preterm neonates, and the difference was statistically not significant (p=1.000).

Table 6. Accuracy of Ponderal Index in the diagnosis of fetal malnutrition considering CANSCORE as standard of reference

Ponderal index	**CANSCORE ≥25 (n=38)**		**CANSCORE < 25 (n=12)**	
	Number	**Percentage**	**Number**	**Percentage**
<2.25	4	10.53	6	50.00
≥2.25	34	89.47	6	50.00

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

Total	**38**	**100.00**	**12**	**100.00**

p = 0.007; Sensitivity=50%; Specificity=89.47%; PPV=60%; NPV=85%; DA=80%

In the present study 12 (24%) neonates had CANSCORE of <25. Among them, 6 each (50%) had PI <2.25. the accuracy of PI considering CANSCORE as thestandard of reference in the diagnosis of fetal malnutrition showed a diagnostic accuracy of 80% with a sensitivity of 50%, a specificity of 89.47%; PPV of 60%, andNPV of 85%, and this observation was statistically significant (p=0.007).

Table 7. Correlation between CANSCORE and MAC/HC

CANSCORE MAC/HC	**≥25 (n=38)**		**< 25 (n=12)**	
Number		**Percentage**	**Number**	**Percentage**
<0.27	2	5.26	8	66.67
≥0.27	36	94.74	4	33.33
Total	**38**	**100.00**	**12**	**100.00**

p < 0.001; Sensitivity=66.67%; Specificity=94.74%; PPV=80%; NPV=90%; DA=88%

In this study, 12 (24%) neonates had CANSCORE of <25. Among them, 8 (66.67%) neonates had MAC/HC ratio of <0.27, and 4 (33.33%) neonates had MAC/HC ratio of ≥0.27. The accuracy of MAC/HC ratio considering CANSCORE as the standard of reference in the diagnosis of fetal malnutrition showed a diagnostic accuracy of 88% with a sensitivity of 66.67%, a specificity of 94.74%; PPV of 80%, and NPV of 90% and this observation was statistically significant (p<0.001).

The correlation between length and CANSCORE is as shown in graph 9 and there was strong positive correlation between length and CANSCORE (ρ=0.566; R2=0.311; p<0.001).

The correlation between birth weight and CANSCORE is as shown in graph 10, and there was a strong positive correlation between birth weight and CANSCORE (r=0.654; R2=0.424; p<0.001).

The correlation between head circumference and CANSCORE is as shown in graph 11, and there was a strong positive correlation between head circumference and CANSCORE (ρ=0.591; R2=0.354; p<0.001).

The correlation between midarm circumference and CANSCORE is as shown in graph 12, and there was a strong positive correlation between midarm circumference and CANSCORE (r=0.740; R2=0.547; p<0.001).

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

Table 8. Distribution of neonates according to the gestation and its association with CANSCORE and other parameters determining intrauterine growth

Fetal malnutrition	Term (n=37)		Preterm (n=13)		Gestation Total (n=50)		p value
	No.	%	No.	%	No.	%	
CANSCORE	9	75.00	3	25.00	12	24.00	1.000
PI	5	50.00	5	50.00	10	20.00	0.101
MAC/HC ratio	5	50.00	5	50.00	10	20.00	0.101

In the present study, 12 neonates had malnutrition based on CANSCORE. Among them, 9 (75%) were term babies, and 3 were preterm babies (25%). Malnutrition based on PI and MAC/HC ratio was noted in 10 neonates each. Of which, 5 each (50%) were term and preterm babies respectively. However, the diagnosis of fetal malnutrition based on CANSCORE (p=1.000), PI (p=0.101), and MAC/HAC ratio
(p=0.101) was similar in term and preterm neonates.

DISCUSSION

Fetal malnutrition and low birth weight is a common clinical problem that can have long-term implications on the growth, neurodevelopment, and mortality and morbidity, particularly in developing countries. Fetal malnutrition is traditionally diagnosed based on the use of intrauterine growth standard charts to classify a baby as small for gestational age (SGA) or intrauterine growth-retarded (IUGR) when the birth weight is below the 10th percentile of the weight for the gestational (GA). The presence of fetal malnutrition (FM), often known as clinical signs of wasting in a newborn, is considered to be an indication of intrauterine issues in the baby.[6] However, a low birth weight by itself is not a reliable indicator of fetal malnutrition. It is an indication that the newborn is at high risk and prone to perinatal complications. The currently available markers of nutritional status are not capable of providing an adequate assessment of nutrition, which is most effectively measured by the amount of subcutaneous fat that is deposited throughout the period of time spent in utero. As a result, the identification of the majority of malnourished neonates requires a combination of clinical evaluation and anthropometric measurements.

There are many other methods that are used to determine the nutritional status of newborns at birth, such as weight for gestational age, the Ponderal index (PI), and the mid-arm/head circumference ratio. However, each of these methods has their own unique limitations. Weight for gestational age is one of the most common methods. It is therefore helpful to detect FM at birth in order to identify newborns who are at a higher risk for metabolic

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

disorders linked with aberrant prenatal growth. The CANSCORE is another clinical assessment tool that can be used to diagnose FM. It is extremely important to identify infants who have FM due to the high frequency of neonatal morbidity and long-term consequences such as metabolic syndrome. The clinical signs of FM might vary greatly depending on the stage of pregnancy during which the malnutrition first manifested itself. The present study was undertaken to address fetal malnutrition using CANSCORE and various other parameters to find the effectiveness of CANSCORE in assessing FM in preterm and term neonates and to identify the commonly used anthropometric parameters that can reliably detect the condition. Because FM adversely affects body composition, including reduced muscle mass and protein content, organ structure and composition, bone, chemical composition and metabolic, and enzyme functions, the present study was undertaken to address fetal malnutrition.[7]

From January 2021 through December 2021, this hospital-based cross- sectional study with analytical components was carried out in the Government general Hospital in Kurnool. The study lasted for one full calendar year. There is a total of 50 live born, singleton neonates with a gestational age of more than 34 weeks who were brought for a standard checkup immediately after birth in the outpatient department. Those patients whose hospital stays in the Government general hospital lasted longer than twenty-four hours after giving birth were evaluated for FM using CANSORE as well as other approaches.[8]

Mean birth weight of 50 babies in my study, irrespective of the gestational age is 2604 ± 20 grams, length 47.20 ±3.80. On comparing with other study as mentioned in Table were the highest mean weight and length are noted in study conducted by Sahin Hamilcikan et al. (2017), as 3645 ± 396.9 and 49.38 ± 2.2 respectively.

In my study, Total 50 neonates taken in which among 74% were Term and 26% were Preterm, table comparing my study with other study, Incidence of fetal malnutrition by CANSCORE varies from 10.9 to 68.4, but my study incidence of fetal malnutrition is 24%, which is lower than the other study. Higher incidence of fetal malnutrition is 68.4% in M.Amarendra et al. study. [9]

In others study, it is noted that incidence of SGA varies from 2.8% to 62.5% and in my study, incidence is 34% remaining 66% of the babies were in AGA group.

In the current study, we are using CANSCORE as the gold standard for detecting the nutritional status of newborn at birth, association of fetal malnutrition with neonatal parameters and other commonly used anthropometric indices are discussed below.

On comparing the fetal malnutrition with the sex of the baby there is no significant association i.e., 24% had fetal malnutrition and among male it is 23.5% and female 25%. On comparing the fetal malnutrition with the gestation age, it was found that in newborn babies <34 weeks CANSCORE is not applicable, as all babies had evidence of fetal malnutrition because of poor development of subcutaneous fat tissues.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

BN Ezenwa et al (2013), in his study on preterm babies of gestation age 28 weeks to 36 weeks, were he concluded CANSCORE is even applicable in preterm babies, but AS Ali et al (2016)[63] concluded in his study that though CANSCORE is good screening tool for identification of fetal malnutrition, for better accuracy there should be some adjustment in variable and scoring.

As discussed early fetal malnutrition is found even in AGA babies, this is the comparison showing incidence of fetal malnutrition in SGA & AGA babies. In our study it was found 9% AGA babies and 52.94% SGA were with fetal malnutrition, which is high on comparing this data, with others studies incidence of FM in AGA varies from 5.53% to 58.6% and in SGA from 23.2% to 93.80%

On comparing CANSCORE with PI, CANSCORE detects more no of fetal malnutrition than Ponderal Index, it is varying from 8 to 78% and in my study 24% fetal malnutrition was detected by CANSCORE and 20% by PI.

Having ponderal index as a tool for malnutrition babies are classified into two group in which 20% were noted to have malnutrition, were on comparing with other studies it was reported, malnutrition rate is as high as 78% and 61.6% by the study conducted by Sahin Hamilcikan et al (2017) and M. Amarendra et al. respectively.

Having CANSCORE as gold standard, sensitivity, specificity, PPV and NPV were calculated and these reports is compared with other studies as tabulated. In my study sensitivity of PI is 50% which is more on comparing with other studies, Dhanorkar AK et al.it is 61% and M. Amarendra et al i.e., 69.5% respectively. Specificity is 89.47% which almost equal on comparing with other studies.[10]

On comparing CANSCORE with kanawati index, CANSCORE detects more no of fetal malnutrition than kanawati index, it is varies from 20 to 60% and in my study 24% fetal malnutrition was detected by CANSCORE and 20% by kanawati index, except a study conducted by Mahalingam Soundarya, kanawati index detect the fetal malnutrition than the CANSCORE .

Having kanawati index as a tool for malnutrition babies are classified into two group in which 20% were noted to have malnutrition, were on comparingwith other studies it was reported, malnutrition rate is as high as 59.1% and 56% by the study conducted by Ajay sethi et al (2016) and M. Amarendra et al. respectively.
Having CANSCORE as gold standard, sensitivity, specificity, PPV and NPV were calculated and these reports is compared with other studies as tabulated. In my study sensitivity of kanawati index is 66.67% which is less on comparing with other studies, Dhanorkar AK et al.it is 76% and M. Amarendra et al i.e., 77.7% respectively. Specificity is 94.74% which more on comparing with other studies.it may be interpreted that the MAC/HC ratio is highly accurate, considering CANSCORE as a standard of reference in the diagnosis of FM than PI. Hence MAC/HC ratio seems to be a more accurate index than PI. This fact may be further

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

explained by the fact that PI is an index which relies on the principle that the length is spared at the expense of weight during acute malnutrition, however, it does not take into account chronic malnutrition where both weight and length are affected with their ratio being normal; hence such newborns who are malnourished will be misdiagnosed as normal. These observations were similar to that of Georgieff MK and Sasanow SR (1986), who found MAC/HC a more accurate index. Earlier, a study by Cole TJ et al. (1997) also concluded that PI is not an appropriate index for measuring intrauterine malnutrition as it fails to adjust for length at all gestational ages. On the contrary, Soundarya M. et al. (2012) reported that on analysis of the relation of MAC/HC with CANSCORE, a very poor sensitivity was obtained with a reasonable specificity, the positive predictive value was also very low, hence making MAC/HC a very poor indicator in detecting fetal malnutrition.

In the present study there was strong positive correlation was noted between CANSCORE with length (ρ=0.566; R2=0.311; $p<0.001$), birth weight (r=0.654; R2=0.424; $p<0.001$), head circumference (ρ=0.591; R2=0.354; $p<0.001$) and midarm circumference (r=0.740; R2=0.547; $p<0.001$). These observations propose that CANSCORE as a diagnosis of FM is not only based on the single entity like length, birth weight, head circumference, and midarm circumference, but it is a product of all these measures; hence seems to be a reliable method for the diagnosis of FM.

The other important findings of the study were that the diagnosis of FM based on CANSCORE (p=1.000), PI (p=0.101), and MAC/HAC ratio (p=0.101) was similar in term and preterm neonates. Similarly, no association was found between CANSCORE and Ballard score (p=0.061), suggesting that the diagnosis of FM based on CANSCORE did not differ significantly with gestational age and prematurity and also across the boys and girls, which makes it a reliable method for detecting FM. These findings are partly in agreement with the observations reported by Metcoff J. who reported that babies whose length, HC, weight are significantly reduced were probably exposed to malnutrition early in the second trimester and babies whose length and HC are less affected but are small, underweight with loss of subcutaneous tissue probably became malnourished early in the third trimester. Our study reemphasizes the observations of Metcoff J. that fetal malnutrition is a clinical diagnosis, independent of birth weight. The advantages of CANSCORE are that it is a simple, easy to perform without the aid of any sophisticated equipments. Overall, the present study reemphasizes that FM is a major problem in the study area as the incidence of FM in the study area is as high as one in four newborns are likely to have FM based on CANSCORE. Further, the present study reemphasizes that CANSCORE is a simple systematic method to identify fetal malnutrition. It does not require any sophisticated equipments or time-consuming calculations. Hence it is the method preferred for/ ideal for screening malnourished babies. At the same time, MAC/HC ratio seems to be a more accurate index than PI as the diagnostic accuracy of PI is slightly less than MAC/HC ratio. This tool is beneficial in periphery where availability of qualified personnel is less, which will help the health workers to identify FM easily in developing nations where the incidence of FM is high.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 10, 2023

However, these observations require further validation due to the potential limitations of the study.

CONCLUSION

The present study reemphasizes that FM is a significant problem in the study area as the incidence of FM in the study area is as high as one in four newborns are likely to have FM based on CANSCORE. Further, the present study also reemphasizes that CANSCORE is a simple systematic method to identify fetal malnutrition. It does not require any sophisticated equipment or time-consuming calculations. Hence it is the method preferred for or ideal for screening malnourished babies. At the same time, MAC/HC ratio seems to be a more accurate index than PI as the diagnostic accuracy of PI is slightly less than MAC/HC ratio. This tool is very helpful in the periphery where the availability of qualified personnel is less and will help the health workers to identify FM easily in developing nations where the incidence of FM is high. However, these observations require further validation due to the potential limitations of the study.

REFERENCES

1. Clifford SG. Post-maturity with placental dysfunction: Clinical syndrome and pathologic findings. J Pediatrics 1654; 44:1-2.
2. Von Grebmer K, Bernstein J, de Wall A, Prasai N, Yin S, Yohannes Y. 2021 Global hunger index: armed conflict and the challenge of hunger. Intl Food Policy Res Inst; 2015 Oct 12.
3. Black RE. Global Prevalence of Small for Gestational Age Births. Nestle Nutr Inst Workshop Ser. 2015; 81:1-7. Doi: 10.1159/000365790. Epub 2015 Jun 16. PMID: 26111558.
4. Embleton ND, Katz J, Ziegler EE (eds): Low-Birthweight Baby: Born Too Soon or Too Small. Nestlé Nutr Inst Workshop Ser. Nestec Ltd. Vevey/S. Karger AG Basel, © 2015, vol 81, pp 1-7
5. Colella M, Frérot A, Novias‘ ARB, Baud O. Neonatal and Long-Term Consequencesof Fetal Growth Restriction. CurrPediat Rev.2018; 14(4):212218. doi:10.2174/1573396314666180712114531. PMID: 29998808; PMCID: PMC6416241.
6. Pick W. Malnutrition of the newborn secondary to placental insufficiency. N Engl J Med 1954; 250:905-7.
7. Battalgia FC, Lubchenco LO. A practical classification of newborn infants by weight and gestational age. J Pediatr 1967; 71:159-63.
8. Fitzhardinge PM, Steven FM. The small for date infant. Neurological and Intellectual Sequelae. Pediatrics 1972; 50:50-7.
9. Haymond MW, Karl IE, Pagliara AS. Increased gluconeogenic substrates in the small-for-gestational age infant. N Engl J Med 1974; 291:322-8.
10. Fancourt R, Campbell S, Harvey D. Follow-up study of small for-date babies. BMJ 1976; 1:1435-7.