Medical and Research Publications
International Open Access

Research Article **Journal of MAR Pediatrics (Volume 4 Issue 2)**

Study of Fetal Malnutrition by Body Mass Index (BMI) and Other Anthropometric Indices

Dr. Edwin Dias [1], MD, DCH, DNB *, Dr. Vandana. G.P [2], Dr. Shreya Dinesh Shetty [3]

1,2,3. Department of Paediatrics, Srinivas Institute of Medical sciences and Research Centre Mangalore, India.

Corresponding Author: Dr. Edwin Dias, Department of Paediatrics, Srinivas Institute of Medical sciences and Research Centre Mangalore, India.

Received Date: May 09, 2023

Published Date: June 01, 2023

Abstract

A baby's weight at birth is a strong indicator of maternal and newborn health and nutrition. Fetal growth restriction can occur at any gestational period and is affected by maternal, placental and environmental factors. Being undernourished in the womb increases the risk of death in the early months and years of a child's life. Those who survive tend to have impaired immune function and increased risk of disease; they are likely to remain undernourished, with reduced muscle strength, cognitive abilities and IQ throughout their lives. Thereby it is important to assess the nutritional status at birth.

Nutritional status at birth is assessed by using various anthropometric parameters and proportionality indices. Present study aims to assess the utility of BMI and other anthropometric indices in identifying fetal malnutrition (FM).

Objectives: *To assess fetal nutrition in newborns by using body mass index(BMI) and ponderal index.*

Materials and Methods: *Nutritional status of 100 neonates delivered in Department of Pediatrics, Srinivas Medical College and Hospital, Mukka during the period of June 2021 to February 2022 was assessed using BMI, mid arm circumference/head circumference ratio and ponderal index. Effectiveness of each parameter in detecting FM was assessed and compared using appropriate statistical tools.*

Results: *Out of 100 newborns, 25 newborns (25%) had BMI below 10th centile out of which 9 (9%) had BMI less than 3rd centile suggesting severe malnutrition. Malnutrition as per CAN Score was seen in 32(32%) infants. When CAN score and BMI was compared, among the 35 babies who had CAN score less than 25 indicating FM, only 12(36%) had BMI less than 10th centile. In 13 of the 25 infants with BMI less than 10th centile, CAN score was normal. This difference was statistically significant ($p < 0.001$). Hence these two parameters cannot be compared as CAN score cannot identify disproportionate growth. When individual birth centile were compared with BMI, only 6(6%) of infants with BMI less than 10th centile had weight more than the 10th centile.*

Conclusion: *BMI is considered more reliable as compaired to other anthropometric indices as an indicator of fetal nutritional status.*

Keywords: *Body Mass Index; Fetal Malnutrition; Ponderal Index; SGA.*

Introduction

Fetal malnutrition is defined as failure to gain adequate amount of fat and muscle mass during intrauterine growth term coined by Scott and Usher.[1] It is a risk factor for increased neonatal morbidities and mortalities worldwide Assessment of nutritional status of fetus has been a major concern to many clinicians because of the potentially serious sequelae of malnutrition on multiple organ systems.[2,3]

The traditional classification of newborns based on birthweight that is 2500 grams being the cut off for LBW was replaced by classification based on gestational age and percentile. Small for gestational age (SGA) based on birthweight less than 10^{th} percentile for gestational age were considered malnourished.[4] Perinatal problems and/or long term central nervous system sequelae are known to occur primarily in babies with fetal malnutrition (FM) whether appropriate for gestational age (AGA) or SGA but less so among those who are SGA but without fetal malnutrition.[5]

This prospective observational study aims to know prevalence of fetal malnutrition in term SGA babies and to study occurrence of adverse perinatal events in term SGA babies with or without fetal malnutrition. There is a need for prompt identification of babies with FM. Features of malnutrition must therefore be sought for, and appropriately diagnosed and treated in every baby at risk. The anticipatory management of such infants at birth may decrease morbidity and improve the survival of such infants.

Methodology

The present study was planned in Department of Pediatrics, Srinivas Medical College and Hospital, Mukka during the period of June 2021 to February 2022. Total 100 cases of new borns delivered in our hospital were enrolled in the present study.

The following parameters were recorded in all babies (Weight was recorded at birth, length, mid arm circumference and head circumference were recorded between 24-48 hrs of life). Nude birth weight was recorded using electronic weighing scale. Length was measured using infantometer. Mid arm circumference (MAC) was measured in the left arm at a point midway between tip of the acromion and the olecranon process. Head circumference (HC) was taken at the largest circumference of skull using a non-stretchable tape.

Weight and length obtained were plotted on intrauterine growth charts to classify the newborns as appropriate for gestational age (AGA), small for gestational age (SGA) and large for gestational age (LGA).[6] Ponderal index (PI) was calculated using the formula: weight (gms)X 100/ length (cm)3, value less than 2.2 was considered as malnutrition.[7]

Aims and Objectives

The aim of this study was identifying the incidence of FM using BMI and compare the nutritional assessment with anthropometry and evolve a screening tool for rapid assessment of FM.

Inclusion Criteria: Live born singleton neonates of gestational age between 37 weeks and 42 weeks.

Exclusion Criteria: Preterm neonates, neonates with congenital anomaly, neonates requiring admission to neonatal intensive care unit (NICU), multiple gestation and neonates born to gestational Diabetes Mellitus mother were excluded from the study.

Results

	Mean	Std. Deviation
Gestational age (weeks)	38.11	.984
weight(grms)	2966.76	431.026
Length (cm)	48.456	2.2909
HC (cm)	33.53	1.216
BMI	12.595	1.811

gender	Frequency	Percent
Boy	55	53.9
Girl	47	46.1
Total	102	100.0

WEIGHT IN PERCENTILE	Frequency	Percent
>10	81	79.4
3-10	12	11.8
<3	9	8.8
Total	102	100.0

LENGTH IN PERCENTILE	Frequency	Percent
>10	85	83.4
3-10	12	8.8
<3	8	7.8
Total	102	100.0

Head circumference in percentile	Frequency	Percent
>10	92	90.2
3-10	8	7.8
<3	2	2.0
Total	102	100.0

BMI in percentile	Frequency	Percent
>15	64	62.7
3-15	15	14.7
<3	23	22.6
Total	102	100.0

		WEIGHT (Percentile)		Total
		>10	<10	
BMI (Percentile)	>15	63	1	64
	<15	18	20	38
Total		81	21	102

Sensitivity= 95.24%, specificity= 77.78%, PPV= 52.63%, NPV=98.4%.

		WEIGHT (Percentile)		TOTAL
		>3	<3	
BMI (Percentile)	>15	78	1	79
	<15	15	8	23
Total		93	9	102

Sensitivity= 88.89%, specificity= 83.87%, PPV= 34.78%, NPV=98.73%.

Discussion

The group study consisted of 100 term neonates (37 to 42 weeks) with equal distribution in gender. Their birth parameters and BMI were studied to assess the nutritional status. BMI charts were used to plot the birth centiles in this study **[**8**]**. Anthropometric values which were disproportionate for only one parameter were excluded from analysis. Birth weight and BMI values showed a normal distribution while length and HC were skewed to the right with kurtosis. This suggested that birth weight and BMI were representative of the nutritional status in newborn. The difference in mean birth weight when compared with intrauterine growth charts by Olsen et al progressively widened with increasing gestational age ranging between 186 grams to 360 grams at 37 weeks and 40 weeks respectively **[**9**]**. Similar trend was also seen with length and head circumference. On the contrary, BMI difference showed a declining trend ranging between 0.89 and 0.53 at 37 and 40 weeks respectively.This suggested that the velocity of growth in the study population plateaued by 38 weeks of gestation. The present study using Olsen chart observed that 27% had birth weight less than 10th centile indicating SGA **[**10**]**. Corresponding values noted in other studies include: 35.5% by Salihoglu et al, 45.4% by Sankhyan et al, 62.5% by Singhal et al and 23% by Soundarya et al **[**11,12,13**]**. When compared to weight centiles the percentage of babies with length less than 10th centile were 10.6% and in majority it was less than 3rd centile. This again suggested that BMI would be more reliable as an indicator of fetal nutritional status than birth weight alone. Only 7.3 % of the babies HC was less than 10th centile suggesting brain sparing in our study.

By BMI, 25.9% of the study population were less than 10th centile. Kamath et al identified 26.59% of the newborns had BMI less than 10th centile which was comparable to the present study.The incidence of disproportionate growth was less in the present study than values observed by Thammanna et al and Soundarya et al which accounted for 39.45% and 40.3% respectively **[**14**]**. When BMI and weight were compared in the present study it was observed that 22 neonates (21.5%) who were SGA had BMI more than 10th centile. A similar result was obtained by Kamath et al in which 64(28.8%) neonates who are SGA had BMI more than 10th centile **[**15**]**. When length was compared with BMI 92(86.8%) neonates who were stunted had normal BMI.

Conclusion

The data generated from the present study concludes that classifying babies on basis of weight as SGA, AGA and LGA may miss to diagnose some of the cases who are affected very late in third trimester.

BMI is the best screening tool for malnutrition and when coupled with PI will identify most normally nourished newborns.

References

1.Scott KK and Usher RH. Fetal malnutrition: Its incidence causes and effects .Am J Obstet Gynaecol 94: 951-63,1966.

2. Lockwood CJ and Weiner S. Assessment of fetal growth. Clin perinatol 13:2-35,1986.

3. Georgieff MK and Sasanow SR. Nutritional assessment of the neonate. Clin Perinatol 13:72- 89, 1986

4. Korkmaz A, Teksam O, Yurdakok M, Yigit S, Tekinalp G. Fetal malnut rition and its impacts on neonatal outcome in preterm infants. Turk J Pediatr. 2011; 53:261

5. Metcoff J. Clinical assessment of nutritional status at birth. Fetal malnutrition and SGA are no synonymous. Pediatr Clin North Am 41:875-91,1994.

6. Battaglia FC, Lubchenco LO. A practical classification of newborn infants by weight and gestational age. J Pediatr, 1967; 71:159-63.

7.Mohan M, Prasand SR, Chellani HK, Kapani V. Intrauterine growth curves in North Indian babies: weight, length, head circumference and Ponderal index. Indian Pediatr. 1990; 27(1):43-51.

8. Winter JD, Taylor Y, Mowrer L, Winter KM, Dulin MF. BMI at birth and overweight at age four. Obesity Research & Clinical Practice. 2017 Mar 1;11(2):151-7.

9.Olsen IE, Groveman SA, Lawson ML, Clark RH, Zemel BS. New intrauterine growth curves based on United States data. Pediatrics. 2010 Feb;125(2):e214-24.

10. Olsen IE, Lawson L, Ferguson AN, Cantrell R, Grabich SC, Zemel BS. BMI curves for preterm infants. Pediatr. 2015;135:572-85.

11.Salihoglu O, Karatekin G, Baksu B, Can G, Nuhoglu A. Frequency and risk factors of fetal malnutrition among live born singleton term neonates using a computerised perinatal database, 2000-2006. J Pediatr Child Health. 2012;48(10):2006-30.

12. Sankhyan N, Sharma VK, Singh S. Detection of fetal malnutrition using CAN score. Indian J Pediatr. 2009;76:903-6.

13. Singhal V, Agal P, Kamath N. Detection of fetal malnutrition by CAN score at birth and its comparison with other methods of determining intrauterine growth. Indian J Clin Prac. 2012;22:576-82.

14. Soundarya M, Basavaprabhu A, Raghuveera K, Baliga BS, Shivanagaraja BSV. Comparative assessment of Fetal malnutrition by anthropometry and CAN score. Iran J Pediatr. 2012;22(1):70-6.

15. Kamath M, Rao SS, Shenoy RD. Assessment of fetal malnutrition by body mass index and intra uterine growth curves: a comparative study. Int J Contemp Pediatr. 2016;3(3):773-7.