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Original Article

Comparison of the CAN (Clinical Assessment of Nutrition) Score with other Anthropometric Parameters to Determine the Importance of The Skin Fold Thickness for Foetal Nutrition Assessment

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ABSTRACT

Skin fold thickness (SFT) evaluation is affordable, trustworthy, noninvasive and straightforward way of assessing fat in the body at all age-groups, including the infant**s. Objective:** To do the comparison of the CAN (Clinical Assessment of Nutrition) score with various anthropometric parameters in assessing the importance of the skin fold thickness for foetal nutrition assessment. **Methods:** This observational and prospective study was carried out in the Pediatric Department of Bacha Khan Medical Complex, Swabi during the period from 21st July 2022 to 20th 2023. Total 130 babies had their anthropometry measured and their CAN scores recorded. The scores of CAN were calculated, and individuals with scores below 25 were deemed to have foetal malnutrition. For each neonate, skin fold thickness measurements were made by means of the Slim Guide caliper. At each site, two interpretations were recorded, and the mean was noted. The CAN score was correlated with all measurements of skin fold thickness, and statistical comparisons were performed. **Results:** 40.88% of children had foetal malnutrition. The mean (SD) for all skin-fold thickness sum at all sites for females and males were 4.26 ± 0.28 and 4.6 ± 1.89mm respectively. The sum of all data comparing fetal malnutrition and no fetal malnutrition using the mean (SD) of infant anthropometric data and Clinical Assessment of Nutrition score was significant statistically (p-value < 0.001). **Conclusions:** The five skinfold measurements sum can be a beneficial tool of screening for foetal malnutrition in terms of its relevance, simplicity and objectivity but is not specific or sensitive enough to replace the scores of CAN in identifying foetal malnutrition among newborns.

INTRODUCTION

Skin fold thickness (SFT) evaluation is affordable, trustworthy, noninvasive and straightforward way of assessing fat in the body at all age-groups, including the infants [1, 2]. The term "foetal malnutrition" (FM) refers to a clinical condition in which child fails to gain enough weight or loses muscular mass/ subcutaneous fat in utero [3, 4]. A neonate with less than 10th percentile is referred to as being small for gestational age (SGA) or having FM, according to a regularly used method of assessing the nutritional condition of newborns called intrauterine growth chart [5, 6]. However, not all SGA newborns had foetal malnutrition, and a child might have intrauterine growth restriction (IUGR). Babies who are categorized as appropriate for gestational age, on the other hand, may exhibit FM characteristics [7]. There have been unsuccessful attempts to establish FM using anthropometric standards. A newborn's nutritional status was initially evaluated using Metcoff's CAN (Clinical Assessment of Nutrition) score. Its sensitivity and specificity are around average, and it entails looking for nine clinical signs [8]. The CAN score has been suggested for usage in nations with low-income since it can identify

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FM symptoms in newborns even if their weights are within normal range for gestational age [9]. It has significant drawbacks, though, in that it requires the assessment of nine clinical indicators, which takes time and involves some biasness. As a result, it might not be the best option in developing nations with high fertility rates and a shortage of man power [10]. In developing nations like ours, where SGA births are frequent, FM is anticipated to be widespread since SGA newborns are known to be more likely have FM than another babies [11, 12]. There have only been a few numbers of FM studies conducted too yet. Estimates of body fat are often based on static measurement of skin fold, a technique that has been shown to be reliable for evaluating child malnutrition [13]. The goal of this study was to test the validity of static thickness of the skin fold, a quick, inexpensive, and non-invasive method for determining FM.

METHODS

This observational and prospective study was carried out in the Pediatric department of Bacha Khan Medical Complex, Swabi during the period from 21st July 2022 to 20th April 2023. As recommended by the Institute's Ethics Committee, ethical approval was obtained. The study included all singleton newborns who were born with a gestational age (GA) between 37 and 42 weeks, and had less than 48 hours of life. 130 babies had their anthropometry measured and their CAN scores recorded. A new Ballard score that was developed by Ballard was used to determine the gestational age of each neonate. The study excluded 5 infants with congenital malformations, requiring NICU care, born before 37 weeks of gestation and delivered to mothers who had unreliable gestational age calculation and gestational diabetes mellitus. All newborns had their length, weight, head and mid-arm circumference measured between 24 and 48 hours after birth. Other measurements included: I Birth weight: Using an electronic weighing scale, the naked birth weight is calculated with minimum error of less than 10 grams. (ii) Crown to heel measurement: Using an infant meter, length of the baby was recorded with minimum error of 0.1 cm (iii) Occipitofrontal circumference: By means of a non-stretchable and flexible tape, the circumference of the skull was measured (iv) Circumference of the Mid Arm: On the left arm, the measurement was made using non-stretchable and flexible tape at a location halfway between the acromion tip and the olecranon process. The length and birth weight of babies were plotted on intrauterine growth graphs to categories the neonates as SGA, LGA and AGA and the given variables were then determined and clinically compared using the CAN score to evaluate their efficacy in recognizing malnourishment. Both well-nourished and malnourished infants were categorized based on the Ponderal index. An indicator of malnutrition was thought to be a ponderal index < 2.2 gm/cm3. Various maternal variables were noted when the sample was being taken counting, maternal education, age, eclampsia, smoking, hypertension and pre-eclampsia history in all mother were noted. There was a correlation between these maternal variables and FM. For each neonate, skin fold thickness measurements were made by means of the Slim Guide caliper for skin fold at the biceps, triceps, superior iliac, quadriceps and sub scapular regions. All calculations were done on the right body side. At each site, there were two readings recorded, and the mean was noted. In order to identify FM, we employed CAN score, which ranged from nine (the lowest) to 36 (highest). FM was identified as having a CAN score less than 25, and well-nourished newborns were identified as having a score greater than 25. The CAN score was correlated with all measurements of skin fold thickness, and statistical comparisons were performed. The data were analyzed and entered in SPSS version 22.0. The findings were analyzed statistically be means of the EPI INFO version-7 statistical tool, and the Chi square and "t" test were applied to govern the relation between anthropometrical characteristics and CAN score.

RESULTS

There were 125 neonates in all, of whom 70(56%) were male. Among all babies who were born: 65(52%) born at <39 weeks and 60(48%) born at> 39 weeks, and of them, 80 (64%) were AGA, 4 (3.2%) were LGA, and 41 (32.8%) were SGA. In 18(14.4%) of the cases, the mother age was < 20 years and in 107(85.6%) of cases, the mother's age was >20 years, respectively. Table 1 shows the mean (S.D) values of several anthropometric measurements taken from newborns.

Table 1: Shows the derived and measured anthropometry in newborns and their mean values

Anthropometry	Male	Female	p-value
Length (cm)	50.21 ± 4.01	48.15 ± 3.18	0.152
Weight at Birth (kg)	2.62 ± 0.597	2.79 ± 0.524	0.655
Chest circumference (cm)	30.87 ± 1.45	32.79 ± 25.31	0.201
Mid-upper-arm circumference (cm)	12.64 ± 1.05	10.92 ± 1.19	0.83
Ponderal Index (g/cm3)	1.99 ± 3.18	1.29 ± 2.67	0.145
Occipital frontal circumference (cm)	35.07 ± 1.29	34.59 ± 1.35	0.06

Although all of the anthropometric characteristics in male babies were higher than those in female babies with statistically significant difference (p > 0.05). Using the CAN score, foetal malnutrition was identified in 19.8% of the now-born, whereas using the PI score shows that 34.2% were well-nourished and 62.5% of the infants were malnourished. The infants' mean (SD) of anthropometric data, comprising the sum of all data, were considerably lower in FM new-born (p-value 0.001) (Table 2).

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Table 2: Shows the neonates' anthropometric measures in mean (SD) with reference to nutritional status (CAN score)

Anthropometric measure	Malnourished	Well nourished	p-value
Length (cm)	48.30 ± 1.18	50.48 ± 3.72	< 0.001
Weight at Birth (kg)	2.05 ± 0.301	2.96 ± 0.22	< 0.001
Chest circumference (cm)	26.76 ± 2.14	30.08 ± 1.86	< 0.001
Occipital frontal circumference (cm)	33.41 ± 1.79	35.92 ± 1.95	< 0.001
Ponderal Index (g/cm3)	1.95 ± 0.15	2.54 ± 0.18	< 0.001
Mid-upper-arm circumference (cm)	8.55 ± 0.98	12.80 ± 1.95	< 0.001
Sum of all	26.27 ± 1.34	24.10 ± 1.56	< 0.001

The infant's distribution with FM in proportion to gestational weight is shown in Table 3. The foetal malnourished babies have been found among SGA and AGA infants. FM was not present in any of the infants with LGA.

Table 3: Shows the relation between FM and LGA/SGA/AGA

LGA /SGA /AGA	Malnourished	Well nourished	p-value
SGA	48 (60%)	32 (40%)	< 0.001
LGA	0	4 (100%)	
AGA	3 (7.3%)	38 (92.7%)	
Total	51 (40.8%)	74 (59.2%)	

The percentage of infants with foetal malnutrition was noticeably greater among the SGA infants. The sum of the five measurements demonstrated the best association out of all the skinfold thickness measurements, which were strongly related with the CAN score (Table 4 & 5).

Table 4: Shows the skin fold thickness mean with reference to foetal nutritional status

Skin fold measurement	CAN Score		p-value
	Malnourished	Well nourished	
Biceps (mm)	2.58 ± 0.45	3.68 ± 0.81	< 0.001
Triceps (mm)	3.78 ± 0.94	4.66 ± 0.63	
Supra-iliac (mm)	2.10 ± 0.26	3.54 ± 0.58	
Sub scapular (mm)	4.18 ± 0.41	5.88 ± 0.64	
Quadriceps (mm)	4.23 ± 0.74	6.02 ± 1.51	
Sum of all (mm)	3.34 ± 0.96	4.21 ± 0.35	

Table 5: Shows the CAN score correlation with skin fold thickness

Skin fold thickness (mm)	Correlation coefficient (r)	p-value
Biceps (mm)	0.650	< 0.001
Triceps (mm)	0.692	
Supra-iliac (mm)	0.535	
Sub scapular (mm)	0.615	
Quadriceps (mm)	0.631	
Sum of all (mm)	0.607	

DISCUSSION

FM and LBW are frequent clinical issues with long-standing effects on neurodevelopment, growth, morbidity, and death in poor nations [14]. SFT, an adiposity index, inferentially evaluates nutritional reserve. It is recommended for use in determining a person's nutritional status because it has been demonstrated to compare favorably with subcutaneous fat dual-energy X-ray absorptiometry results. This study looked at how SFT might be used to evaluate the nutritional state of newborns at birth and, implicitly, the nutritional health of the fetus [15, 16]. At all locations, females had thicker skinfolds, but this was not statistically significant. This was in line with past findings that women tend to gain more weight than men do, particularly during the third trimester [17]. According to the CAN score, 40.8% of people had Foetal malnutrition, which is a reasonable comparison to the rates of 39.1% and 36.1% recorded from Nigeria, Pune, Ilesa, India, correspondingly [18, 19]. The disparities between the various studies could be partially attributed to variations in the status of nutrition of the research groups [20]. This study showed that the sum of all the distinct skinfold thicknesses in malnourished babies was significantly lower than in well-nourished babies and this result is constant with the loss or reduction of subcutaneous fat that is typical of malnutrition [21]. Similar to Farmer G's study, which discovered that the skinfold measurement of the quadriceps and the total thickness of all 5 skinfolds best linked with the nutritional state of the fetus, this study discovered that the total thickness of all five skinfolds best connected with the absence or presence of FM [22]. Due to the lack of the anticipated benefit of time savings, adopting the average of 5 skinfold evaluation as a substitute to the CAN score may not be the best choice [23]. In addition, its level of sensitivity and specificity, both individually and collectively, is insufficient to suggest it as a viable replacement for the CAN score [24]. Because to its accessibility and simplicity, the total of all five skinfold measurements is a helpful screening FM tool but it cannot be suggested as a substitute for the CAN score when evaluating foetal malnutrition [25]. In the non-availability of a pediatrician, the use of such a straightforward screening technique can be beneficial in identifying Foetal malnutrition by health providers working in peripheries. In addition to decreasing the load on the higher centers, this prioritizes care for individuals who are actually undernourished.

CONCLUSIONS

The five skinfold measurements sum can be a beneficial tool of screening for foetal malnutrition in terms of its relevance, simplicity and objectivity but is not specific or sensitive enough to replace the scores of CAN in identifying foetal malnutrition among newborns.

Authors Contribution

Conceptualization: HG
Methodology: IU
Formal analysis: AK
Writing-review and editing: BA, AKH, MQK

All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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