Assessment Of Nutritional Status Of Under Five Children In Sokoto North Local Government Area, Sokoto State.

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Abstract
Background: *Malnutrion is an imbalance between the intake of calorie and the body's requirement. When the body's requirement supersedes the intake, it is under nutrition and when the intake is more than the body's requirement, it leads to overweight or obesity. Both instances are forms of malnutrition. The study aim to determine prevalence of under nutrition among the study subject , age variation in relation to under nutrition and compare results of malnutrition obtained from Mid-Upper-Arm circumference and other methods of determining Nutritional status (weight-for-Age and height-for-Age*
Materials and Methods: *a descriptive cross-sectional study was conducted among 112 under five children in Sokoto North LGA. Multi stage sampling technique was used for selection where 3 districts were randomly selected from the 11 districts in Sokoto North LGA, and 4 areas where the study was carried out were randomly selected from the 3 districts.*
Results: *The prevalence of stunting was 53.6% among which 22.3% were mildly stunted , 15.3% were moderately stunted, and 16.1% were severely stunted. The prevalence of wasting was 53.6% of which 14.28% had Grade 1 wasting, 9.8% of the subjects were moderately wasted (grade 2), 12.5% were severely wasted(grade3) and 17% had very severe wasting. Majority of the children (80.4%) had suffered from one form of illness or the other. Mean of under 5 years Feeding practices showed that 98.2% were breastfed, 12.9% of those who breastfed were stopped abruptly, majority of the study subject were introduced to complementary feeding at 6 months of age (50.9%) and majority (79.4%) have received one form of immunization or the other. Determinants of malnutrition were maternal level of education, time of introduction of complementary feeding as well as the type, frequency and quality of food introduced, childhood illness, immunization status, parents' occupation among others.*
Conclusion: *The results showed that there is high prevalence of malnutrition among under-five children in Sokoto North Local Government Area of Sokoto State*
We recommended that mothers should be educated and encourage for exclusive breastfeeding .
Keyword: *Assessment; Nutritional Status; Under Five Children; Sokoto North Local Government Area; Sokoto State.*

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I.   Introduction

Background Information

Protein energy malnutrition (PEM) describes the range of pathological conditions arising from coincident lack of proteins in varying proportions occurring most frequently in infants and young children and commonly associated with infections[1].

Malnutrition is the most important public health problem in under developed countries in the world today. Due to malnutrition, it was found that only about 50% of under 5 children are able to reach the age of 5 years, also the death rate in malnourished children was found to increase by 20-50 fold than those children in well-nourished state. The study objectives are

i. To determine prevalence of under nutrition among the study subject
ii. To determine age variation in relation to under nutrition.
iii. To compare results of malnutrition obtained from Mid-Upper-Arm circumference and other methods of determining Nutritional status (weight-for-Age and height-for-Age)

II. Material And Methods

Study Design
The study was a descriptive cross-sectional design conducted to determine the level of malnutrition in the local government area between 10th August and 20th August, 2024.

Study Area; Sokoto north local government area in Sokoto state, Nigeria.

Study Population; Under five and their mothers were chosen in selected wards to participate in the study

Exclusion Criteria; Under five children-mother pair on visit were excluded

Sample Size And Sampling; The minimum sample was determined using the formula[2] **n = Z²pq/d²** and was 124 . Multi stage sampling technique was used in selecting the study populations. Three districts were selected from the 11 districts of Sokoto north LGA by simple random technique method. Four Areas were further selected from the three districts by random sampling were the research was carried out.

Ethical Clearance and Consent Form; All ethical issues were adhered and informed consent was obtained prior to the recruitment of participant .

Data Collection
Tools for data collection; The tools for data collection include; height board, questionnaire, UNICEF weighing scale and MUAC (mid upper circumference) tapes
Techniques for data collection; Instrument used in the research was an adopted questionnaire[3]. Relevant data on the factors related to malnutrition were obtained with the help of the schedule and review of any available relevant health records. For assessing the nutritional status of the subjects, anthropometric measurements were carried out following standard operating procedures[4]. The data include weight, recumbent length (if the child is not able to stand without support), and height, and mid upper arm circumference for children above 6 months old and their mothers

Anthropometry
Age determination
Age was determined using available records or using local calendars.

Weight determination
Weight was measured to the nearest 0.1 Kg using UNICEF Seca weighing scale with subjects in minimal clothing. The scale was occasionally checked for standardization to avoid faulty reading.

Length/height determination; Height was measured using a length/height board, with the participant standing on a firm/level surface and it was measured to the nearest 0.1 cm. Recumbent length was measured using an infantometer. Each measurement was done twice, and the mean of the two readings were recorded.

Mid upper arm circumference (MUAC); The mid upper arm circumference was determined using shirkir's strip(arm circumference non-stretch tape) to the nearest 0.1cm. the left arm was used, it was allowed to hang freely down by the side of the child, the arm half way between the point of the shoulder and the tip of the elbow was marked and the strip was placed round the marked point for measurement. The value was recorded to the nearest 0.1cm

III. Results

Socio-demography

Table 1: Age Distribution

Age range (years)	Frequency	Percentage(%)
0-<1	7	6.3
1-<2	27	24.1
2-<3	40	35.7
3-<4	22	19.6
4-<5	16	14.3
total	112	100

Most of the study were in the 2- <3years age group

Table 2: Sex Distribution

sex	Frequency	Percentage (%)
Male	58	50.4
Female	54	49.6
total	112	100

Male (58%) constituted the majority of the study subjects

Table 3: Informant Relationship

Informant relationship	Frequency	Percentage (%)
Mother	108	96.4
Aunty	4	3.6
Sister	0	0
Total	112	100

Majority of the informant is the mother (96.4%)

Parents' Occupation

Table 4: Mother Occupation

Mothers occupation	Frequency	Percentage (%)
Housewife	97	86.6
Teacher	7	6.3
Civil servant	5	4.5
Others	3	2.7
Total	112	100

A great percentage of the mothers are housewives (86.6%)

Table 9: Father Occupation

Fathers occupation	Frequency	Percentage (%)
Tailor	6	5.4
Trader	14	12.5
Business man	53	47.3
Civil servant	39	34.8
Total	112	100

Majority of the fathers are business man(47.3%) while a few(5.4%) are tailors

Parents Level Of Education

Table 6: Mothers Level Of Education

Mothers level of education	Frequency	Percentage (%)
Primary	19	17.1
Secondary	38	33.9
Tertiary	7	6.25
Others	48	42.9
Total	112	100

Majority of the mothers have only Quranic education (others: 42.9%) a few (6.25%) have tertiary education

**Table 7: Fathers Level Of Education**

Fathers level of education	Frequency	Percentage (%)
Primary	6	5.3
Secondary	42	37.5
Tertiary	32	28.6
Others	32	28.6
Total	112	100

Majority of the father's occupation is secondary education (37.5%)

**Table 8: Population Of The Family**

Family size	Frequency	Percentage (%)
1-10	88	78.6
11-20	5	4.5
21-30	19	17.0
total	112	100

Most (58.9%) of the study subjects were from polygamous and 41.1% from monogamous family and most of the range of family size (78.6%) are 1-10 members 56.4% of subjects' mothers have between 1 to 4 children while 43.6% have between 5 to 9 children
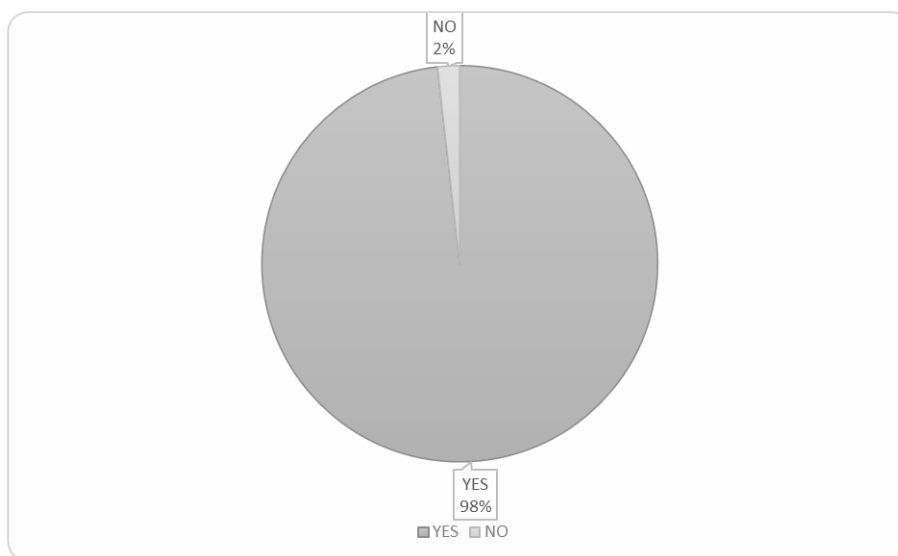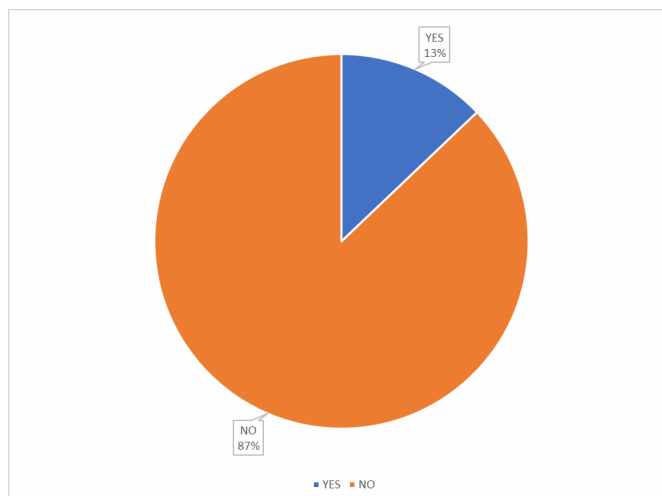

Figure 1: Breastfeding History

Most of the study subjects (98.2%) were breastfed 24.1% are still breastfeeding and 75.9% are not breastfeeding
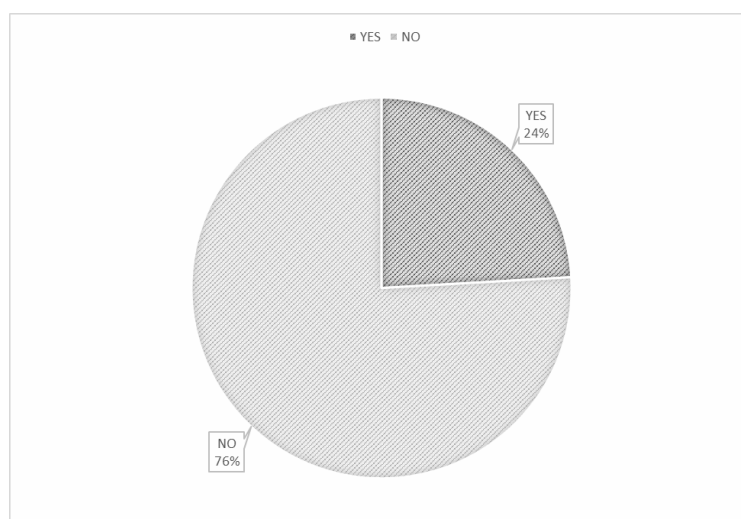

Figure 2: Study Subjects That Are Still Breastfeeding And Those Not Breatfeeding

24.1% from the 112 study subjects are still breastfeeding and 75.9% are no longer breastfeeding

Figure 3: Subjects In Which Breastfeeding Stopped Abruptly Or Not Abruptly

Among 75.9% that were no longer breastfeeding, in 12.9%, breastfeeding was stopped abruptly while in 87.1%, the breastfeeding were not stopped abruptly.
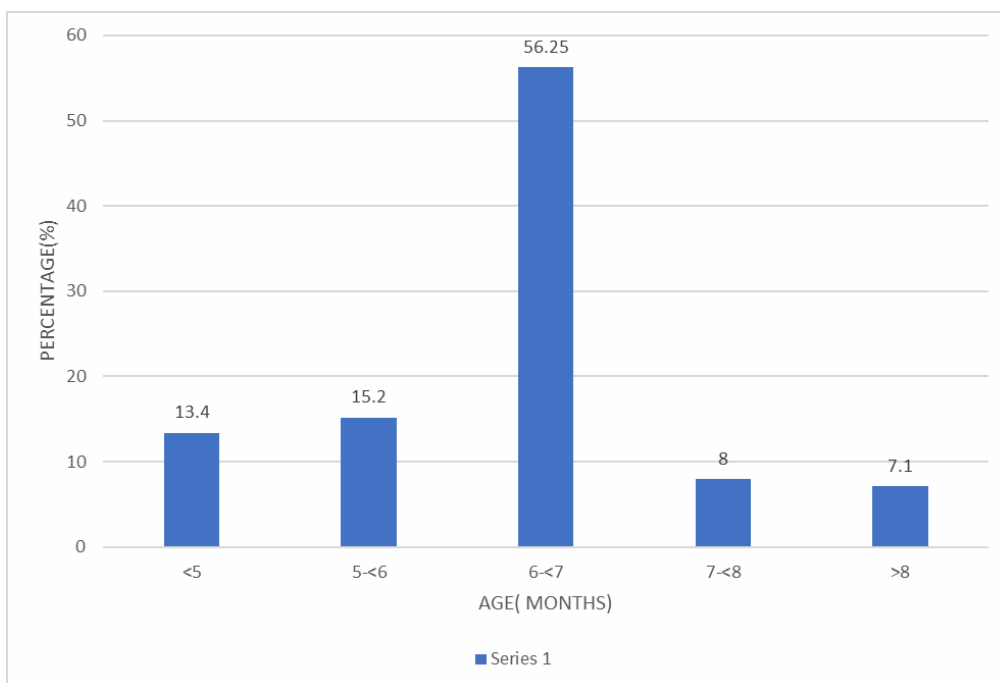
Figure 4: Age Child Was Introduced To Complementary Feeding

Majority of the study subject were introduced to complementary feeding at 6 months of age (50.9%) while few of the subjects (8%) were introduced at 7 months of age
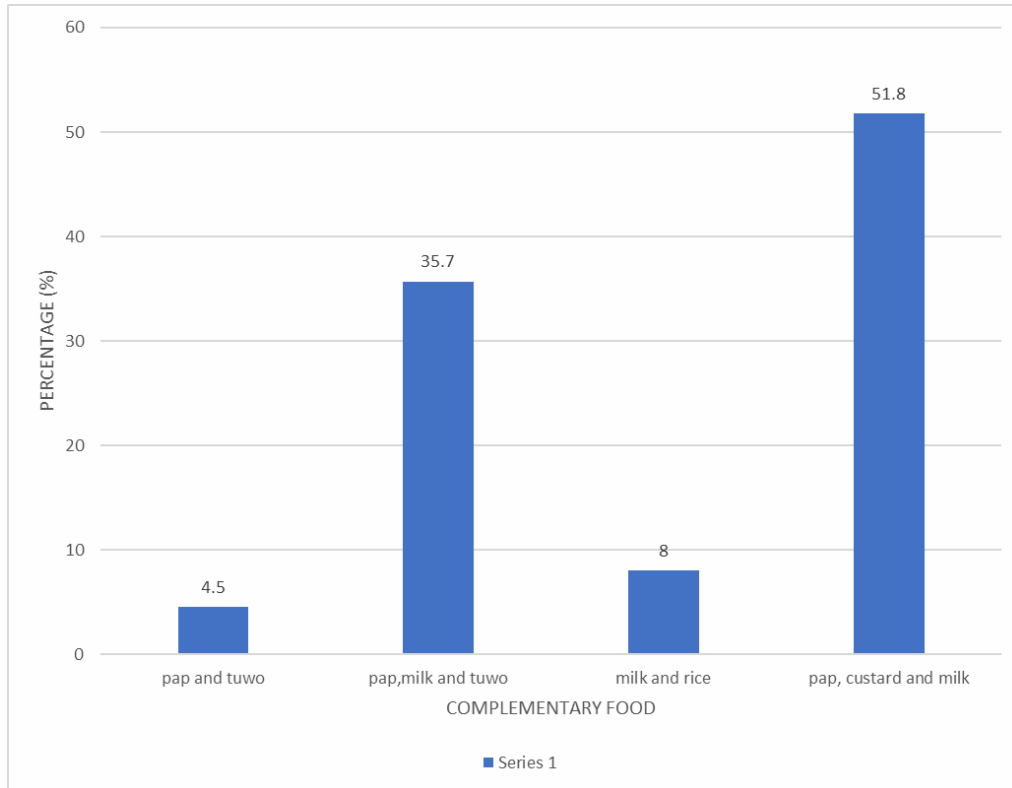
Figure 5: Complementary Food Introduced

Majority of the subjects were introduced to pap-custard-milk combination (51.8%) 35.7% to pap-milk-tuwo combination and 5% pap-tuwo combination
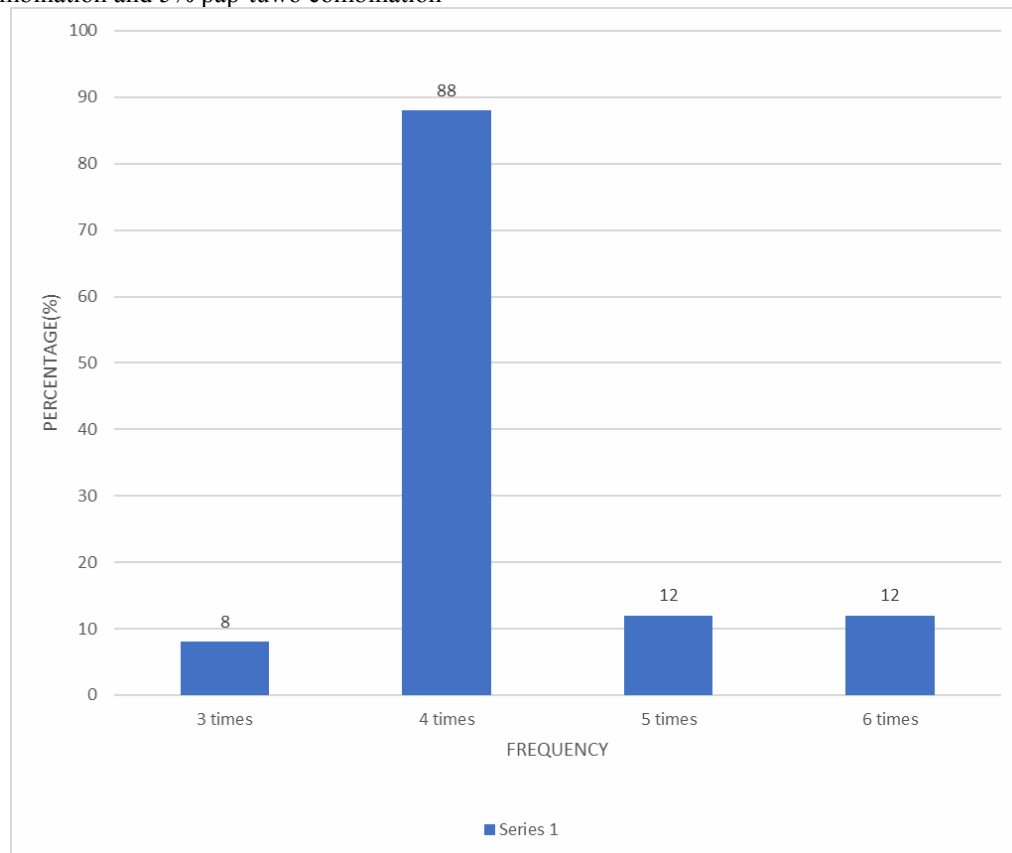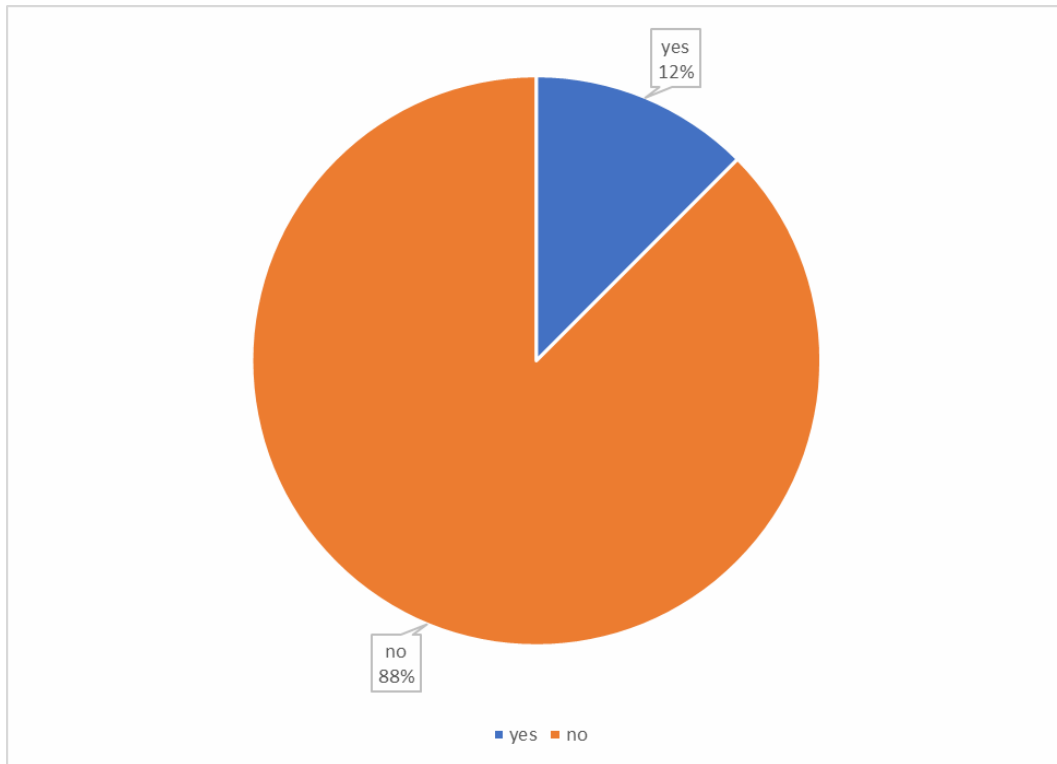

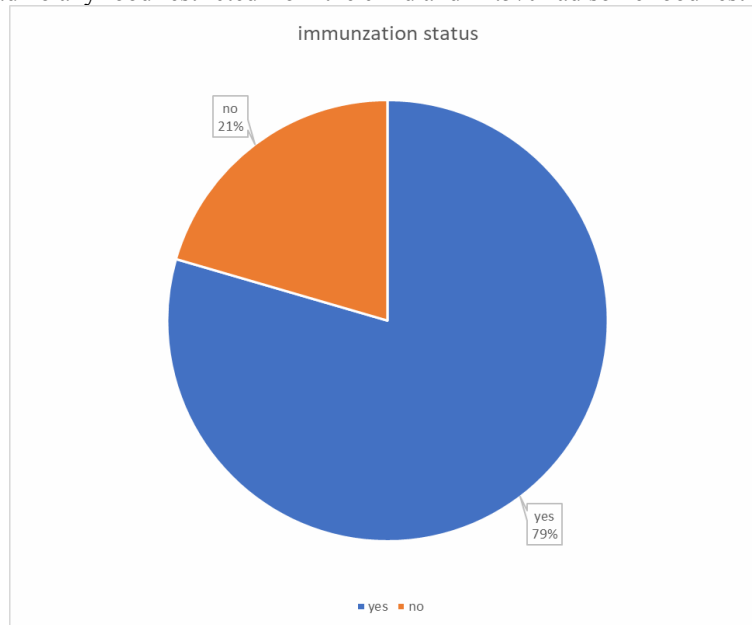**Figure 6: Number Of Times Food Given**

8% of study population was given food 3 times a day and about 88% 4 times daily

Figure 7: Food Restricted From The Child

Majority (87.5%) had no any food restricted from the child and 12.5% had some food restriction

Figure 8: Subject That Have Received Any Form Of Immunization

Majority of subjects (79.4%) have received one form of immunization or the other.
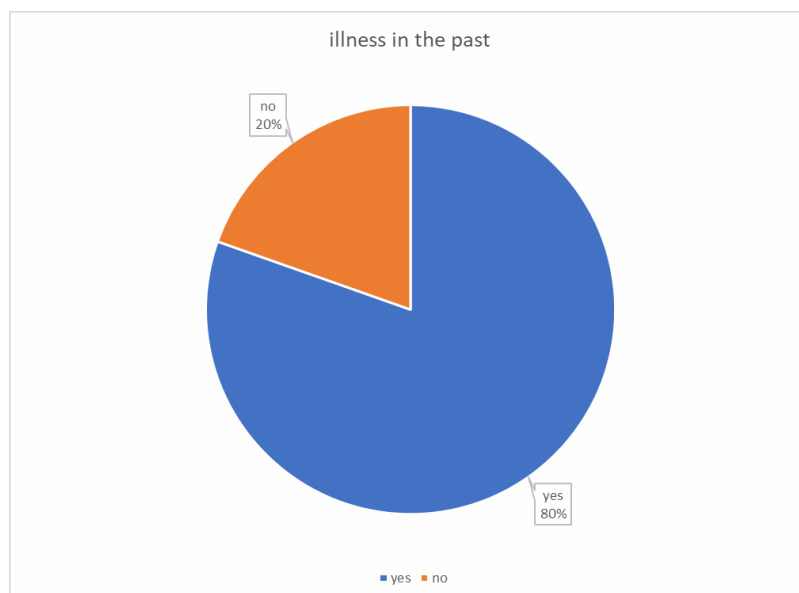
Figure 9: Subject Who Have Suffered From Illness

Majority of the subject that participated has suffered from one illness or the other in the past (80.4%) and 19.6% have not. 91.1 % of subjects were given treatment while 9.9% weren't given any form of treatment

Among the subjects who have suffered from illness in the past, 6.3% was given traditional medication, 45.5% was given modern treatment and 48.2% was taken to the hospital for treatment

Anthropometry

Table 9: Weight For Age

| Variables (Age In Years)	Frequency	Weight(Kg)			Expected For Age
		3-5 Kg	**6-10kg**	**11-15kg**	
1	**7**	**1(14.3%)**	**6(85.7%)**	**0(0.0%)**	**10kg**
2	**27**	**3(11.1%)**	**11(40.7%)**	**13(48.1%)**	**12kg**
3	**40**	**0(0.0%)**	**14(35.0%)**	**26(65.0%)**	**14kg**
4	**22**	**0(0.0%)**	**9(40.9%)**	**13(59.1%)**	**16kg**
5	**16**	**0(0.0%)**	**6(37.5%)**	**10(62.5%)**	**18kg**
Total	**112**				

Table 10: Interpretation Of Table Above Using Modified Gomez

Age	Frequency	Normal >80% Expected	Grade 1 71-80% Expected	Grade 2 61-70% Expected	Grade 3 51-60% Expected	Grade 4 ≤50%
1	7		6(80%)			1(40%)
2	27	13(108%)		11(66.7%)		3(33.3%)
3	40	26(92.9%)			14(57.1%)	
4	22	13(81.2%)				9(50%)
5	16		10(72%)			6(44.4%)
Total	112					

About 85.7% of children 1 year of age are grade 1 malnourished (71-80% expected) and 14.3% **GRADE 3** malnourished **(**between 51-60% expected)

48% of children around 2 years of age shows **NORMAL NUTRITIONAL STATUS** with %expected above 80% while a total of 11.1% of subjects around two years of age are severely malnourished 37% of subjects around 5 years of age are **GRADE 4** malnourished with % expected weight of 44.4%

figure 10: LEVEL OF MALNUTRITION AMONG UNDER 5 USING MODIFIED GOMEZ CRITERIA WEIGHT FOR AGE
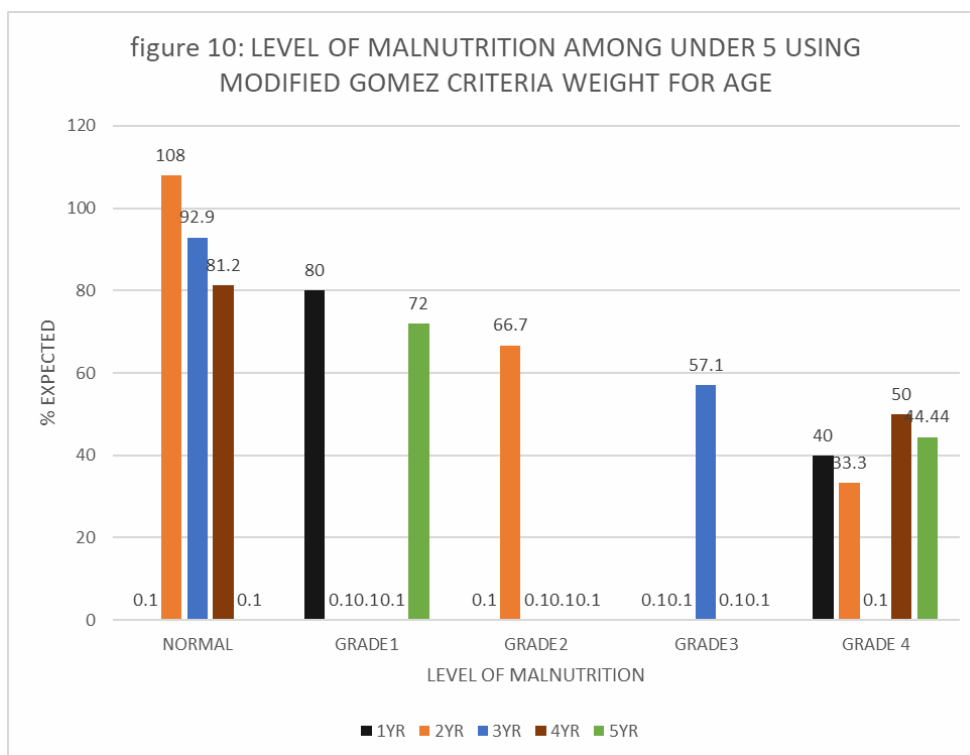
48.1%, 65% and 59.1% of subjects around 2, 3 and 4 years respectively show **NORMAL NUTRITIONAL** status (>80% expected) while negligible percentage of children under 1year and 5 years are well nourished

14.3% of children around 1 year of age and 62.5% of children around 5 years show **GRADE 1** level of malnutrition (70-80% expected weight)

40.7% of children around 2 years of age show moderate degree of malnutrition

14.3%, 11.1%, 40.9% and 37.5% within ages 1,2,4 and 5 shows **GRADE 4** malnutrition

35% of subjects around the age 3 shows **GRADE 3** malnutrition

Table 11: Height/Length For Age

Age	Frequency	Height(Cm)				Expected For Age
		70-79cm	80-89cm	90-99cm	100-109cm	
1	5	2(40.0%)	3(60%)	0(0.0%)	0(0.0%)	83cm
2	26	9(34.6%)	11(42.3%)	6(23.0%)	0(0.0%)	89cm
3	40	6(15.0%)	10(25.0%)	24(60.0%)	0(0.0%)	95cm
4	21	1(4.8%)	2(9.5%)	12(57.1%)	6(28.6%)	101cm
5	20	0(0.0%)	0(0.0%)	7(35%)	13(65%)	107cm
Total	112					

A total of 40% of subjects around 1 year of age has a height of 70-79cm and 60% between 80-89cm, 28.6% and 65% of children age 4 and 5 years respectively have height above 100cm

Table 12: Interpretation of Table Using W.H.O Criteria For Malnutrition Using Height-For-Age

Age(Years)	Normal >95% Expected	Mildly Stunted 90-95% Expected	Moderately Stunted 85-89% Expected	Severely Stunted <85% Expected
1	3(101%)	2(90%)		
2	6(106%)	11(94.9%)		9(83.7%)
3	24(99.5%)		10(88.9%)	6(78.4%)
4	6(103%)	12(93.5%)		1(73.8%) 2(83.7%)
5	13(97.7%)		7(88.3%)	

A total of 60% of subjects aged around 1 year shows normal height i.e. above 95% of expected while 40% are Mildly Stunted

For children aged 2 years, 23% shows normal height and 42.3% are **mildly stunted** i.e. between the range of 90-95% expected

For subjects aged 3 years, 60%, 25% and 15% shows **normal, moderate and severe stunting** respectively with % expected of 99.5, 88.9 and 78.4% respectively

4.8% of children aged 4 years are 70-79cm tall as well 9.5 % with height of 80-89cm both show **severe degree** of stunting with %expected heights of <85%

For subjects aged around 5 years old, 65% shows normal height while 35% shows **moderate stunting**
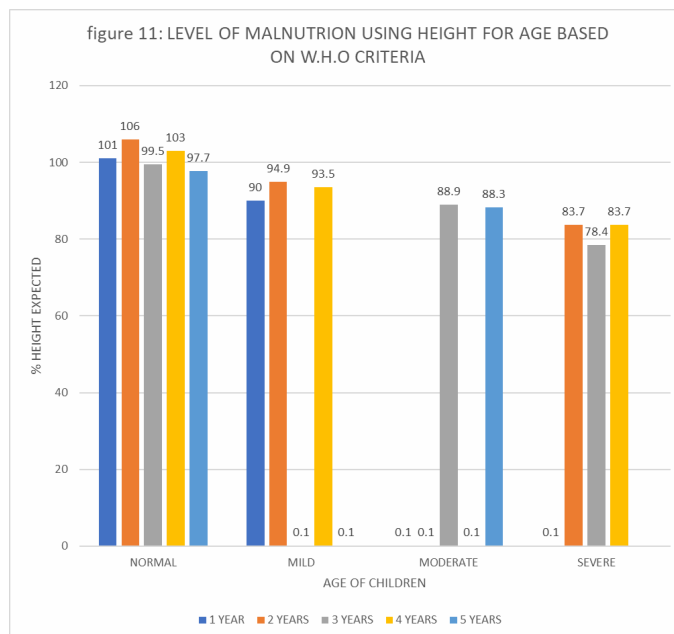
Figure 12: Mid Upper Arm Circumference
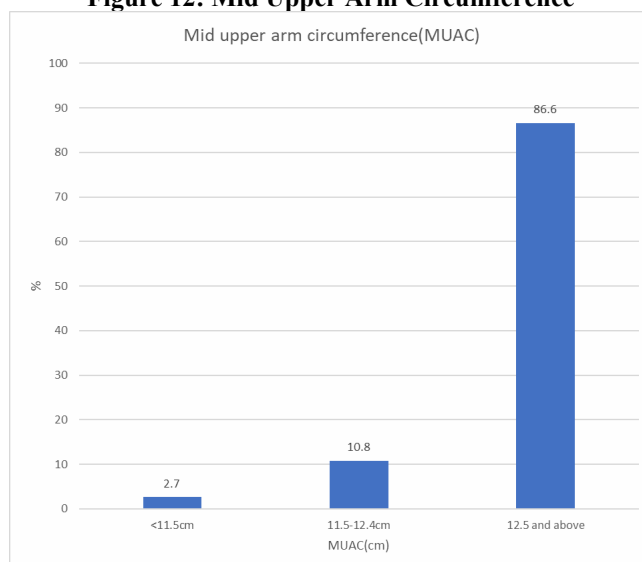
Majority of the subjects (86.6%) have mid upper arm circumference above of 12.5cm reflecting **normal nutritional** status and above. 10.8% have MUAC ranging between 11.5-12.4cm shows **borderline**. a few (2.7%) candidates fall within MUAC range of less than 11.5cm which indicates **malnutrition**

IV. Discussion

In this index study, majority of the children were found to have varying degree of malnutrition (stunting and wasting) which is comparable to similar studies conducted in Sagamu Southwestern Nigeria[5] and Pakistan.[6]

The prevalence of stunting were 53.6% (<95% expected height) among which 22.3% are mildly stunted (90-95% expected height for age) , 15.3% moderately stunted(85-89% expected height for age), and 16.1% severely stunted(<85% of expected height for age). The prevalence of wasting was 53.6%(<80% expected weight) of which 14.28% show Grade 1(mild) wasting(71-80% expected weight), 9.8% of the subjects

are moderately wasted grade 2 (%expected weight between 61-70%), 12.5% severely wasted(grade3) (%expected weight between 51-60%) and 17% shows very severe wasting (%expected ≤50%). Similarity between the proportions of wasted and stunted children in this study (53.6% for both wasting and stunting) could be due to the fact that factors causing wasting in early ages may be persistent and continuously present even as the child gets older. These factors may likely include low or no maternal education (42.9%), childhood illness which were either treated with traditional methods or not treated at all (9.9%), poor weaning habit (12.9% stopped abruptly) of the mothers and lack of immunization. Similar study was conducted in Sokoto state in 2012 and a prevalence of malnutrition of 41% was seen among children of under 5 years. This is also on the high side in comparism to this index study.

In a research carried out in Kuje Abuja, prevalence of underweight of 48.9%. and prevalence of stunted children to be 58.9% [7] were seen. The prevalence of malnutrition in the above studies also show high level of malnutrition among under 5 children which is relatively similar with this study(53.6% for stunting a well as 53.6% for wasting). This may be due to the fact that they are from the same region of the country, similarity in cultural values, as well as religion. Also, maternal education is less in both regions and poor breastfeeding practices, and most of the women in Northern regions are full time housewives. In North West, Yobe state, Nigeria , a somewhat high prevalence of malnutrition is also noticed (55%)[8] probably due to similar factors as stated above and similarity in diet composition.

Whereas study carried out in Uyo southern Nigeria shows prevalence of malnutrition to be 27.3%, 17.1% and 11.1% of underweight, stunting and obesity respectively. And there is also a study that shows that prevalence of stunting is lowest in South East (16%) and in other zones[8], stunting varies from 18- 21% in south-south[8]. The variation in the prevalence of malnutrition may be due to high level of parental education in the southern part of Nigeria, also most of the mothers are working class, which shows that they are not totally dependent on their spouses in order to carry out household expenses unlike in the North.

In Ghana, the prevalence of underweight was found to be 11% [3] which is less as compared to this index study. Increased and worsening level of insecurity in North eastern Nigeria amongst other factors as compared to Ghana may account for this variation

The prevalence of overweight and obesity have increased dramatically over the past few decades in most industrialized countries.[8] North America, Europe and parts of the western pacific have the highest prevalence of overweight among children, in the range of 20-30%.[9] unlike the index study as well as other studies in Nigeria and other African countries still battling with underweight as a major problem of malnutrition. This is because they have better socio-economic status than most of the African countries, excessive intake of junks foods as well as consumption of high calory containing food.

In addition to the above stated contributory factors of malnutrition found in the studied area, other factors may also be due to relative increase in insurgencies as well as increased poverty index in the country. This directly affects the family income predisposing the children to malnutrition. Other factors may include recent corona virus pandemic preventing the fathers from going to work as well as cholera outbreaks causing illness to the studied population

V. Level Of Malnutrition Among Children (Under 5) In Sokoto North Local Government Area

Three different indices were used to access the level of malnutrition in the study. It includes; **weight for age** using modified Gomez criteria, **height for age** using WHO criteria and **Mid Upper Arm circumference** using the WHO Shirkir strip.

Weight for age distribution among children under 5 years in Sokoto north LGA

46.4% of the studied sample are normal. 53.6% are wasted. Among those that are wasted, 14.3% are mildly wasted (grade 1), 9.8% are moderately wasted (grade 2), 12.5% severely wasted(grade3) and 17% very severely wasted (grade 4)

In children around 1 year of age, 85.7% were found to be mildly underweight and 14.3% severely malnourished. None of the studied sample around 1 year old showed normal nutrition.

In children around ages 2, 48.1% are normal, 40.7% are moderately wasted while 11.1% are severely wasted(grade4)

In children age 3 years: 65% are normal while 35% are severely malnourished

In children around 4 years of age, 59.1% are normal while 40.9% are very severely malnourished (grade 4)

In Children age 5, 62.5% are mildly wasted while 37.5% are Very severely wasted

In this index research, it shows that children at the age of 4 years have the highest prevalence of wasting of different degrees in Sokoto north local government area

In a study carried out in Purulia district West Bengal, India, a "backward" district in India[10] , children around age 3 has the highest prevalence of severe wasting wasting(39.9%)[10] . this is in keeping with this index study where the highest prevalence of severely underweight is also found among children age 3 years (35%)

In another study carried out in Purulia, India, wasting is more prevalent among children around 2 years of age (62.4%)[10] as against what is found in this research as well as the research in Bengal india[10] with highest severely wasted children around the ages of 3 years. Reasons for the high prevalence of wasting in younger age groups of 2 and 3 years from the above stated studies may be because of the fact that this is the age where infants are most vulnerable to various childhood illnesses.

However, in a study conducted in south east Nigeria, highest prevalence was found in children age around 1 year[11]. This is in contrast to this index study whereby the highest prevalence is seen in children age 3 years Reason for the increased prevalence of wasting in children under 1 year of age in the south eastern region may be due to gradual replacement of natural breast milk with supplements, inadequate breastfeeding in stipulated hours during work time against the ideal breastfeeding on demand because of work.

Height for age distribution

Using height for age, 46.4% of the children show normal nutrition and 53.6% stunted were found to be stunted in this study. For those stunted, 22.3% mildly stunted, 15.2% are moderately stunted and severely 16.1%

In children age 1, 60% are normal, 40% shows mild stunting. No child showed moderate or severe shunting
In children age 2, 23%,42.3%, 34.6% are normal, mildly and severely stunted respectively.
In children around 3 years of age, 60%, 25%,15% showed normal, moderately and severely stunting
Children age 4, 28.6%57.1%, 14% are normal, mildly and severely stunted
In children aged 5, 65%, 35% are normal and moderately stunted

From the above data and analysis, it is found that the highest degree of stunting within the age distribution in this index study is found in the age of 4 years

In Congo, studies reveal stunting for children aged 1,2,3,4 and 5 years to be 46.5%, 48.5% ,49.4% and 55.1%, 53% respectively[11] with highest prevalence of stunting at age 4 years. This is in keeping with this study as the highest prevalence of stunting was also seen in children around 4 years (57.1%). Common factors that may account for similar high level of stunting in Congo and Sokoto north LGA include high level of illiteracy among mothers, as well as poor health seeking behaviour. Stunting being a function of chronic malnutrition is evident in this age. However, it is noticed that a significant contrast in age distribution of stunting was found when compared to a study conducted in South- eastern part of Nigeria where no case of stunting was found at age 1 and below[10]. However, at ages 2,3 and 4 were found to be 5.1%, 2.4%, 4.2% respectively [32]in the south eastern part of Nigeria with age 4 years still the age of highest prevalence of stunting[32] similarly to what is seen in the index case.

Mid upper arm circumference (MUAC)

Using MUAC as a proxy, only about 2.7% of the children under 5 years in the Sokoto north local government were discovered to be malnourished which is less than the state average of 7.9% (NDHS, 2018), 10.8% were borderline and 86.6% were well nourished. This is in contrast to the prevalence of malnutrition derived from the Modified Gomez weight-for-age (53.58% wasted) as well as the WHO classification of Height-for-age (53.6%).

In 2009, WHO estimated about 40% overlap between the 2 indicators[10] since then there have been reports from individual countries indicating that the proportion of children identified by both criteria varies from country to country[10,12,13]

In Kenya, 65% WFH, -3SD severe acute malnutrition also had a MUAC< 11.5cm and 56% of the children also had a WHO Z-SCORE(WHZ)<-3SAM[10]. Overall, only about 43% were identified by both indices[7]

Fernandez et al. reported that among 34937 children between the age of 6-59months from 39 nutritional survey, 75% of the children with WHZ<-3SD were not identified by MUAC<11.5cm[13]

In Cambodia, this proportion was increased by 90%, whereas 80% of MUAC<11.5cm were not detected by WHZ<-3SD[14]

These discrepancies in results is in keeping with what is obtained in the index study
Possible explanation to these discrepancies may be:

Firstly, part of the explanation must be related to the fact that, in contrast to weight and height-for-age, relies on a single absolute cut off point independent of age weight or height. As the child grows, height, weight and MUAC but may be at different rate. Thus, those diagnosed as malnourished by MUAC are likely to be substantially younger

Secondly, natural variety in body shape of individual such as endomorphic, mesomorphic and ectomorphic whereby those with ectomorphic shapes may tend to show higher prevalence of detectable malnutrition using MUAC due to relative thinner arms as compared to other body parts.

Those with higher fats in the limbs than the torso may show a higher false lower proportion of undernutrition using the MUAC

Thirdly, technicalities in determining the accurate anatomical site where measurement for MUAC will be taken may account for discrepancies among researchers.

However, this study places more relevance on anthropometric data derived from weight for age and height for age for the determination of result, interpretation, conclusion as well as recommendations.

VI. Conclusion

From the results obtained, The prevalence of malnutrition in Sokoto north LGA is 53.6% using modified Gomez classification for weight-for-age and also prevalence of stunting of 53.6% using WHO height-for-age as a criteria.

VII.   Recommendation

i. mothers should be educated and encourage for exclusive breastfeeding via the midwives or traditional birth attendants
ii. encourage girl child education because they are mothers of tomorrow in order to ensure they are exposed and acquire basic health education

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