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NUTRITION STATUS OF CHILDREN IN A WELL-CHILD CLINIC IN LAGOS NIGERIA

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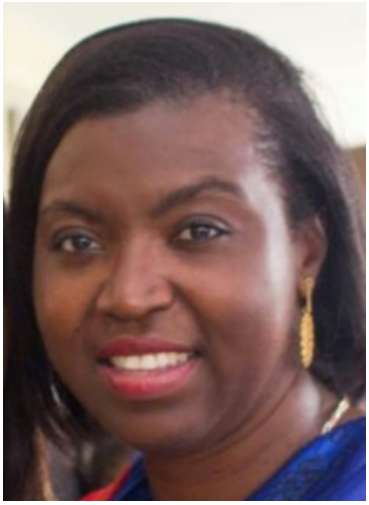

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ABSTRACT

The burden of malnutrition is evident around the world and more pronounced in developing countries affecting vulnerable groups such as infants, children under five years of age and pregnant women. This study assessed the nutritional status of infants and children aged 9-59 months who visited a well-child clinic at a teaching hospital in Lagos Nigeria. A descriptive cross-sectional study was conducted on 207 children consecutively recruited at a well-child clinic in 2013. Data was collected using structured interviewer-administered questionnaires. Information collected includes the socio-demographic details of each child and caregiver. In addition, selected anthropometric measurements, biochemical tests comprising serum ferritin and total blood protein levels as well as dietary information for each child participant were obtained by trained data collectors. The sampled children were aged 9-59 months, with slightly over half (53.6%) being 12 months old and above. There were more female children and the number of Fathers 84.1%who had attained tertiary education was higher (84.1%) than that of mothers (76.3%). Serum protein and ferritin levels were less than the normal reference values in 1.8% and 26.2% of the children respectively, while the prevalence of underweight children was 4.9% and 8.1% of the children were overweight based on weight-for-age z-scores. Results from the dietary survey showed that the children consumed fewer proteins than carbohydrates. Furthermore, only 18.8% and 12.6% of parents reported feeding their children fruits and vegetables. Significantly more mothers (97.5%) with tertiary education had children with normal weight for age ($P<0.05$). Despite the low prevalence of malnutrition among the sampled population, it was found that consumption of fruits and vegetables was low, yet these are major sources of vital micronutrients. Results indicated that the prevalence of malnutrition among the study group was generally low. Therefore, steps must be taken to ensure nutrition specific and nutrition sensitive intervention programs aimed at improving the nutritional status of children

Key words: Nutritional status, assessment, children, weight, ferritin, protein, diet, malnutrition, clinic

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INTRODUCTION

The World Health Organization (WHO) estimates that approximately 2 billion people of the World's 7 billion people suffer from micronutrient malnutrition and almost 300 million people suffer from calorie deficiency [1]. In addition, an estimated 3-5 million children die of hunger-related diseases annually and some survivors tend to be physically or mentally stunted [2]. Early childhood malnutrition may affect concentration, school aptitude, and attentiveness which could ultimately lead to delays in starting school and attainment of academic achievements.

The burden of malnutrition is evident around the world, with developed countries often dealing with effects of overnutrition while developing countries struggle to combat undernutrition and growing overnutrition amongst the elites. Countries such as Bangladesh, Ethiopia, Nigeria, and Vietnam have over 30% of their population being underweight [3]. On the other hand, in nations such as the United States, Germany, and Brazil, over 30% of the population in these countries are overweight [3, 4].

Stunting rates in developing countries are expected to decrease based on projections. However, this reduction will vary by region. Africa's stunting prevalence is expected to decrease from 34.9% to 31.2% by 2020, yet the number of affected children is expected to increase due to projected population growth [5]. This prediction is supported by more recent WHO anthropometric data, which show slight decreases in the number of children less than five years who are underweight, stunted and overweight. However, this data also shows slight increases in the number of children who are wasted [6]. It has been observed that child survival and development in South Asia and sub-Saharan Africa are threatened by high levels of undernutrition [7].

Underweight, malnutrition and infectious diseases are major health problems in the developing world, however overweight and obesity are also fast-growing problems [5]. Nigeria is one of the five countries with the highest levels of severe acute malnutrition. The top five countries and the number of children affected include: India (8.0 million), Democratic Republic of Congo (DRC) (1.3 million), Pakistan (1.2 million), Nigeria (1.1 million) and Ethiopia (0.6 million) [2]. Data from the United Nations International Children's Emergency Fund (UNICEF) shows Nigeria is one of the countries where the prevalence of stunting among children under five years is about 40% or more with recent statistics placing the prevalence at 46% [7].

Various techniques exist for the evaluation of children's nutritional status. These include Anthropometry, Biochemical Analysis, Clinical evaluation, and Diet history. Selection of evaluation techniques is dependent on multiple factors such as hospital resources and type of treatment required. Regardless of the nutritional assessment technique chosen, it is essential that both objective and subjective data be synchronized to yield maximum information that could guide policy decisions and implementation of relevant therapeutic or supplementary interventions [8]. The goal of this study was to appraise the nutritional status of children attending the well-child clinic of the only state-owned teaching hospital in Lagos, Nigeria.

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MATERIALS AND METHODS

Lagos State is one of the 36 states and the former capital of Nigeria. It is situated in the south-western region of the country spanning the Guinea coast of the Atlantic Ocean for over 180km on the South, bounded by the Republic of Benin to the west and Ogun State to the East.

Lagos State University Teaching Hospital (LASUTH) is the only state-owned tertiary health institution in Lagos which metamorphosed from a cottage hospital to a General Hospital and subsequently to a Teaching Hospital, providing improved health care services for the populace.

A descriptive cross-sectional study was conducted on children aged 9-59 months. These children were brought for routine clinical assessment and immunization against vaccine-preventable diseases according to the National Program on Immunization (NPI) in the well-child clinic of the Community Health and Primary Health Care Department over a 6-month period in 2013.

Data was collected using a structured interviewer-administered questionnaire which sought information on the socio-demographic details of each child and the caregiver. Anthropometric measurements, biochemical parameters as well as dietary information for each child were also sought

Consenting mothers of the children were consecutively recruited on clinic days over the study period and interviewed using the structured questionnaire.

Other inclusion criteria include children between the ages of 9 and 59 months attending the well-child clinic during the study period. Children below 9 months of age and those who were ill were excluded from the study.

Anthropometric measurements included weight at presentation, Mid-Upper Arm Circumference (MUAC) and information on birthweight. A digital weighing scale was used for measuring the weight of participants who were required to remove all clothing except for briefs, and stand upright with the weight evenly distributed on both feet and the right arm hanging loosely at the sides. When an infant or toddler was unable to stand unassisted on the digital weight scale, weighing was done with the assistance of an adult or guardian who was weighed and then participant handed over and re-weighed with the weight difference calculated [9,10]. Routine calibration of the scale was done to ensure that the equipment produced accurate measures.

The arm circumference was measured by wrapping a plastic measuring tape on the posterior surface of the right arm at the level of the upper arm mid-point mark. The two ends of the overlapping tape were pulled together such that the zero end was below the measurement value with the result on the lateral aspect of the arm. The tape was made to fit around the arm without compressing the skin and measurement to the nearest tenth of a centimeter (0.1 cm) [11].

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Children with a weight-for-age (WFA) z-score of less than -2 and -3 were classified as underweight and severely underweight, respectively [12].

In addition, 3 millilitres of venous blood samples were obtained from the children by standard aseptic venipuncture technique into plain vacutainer bottles by trained medical laboratory personnel. Specimens were transported promptly to the laboratory after collection (within one hour) from the site of collection. Serum samples were separated and stored at -20^{0}C until the required sample size was obtained. Samples were assayed and analyzed for serum ferritin (Human ferritin enzyme immunoassay test kit: ELISA) and total protein (Randox protein kit: Biuret method) using normal reference values of 70-140ng/ml and 4.2 - 7.6 g/dl, respectively [13]. Data analysis was done using the Statistical Package for the Social Sciences (SPSS) with IBM SPSS for Windows version 19. Armonk NY USA 2010.

Univariate and bivariate analyses were done and tests of significance were performed to determine associations between variables using a 95% confidence interval, and the level of significance set at $P<0.05$.

Ethical Considerations

Ethical approval was granted by the LASUTH Health research and ethics committee prior to the commencement of the study. The clients were only recruited for participation following verbal consent from their parents or guardians to participate in the study. The study protocol was thoroughly explained to the caregiver in order to obtain informed consent. It was emphasized that refusal to participate would not affect access to services or result in victimization of any kind. Participants were also informed of their freedom to withdraw from the study at any stage.

RESULTS AND DISCUSSION

This study was conducted on a sampled group of children aged 9-59 months. Slightly fewer mothers were found to be breastfeeding their children at the period of the study (48.8%), with just over half (51.2%) of the children being breastfed (Table 1). Food insecurity and malnutrition are common problems in most developing countries consequent upon growing populations, economic recessions, poverty and the increasing cost of food [14]. Malnutrition has been known to occur as a result of macronutrient deficiency, micronutrient deficiency or a combination of both. This tends to impact on the nutritional status of vulnerable groups such as children under five years of age and pregnant women [15].

Slightly over half (53.6%) of the children were 12 months old and above and the first child of their mother (49.8%). Over three-quarters of the children belonged to the first and second birth order which may be an important predictor of childhood nutritional status. This could be due to the foremost parental utilization of available resources. A higher order of birth such as fourth, fifth and sixth have also been associated with malnutrition [16].

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The mean weight at birth was 2.83±1.24 whilst the mean age at presentation was 10.67+3.97 years. The study sample consisted of more female (56.5%) than male children (43.5%).

Most (73.9%). of the children had a "normal" birthweight within 2.5 - 3.5kg. The rest were either underweight (6.8%) or overweight (19.3%) at birth, weighing less than 2.5kg and greater than 3.5kg respectively. The role of birth weight may be prognostic for future nutritional health outcomes as observed in studies that have reported an association between low birth weight and malnutrition in early childhood after controlling for confounders [17, 18]. The majority (76.8%) of the children in this study had a Mid-Upper Arm Circumference (MUAC) of 13.5cm and above which was within normal limits, while 19.3% had below 11.5cm (Table 2). According to WHO guidelines, MUAC below 11.5cm may be indicative of Severe Acute Malnutrition (SAM) necessitating close monitoring and therapeutic nutrition. Anthropometric measurements such as the MUAC is often used in combination with Weight-for-Height Z scores. However, it has been reported that these two indicators have low sensitivity [19, 20].

The prevalence of underweight children in the sampled population was very low (4.9%). This trend may be attributed to the tertiary educational status of the parents/guardians of the sampled children. This is mirrored in a similar South-West Nigerian study by Akorede and Abiola [21] who found a positive correlation between mothers' level of education and the nutritional status of their children. Additionally, in a community-based study, Meshram *et al.* [22] observed that children of non-literate mothers and lower household income earners in Indian tribal areas had a higher risk of being underweight, wasted or stunted. Moreover, a study by Amosu *et al.* [23] in another rural South-Western Nigerian community where 81% of parents were uneducated reported an alarmingly high prevalence of children who were underweight (82.1%), stunted (33.5%) and wasted (85.2%).

The family educational history revealed that most parents (mothers and fathers) had achieved up to a tertiary level of education as opposed to those who had completed only primary or secondary levels. However, a slightly greater number of fathers than mothers had achieved a tertiary level of education (84.1% versus 76.3%). With the majority (76.3%) of parents in this study having attained tertiary levels of education, it is probable that these parents have the skills and financial capacity to ensure adequate nutrient intake for their children. The National Literacy Survey conducted by the National Bureau of Statistics places adult literacy rate in Nigeria at 56.9 percent. This figure varies across states, regions, and gender [24].

The socio-economic and educational status of parents, especially mothers who are often charged with caring for children remain key factors that influence childhood nutrition. Despite rising food prices, with increasing maternal education, family income is higher, enabling improved and healthier food choices. Therefore, children in such families are more likely to be well nourished, complete the recommended immunization cycles and have better educational outcomes over their life's course. They are also less likely to suffer from common health conditions such as diarrhoeal diseases, which afflict infants and young children in developing countries [25]

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It was also found that 97.5% of mothers with tertiary education had children with normal weight for age. A statistically significant association was found between mother's educational attainment and child's weight for age (P=0.01), making those who had not achieved a tertiary level of education more likely to have children with low birthweight (12.2% versus 2.5%).

The predominant micronutrient deficiencies in developing countries include vitamin A, iron, iodine, folate and zinc. These micronutrients are vital for optimal physiological functioning. About 130 children (79.6%) were reported to have Ferritin levels between 70 and 140ng/ml, while 30 children (18.4%) had Ferritin levels above 140 and 1.8% below 70ng/ml. Serum ferritin is a marker of total body iron stores which is a useful determinant of iron deficiency: a common disorder prevalent in resource-poor settings due to nutritional problems and parasitic infections [26]. Even though, 43.4% of the participants had total protein levels between 4.2 and 7.6g/dl, a sizeable proportion (30.3%) had above 7.6 g/dl which may be due to excessive protein intake above metabolic requirements. Studies have reported an increased risk of obesity in the later lives of children who consume excessive proteins within the first two years of life [27, 28]. The mean total protein of 5.48±5.14 and mean ferritin level of 73.29±96.17 observed in this study were within normal reference levels based on the test kit utilized.

Dietary history in this study showed the most commonly consumed meals include cereals (69.6%) and grains (58.0%). Proteins were less consumed; milk (43.5%), meat and fish (32.4%) and eggs (31.4%).

Further review of the food consumption data showed that the intake of fruits and vegetables was inadequate. In fact, only 18.8% and 12.6% of parents reported feeding their children with fruits and vegetables daily (Table 5). Given that these two food groups should constitute a significant proportion of an individual's diet, the sampled children may, therefore, be lacking in micronutrients and health benefits derivable from fruits and vegetables. Such an unbalanced diet sustained over a long period of time may lead to deficiencies resulting in negative health consequences. However, the children seemed to meet and exceed the recommended intake of grains as a food group. These study findings are consistent with a similar Kenyan study which reported findings on dietary diversity of under-fives in which cereals (97%), legumes, nuts and seeds (76.8%) food groups were the most commonly consumed food groups compared to eggs (36%) and meat (19.2%) food groups [29].

Gender inequality related to childhood nutritional status is often observed in less developed nations. This is sometimes attributed to a preference for a male over a female child in terms of gender choice and finances in some settings [30]. The prevalence of children with normal weight was 95.1% based on their weight-for-age z-scores, while 4.9% of the children were found to be moderately or severely underweight. Even though a slightly higher proportion (6.8%) of female children in the sampled group were overweight compared to their male counterparts (2.2%), no statistically significant association was observed.

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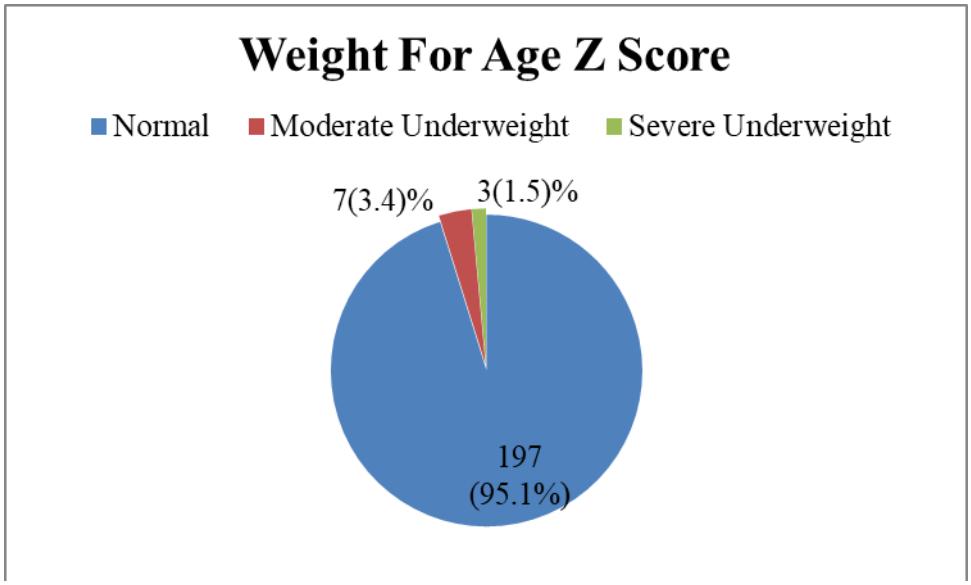

Figure 1: Weight for Age Z Score

A study by Alabi *et al.* [31] found that male children less than five years were more likely to be stunted than females (57.0% versus 52.0%) in North Western Nigeria, while females were more likely to be wasted than their male counterparts (18.0% versus 12.0%).

A comparative analysis of the weight for age z-scores of study participants and the overall scores for Lagos State showed that moderate to severe underweight was more prevalent in the general population than in the study participants (Table 6). The urban nature of the study location and socioeconomic factors such as women's education, status, and economic opportunities may have had an influence in improving the nutritional status of the study population over the broader Lagos State in general which consists of both rural and urban communities.

Similarly, compared to the other Nigerian States, as reported by the Nigerian Demographic and Health Survey (NDHS 2013), Lagos State has generally lower rates of undernutrition [32]. Probably as a result of the fact that it is the economic hub of the nation. Interestingly, the prevalence of undernutrition amongst the sampled children was found to be lower than the average for Lagos State

CONCLUSION

Based on the findings from this study, certain conclusions can be made. First, the prevalence of malnutrition was low among the study sample. However, dietary inadequacies were observed that consumption of fruits and vegetables was low; this constitutes major sources of vital micronutrients. There was elevated serum total protein among a third of the participants.

From these findings, the following recommendation can be made: nutrition-specific interventions are required to tackle the immediate consequences of micronutrient

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deficiencies. Furthermore, nutrition-sensitive interventions such as female education and women empowerment have a higher value in health outcomes of children less than five years of age. Therefore, these must be taken into account to ensure policies and intervention programmes target women in promoting the nutritional status of children. In addition, nutritional educational activities should be practical, easily understood and effective.

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Table 1: Socio-demographic characteristics

Variable	*Frequency (N=207)*	*Percentages (%)*
Age		
9-12 months	96	46.4
Above 12 months	111	53.6
	Mean/Standard Deviation	17.41±11.99
Birth Order		
First	103	49.8
Second	62	30.0
Third	32	15.5
Fourth	6	2.9
Fifth and above	4	1.9
Gender (Child)		
Female	117	56.5
Male	90	43.5
Tribe		
Yoruba	108	52.2
Igbo	41	19.8
Hausa	6	2.9
Others	52	25.1
Mother's Educational Status		
No – Formal	2	1.0
Primary	7	3.4
Secondary	40	19.3
Tertiary	158	76.3
Father's Educational Status		
No – Formal	2	1.0
Primary six	1	0.5
Secondary	30	14.5
Tertiary	174	84.1
Breastfeeding		
Yes	101	48.8
No	106	51.2

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Table 2: Anthropometric data

Variable	*Frequency (N=207)*	*Percentages (%)*	*Mean / Standard deviation*
Birth Weight			
Below 2.5kg	14	6.8	
2.5kg – 3.5kg	153	73.9	2.83±1.24
Above 3.5kg	40	19.3	
Weight (at presentation)			
Below 10kg	71	34.3	
10-19kg	128	61.8	10.67±3.97
20kg+	8	3.9	
Mid Upper Arm Circumference			
Below 11.5cm	40	19.3	
11.5-12.4cm	4	1.9	13.62±3.94
12.5-13.4cm	4	1.9	
13.5cm and Above	159	76.8	

Table 3: Association between selected socio-demographic characteristics and nutritional status

Variable	**Weight for age**		**χ^2 / P-value**
	Underweight No (%)	**Normal No (%)**	
Gender			
Female	**8 (6.8)**	**109 (93.1)**	**2.36**
Male	**2 (2.2)**	**88 (97.8)**	**P = 0.13**
Mother's Education			
Tertiary	**4(2.5)**	**154 (97.5)**	**7.68**
Others	**6 (12.2)**	**43 (87.8)**	**P = 0.01**

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Table 4: Selected biochemical tests

Variable	*Frequency (No.)*	*Percentages (%)*	*Mean / Standard deviation*
Total Protein			
Below 4.2 g/dl	46	26.2	
4.2 - 7.6 g/dl	76	43.4	5.48±5.14
Above 7.6 g/dl	53	30.3	
Total	175	100.0	
Ferritin level			
Below 70ng/ml	3	1.8	
70-140ng/ml	130	79.6	73.29±96.17
Above 140 ng/ml	30	18.4	
Total	163	100.0	

Table 5: Dietary history

Variable	Frequency (No.)	Percentage (%)
Cereal	144	69.6
Grains	120	58.0
Roots	103	49.8
Milk	90	43.5
Legumes	74	35.7
Meat and Fish	67	32.4
Egg	65	31.4
Fruits	39	18.8
Oils	31	15.0
Vegetables	26	12.6

Table 6: A comparison of the prevalence of undernutrition between the present study and Lagos state

Variable	*Lagos State (%)*	*LASUTH Study (%)*
Weight for age z-score		
Severe underweight	3.0	1.5
Moderate underweight	12.9	3.4
Total	15.9	4.9

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