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Original Research Article

Relationship between Weight and Mid-Upper Arm Circumferences (MUAC) among Apparently Healthy Children on Illela Local Government Area, Sokoto State, North-West, Nigeria

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A b s t r a c t

Efforts were made in the present study to determine the moderate forms usually seen in apparently healthy looking children. During the health camping in Illela Local Government Area (LGA) of Sokoto State, it has been observed that the local health facilities were in dearth of tools for recording the practical indicators of levels of malnutrition in children and skilled rural health aides to do the job. Therefore two simple but acceptable anthropometric indices were considered for measuring the levels of malnutrition in children and determined the strength of correlation with a view of suggesting anyone of the two for this purpose. The weight and MUAC of all consented apparently healthy children of age 1-14 years seen at the twenty (20) randomly selected health camps were taken. Respondents were stratified and analyzed into sex and ages of ≤ 5 years and > 5 years. Pearson's correlation coefficient was used to determine relationship between parameters and student-t test to compare means of sample. *P*-value was set at ≤0.05. One hundred and seventy one (171) apparently healthy children were enrolled in the study. Out of these, 52% are females and about 70.2% were of the age 1-5 years. The mean MUAC of the children was 14.6 ± 2.1 cm and was 13.8± 1.7 cm for those 1-5 years of age. A strong correlation was observed between weight and MUAC of the children (r = 0.701, *p*=0.01) and it was so for those with optimum as well as those with records less than what is optimum for their ages and sex. Therefore the present study advocates that the moderate forms of malnutrition which has often been passing unnoticed may now be picked easily by adopting weight or MUAC measurements when weighing scale or arm circumference tape is acquired and the rural health assistant is trained on either of the instruments.

K e y w o r d s

Healthy children
Malnutrition
Mid-upper arm circumference
Weight

Introduction

The objectivity of simultaneous use of two or more practical indicators of the nutritional status for monitoring the normalcy or otherwise in growing children to be able to pick those that requires intervention is not debatable. In a typical rural settings of sub-saharan Africa however, there is dearth of tools for carrying out these indicators. And also, where the tools are provided by the Government or donor agencies the necessary skilled personnel to get accurate records of the parameters become issues. Against this background the present study has been aimed to carry out simple, quick, inexpensive, available and acceptable procedures of measurement of weight and MUAC of apparently healthy children and to assess the correlation between the parameters with a view to suggest anyone of the two (weight or MUAC), depending on the strength of correlation. It is hoped this could be used for rapid assessment of nutritional status of children whether in ordinary or in extreme situations as found among displaced populations, draught or famine. If expected outcome is achieved it will serve as a feasible option for measuring growth or recognizing quickly a malnourished child even while still moderate, acknowledged as a cause of more annual death of children (Connor and Manary, 2011) before a severe, less economic and more difficult intervention conditions arise.

Arm circumference has been reported to be strongly correlated with weight in non-pregnant women at a memorandum from a USAID/WHO/PAHO/Mother care meeting and reported in the World Health Organization bulletin (WHO, 1991) and in children at New Territories, Hong Kong (Cattermole et al., 2010). Bob-Manuel and Udoaka (2008) in Choba, a semi urban community in Portharcourt, South-South Nigeria also found a positive correlation between MUAC and height of children and Nwokoro et al. (2006) in Benin, South Nigeria found strong correlations among age, height, weight and arm circumference of children.

From our literature search however, no similar finding has been reported in apparently healthy children in Sokoto, North-west Nigeria. Besides, conventional charts developed and has hitherto been adapted to depict the course of normal growth used as references has been widely acknowledged as a guide but it has also been in the domain of investigators that it may not adequately reflect the normal growth of a child in the study environment with its peculiar ethnic, genetic and socio-economic differences (Ahmed and Ighogboja, 1995). Some disease conditions such as nephritic syndrome can affect the records that can be obtained in anthropometric measurements; therefore, in this study only apparently healthy children were enrolled.

Materials and methods

Background

The findings are the product of the observations of the doctors who served as heads of the teams deployed to Illela LGA of Sokoto state for health camping. Data were collected during the pilot Health Camp exercise which is a brain-child of the UNICEF using National Polio Emergency Operation Centres as leverage to achieve the oral polio vaccination project in the state. The exercise was well advertised by effective local town announcers (*maishella*) lasted for about four (4) days and included five wards (Araba, Damba, Illela, Kalmalo, and Rungumawa gatti) in Illela LGA, a part of eastern senatorial district of the state. The LGA form the border between the state and Niger Republic and it is situated about 84 km from the Sokoto metropolis. The LGA has a total land size of about 1316.156 km^2. The population of children (0-14 yrs) is about 47.3% (70984/150133) of the LGA population (NPC, 2011). Rice and corn is the most staple food of the people (Sokoto and Ibrahim, 2007). This, Bethany World Prayer Centre (1991) corroborated that grains are the most staple food in Sokoto but added that milk is also consumed fresh and meat is taken during ceremonies.

Study design and population

It was an intermittent anthropometric assessment of the weight and MUAC of apparently healthy children in the age bracket 1-14 years. The children were seen at the various health camps spread over the 5 randomly selected wards in Illela LGA of Sokoto State.

Eligibility and sampling method

Every child within the age group 1-14 years who turned-up at any of the 20 (4 per ward) Health Camps on the day stipulated for each camp was enrolled in the study, after obtaining the consent from the parent/guardian or from the child.

Exclusion criteria

Children outside the age bracket 1-14 years or with some chronic illnesses or presentations (following a series of questions by the medical doctor of the team) in keeping view of such were not on the list. Also, those with some form of prolonged medications were not recruited for the study. Visiting children or those who belong to a race alien to the environment were excluded. Married children even if less than 14 years and healthy were excluded from the studies.

Procedure protocol

The following information was obtained for every eligible child enrolled for the study, in order: Name, Age (yrs), Sex, Name of settlement, Weight (kg) and MUAC.

Measurements

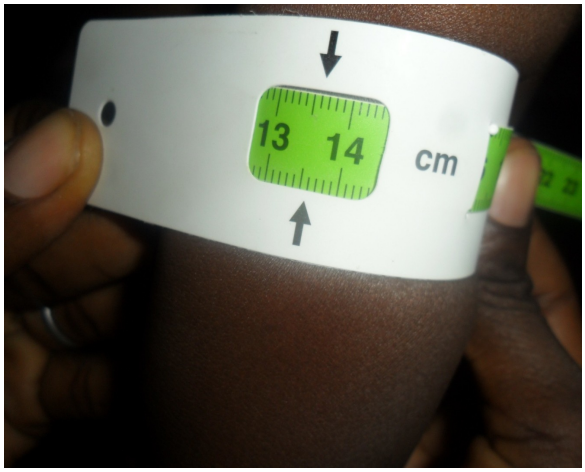
Weight: Each child's weight (kg) was measured on bare feet and in pant or light clothing using a simple mechanical, portable weighing scale (Camry, China, ISO 9001:2008 certified by SGS, Model: BR 9012). The scales used were standardized each day (Southall et al., 2003) using a known weight. A knob at the rears was utilized at each measurement to ensure the pointer is at the zero point before each child's weight is taken. For the uncooperative children, a subtraction of the weight of an assisting parent from that of the child plus parent taken together was adopted to obtain their weight.

MUAC: Shakir's tape/strip was used throughout the study, based on conviction in the report of Ogunranti (1987) in Eastern Nigeria. The MUAC was taken to be the measurement obtained when the tape is applied around the upper arm at the mid-point between the tips of the Olecranon and the Acromion processes of the same arm (Obidike, 2004) determined while placed akimbo, for reproducibility (Figs. 1, 2 and 3).

Fig. 1: A child being weighed.

Fig. 2: The mid-upper arm of a child being determined.

Fig. 3: The MUAC of a child being taken after examining the exact position.



Statistical analysis

Data were entered into and analyzed using statistical package for social sciences (SPSS), version 20.0. Values were expressed as the mean ± S.D. Data were also presented using tables for frequency and percentage of variables. Students' t-Test was used to compare sample means and Pearson correlation coefficient was used to determine relationship between parameters. *P*-value was set at ≤0.05 for statistical significance.

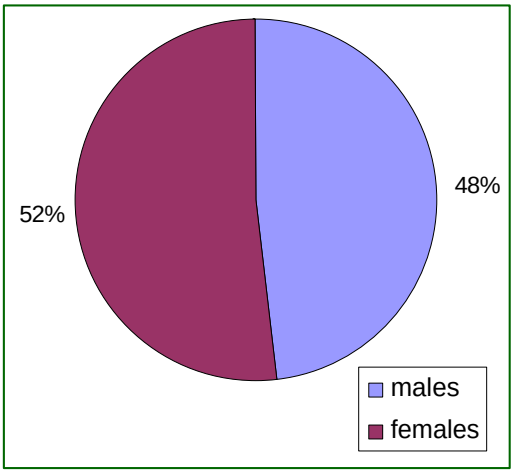
Ethical clearance

The National Polio Eradication Operation Centre/UNICEF, Sokoto office's recommendation to was had to head the Health Camp teams. The written permission was obtained from the Chairman of the Illela LGA to document and report observations of the present study. The consent was obtained from all the children enrolled or from their guardian or parent.

Results

One hundred and seventy one (171) apparently healthy children were studied during the four (4) days Health Camp exercise. About 52% (89/171) of the children are females while the males constitute 48% (Fig. 4). The mean age was 4.61±3.28 years with range 1-13 years. The weight ranges 5-40 kg with a mean of 14.54±7.45 kg. The mean weight for the female children was 14.88±7.64 kg which is a bit higher than the male children, 14.04±7.22 kg but not statistically significant (p = 0.997).

Fig. 4: Distribution of the children into males and females.



The mean MUAC for the children was 14.6±2.1 cm with range of 10.5-22.1 cm. The mean for the females was 14.7 ± 2.2 cm which is slightly higher than that of their male counterparts of (14.4 ± 0.2 cm). Most of our subjects (70.2%, 120/171) were in the age range 1-5years, while only (29.8%, 51/171) belong to the age group greater than 5years (Table 1). The mean MUAC for those with ages in the range 1-5 years was 13.8±1.7cm and 16.3±2.0cm for those with ages greater than 5 years.

Table 1. Distribution of the children into major age groups with their associated frequencies and mean MUAC.

Ages (years)	1-5	> 5
Frequencies	120.0	51.0
Mean MUAC (cm)	13.8	16.3

We have found a strong correlation between the weight and MUAC of the children (r = 0.701, p=0.01). This was also our finding even among the sub-group 1-5years who apparently falter in their growth (46.7%, 56/120) i.e. those with ages in the range 1-5 years had mean weight of 9.14±3.05 kg and with MUAC less than 13.5 cm (N = 56, mean = 12.36±0.8 cm), (r = 0.484, p = 0.01).

Discussion

The results of the present showed a slightly higher preponderance of females with also a slightly higher mean weight (14.88±6.4 kg) than their male counterparts (14.04 ±7.22 kg), but not statistically significant (p= 0.300). This was also the trend in the mean MUAC but it was not statistically significant (p=0.209) and it is contrary with the findings of Bob-Manuel and Udoaka (2008) in Choba, a semi urban settlement in South-South Nigeria where they found the MUAC of males were higher than the females but also not statistically significant. Amosu et al. (2011) found in south-west Nigeria that males have significantly higher lean body mass (LBM) than females. The rural/semi-urban Northwestern Nigerian preferential treatment for female children may explain this trend compared to the uniform treatment for both sexes in the southern part of the country.

Our findings also showed most of our subjects (70.2%) to belong to the most vulnerable group of children (under-five year) to Protein Energy

Malnutrition/PEM (Kliegman et al., 2006). But our under-five children showed a mean MUAC (13.8± 1.7cm) which is optimum for their age and slightly above the 12.5 cm–13.5 cm cut-off for risk of malnutrition suggested by other authors such as Ahmed and Ighogboja (1995) and Obidike (2004). While our observations may not be unrelated to the fact that our subjects are not only apparently healthy children but has not been victims of any recent extreme conditions such as flood, draught or famine our value is below what Dairo and co-workers (2012) in a western Nigerian town found in their under-fives, mean MUAC of 15.47 cm. This is in tandem with our finding of the percentage of under nutrition (46.7%) compared to the 5.6% in the work of Dairo et al. (2012) in Ibadan, an urban western Nigerian settlement where it is expected that there is better education, socio-economic conditions and therefore better nutrition and growth, for the urban dwellers (Tunau et al., 2012). This is also consistent with the 3.3% prevalence of children obesity in Sokoto by Ahmad et al. (2013). Amosu et al. (2011) found that 85.15% of children of low-income earners in south-west Nigerian were wasted.

A strong correlation exists between the weight and mean MUAC ($r = 0.701$, $p = 0.01$) in the present investigation and this affirmed the findings of earlier researchers such as Cattermole et al. (2010) when in Hong Kong they determined which of age, height, foot-length or MUAC had the strongest relationship with weight in healthy children. The results also corroborated with that of the findings obtained by Connor and Manary (2011) in Toronto, Canada who reported after a retrospective analysis of children with moderate malnutrition suggested use of MUAC by village health aides to estimate weight, where the facility is a low resource type. The present study also found that the relationship between weight and MUAC gets stronger with increase in either or both of the parameters as shown and it is lower among the children that falter in their growth among the under-five ($r = 0.484$, $p= 0.01$). Lapidus et al. (2009) however worked on under-five children in Niger Republic though among already malnourished children and found that MUAC does not offer good option for prognosis. Dairo et al. (2012) also reported that MUAC was poorly sensitive to measuring under nutrition. Briend et al. (2012) in Tampere, a rural Senegal settlement had reported a finding that appeared incongruential to that by Lapidus and co-workers (2009) by preferring MUAC alone for assessing the risk of malnutrition among the under-five children. The results of Briend and co-workers (2012) therefore in part corroborated our findings and could also form a basis of our study.

Conclusions and recommendations

In conclusion, the weight and MUAC of healthy children strongly correlates in Illela LGA of Sokoto state and this is so even among those children who fail to attain optimum values for their age, but less strongly. It may therefore be correct to opine that either of weight or MUAC alone will suffice to determine if a child is well-nourished or not, among healthy children in the present study environment.

It is recommended that health aids in low resource, particularly rural facilities may only need to familiarize their selves with anyone of either weight or MUAC. More work including statistical (multiplication or division factors) is however required to determine how the MUAC recorded, having found a strong relationship with it and weight will be adjusted to determine the dose of drugs, fluid or in choosing appropriate equipments to use when managing children.

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