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A Tale of Two Woes: Hidden and Overt Hunger in School Children from a Sub-urban Community in South-Eastern Nigeria

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Abstract Anaemia and thinness are indicators of hidden and overt hunger respectively. Yet they are underreported in non-urban dwelling Nigerian children. Two public schools in a sub-urban community in South-Eastern Nigeria were selected for this study. All the children who met the inclusion criteria [total: 176 (52.3% females), age: 5 to 12 years], were recruited and studied. Anaemia and thinness were determined using standard methods and appropriate statistical tools were used for data analysis. The results indicated that 42.0% (10.9% females; 76.1% males; $p < 0.001$) and 31.8% (32.6% females; 31.0% males; $p > 0.05$) of the studied children were thin and mildly anaemic respectively - a tale of two woes. Interestingly, only 0.6% of the entire population (0.0% for females; 1.2% for males) were obese and there was no case of severe or moderate anaemia in the population. Both hidden and overt hungers were prevalent to different degrees in the studied population. Nutritional interventions targeting macro- and micro-nutrient sufficiency at household and community levels are advocated.

KEYWORDS: Anaemia, Hidden hunger, Nutritional deficiency, Thinness

1.0 Introduction

Anaemia refers to a condition of sub-optimal haemoglobin concentrations, is a serious global public health problem, affecting an estimated 42.6% of children less than 5 years of age (WHO 2015). The bulk of the number comes from the developing world. Earlier estimates showed that up to 40% of school age children in developing countries suffer from anaemia (Benoist *et al*., 2008). In Africa, anaemia affects 60.2% of under 5 children, but 71% in Nigeria (WHO, 2015). About 50% of anaemia cases are due to iron deficiency anaemia (IDA), the rest arising from haemoglobinopathies (especially sickle cell anaemia), malaria and other parasitic infestations/infections and micronutrient deficiencies (WHO, 2015; 2017). IDA usually results from insufficiency in nutrient intake as iron excretion is fairly minimal (particularly in children). Consequently, IDA is one of the markers of micronutrient deficiency or hidden hunger (WHO, 2015; 2017).

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Thinness, on the other hand is low body mass index for age. It is a 'marker' of both recent and chronic weight loss often due to starvation, severe disease or both (WHO Multicentre Growth Reference Study Group, 2006; Mushtaq *et al*., 2011). Thinness is a public health challenge in economically developing and less developed countries where poverty rates are still high and access to nutritious food for a large portion of the population is limited (Adekanmbi *et al.*, 2013; Ejike, 2016). Global and regional prevalence of thinness are hard to come by. In Nigeria, prevalence of 13% to 24.2% in children and adolescents have been reported (Ene-Obong *et al*., 2012; Ejike *et al*., 2013). Because thinness is really about not having enough to eat, it is an index for under nutrition, or overt hunger.

Anaemia and thinness existing in the same community are manifestations of nutritional deficiencies both at the micro and macro levels – a tale of two woes. Both anaemia and thinness result in developmental challenges such as poor cognitive development, reduced intellectual and educational achievement, reduced physical growth and a compromised immune system

(WHO, 2015; Jimoh *et al*., 2018). Consequently, affected children have the worst chance of getting a head-start in life; they (if they survive into adulthood) are more likely to have retarded growth than their well-nourished counterparts; and this in turn perpetuates the cycle of poverty which is often the cause and effect of both anaemia and thinness. To prevent this, it is important to quantify the population affected and those at risk, understand the dynamics of the problems, and then design effective strategies to combat them at the family and community levels. This study was, therefore, designed to examine the coexistence of anaemia and thinness in a sub-urban community in South-Eastern Nigeria.

2.0 Materials and Methods

2.1 Subjects and Methods

School-going children aged 5 to 12 in Ossah-Ibeku, a sub-urban community on the outskirts of Umuahia, the capital of Abia State, Nigeria were recruited for this study. The community was chosen simply for convenience. Ethical approval was obtained from the Education and Health Secretaries of the Umuahia North Local Government Area, and the Board of the Department of Biochemistry, Michael Okpara University of Agriculture, Umudike (MOUAU). Additional approval was obtained from the Head Teachers of the two schools.

Only children whose parents consented to their participating in the study were recruited. Those who had overt signs of ill-health, or who reported taking medications for malaria or any parasitic infection, or having reached menarche (in girls) were excluded from the study.

A total of 176 subjects (92 females, 84 males), representing all the children who met the inclusion criteria were recruited and studied. No honoraria were paid to the subjects.

Age at last birthday was recorded for each child. Anthropometric data were obtained following standard procedures recommended by the WHO (WHO Multicentre Growth Reference Study Group, 2006). From the data on weights and heights, body mass index (BMI) were calculated using the equation: BMI = Weight (kg)/ [Height (m)]^2. Thinness was defined as a BMI of < 2 standard deviations from the median value for the child's age and sex, as contained in the WHO growth charts. The haemoglobin concentrations of subjects were determined using a portable haemoglobinometer, HemoCue Hb 301 (HemoCue AB, Angelholm, Sweden), with capillary blood samples aseptically collected from each child's fingertip.

Anaemia was defined in accordance with the WHO standard for children as haemoglobin concentrations below 11.5 g/dl for children aged 5–11 and below 12.0 g/dl for 12 years old children (WHO, 2017).

2.2 Statistical Analysis

The prevalence of anaemia and thinness were determined using frequency counts. Significant differences between prevalence values between the sexes were determined using the Chi square test or (where necessary) the Fischer's exact test. The mean values of the weights, heights, BMI and haemoglobin concentrations of the children were calculated as per age and sex and differences between them was subjected to statistical analysis using the One Way Analysis of Variance. The Pearson's correlation coefficients were used to assess the correlations between haematological and anthropometric indices. A significant threshold of $p < 0.05$ was adopted for all analyses. Data analyses were done using the IBM-SPSS Statistics version 20 (IBM Corp., Armonk, New York).

3.0 Results and Discussion

Mean height, weight and BMI increased progressively from age 5 to age 12 in both boys and girls (Table 1). There were, however, no significant difference ($p>0.05$) between the sexes for any particular age, for any of the three anthropometric indices. The marginally higher heights of the girls up to age 10 may be due to the growth spurt which occurs earlier in girls than in boys (Ejike, 2016). This is plausible especially given that by age 12 (when boys begin to experience the growth spurt) the girls were marginally shorter than the boys. From the mean heights reported, it is obvious that a majority of the subjects (and particularly among the boys) were shorter than their reference peers as seen in the WHO reference data. The same observation is applicable to the weights and BMI of the children. The developmental challenges posed by these deficits and the long term economic implications they portend (Ejike *et al*., 2013; WHO. 2015; Ejike, 2016; WHO, 2017) are worrisome.

From Figure 1, it is seen that male children were thinner than their female counterparts. Thinness (irrespective of sex) was found in 42% of the entire population (10.9% females; 76.1% males). This is a clear case of moderate (girls) to severe (boys) under nutrition in the population. Thinness was highest at 5, 9 and 10 years of age (50-53%), and lowest (15%) at age 12. The prevalence of thinness is alarming in boys, reaching 93% at 9 years of age, and remaining as high as 25% in 12 year old boys. It appears that the cause of the thinness may be nutritional deficits carried on, and persisting, from their earlier years. The drop in the prevalence especially at age 12 may be ascribed to catch-up growth and an increasing ability of the children to fend for themselves, thus depend less on their parents/guardians. Interestingly, only 0.6% of the entire population (0.0% for females; 1.2% for males) were obese, while 2.8% (1.1% females; 4.8% males) were overweight. The values for thinness in the present study are higher than those reported in earlier studies on the region (Ejike *et al*., 2010; Ene-Obong *et al*., 2012; Ejike *et al*., 2013). The observation that boys were disproportionately affected by thinness is consistent with earlier reports (Ejike *et al*., 2010; Ejike *et al*., 2013; Ejike, 2016) and may be driven by cultural practices that favour the girl child in terms of access to food and protection from physically exerting activities. The near absence of obesity and the alarmingly high prevalence of thinness, in the studied population is an indication of a population-wide nutritional deficiency requiring urgent attention.

There were no significant differences ($p>0.05$) between the mean haemoglobin concentrations in both sexes and per age of the children (Table 1). Interestingly, the mean haemoglobin concentrations were slightly higher than the 10.9 g/dl (9.9 -10.2 g/dl) values reported for Central and West Africa (Stevens *et al*., 2013) regions where anaemia is very prevalent. Though the mentioned report is for children aged 5 or younger, it still offers some insights into the performance of the studied children relative to others from the region. When viewed *vis-a-vis* the reference cut-off points for anaemia, it suggests absence of severe anaemia. The data for haematocrit (though obtained) are not shown as they are derived from the haemoglobin measurements.

There was no case of severe or moderate anaemia in the population. Mild anaemia was moderately prevalent, affecting 32% of the entire population (32.6% females; 31.0% males, $p>0.05$) (Figure 2). It ranged from 13- 62% of the population. Mild anaemia was highest among 8 year old boys (47%) and 10 year old girls (62%). This prevalence of anaemia is markedly lower than the values reported for anaemia globally in school age children (40%) (Benoist *et al*., 2008), and significantly lower than those reported for Nigeria (71%) (WHO, 2015). It is plausible that the wide difference between the WHO data and the findings in this study is due to difference in the geographical location. Typically in Nigeria, children in the South are often better nourished than their counterparts in the North, resulting in higher prevalence of nutritional deficiencies in the North of Nigeria (Adekanmbi *et al*., 2013; Jimoh *et al.*, 2018).

The absence of severe anaemia in this population should not be interpreted wrongly as anaemia may result in fatalities even when not severe (Alelign *et al*., 2015). The fact that mild anaemia only was present is an indication that the anaemia may be entirely due to nutritional IDA (Melku *et al*., 2018). This is even more plausible given that children who had other indicators for anaemia were excluded from the study. A particular strength of the present study is that the design had deliberately ensured that confounding variables such as malaria and other parasitic diseases, which are known to impact anaemia prevalence in West Africa negatively (Stevens *et al*., 2013), were considerably eliminated. But herein lies the problem: in children who have no signs of overt anaemia, anaemia was still present in as much as 32% of the population; that is, one in three children was anaemic. Viewing the prevalence of anaemia and thinness in the girls comparatively indicates

Table 1: Anthropometric Parameters and Haemoglobin Concentrations in the Studied Children

Age	Height (cm)		Weight (kg)		BMI (kg/m^2)		Hb (g/dl)	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
5	110.5±7.4	107.6±5.1	17.5±2.2	17.6±2.0	14.3±1.0	15.1±1.2	12.1±1.5	11.5±1.1
6	112.4±9.3	118.4±7.9	19.3±2.9	19.8±2.0	15.3±0.9	14.2±1.9	12.7±1.6	12.5±1.2
7	122.9±11.4	123.7±3.9	23.1±5.1	21.8±3.2	15.2±2.7	14.1±1.4	12.3±1.0	11.9±1.6
8	127.4±6.6	127.4±5.4	24.8±2.7	24.7±3.7	15.2±1.3	15.2±1.3	12.1±1.1	12.3±1.1
9	127.5±4.8	130.9±4.9	25.7±2.7	25.5±1.5	15.1±0.8	14.7±1.2	12.0±1.7	12.7±1.2
10	135.8±7.5	137.4±9.1	28.9±3.0	28.3±3.4	15.7±1.0	14.9±1.3	12.5±1.1	11.9±0.9
11	138.2±8.2	137.5±5.8	29.7±5.2	30.2±3.6	15.8±1.7	15.9±1.4	11.4±2.3	12.4±1.3
12	146.1±8.3	142.1±4.9	36.1±5.0	34.2±3.7	17.9±2.4	16.9±1.7	12.8±1.9	12.8±1.2

The data were compared for significant difference between the sexes using One Way ANOVA. No significant differences ($p > 0.05$) was found between the sexes for each factor, per age.

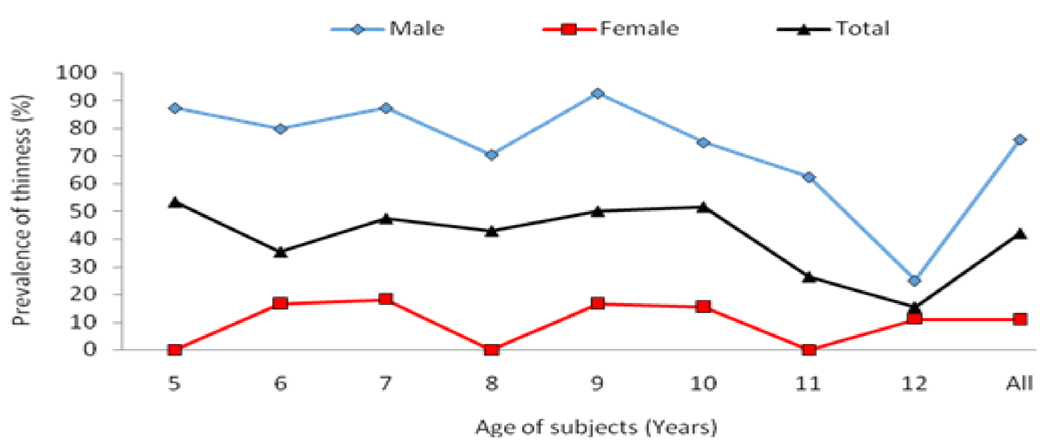

Figure 1: Prevalence of thinness in the population determined by the WHO reference standards

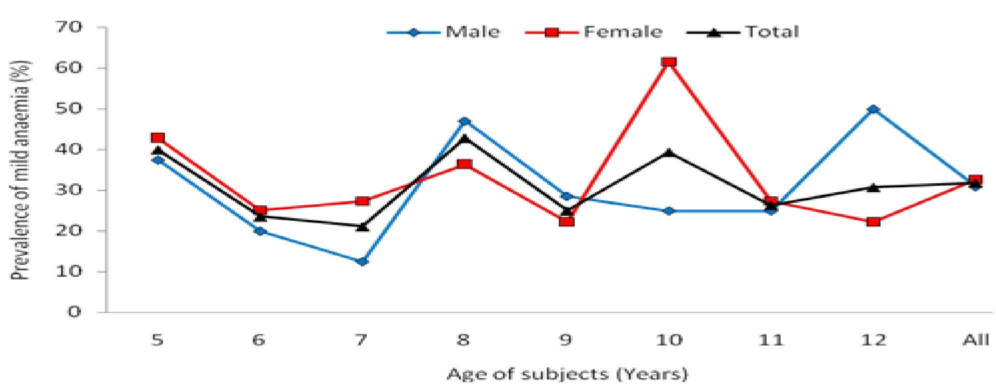

Figure 2: Prevalence of mild Anaemia in the studied School-age Children

that there is a case of hidden hunger in the community as only 11% of the girls were thin while 33% were anaemic. The observation that the anaemia is likely IDA implies that it is iron-amenable such that simple interventions may address the problem.

Haemoglobin concentrations and haematocrit were positively but weakly correlated with only height (Hb: r = +0.157, P = 0.038; Hcr: r = +0.155, P = 0.040) and no other anthropometric variable. This may be related to taller children having better nutrition (reflected in their not being stunted or short-for-age) and therefore, a better haemoglobin status. It underscores the earlier position in this paper that addressing nutritional insufficiency in the population may be sufficient to address the case of anaemia in the population. Some studies have highlighted the role of economics in food security and household nutritional well-being (Ene-Obong *et al*., 2012).

This study is limited by its small sample size and its localisation to just one sub-urban community. It would have benefitted from a larger sample size that would have made the findings more representatives of school-going children (at least) in the region. Additionally, a wider panel of measures of nutritional deficiency in children would have made it possible to provide more insights into the nutritional challenges of the studied population. Unfortunately, we did not have the material resources required to enrol more children in this study, or to go beyond the study site. This necessarily warrants a cautious interpretation of the data presented as it cannot be extrapolated to represent school children in the whole of Abia State, or Nigeria. Nonetheless, our goal was to use this pilot study to provide data that could provide a basis for larger and more detailed studies of the subject. This objective was met. The other strengths of this study are the simplicity if its design and the realisation of its objectives.

Conclusion

The study concluded that mild anaemia is usually due to nutritional deficiencies; the challenges to growth and development of the children posed by these disorders can be overcome by nutritional interventions targeting macro- and micro-nutrient sufficiency at household and community levels.

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