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# Nutritional Survey of Pre-school Children in Oredo Local Government Area, Edo State Nigeria

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**Abstract:** This is a cross-sectional study of the nutritional status of pre-school children (between the age of 3-5years old) in Oredo Local Government of Edo State. 209 children randomly selected, comprising of 103 female and 106 male were examined using anthropometric parameters. The physical examination and anthropometric data were used to classify the children into normal and protein deficiency groups. Those children who scored less than -2 Z-score in mid-arm circumference-for-age (MAFA) indicator and showed the presence of clinical features were classified as protein deficient (PD). The result showed that the estimated prevalence of children (45.2%) with mid-arm circumference-for-age, MAFA less than -2 Z-score was higher than those for other anthropometric indicators (height-for-age, HFA 17.9%; weight-for-age, WFA 22.1% and weight-for-height, WFH 15.9%). Due to the fact that the aetiology of PD is multifarious, a community-based intervention programme should include balanced diet, proper cooking, establishment of community educational/health centres and increased employment opportunities.

**Keywords:** Nutritional Survey, Pre-school, Children, Community-Based, Intervention, Programme

## 1. Introduction

Proper and adequate nutrition in childhood is considered to play a crucial role in the physical, mental, and emotional development of children through to their later adult age (Dehghan et al., 2005; Scrimshaw, 2001).

Different diseases of adults are considered to have a close relationship with malnutrition and incorrect or improper nutrition in childhood. The association between childhood diet and being underweight or overweight as children or even as adults has been shown in numerous studies (Dennison et al., 2005; Gonzales-Suarez et al., 1997; Nuruddin et al., 2008).

Childhood malnutrition is majorly characterized by growth failure. Anthropometric measurements in children are particularly important in assessing their nutritional status. According to Dawson (1992), heights and weights of children, particularly those less than 5 or 6 years of age, and pregnant/lactating women, are accepted measures for monitoring their growth and nutritional status, and are also considered as an indicator of the nutritional status of the entire community.

Three indicators used for classification of the nutritional status of a child by comparison with a reference population (NCHS/ WHO International growth reference) are: weight for height; weight for age and height for age. Low weight – for – height that is below 2SD of the median value of the NCHS/WHO International weight – for – height reference shows the presence of wasting while low weight for age at below 2SD of the median value of the NCHS/WHO International reference for weight for age points to the child being underweight and stunting refers to shortness that is a deficit or linear growth that has failed to reach genetic potential. It is defined as low height for age at below 2SD of the median value of the NCHS/WHO International growth reference. A prevalence of wasting or acute malnutrition between 5 – 8% indicates a worrying nutritional situation and prevalence greater than 10% corresponds to a serious nutritional situation (SCN, 1995). A lot of reports show that there exists a problem of malnutrition among Nigerian children. Report by WHO (2000), showed that 37.7% and 39.1% of preschool children are stunted and underweight, respectively, in Nigeria.

However, information about food habits and dietary practices which is an important preliminary step in planning is lacking (Fidanaza 1991; Reinbott and Jordan, 2016).

In view of this, a cross-sectional dietary survey was conducted in Benin (a semi-urbanised area of Nigeria) in Oredo local government area, Edo State, to assess the nutritional status of the pre-school children.

# 2. Materials and Methods

### 2.1. Materials

Pre-school children of Oredo local government area of Edo state were used as subjects in the nutritional survey. 209 children selected randomly volunteered to take part in the exercise. 103 of them were female while the rest 106 were male, all aged between 3 to 5 years old. Children in this study were drawn partly from the primary health care centre of Edo State Nutrition unit which caters for children from various parts of the city as well as the surrounding villages. The other group of children were randomly selected from playgroups within the city and the children from day care centres. Children from households around Sakpoba area were also included in this study.

Structured questionnaires was developed and direct anthropometric measurements were carried out.

### 2.2. Methods

#### 2.2.1. Anthropometric Measurements

The survey work was organised into four teams, each consisting of a team leader (nutritional field worker), 2 or 3 trained assistants and a language interpreter. A one day orientation training program was organised for the field workers. The training was done by an experienced field consultant. The anthropometric factors/parameters measured were according to methods described by Jellife (1966):

a. Height measurement: This was measured by means of a somatometer with a range of 1-200cm. It was secured to the vertical wall by means of nails. For each measurement, contact was established between the horizontal projection of somatometer and the head. Heights were measured without shoe on the feet of the subjects.

b. Mid Upper Arm Circumference (MUAC) Measurements: Non-elastic tape-rule graduated into 3 main portions marked with different colours was used. Each colour band denotes the level or extent of malnutrition. The tape-rule was designed in such a way that when wound round the upper arm, any reading, (between 5.5cm-12cm) falls within the red band and denote severe malnutrition. The readings (between 12.5cm and 13.5cm) fall within yellow band which denote moderate state of nutrition while 13.5cm and above is the green band which denote normal state of nutrition. To establish the mid-upper arm circumference, the subject (child) would raise his/him arm up to be at $90^{o}$ to the body. At this point, there will be a projection around the shoulder called acromion. The notch around the elbow called olecranon is located and marked. Half the distance between the acromion and olecranon gives the mid upper arm. Thus the tape-rule measurement around the muscle in the region gives the MUAC.

c. Skin fold Measurements: This was done using Harpenden Caliper (Gunston, 1992; Chopra and Shama, 1992). The fold of skin and subcutaneous tissues at different sites were swept up fingers and the jaws of the calliper closed on to the tissue mass with little pressure to read the thickness expressed in centimetres. The measurements were done in triplicate at various sites such as triceps, biceps, sub-scapular and supra-iliac regions.

d. Weight Measurements: Measurements were done with standard weighing machine. Each child was made to stand upright on the scale without shoes and minimal clothing on. For those that could not stand upright due to weakness, measurements were taken in sitting position. Measurements were recorded to the nearest 0.1kg.

#### 2.2.2. Data Analysis

The data collected were coded and the standard deviation scores/indices (Z-scores) for anthropometric parameter were calculated using EPINUT software package.

#### 2.2.3. Dietary/Energy Intake

The approach used was the memory recall of the diets taken within the last 24 hours via the administration of questionnaires. Estimates of energy or caloric intakes were done via a computer package (Bender, 1993) and direct estimation based on reference books on nutrients composition of foods (Leung, 1968). Total energy intakes for each subject were derived by summation of the energy from nutrients.

#### 2.2.4. Clinical Assessments

These were done using physical examinations. One of the investigators assessed the study children at least once daily. Additional assessment were performed for clinical management. Each child was weighed every morning, without clothes, to the nearest 0.5gm. Peripheral palpation of the children (subjects) were done while clinical examinations, such as presence of cough, difficulty in breathing, fever, pulse and respiratory rates, presence of oedema, mental status, dehydration status, stool frequency, consistency and content of mucus were carried out(Chowdhury *et.al*, 2002). Their health history were also obtained via questionnaire.

# 3. Results

### 3.1. The Anthropometric Indicators

The data (height, weight, skin-fold measurement, etc) generated were translated into the following anthropometric indicators:

- Height-for-Age (HFA)
- Weight-for-Age (WFA)
- Weight-for-Height (WFH)

- Mid Arm circumference – for – Age (MAFA)

Table 1 shows the z-score distributions for each of these indicators.

*Table 1. Anthropometric indicators and their z-scores.*

| Indicator | Sex | No. of Children | Mean z-score | S. D of Z-score |
|---|---|---|---|---|
| | Male | 106 | -0.91 | 1.46 |
| H. F. A | Female | 103 | -2.73 | 0.69 |
| | Total | 209 | -0.69 | 1.43 |
| | Male | 106 | -0.89 | 0.83 |
| WFA | Female | 103 | 1.05 | 1.02 |
| | Total | 209 | -1.18 | 1.06 |
| | Male | 90 | -1.89 | 0.74 |
| MAFA | Female | 75 | -1.94 | 0.75 |
| | Total | 165 | -1.91 | 0.74 |
| | Male | 106 | -0.96 | 1.13 |
| WFH | Female | 103 | -0.88 | 1.04 |
| | Total | 209 | -0.92 | 1.84 |

I. Height-for-Age (HFA) Indicator

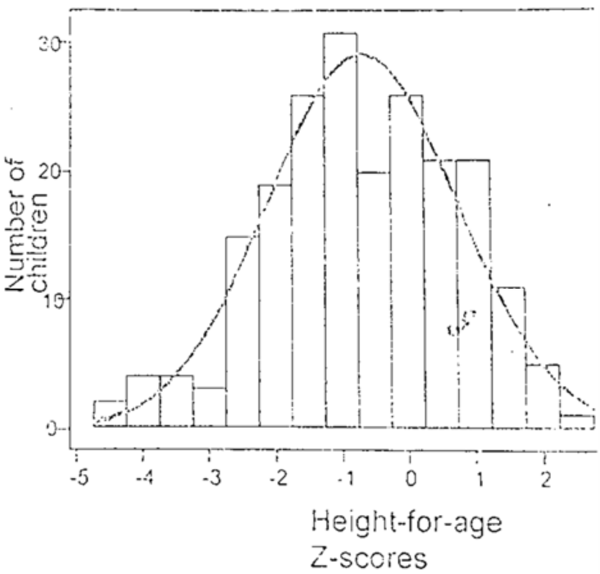


***Figure 1.** Height for Age Z-Score Vs Number of Children.*

Figure 1 shows the binominal curve for HFA z-scores of the surveyed children. The mean z-scores were calculated to be -0.69 while the standard deviation was 1.43. From the curve, more than two third of the children fell within the central point of ± 2 z-scores. A relatively small number fell above + 2 when compared with those below -2 z-scores. 83.5% female children have their z-scores located between ±2 which can be regarded as normal according to W. H. O definition (WHO 1995). 13.59% were stunted with z-score < -2 and SD (standard and deviation) of 0.69. About 2.91% had high z-score i.e > +2 and SD of 0.059. The mean z-score and SD of H. F. A. for the female children were -0.47 and 1.37 respectively.

For the female children however, 75.4% fell within ±2 z-scores range with mean z-score of -0.337 while the SD was 1.009. Those with stunted growth were 23.58% while only 1% had > ±2 z-score. The mean z-score and SD of H. F. A were -0.91 and 1.46 respectively.

3.11. Weight-for-Age (WFA) Indicator

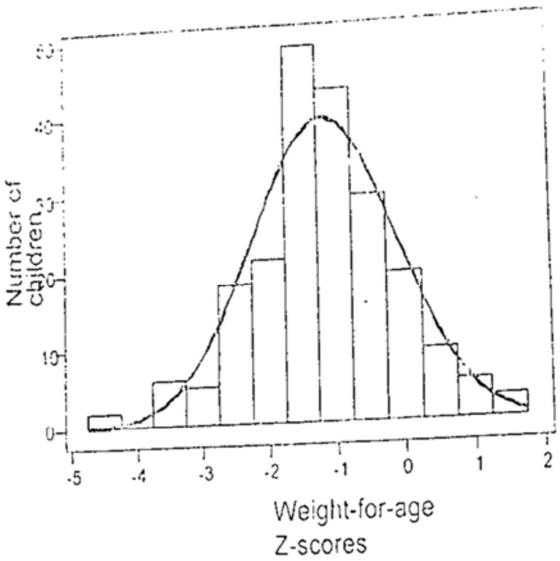


***Figure 2.** Weight for Age Z-Score Vs Number of Children.*

Figure 2 shows the normal curve of WFA z-scores. The mean and SD of the z-score were 1.18 and 1.06 respectively. Majority of the children were found in between -2 and +1 WFA z-score while no child was found above +2 z-score. 77.36% male children were found between ±2 z-score and were categorized as normal (WHO, 1995). They have mean WFA z-

score of -0.89 and SD of 0.83. However, 22.64% were underweight (z-scores < -2) with mean WFA z-scores > +2. The mean WFA z-score for male is -1.30 and SD 1.09.

For female, 81.55% were normal (Z-scores fall between ±2) with the mean WFA z-score of -0.70 and SD of 0.74. Under-weight female children amount to 18.45% with mean WFA z-score of -2.58 and SD of 0.62. No child recorded high WFA i.e z-score > +2. The mean WFA z-scores for female surveyed is 1.05 and SD is 1.02.

Mid Arm Circumference-for-Age (MAFA)

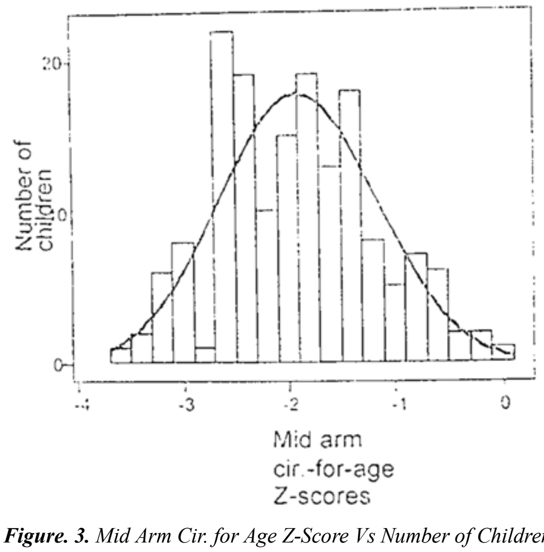


***Figure. 3.** Mid Arm Cir. for Age Z-Score Vs Number of Children.*

The mean of the children surveyed was found to be -1.91 and SD of 0.74. A high number were below -2 z-score as shown in figure 3. The female constitute 45% of the children surveyed for MAFA, out of which 52% were categorized as normal (WHO 1995) with z-scores between ±2. The mean MAFA z-score i.e < -2 z-scores with a mean of -2.55 and SD of 0.39. No child had high MAFA z-score. 58% male children could be regarded as normal with z-scores between 0 and -2. The mean z-score is -1.36 and SD 0.44. however; 42% had low MAFA (<-2 z-scores) with mean of -0.61 and SD 0.35. the mean z-score for the male children was 1.89 and SD 0.74. protein-energy-malnutrition is diagnosed as severe if MAFA has z-score below -3.5 (Van Den Broeck, 1996). Some investigators (Erinoso et. al., 1993) have used MAFA with z-score below -2.5 and clinical sign of muscle loss as criteria to define mild-to-moderate wasting and PEM.

Weight – for – Height (WFH) Indicator

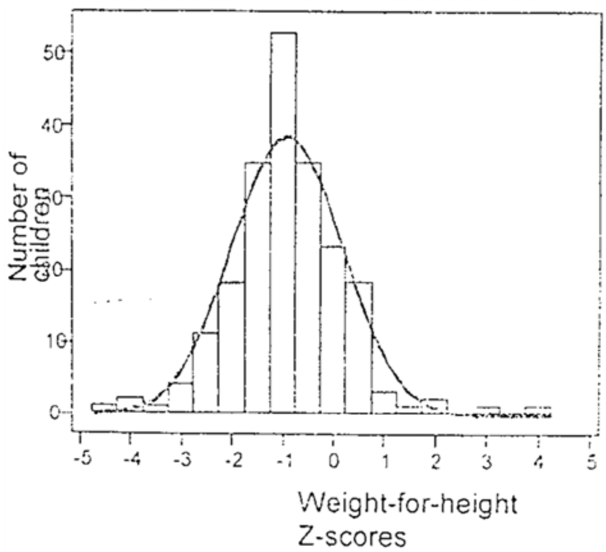


***Figure 4.*** *Weight for Height Z-Score Vs Number of Children.*

The mean z-score and SD of the children were -0.92 and 1.08 respectively. Large proportions of the children were in the normal range i.e. ± 2 z-scores. Small numbers of children were +2 z-score, while a relatively high number were below -2 z-score as shown in figure 4.

For female children 86.4% were normal, (i.e fall between ± 2 z-score) with mean z-score of 0.66 and SD of 0.79, "Muscle wasting" were noticed in 12.62% i.e. under weight (< - 2 z-score) with mean at -2.57 and SD at 0.56. only one child was over-weight (z-score > +2). The mean WFH z-score and SD for female were -0.88 and 1.04 respectively. 83.02% male children were normal with the mean z-score or -0.75 and SD of 0.07. However, 15.1% were underweight with mean and SD of -2.63 and 0.68 respectively. Only 2% were over-weight with mean z- score and SD of 3.31 and 0.68 respectively, the mean WHF z-score for male children was found to be -.096 and SD 1.13.

***Table 2.*** *Estimate of Prevalence Anthropometric Deficits.*

| Indicator | Estimated Prevalence of Deficit (%) |
|---|---|
| H. F. A. | 17.9 |
| W. F. A. | 22.1 |
| M. A. F. A. | 45.2 |
| W. F. H. | 15.9 |

A pronounced deficit was noted in MAFA. This is to say nearly half of the children had MAFA lesser than normal. Also, approximately 18% were not having the correct height for their corresponding age, while 22% did not have weight that correspond to their age. About 16% of the children were underweight, as shown in Table 2.

### *3.2. Body Composition*

The indices used to estimate the body composition of the surveyed children are as designed by Fidanza (1991):

I. Body Mass Index (BMI):

This index increased marginally from 13.65kg/m$^2$ for male and

female at 3years of 13.86kg/m$^2$ at 5 years old as shown in Figures 5a & 5b. The BMI of children with z-score less than -2.10 (i.e. malnourished) (WHO 1995) do not show any significant difference (P< 0.01) from thos regarded as normal.

II. Sum of Skin-fold Thickness (SST)

Figures 6 and 7 show the variations of mean SST (Triceps + Biceps + Subscapular + Supra-iliac) with age for both male and female in the categories of Protein deficient (PD) and Normal children.

Though the normal children recorded higher values from 3 to 5 years over the PD children, there was no clear cut relationship between the mean SST and age.

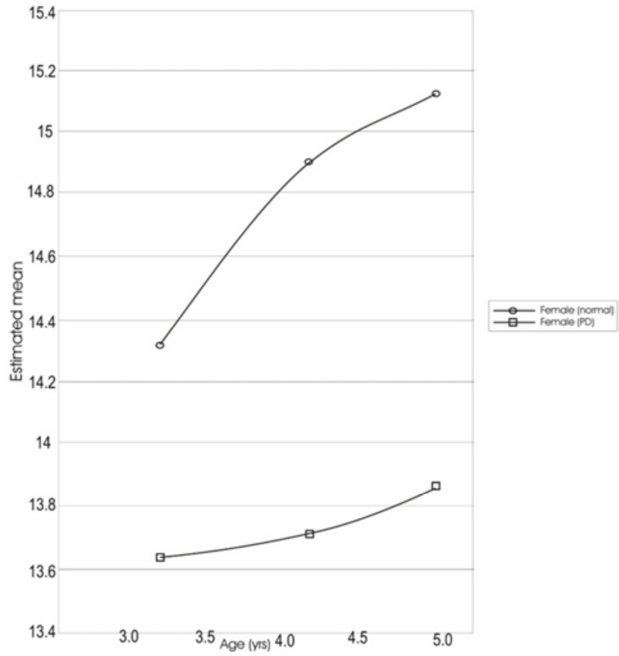


***Figure 5a.*** *Estimated Mean of Body Mass Index (B. M. I) For Normal and PD Female Children 3-5yrs.*

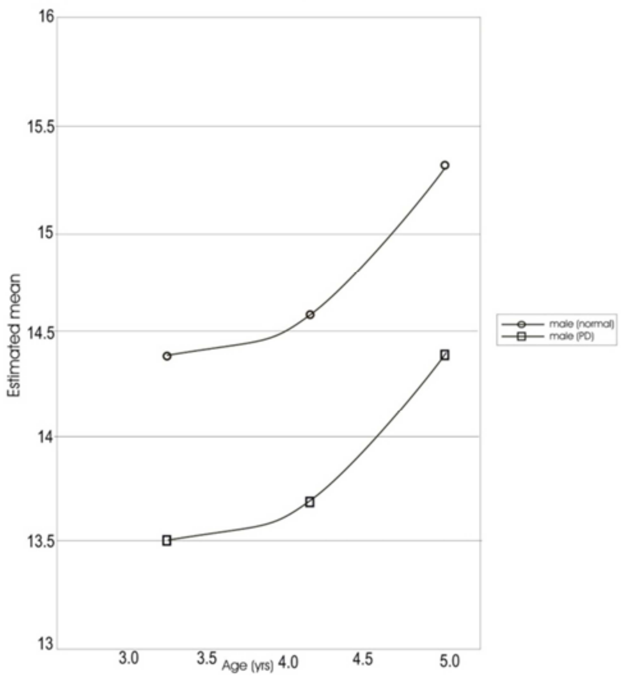


***Figure 5b.*** *Estimated Mean of Body Mass Index (B. M. I) For Normal and PD Male Children 3-5yrs.*

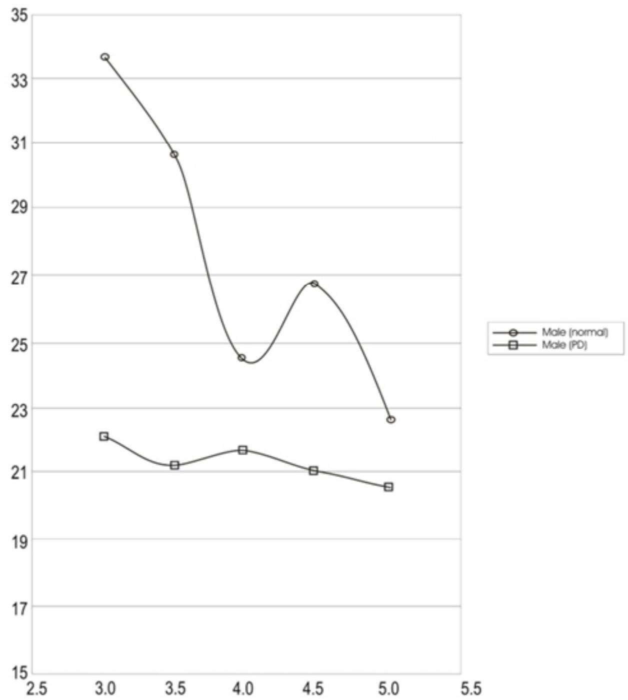


***Figure 7.*** *Estimated Mean of Sum of Skinfold Thickness for PD and Normal Male Children 3-5yrs.*

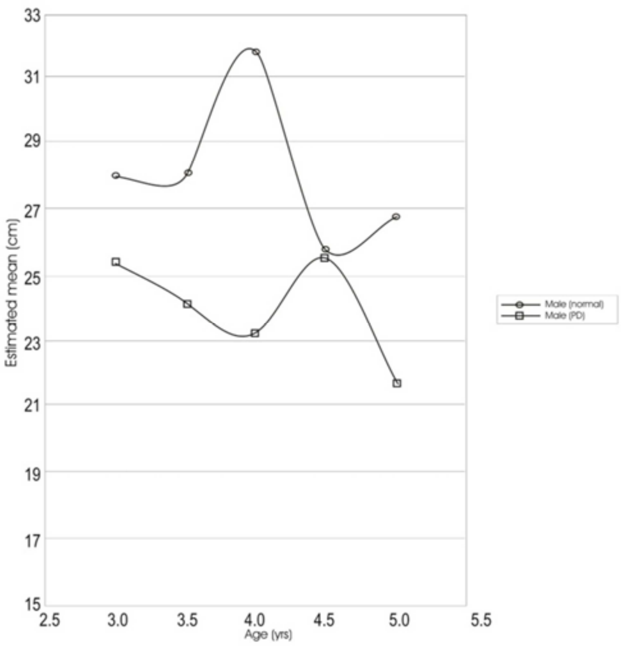


***Figure 6.*** *Estimated Mean of Sum of Skinfold Thickness for PD and Normal Female Children 3-5yrs.*

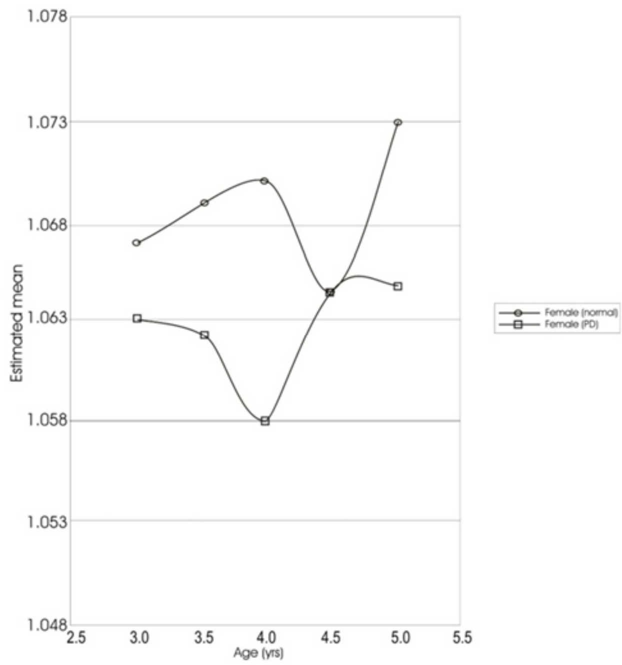


***Figure 8.*** *Estimated Mean of Body Density for PD and Normal Female Children 3-5yrs.*

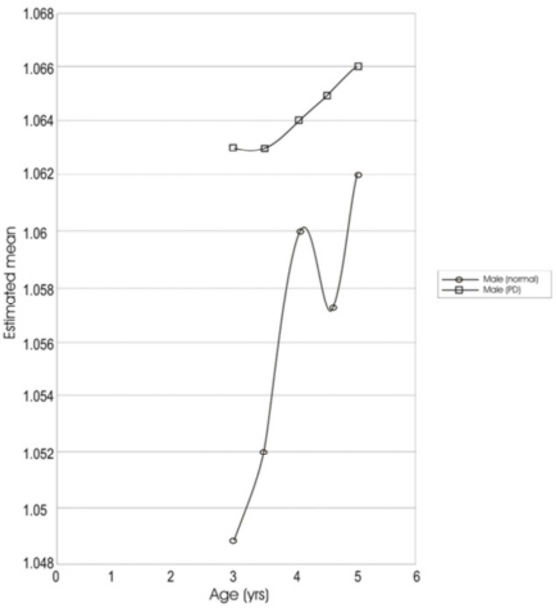


*Figure 9. Estimated Mean of Body Density for PD and Normal Male Children 3-5yrs.*

In females, the normal children at 4 years had highest mean SST of 31.5cm with PD children was just 23.4cm. at 4.5 years, the PD female had the highest mean SST of 25.5cm while their peers in "normal" category recorded a fall from 31.5cm to 26cm. Normal males showed high mean SST over the PD ones. The general trend is decrease in mean SST as age increases. The results showed significant difference ($P < 0.01$) in sexes.

III Body Density

An increase in body density was recorded as age increased for both PD and normal children. However, the proportionality differs as illustrated in figures 8 and 9.

IV Percent Body Fat

A decrease in percent body fat for PD and normal children was recorded between the ages of 3 – 5 years. The

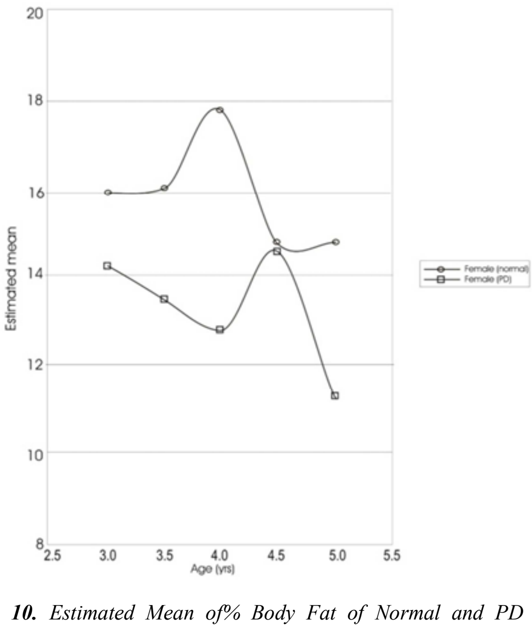


*Figure 10. Estimated Mean of% Body Fat of Normal and PD Female Children 3-5yrs.*

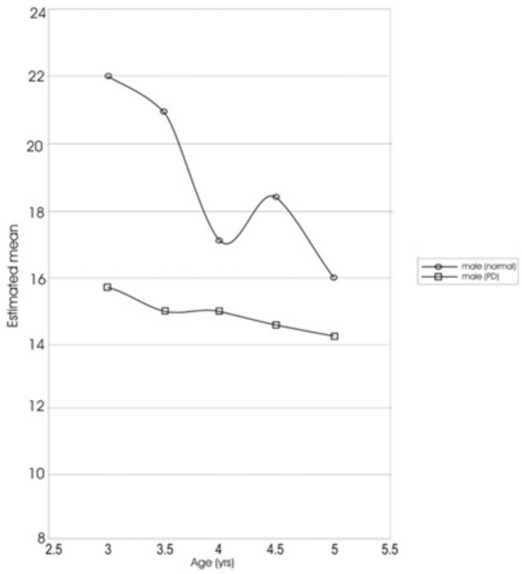


*Figure 11. Estimated Mean of % Body Fat of Normal and PD Female Children 3-5yrs.*

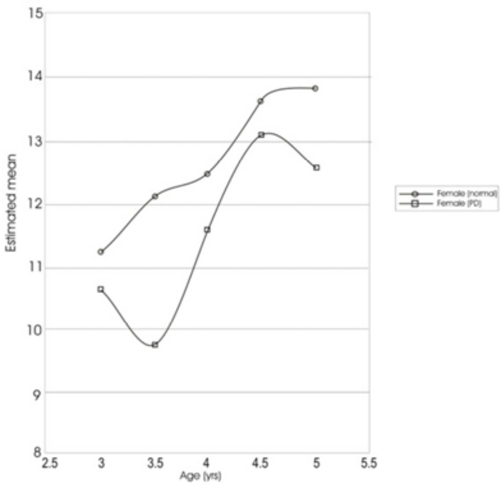


*Figure 12. Estimate Mean of Fat Free Mass for PD and Normal Female Children 3-5yrs.*

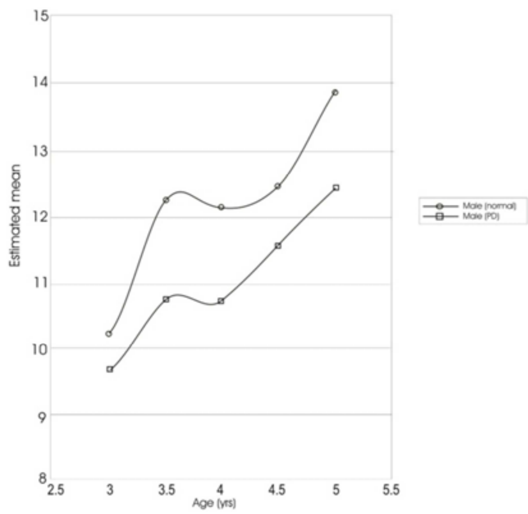


*Figure 13 Estimate Mean of Fat Free Mass for PD and Normal Female Children 3-5yrs.*

Percent body fat for PD female decreased from 14.4% at 3 years to 11.38% at 5 years, while that of PD male decreased from 15.50% to 14.35% within the same period under investigation. The same trend was observed for normal male and female as illustrated in Figures 10 and 11.

V Fat Free Mass (FFM)

PD female initially showed a steady fall in FFM with age until about 4 years and above when a steady rise was recorded (Figure 12). On the hand, PD male recorded a steady rise. The mean FFM for PD male rose from 9.73kg at 3years to 13.76 at 5years as illustrated in Figure 13. Normal female had an increase in FFM from 1.31kg at 3 years to 13.76 at 5years which insignificantly different (P<0.01) from the lower values obtained for PD female children. The normal male children also has significantly high FFM values (P<0.01) than the PD male contemporaries.

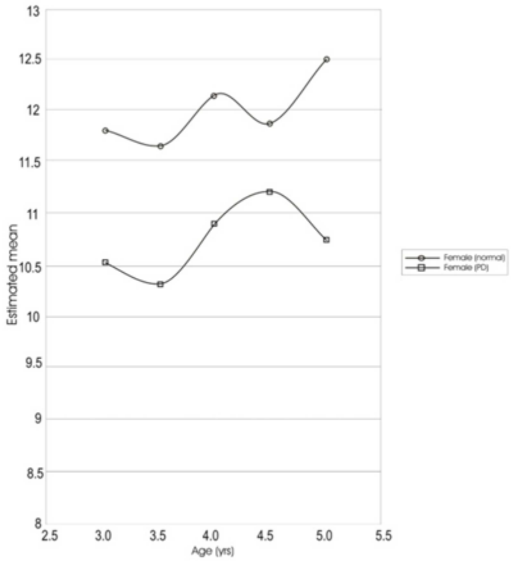


***Figure 14.*** *Estimated Mean of Mid-Arm Muscle Circumference (MAMC) For Protein Deficient (PD) and Normal Female Children (3-5years).*

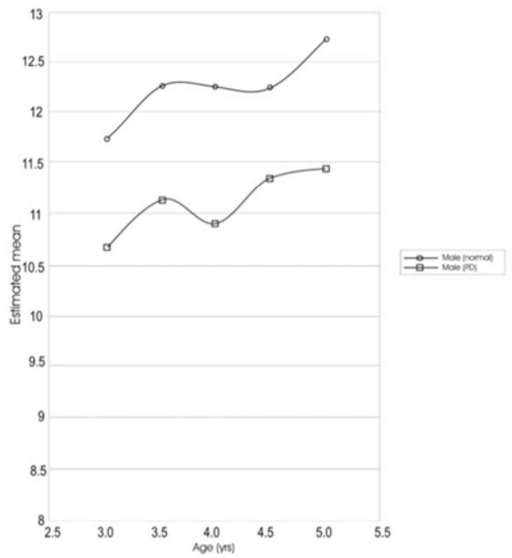


***Figure 15.*** *Estimated Mean of Mid-Arm Muscle Circumference (MAMC) For Protein Deficient (PD) and Normal Female Children (3-5years).*

VI. Mid-arm Muscle Circumference (MAMC)

The MAMC values for PD female ranged between 10.53cm to 10.74cm while the PD male had values between 10.71cm and 11.44cm (Figures 14 and 15).

### *3.3 Clinical Assessment*

Table 3 shows the percentages of children with Oedema, skin and hair change. The relatively high level of oedema, skin and change among the children between the age of 3-5 years is in consonance with previous report which suggested that protein deficiency (Kwashiorkor) occurred mainly after weaning from breast milk (Latham, 1991). Latham (1991) noted that a characteristic dermatosis is often seen in young children suffering from Kwashiorkor.

***Table 3.*** *Prevalence of Oedema, Skin and Hair –change among children.*

| Age(Years) | Total no. of Children | Presence of Oedema Skin and Hair change | Expressed in Percentage (%) |
|---|---|---|---|
| 3.0 | 58 | 28 | 48 |
| 3.5 | 16 | 07 | 44 |
| 4.0 | 58 | 28 | 48 |
| 4.5 | 14 | 06 | 43 |
| 5.0 | 63 | 32 | 51 |

## 4. Discussion

Based on the mean Z-score results for the anthropometric indicators measured (HFA, WFA, WFH and MAFA), the children had the lowest value in MAFA (-1.91) – which is a measure of acute malnutrition (Onis et. al., 1993) and the highest value (-0.69) in HFA-which indicates long term cumulative inadequacies of health and/or nutrition (WHO, 1995). The tendency for 'catch up' growth in children could account for the observed differences between MAFA and HFA in this study.

The standard deviation (SD) values (1.43 for HFA, 1.06 for WFA and 1.08 for WFH) in this study were comparable to previous reported (WHO, 1995) values (1.4-2.8 for HFA; 1-1.2 for WFA, and 0.85-1.10 for WFH). The SD values represent one of the ways of testing the quality and validity of anthropometric measurements.

Previous reported prevalence of anthropometric deficits in Nigeria, for children below 5 years were 35.7% for underweight (low WFA), 43.1% for stunting (low HFA) and 9.1% for wasting (low WFH)(Onis et.al., 1993). Differences between these prevalence estimates in Nigeria compared with our results may have resulted from regional variations in the population studies and/or season when the studies were conducted. The superiority of low MAFA in being able to identify PD children compared with other anthropometric parameters appears to be its ability to provide a relative assessment of fat and muscle mass (Sauerwein et. al., 1997).

Of all the anthropometric indicators measured, the most sensitive to the nutritional status of the children is the mid arm circumference – for – age (MAFA). It requires simple instrument for field assessment.

Also, the male children are at greater risk of protein deficiency than their female counterparts based on mean 2-scores of the anthropometric indicators. This may probably be due to their increased physical activity which also expose them to injuries, infections and diseases.

In conclusion the extent of undernutrition as presented here is of public health significance. The intervention necessary may be the introduction of cheap vegetable-origin proteins e.g. soyabeans that these low-income group parents (FAO/WHO, 1992) can afford to include in their children diet.

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