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NUTRITIONAL STATUS AND DIETARY PATTERN I: PRESCHOOL AGE CHILDREN IN AKINYELE LOCAL GOVERNMENT AREA OYO STATE

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Abstract: The study investigated dietary pattern and nutritional status of preschool aged children in Akinyele Local Government Area, a sub-urban setting in Oyo State compared with FDN reference standards. The study determined dietary intake of their 24-hr recall intake samples for proximate composition, vitamins and mineral profiles using established standard methods while inferential statistics of t-test at a significant level of $p<0.05$ was used to test the acceptance or rejection of the study hypotheses. Results obtained shows that protein content per meal of their meal intake was below 13 – 14 g/100g while same was observed for fat/oil content intake which cannot provides up to 28.4 % energy recommended as fat allowance contribution in food. However, all the samples analyzed can provides them with enough energy per 100 g compared with reference standard and adequate presence of minerals in their food connotes a good source of acid-base (ionic) balancing of body fluid system in term of micronutrients. The study revealed that locations/environments have effect on healthy eating habits of preschool aged children, hence an adequate healthy eating policy and implementation needs to be put in place for preschool aged children especially in rural and semi-urban areas to prevent malnutrition and intestinal disorder and diseases which can have pronounce effect on their growth.

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1.0 Introduction

The first six years of a child's life mark a period of rapid physical, emotional and mental development. These formative years is characterized with social, culture and environmental development as the most active period. Early childhood development pertains to physical, mental and social growth and consists of various interventions, such as those involving the promotion of nutrition, health, mental and social development [1]. Consumption of a healthy diet is essential for children to ensure that they undergo normal growth, development and to prevent a variety of nutrition-related health problems, such as anemia, growth retardation, malnutrition, compromised cognitive achievement, obesity, dental problems, and chronic diseases later in life [2]. The healthy development of a person starts, before they are even born, with the health and nutrition of the mother and is a process that continues throughout their life. The part of this process that begins at birth and lasts until the age of compulsory education is called the "preschool education period".

This period is the most significant stage of human development coupled with the exposure children are subjected to provide qualified stimulants that will influence their mental and social development positively. The importance of having proper nutrition has in recent years been emphasized as a key factor in leading a healthy life and has contributed to the trend toward healthier diets [3]. It is of critical importance that nutrition education be given at early ages, particularly in the preschool period, to ensure that a healthy lifestyle is maintained. It has been well-established that nutrition education programs have a positive impact on nutritional knowledge and eating habits of preschool aged children [4]. In addition, delayed motor development, impaired cognitive function, poor school performance and low intelligent quotient (IQ) are associated with early childhood malnutrition [5]. Improvement in infants and young child's nutrition should be of top priority for improved nutritional status, key household decisions and practices that determine the survival, growth and development of the child preschool aged children.

Reports abound that availability of food does not always translate into corresponding consumption of the food due in part to ignorance of what to eat, when to eat and how to eat. According to Black et al. [6], training and nutrition education of the mothers is necessary to change feeding practices and provide correct information while the importance of varying the

preschool aged children diet and practicing good hygiene when handling and storing of preschool aged children food can be included as well [7]. The teaching and training of nursing mothers could have a long-term impact on weaning practices and nutritional status of preschool aged children. Therefore, in an economy undergoing high inflation trends like Nigeria, malnutrition is bound to be prevalent. This may be due to hunger, poverty and economic instability among others. The ravages of malnutrition on the health of children may be enormous ranging from growth retardation, low academic potentials, to disease conditions and even death. It became apparent that the dietary pattern and nutritional status of children must first be determined before interventional measures can be taken. Therefore, the purpose of this study was to investigate the dietary pattern and nutritional status of preschool aged children in Akinyele Local Government Area, a sub-urban setting in Oyo State Nigeria as a case study to ascertain the adequacy or otherwise of their food consumption.

2.0 Materials and Methods

2.1 Material

Samples of the 24-hr recall food intake during the last 24 hours for morning, afternoon and evening were collected, dried at 55±5 ºC for 6 hr using hot air oven (Model: Genlab, DC 500; Serial number: 12B154) and then allowed to cool, packed and stored in low density polythene nylon for laboratory analysis.

2.2 Methods

Nutritional status is a condition of nourishment that depends on dietary intake and their use in the body. Assessment of nutritional status was carried out using dietary tests to determine macro, micronutrients and total energy intake in order to know their nutrients intake during the last 24-hr comparable to FDN [8] reference standard.

2.3 Proximate composition of the dried 24-hr recall food intake samples

Proximate analysis of the samples was carried out using AOAC [9] methods. Moisture content was determined by air oven method at 105 °C. The protein content of the sample was determined using micro-Kjeldahl method. Fat was determined by Soxhlet extraction method using petroleum ether as extracting solvent. The ash content was determined by weighing 5 g of charred sample into a tarred porcelain crucible. It was incinerated at 600°C for 6 hours in ash muffle furnace until ash was obtained. Crude fibre was determined by exhaustive extraction of soluble substances in a sample using H_2SO4 and NaOH solution, after the residue was ashed and the loss in weight recorded as crude fibre. Carbohydrate content was calculated by differences while gross energy value of the samples was estimated (kJ/100 g) by using this formula according to Famakin et al. [10].

Gross energy (kJ/100 g dry matter) = (Protein × 16.7) + (Lipid × 37.7) + (Carbohydrate × 16.7)

2.4 Mineral and Vitamin profiles of the dried 24-hr recall food intake samples

Mineral profiles were determined as described by AOAC [9] using an inductively-coupled plasma atomic emission spectrometer (ICPAES, USA, TL6000 Model). The ash was digested with 3 cm3 of 3 M HCl and made up to the mark in a 100 cm3 standard flask with 0.36 M HCl before the mineral elements (calcium, zinc, magnesium, iron and potassium) were determined by atomic absorption spectrophotometer (PYE Unicam SP 2900, UK). Provitamin A was determined using the method adopted by IVACG [11] while vitamin B_1, B_2, B_{12} and vitamin C were determined using the method of AOAC [9].

Data analysis

The statistical analyses were performed using SPSS software (Systat Statistical Program version 21 Inc., USA). Data generated through the administration of the questionnaire was reported as mean, frequency count, and percentages while the hypothesis was analyzed using the test of difference between two proportions (t-test). The food intakes of the children were compared with Food and Nutrition, FDN [8] reference standard. The recorded anthropometric measurements (height, weight) of the preschool aged children were analyzed using the t-test of statistical analysis at a significant level ($p<0.05$) to test the acceptance or rejection of the study hypotheses while laboratory results were expressed as mean of triplicate analyses. A one-way analysis of variance and Duncan's test will be used to establish the significance differences among the mean values at alpha 0.05.

Results and discussions

Average proximate composition of 24-hr recall meals per 100g/dry weight

Results of the proximate composition of the 24-hr recall food intake per 100g were shown in Table 1. There was no significant difference in term of moisture content, crude protein, crude fat, crude fibre and ash content in all their food intake during the last 24 hours with values ranged from 8.86 – 8.92 % 5.69 – 6.63 %;3.66 – 3.97 %; 1.34 – 1.94 % and 2.93 – 3.41 %, respectively. Carbohydrate value of their 24-hr recall food intake showed no significant difference @ alpha $p<0.05$. The value ranged from 75.43 in Orogun town area to 76.92 % in Alabata town area, respectively while statistical difference ($p<0.05$) was not observed in the energy values of the food intake in the study areas which

ranged from 380.37 – 382.80 kcal/100g in Sasa town area to Alabata town area, respectively.

The moisture content of all the samples was relatively low and not statistically different from one another. Moisture content is a good indicator of storage ability of food product, mould formation and avoidance of lump storage/keep. All samples moisture contents were less than 10 % (8.86 – 8.92 %) which agreed with the work of [12] and [13]. The protein content per meal of their meal intake was below 13 – 14 g/100g according to Anigo et al. [14] while same thing was observed for fat/oil content of their intake which cannot provides more than 28.4 % energy recommended by [15] as fat allowance contribution in food. This may be so because sample dry weight was determined which may have allowed some of the fat/oil evaporated during sample drying. However, since they are taken more than 100 g of food/meal per intake this would have been taken care of. Proteins enhance immune booster, cell division, repairment and growth while fat provides soluble vitamins (ADEK) and other cell biochemical activities and insulate organs [16]. Crude fibre of all the samples was less than 5.0 g/100g as reported by [10].

Table 1: Average proximate composition of 24-hr recall meals per 100g/dry weight

Parameters (%)	Alabata Town	Iroko Town	Sasa Town	Moniya Town	Orogun Town
Moisture content	8.92 ± 0.03^{a}	8.86 ± 0.11^{a}	8.88 ± 0.16^{a}	8.91 ± 0.00^{a}	8.90 ± 0.09^{a}
Crude protein	6.13 ± 0.01^{b}	5.92 ± 0.00^{ab}	6.30 ± 0.08^{a}	5.69 ± 0.17^{c}	6.63 ± 0.13^{b}
Crude fat	3.66 ± 0.04^{ab}	3.88 ± 0.03^{ab}	3.72 ± 0.01^{a}	3.23 ± 0.05^{bc}	3.97 ± 0.05^{b}
Crude fiber	1.34 ± 0.00^{a}	1.74 ± 0.01^{bc}	1.66 ± 0.02^{b}	1.94 ± 0.00^{ab}	1.58 ± 0.00^{ab}
Crude ash	3.03 ± 0.07^{a}	2.93 ± 0.01^{a}	3.41 ± 0.01^{ab}	3.22 ± 0.02^{b}	3.49 ± 0.04^{b}
Carbohydrate	76.92 ± 0.18^{bc}	76.67 ± 0.32^{bc}	776.03 ± 0.38^{c}	776.41 ± 0.23^{a}	75.43 ± 0.21^{b}
Energy, Kcal/100 g	382.80 ± 0.27^{bc}	383.02 ± 0.83^{c}	380.37 ± 0.22^{cd}	380.48 ± 0.19^{a}	381.68 ± 0.42^{b}

All values are expressed as means ± SD of 3 replicate determinations while values with different superscript within the same row are significantly different @ $p<0.05$. SD: Standard deviation.

According to Soetan and Olaiya [17], dietary fibre play good and vital role in glucose absorption and reduces risk of hyperglycemia. The presence of ash in the samples indicates minerals salts in their food which provides them with needed minerals in their body for biochemical activities. The presence of minerals in their food connotes a good source of acid-base (ionic) balancing of body fluid system [18]. All their food/meal samples analyzed can provides them with enough energy per 100 g. This will allow protein to be useful for its primary work. Carbohydrate, according to Sushma et al. [19] contributes effectively to muscles coordination, blood and Kreb's circle activities and also acts as mild laxative.

Average mineral profiles of 24-hr recall meals per 100g dry weight compared with FDN reference standard

Table 2 shows the average mineral profile of the 24-hr recall food intake of the study areas household per 100 g. Statistical difference was observed in all the 24 hours recall food intake samples determined. There values ranged from 32.11 – 39.74 mg/100g (Ca); 1.03 – 1.25 mg/100g (Fe); 0.9 – 1.02 mg/100g (Zn); 37.39 – 52.34 mg/100g (Na); 53.26 – 59.10 mg/100g (P); 37.13 – 40.14 mg/100g (Mg) and 226.17 – 245.88 mg/100g (K), respectively. The sodium potassium ratio of all the 24 hours recall food intake samples ranged from 0.15 in Iroko town area to 0.19 in Moniya town area while calcium phosphorus ratio ranged from 0.60 in Iroko town area – 0.73 in Moniya town area, respectively. Mineral profiles of all the samples were determined and statistically differences ($p<0.05$) at alpha 0.05 were observed in all the samples compared with [8]. Calcium and iron of the samples ranged from 32.11 – 39.74 mg/g and 1.03 – 1.16 mg/g, respectively compared to FDN [8] reference standard of 30.00 mg/g and 0.61 mg/g, respectively. Same trends were observed for zinc, sodium, phosphorus, magnesium and potassium compared with [11] reference standard. Studies have shown that minerals in the body apart from providing ionic balance and electrolyte fluid for the body, it also performs many biochemical processes and stabilizes protein reaction in the body [20].

Table 2: Average mineral profiles of 24-hr recall meals per 100g dry weight compared with FDN Reference standard

Parameters (mg/g)	Alabata Town	Iroko Town	Moniya Town	Orogun Town	Sasa Town	FDN Ref. Std
Calcium	34.71 ± 0.58^{b}	32.11± 0.32^{ab}	39.74 ± 0.38^{cd}	37.38 ± 0.17^{c}	36.57 ± 0.26^{c}	30.0 ± 0.00^{a}
Iron	1.14 ± 0.01^{b}	1.03 ± 0.00^{b}	1.16 ± 0.03^{b}	1.25 ± 0. 01^{bc}	1.06 ± 0.03^{b}	0.61 ± 0.00^{a}
Zinc	0.97 ± 0.02^{bc}	0.85 ± 0.00^{b}	1.02 ± 0.01^{c}	1.01 ± 0.00^{c}	0.98 ± 0.02^{bc}	0.30 ± 0.00^{a}
Sodium	42.11 ± 0.00^{c}	35.06 ± 0.01^{b}	47.50 ± 0. 01^{d}	43.24± 0.00^{cd}	37.39 ± 0.00^{b}	5.0 ± 0.00^{a}
Phosphorus	51.23 ± 0.23^{b}	53.26 ± 0.23^{c}	54.10 ± 0.22^{c}	52.12± 0.09^{bc}	52.43± 0.18^{bc}	47.0 ± 0.00^{a}
Magnesium	38.77± 0.19^{bc}	37.13 ± 0.07^{b}	40.08 ± 0.00^{cd}	39.23 ± 0.06^{c}	40.14± 0.13^{cd}	25.0 ± 0.00^{a}
Potassium	232.17± 0.98^{b}	240.08± 1.52^{b}	251.16± 0.33^{b}	248.21±1.07^{ab}	235.34± 0.19^{b}	37.0 ± 0.00^{a}
Na : K	0.18 ± 0.00^{bc}	0.15 ± 0.00^{a}	0.19 ± 0.00^{bc}	0.17 ± 0.00^{b}	0.16 ± 0.00^{ab}	0.14 ± 0.00^{a}
Ca : P	0.68 ± 0.39^{bc}	0.60 ± 0.71^{c}	0.73 ± 0.57^{a}	0.72 ± 0.52^{a}	0.70 ± 0.69 ^{b}	0.64 ± 0.00^{b}

All values are expressed as means ± SD of 3 replicate determinations while values with different superscript within the same row are significantly different @ p<0.05. SD: Standard deviation; FDN: Food and nutrition.

Some of these minerals in foetus and child development work against impair physical and cognitive development and reduces morbidity in child bearing, bone formation and utilization during Kreb's circle activities. Penido [21] reported that minerals play an important role in the generation of ATP, maintenance of homeostasis and nucleic acids production. The Ca : P molar ratio in this study ranged from 0.06 – 0.73 which according to Koua et al. [12] indicates good absorption of dietary calcium availability n the diet while less than 0.50 indicates poor calcium absorption. The molar ratio of Na : K ranged from 0.14 – 0.19 which indicates good absorption of potassium and health body promoter by reducing incidence of hypertension [22].

Average vitamins assay of 24-hr recall per 100g/dry weight

Average vitamins assay if 24-hr recall food intake per 100 g dry weight was as shown in Table 3. There were significant differences (p<0.05) for all the 24 hours food intake samples determined compared to established standard. There values ranged from 1442.34 – 1547.10 IU; 0.83 – 1.01 mg; 0.78 – 1.12 mg; 0.65 – 0.73 mcg and 25.63 – 28.13 mg for vitamin A, B_1, B_2, B_{12} and C, respectively. Statistical differences (p<0.05) were observed in the entire vitamins determined compared with [8] reference standard except vitamins B_2 and B_{12}, respectively.

Vitamin A is also known as retinol because it produces pigment in the retinal of the eye. The presence of vitamin A in their diet could help in healthy teeth, skeletal bone, soft tissues, skin and night blindness [23]. Vitamin B_1 obtained in this study is higher than 0.21 – 0.24 mg/100g obtained in the work of [24]. It has been reported that vitamin B_1 enhance energy utilization and activities while vitamin B_2 works as an antioxidant to help fight free radicals and prevent early aging and heart disease development [25]. The result for vitamin B_{12} in this study ranged from 1.09 – 1.16 mcg.100g which is lower than [8] reference standard of 1.20 mcg/100g.

Table 3: Average vitamins assay of 24-hr recall per 100g/dry weight

Vitamin	Alabata	Iroko	Moniya	Orogun	Sasa	FDN Ref. Std
A (IU)	1447.15±3.19^{bc}	1422.34±1.46^{b}	1483.29± 3.78^{c}	1547.10±3.82^{d}	1522.02±1.94^{cd}	1333.00 ± 0.00^{a}
B_1 (mg)	0.83 ± 0.00^{b}	0.89 ± 0.05^{c}	1.01 ± 0.06^{e}	0.93 ± 0.00^{d}	0.86 ± 0.00^{bc}	0.60 ± 0.00^{a}
B_2 (mg)	2.01 ± 0.11^{a}	2.20 ± 0.17^{d}	2.35 ± 0.02^{e}	2.21 ± 0.10^{d}	2.15 ± 0.07^{c}	2.10 ± 0.00^{b}
B_{12} (mcg)	1.06 ± 0.09^{a}	1.14 ± 0.00^{bc}	1.11 ± 0.00^{b}	1.16 ± 0.07^{c}	1.09 ± 0.03^{cd}	1.20 ± 0.00^{d}
C (mg)	27.89 ± 0.31^{c}	28.13 ± 0.06^{d}	25.63 ± 0.18^{a}	26.25 ± 0.25^{b}	28.78 ± 0.19^{d}	25.00 ± 0.00^{a}

All values are expressed as means ± SD of 3 replicate determinations while values with different superscript within the same row are significantly different @ p<0.05. SD: Standard deviation; IU: International unit; FDN: Food and nutrition.

Vitamin B_{12} is a water soluble vitamin that is naturally present in many foods especially fruits and vegetables. The vitamin is required for red blood cell formation, neurological function and DNA synthesis [26]. Vitamin C result (25.63 – 28.78 mg/100g) of the study is higher than reference standard (25.00) reported by [11] which also higher than that of [24] who reported a range lower than 10 mg/100g in their study. Vitamin C enhances absorption of non-heme iron from cereals according to Onabanjo et al. [27].

t-test correlation of mean weight of the preschool children based on their geographical location

Table 4 showed that the t-test correlation of mean weight, height and BMI among the study (rural, semi-urban and urban) area preschool aged children on their geographical location. In term of weight, rural area had a mean score of 14.99 with standard deviation of 0.32; semi-urban area had 15.38 with 0.19 standard deviation while urban area had mean score of 15.95, respectively. Applying the independent t-test, the value of t-calculated (t_{cal}) for rural area is 6.00 while its critical value (t_{cri}) is 3.18 at alpha 0.05. Likewise, the value of t-calculated (t_{cal}) for semi-urban area is 6.00 while its critical value (t_{cri}) is 3.18. The value of both t_{cal} is greater than their correspondent t_{cri} hence the null hypothesis was accepted for both areas and their alternative hypothesis rejected.

Table 4: t-test correlation of mean weight and height of the preschool children based on geographical location

Variables	Group	N	X	SD	Df	t-cal	t-cri	t_{cal} vs t_{cri}	Decision (p<0.05)
Weight (kg)	**Rural Area**	**4**	**14.99**	**0.32**	**3**	**6.00**	**3.18**	**6.00>3.18**	**Sig. difference**
	Semi-urban	4	15.38	**0.19**	3	6.00	3.18		Sig. difference
	Urban Area	4	15.95						

All values are expressed as means ± SD of 3 replicate determinations while values with different superscript within the same row are significantly different @ p<0.05. SD: Standard deviation; X: Mean; Df: Degree of freedom.

Hypothesis I

Hypothesis I stated that there is no significant difference between nutritional statuses of preschool aged children in Akinyele local government area in term of weight and those of children in [8]. Result shows that there is significant relationship between the two variables tested. It was found that nutrition status of urban preschool aged children was in tandem with [8] reference standard but differed with rural and semi-urban area of the study area. This was in line with the work of [28] and [29] who posits that parental socio-economic (environment) status affect children knowledge of healthy food and food intake. Early et al. [30] stressed that high socio-economic status of parents are able to provide their children with high quality child care including nutritious foods. This study finding portrait that preschool aged children in the rural and semi-urban areas are not having adequate healthy food which espouses them to intestinal infections hence, their average weight was lower (underweight) than their correspondent counterpart of the reference standard of [8].

t-test correlation of mean height of the preschool children based on their geographical location

Table 5 shows that the respondents' height in rural area had a mean score of 94.73 with 0.96 standard deviation while semi-urban area had mean score of 96.86 with 0.38 standard deviation, respectively. Using independent t-test to determine their correlation with urban area, t-calculated (t_{cal}) is 11.93 while its critical value (t_{cri}) is 3.18 at p<0.05. The value of t-calculated (t_{cal}) for semi-urban area is 8.90 while its correspondent critical value (t_{cri}) is 3.18. This result revealed that the values of both t-calculated (t_{cal}) are greater than its correspondent critical value (t_{cri}) hence, the null hypothesis was accepted for both areas and their alternative hypothesis rejected.

Table 5: t-test correlation of mean weight and height of the preschool children based on geographical location

Variables	Group	N	X	SD	Df	t-cal	t-cri	t_{cal} vs t_{cri}	Decision (p<0.05)
Height (cm)	**Rural Area**	**4**	**94.73**	**0.96**	**3**	**11.93**	**3.18**	**11.93>3.18**	**Sig. difference**
	Semi-urban	4	96.86	0.38	3	**8.90**	3.18		Sig. difference
	Urban Area	4	98.56						

All values are expressed as means ± SD of 3 replicate determinations while values with different superscript within the same row are significantly different @ p<0.05. SD: Standard deviation; X: Mean; Df: Degree of freedom.

Hypothesis II

Hypothesis II stated that there is no significant difference between nutritional statuses of preschool aged children in Akinyele local government area in term of height and those of children in [8]. The result revealed that there is significant differences ($p<0.05$) between the two variables tested. The preschool aged children in urban area have higher height ration compared with their counterpart in rural and semi-urban area of the study area. The study revealed that most couples (families) in the urban area of the study locations are nucleus families with less than four children per family. This may have contributed to their ability and capability to give their children healthy foods which invariably leads to weight and height gain by their children compared to reference standard [8] and Anton-Paduraru [31] than rural area preschool aged children. It may also be deduced that education/elites status of people living in urban area which according to Wieczorek et al. [32] and [33] who early noted that educated (elite) parents who have been exposed to series of information about healthy foods were more concerned about their children food intake than the uneducated one's. The work of Ilo et al. [34] and [35] supported the results of this study.

Conclusion

In conclusion, the shows that preschool aged children healthy eating habits could be shaped during this formative age years which will go on to impart their adult behaviour nutrition wise. This will have pronounced effect in preventing various likely nutritional diseases as they are growing and increase their immunity against outbreak of diseases. The study revealed that preschool aged children learn how to eat healthy foods and make right choices with the help of their parents and at schools. Preschool aged children in urban area are more exposed to healthy food eating habits than their counterpart in rural and semi-urban areas because of their parental socio-economic and education status which lead to giving more care to their children than those in the rural and semi-urban areas of the study locations. Mean weight and height of the study areas shows that there is a significant difference ($p<0.05$) between the urban, semi-urban and rural areas preschool aged children observed and determined. The results of this study show that nutritional status of preschool aged children in the study area especially rural, semi-urban areas needs to be improved to help their formative year's growth and development. The study results could provide baseline information on the level of malnutrition in Akinyele Local Government Area, Oyo State especially rural, semi-urban areas of the state.

Recommendations

Based on study revelations, the following recommendations were made to foster healthy eating habits and lifestyle among preschool aged children as follows:

- Government should development a specific national nutrition (healthy foods) guides/policy for preschool aged children that is easy to understand, adapt and apply by their parents, educators and caregivers especially in the rural and semi-urban areas.
- Parents, preschool aged children educators and caregivers to have knowledge of healthy food intake and provide anticipatory guidance on the importance of healthy feeding and eating practices to the preschool aged children.
- Preschool aged children should eat various nutritious rich food daily and adequate fruits or snacks between meals in order to increase or enhance their daily nutrients intake.

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