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Nutrient Composition of Frequently Consumed Traditional Foods by Preschool Children in Rivers West Senetorial Zone of Rivers State

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This work assessed the nutrient contents of frequently consumed traditional dishes by preschool children (2–5-year-olds), in the Rivers-West senatorial zone of Rivers state. Random sampling technique was used to select 96 caregivers/mothers from the eight local government areas in the zone. Data on the 8frequently consumed traditional foods were obtained through focus group discussions with caregivers/parents from the 8 communities used for the study. Aliquots of the eight frequently consumed traditional cooked foods were analysed using standard AOAC methods. Results of analysed frequently consumed traditional dishes per 100 g showed that *amafulo* with eba had the highest energy (187.11 kcal), protein (7.03 g), fat (17.64 g), crude fibre (5.13 g), and vitamin A (244.929 µg RE) values. *Burufulo* was the highest in moisture (77.01 g), zinc (17.58 mg) and

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carbohydrate (6.92 g). *Ofe-ede/fufu* had the highest ash (1.23 g) and calcium (4385.77 mg) contents. Iron was significantly higher in *ohwe ede etcha* (193.77 mg) than in other dishes. *Ede soup/ogbolo* proved superior in iodine (11340 µg). Folate was very low in all food samples with the highest value in *ohwe ede etcha* (0.05 µg). The nutrient contents of these traditional dishes revealed that they had good nutrient profiles and are readily available to combat malnutrition; however, consumption rate and nutrition education should be considered to maximize their full potentials.

Keywords: Nutrient Composition; malnutrition; nutrition education; underdevelopment.

1. INTRODUCTION

Malnutrition is common in Nigeria, because of poverty, lack of resources such as land, poor access to nutritious food, illiteracy, and insecurity. It has become a major issue for socio-economic advancement, causing the recycling of underdevelopment to the disadvantage or the less privileged [1]. In Africa, 19-29% of the population are undernourished, meaning their energy intake is not up to the dietary energy requirement [2]. About 12-47% of under-five children are not taking enough nutrients they need to support their physical growth [2]. Traditional foods have been shown to be a major source of nutrients in preschool nutrition as it does not only support growth and development but also combats malnutrition [3]. However there is paucity of information on the contribution of traditional foods to the nutrient intake of preschool children. In Rivers State, lands and water bodies have been polluted by oil spillage impacting local crops and livestock production (Okari et al., 2019). This in turn has affected livelihoods which have been worsened by the dwindling economy of the country and nutritional status especially of the vulnerable population negatively. Preschool children in rural areas are particularly at risk of malnutrition due to poor purchasing power, limited age-appropriate foods and a lack of knowledge of food complementation using ingredients locally available [4,5]. This has also encouraged increased consumption of highly processed, micronutrient-poor convenience foods which are usually energy dense, high in sodium, added sugars and low in dietary fibre. This coupled with unavailability of nutrition and health programmes targeted at this age group in these regions has led to an increased risk of morbidity and mortality.

Data on nutrient content of food is fundamental for planning and in determining adequacy of diets of any individual or a group of people, but the food composition data for Nigeria is limited in foods and nutrients. This study addresses the knowledge gap of limited food composition data for preschool children in the Rivers West senatorial zone, highlighting the need for accurate information to guide nutrition planning for this age group. The lack of sufficient data makes it difficult for nutrition professionals to plan adequate or therapeutic diets using foods in the area. Hence this study seeks to document nutrient composition of traditional foods consumed by preschool children in Rivers-West senatorial zone of Rivers state.

2. MATERIALS AND METHODS

The study was conducted in eight communities randomly selected from the eight local government areas (4 Upland and 4 coastal communities) the makeup Rivers-West senatorial zone of Rivers state. Twelve (12) [6] mothers/caregivers whose children were within ages 2-5 years were randomly selected from each community to form the focus group per community, a total of 96 mothers/caregivers from the 8 communities were used in focus group discussion (FGD).

Data collection was done using structured questionnaire, focus group discussion (FGD), and nutrient analysis of food samples collected from the communities. The FGD sessions were carried out to elicit information on the types of dishes fed to preschool children frequently, and the method of preparation. The structured questionnaire was also used to obtain data on demographics, socioeconomic, types of traditional dishes fed to children 2-5 years old, and factors that influence their choices of food from caregivers and mothers of preschool children who participated in the study. The questionnaire was researcher/interviewer administered during the FGD sessions. Ethical clearance for the study was obtained from Rivers State Ministry of Health (MH/PRS/391/VOL.2/717), while informed consent in writing was obtained from the mothers/ caregivers who participated in the study.

Nutrient analysis was done using methods described by the Association of Analytical Chemists AOAC, [7] for proximate and micro nutrients studied. Carbohydrate content was assessed by difference. Statistical Product and Service Solutions (SPSS, Version 25.0) software was used for statistical analysis. Results were presented as frequency, percentages, means and standard deviation. Analysis of variance was used to compare nutrient means of the food samples. Significant difference was accepted when $p < 0.05$.

2.1 Food Sample Collection and Preparation

During the focus group discussion (FGD), different types of traditional dishes peculiar to each community and fed to children 2-5 years were documented and the most frequently consumed identified. Thereafter the eight identified cooked food samples were collected from volunteers (mother/caregiver) in different household on a set date. The identified frequently consumed food per community was prepared according to the agreed recipes during FGD. The foods were packaged in well-labelled air-tight plastics and kept frozen in a deep freezer (-18^0C) pending analysis. On the day of analysis, the food samples were thawed to room temperature, then homogenised using a household food processor and then analysed. The proximate and micronutrient contents (vitamin A, folate, iodine, calcium, zinc and iron) of the foods were analyzed per 100g edible portion, and the mean values reported. Analysis was done in triplicate.

3. RESULTS

3.1 List of Traditional Foods Consumed Frequently by Preschool Children in Rivers West Senatorial Zone

Table 1 presents the traditional foods consumed frequently by preschool children in the study area. A total of 12 traditional foods frequently consumed in the study area by preschool children with their local names, English names, scientific names, ingredients used in preparing them and the method of cooking. The roots and tubers food group dominated their menu with cassava and cassava products been the most consumed. The meat fish and poultry food groups were mostly seafoods. Legumes, nuts, cereals and grains were seldom consumed. Corn, yam, plantain, cassava, cocoyam rice, okra, beans, fish, and meat were the commonly consumed staples in the study area. Boiling was the most used method of cooking these foods.

3.2 Selection of Commonly Consumed Food in the Community by Focused Group Discussion

Table 2 represents the information from the Focused Group Discussion. A total of twelve women (mothers/caregivers of the preschool children aged 2 – 5 years) participated in all the eight communities. Sixteen dishes were proposed to be consumed with eight being commonly consumed. The total number of participants was divided by the total number of dishes to obtain the mean score (decision rule) for acceptance, and a mean score of six (6) and above was accepted as commonly consumed in each community. Okurufulo na otira was accepted for Abonnema, burufulo for Buguma, odorfulo-Degema, amafulo-Bonny, onunu and freshfish peppersoup - Abua, ofe ede - Ahoada East, ofor soup with fufu - Ahoada West (Odiokwu), and for Omoku – ohwe ede etcha was the commonly consumed dish by preschool children.

Table 3 represents the proximate composition and energy values of frequently consumed foods by preschool children (2-5 years) per 100 g. The moisture content of the dishes ranged from 69.0 g in *amafulo* to 76.42 g in *okurufulo na otirana*. The ash content ranged from 0.66 g in *odorfulo* with eba to 1.23 g in *ede*-soup with *fufu*, the ash composition of *onunu* with catfish pepper soup (1.19 g) was comparable to that of *burufulo (1.11g)* There was no statistically significant difference ($p > 0.05$) in the ash contents of foods. Protein values of *okurufulo na otirana* (5.25 g) was significantly lower than that of *amafulo* (7.03 g). Fibre contents of dishes ranged from 0.53 g in *odorfulo* with *eba* to 5.13 g in *amafulo*, these were statistically significantly different ($p < 0.05$). The carbohydrate composition of the dishes was highest in *onunu* with catfish pepper soup (6.85 g) and lowest in *okurufulo na otirana* (0.04g); this difference was significant statistically ($p < 0.05$). The energy values of the dishes ranged from 125.34 kcal in *burufulo* to 187.11 kcal in *amafulo*. There was no statistically significant difference ($p > 0.05$) in the energy composition of these dishes.

Table 1. List of traditional foods consumed frequently by preschool children in Rivers West Senatorial Zone

Foods in Local Name	Scientific Name	Ingredients	Cooking method
Foite/soortembiaka, mbi, nji, ube	*Zea mays* *Cocos nucifera* *Sardina pilchardus*	Corn, coconut, fish,	Roasting or boiling
Pulogarri, nji	*Manihot esculenta* *Elaeisguineensis* *Sardina pilchardus*	Garri, palm oil, salt and dry or roasted fish	Frying
Bu garri, nji, mbi, apapa	*Manihot esculenta* *Cocos nucifera,* *Arachis hypogaea* *Sardina pilchardus*	Garri, fish, coconut, groundnut, water, salt, sugar	Boiling
Mbrakasin, njina	*Manihot esculenta*	Cooked cassava and roasted or dry fish	Boiling
Iku fulo Odor fulo Ohwe ede Ofe ede	*Manihot esculenta, Colocasia esculenta* *Tilapia Sparrmanii*	Cocoyam, ofor, achi, fish, leaves, salt, pepper, crayfish	Boiling Boiling Frying and boiling Boiling
Onunu, Iwo-njiordu	*Dioscorea spp* *Musa sapientum* *Manihot esculenta,*	Yam, Plantain, Cassava, palm oil, salt	Boiling
Iwor-njifulo, otira Ede soup with fufu	*Tympanotonusfuscatus, Thais califera, Macrobrachium macrobrachiom* *Tilapia Sparrmanii*	Fresh fish, periwinkle, whelk, prawns, bitter leaves, pepper, salt cocoyam, fufu,	Boiling
Buru-fulo	*Dioscorea spp* *Musa sapientum*	Yam, unripe plantain, dry fish, scent leaves	Boiling
Okuru -fulo Arunsu Foite-mbana Akidi	*Abelmoschus esculentus* *Oryza sativa* *Musa sapientum* *Phaseolus vulgaris*	Okra, fish, bitter leaves, crayfish, salt pepper Rice Plantain Beans, palm oil, salt, pepper, crayfish	Frying and boiling Boiling Boiling Boiling

Table 2. Presents the information from the Focused Group Discussion

Dishes/Comunities	Abonnema	Buguma	Odiokwu (Ahoada West)	Finima (Bonny)	Degema	Obarany (Abua)	Omoku	Upata(Ahoada East)	Total	%
Onunu and catfish pepper soup	1	2	0	0	0	6	0	0	9	9.4
Pulogarri njii	1	0	0	0	1	0	0	0	2	2.0
Ofe-ede and *fufu*	0	0	1	0	0	1	0	7	9	9.4
*Ofo*r soup and *ogbolo*	0	0	6	0	2	1	0	0	9	9.4
Burufulo	1	7	0	0	2	0	0	0	10	10.4
Mbrakasin njii	1	0	0	0	0	0	0	0	1	1.0
Odorfulo and *eba*	0	0	0	0	6	0	0	0	6	6.3
Akidi	0	0	0	1	0	0	0	0	1	1.0
Foite/soortembiaka, mbi, nji, ube	1	1	0	0	0	1	0	0	3	3.1
Okurufulo na otira	6	1	1	0	1	1	0	1	11	11.5
Bu garri, nji, mbi, apapa	1	0	1	0	0	0	0	1	3	3.1
Amafulo (amakufulo)	0	0	1	9	0	1	0	0	11	11.5
Arunsu-rice	0	1	1	2	0	0	0	1	5	5.2
ohwe ede etcha	0	0	1	0	0	1	12	2	16	16.7
Iku fulo	0	0	0	0	0	0	0	0	0	0
Iwor-njifulo, otira	0	0	0	0	0	0	0	0	0	0
Total	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**96**	**100.0**

$\bar{x}$ = 96/16 = 6, scores 6 and above are accepted as commonly consumed

Table 3. Proximate composition and energy values of some traditional foods consumed by preschool children (2-5 years) per 100 g on wet weight basis

Food Samples	Moisture(g) Means±SD	Ash(g) x̄	Protein(g) x̄	Fat(g) x̄	Fibre(g) x̄	Carbohydrate(g) x̄	Energy (kcal) x̄
Ononu with catfish pepper soup	$71.09^{b} \pm 0.05$	$1.19^{f} \pm 0.01$	$5.98^{c} \pm 0.01$	$13.73^{b} \pm 0.09$	$1.16^{c} \pm 0.04$	$6.85^{f} \pm 0.15$	$174.42^{d} \pm 0.65$
Okurufulo na otirana	$76.42^{f} \pm 0.01$	$1.11^{d} \pm 0.01$	$5.25^{a} \pm 0.07$	$15.05^{e} \pm 0.06$	$2.13^{e} \pm 0.02$	$0.04^{a} \pm 0.01$	$156.77^{b} \pm 0.25$
Odorfulo with eba	$76.07^{e} \pm 0.01$	$0.66^{a} \pm 0.01$	$6.01^{c} \pm 0$	$14.51^{d} \pm 0.01$	$0.53^{a} \pm 0.04$	$2.22^{d} \pm 0.03$	$163.60^{c} \pm 0.24$
Ofe-ede with fufu	$76.10^{e} \pm 0.02$	$1.23^{h} \pm 0.06$	$6.63^{e} \pm 0$	$14.11^{c} \pm 0.02$	$1.29^{d} \pm 0.04$	$0.64^{b} \pm 0.11$	$156.19^{b} \pm 0.62$
Burufulo	$77.01^{g} \pm 0$	$1.20^{g} \pm 0.02$	$5.76^{b} \pm 0.05$	$8.28^{a} \pm 0.01$	$0.83^{b} \pm 0$	$6.92^{f} \pm 0.02$	$125.34^{a} \pm 0.05$
Ohweedeetcha (fufu)	$71.44^{c} \pm 0.02$	$0.78^{b} \pm 0$	$6.26^{d} \pm 0.03$	$16.45^{g} \pm 0.06$	$2.13^{e} \pm 0.02$	$2.94^{e} \pm 0.09$	$184.97^{f} \pm 0.32$
Ede soup with (ogbolo)	$73.42^{d} \pm 0.02$	$0.85^{c} \pm 0.01$	$7.00^{f} \pm 0$	$16.06^{f} \pm 0.04$	$1.06^{c} \pm 0.01$	$1.61^{c} \pm 0.06$	$179.07^{e} \pm 0.16$
Amafulo (amakufulo)	$69.00^{a} \pm 0$	$1.14^{e} \pm 0.03$	$7.03^{f} \pm 0.01$	$17.64^{h} \pm 0.02$	$5.13^{f} \pm 0.04$	$0.06^{a} \pm 0.02$	$187.11^{g} \pm 0.11$

SD=standard deviation. Means with different superscripts in the same column are significantly different ($p < 0.05$). Means with the same superscripts in the same column are statistically similar ($p < 0.05$). onunu=cooked ripe plantain, casava, yam and palm oil paste, okurufulo = abelmoschus esculentus soup, otira = eba, odorfulo = seafood soup, ofe-ede = colocasia esculenta soup, burufulo = yam peppersoup

Table 4. Micronutrient contents of foods consumed frequently by preschool children as consumed

Food Samples	Vitamin A (µgRE)	Folate(µg)	Iodine (µg)	Calcium (mg)	Zinc (mg)	Iron (mg)
Onunu and catfish pepper soup	$32.2^{a} \pm 0.531$	$0.03^{e} \pm 0.0$	$4280^{a} \pm 360$	$802.15^{b} \pm 14.8$	$8.42^{a} \pm 0.08$	$125.00^{a} \pm 5.88$
Okurufulonaotira	$158.6^{f} \pm 2.61$	$0.014^{b} \pm 0.0$	$6550^{c} \pm 0.0$	$2606.9^{f} \pm 3.54$	$8.8^{a} \pm 0.58$	$148.64^{c} \pm 2.00$
Odorfulo and eba	$137.9^{e} \pm 2.271$	$0.012^{a} \pm 0.0$	$8320^{f} \pm 360$	$2316.9^{e} \pm 0.0$	$12.8^{c} \pm 1.46$	$168.93^{d} \pm 1.71$
Ofe-ede and fufu	$190.8^{g} \pm 3.141$	$0.016^{c} \pm 0.0$	$9070^{g} \pm 710$	$4385.8^{h} \pm 14.75$	$13.08^{d} \pm 0.17$	$133.80^{b} \pm 6.21$
Burufulo	$49.0^{c} \pm 0.807$	$0.04^{f} \pm 0.0$	$5540^{b} \pm 0.0$	$400.74^{a} \pm 4.92$	$17.58^{e} \pm 0.25$	$128.47^{a} \pm 0.0$
Ohwe ede etcha (fufu)	$60.6^{d} \pm .996$	$0.05^{g} \pm 0.0$	$7560^{e} \pm 0.0$	$2104.17^{d} \pm 18.54$	$8.33^{a} \pm 0.0$	$193.77^{e} \pm 8.83$
Ede soup and Ogbolo(fufu)	$44.7^{b} \pm 8.06$	$0.012^{a} \pm 0.0$	$11340^{e} \pm 1070$	$2776.8^{g} \pm 29.25$	$11.21^{b} \pm 0.13$	$166.68^{d} \pm 0.0$
Amafulo with eba	$244.9^{h} \pm 4.02$	$0.021^{d} \pm 0.0$	$7310^{d} \pm 360$	$1762.64^{c} \pm 0.0$	$12.7^{c} \pm 0.25$	$131.30^{b} \pm 0.21$

Values are means ± standard deviations of 3 determinants. values with different superscripts in the same column are statistically significantly different ($p<0.05$). values with the same superscripts in the same column are statistically similar ($p < 0.05$). onunu=cooked ripe plantain, casava, yam and palm oil paste, okurufulo = abelmoschus esculentus soup, otira = eba, odorfulo = seafood soup, ofe-ede = colocasia esculenta soup, burufulo = yam

Table 4 shows the micronutrient contents of the identified frequently consumed traditional dishes per 100 g. Vitamin A content was highest in *Amafulo* with *eba* (244.929 (µgRE), while *onunu* with catfish pepper soup had the least (32.229 (µgRE). Folate composition of the dishes ranged from 0.03 mcg in *onunu* and catfish pepper soup to 0.021 mcg in *amafulo* and eba. *Ede* soup with *ogbolo* had the highest iodine content (11,340 µg) while the onunu with catfish pepper soup had the least iodine content (4280 µg). Zinc content of the dishes ranged from 8.33 mg in *ohwe ede etcha* (fufu) to 17.58 mg in *burufulo*. Iron composition of the dishes ranged from 125 mg in *onunu* with catfish pepper soup to 193.77 mg in *ohwe ede etcha* (*fufu*).

4. DISCUSSION

4.1 Focus Group Discussion and Documentation of Frequently Consumed Traditional Dishes among by Pre -School Children

Focus group discussions in both upland and coastal regions revealed that soup with cassava were mainly consumed with cassava either as *garri* or *fufu*. This is not much of a surprise as similar reports by Davidson et al. [8] and De Moura et al. [9] confirmed the same food consumption pattern in their study of nutrient composition of cassava and cassava intake among preschool children in South-East (Anambra, Imo, Enugu, Abia and Ebonyi State) Nigeria and South-South(Akwa-Ibom State) Nigeria, respectively. Cassava is the most important staple for rural households in Nigeria [10] because it is available all year round (thereby contributing to the fight against food insecurity), fits well into small-scale farming system being practiced in the area, tolerant to low soil fertility and more resistant to drought, pest and diseases [11]. Cocoyam is also chiefly used to thicken most of the soups. Cocoyam (taro and tannia) is a root tuber that is easily cultivated and readily available especially in rural areas. It is a good source of carbohydrate with easily digestible starch and also contains more crude protein and essential minerals, such as calcium, phosphorous and magnesium than yam and cassava making it nutritionally superior [12]. Other foods less consumed were yam, plantain, and corn with dry fish, coconut and pear. Boiling which is the common method of cooking food by the caregivers, makes the food softer and easily digested. This makes it a suitable method for cooking meals of preschool children who are still in their growth and developmental stage of life. Most frequently consumed foods in the study area were plant based and were usually eaten with animal proteins which have better quality proteins and contributes several other nutrients necessary for growth and development such as vitamin B_{12}, iron, zinc and phosphorus. Availability, affordability, nutrition knowledge and ease in preparation were some factors that influenced consumption.

4.2 Proximate Composition and Energy Value of Frequently Consumed Traditional Foods by Preschool Children (2-5 years) Per 100 g

Energy content of the dishes ranged from 125.34 kcal/100 g in *burufulo* to 187.11 kcal/100 g in *amafulo.* The energy values obtained in these foods were less when compared with the WHO recommended values (1300kcal/day for ages 1-3, and 1800kcal/day for ages 4 -6years), however, this is just one of the meals in the day; energy requirement can be made up through other meals taken in the day. The values obtained in this study were less than those obtained from studies on the evaluation of "*mberiagworagwo*" (470.13± 0.90%), a traditional dish consumed by *Uruagu* Nnewi people in Anambra state Amadi, et al., [13], o*nunu and mgbam* (499.39±48.73%) consumed by *Ikwerre* people of Rivers State [13].

Moisture content of foods analysed ranged from 69.00g/100g in *Amafulo* being the least to 77.01 g/100g in *burufulo*. Moisture content in foods is dependent on the type of dish, the amount of water used in preparation and the ingredients used. It is also an indication of a short shelf life due to microbial spoilage and less concentrated nutrients [14]. Moisture content influences the taste, texture, weight, appearance and shelf life of the food [15]. *Burufulo* is yam pepper soup hence the high moisture content.

The ash content was highest in *Ofe-ede* with *fufu* (1.23g/100g) and least in *Odorfulo* with *eba* (0.66g/100g). Ash content in foods is an indication of the mineral content of the food. These figures are surprising and disappointing because the main ingredients in *odorfulo* are seafoods which are good sources of minerals such as calcium, zinc, iodine, vitamin A [16], fatty acids and proteins (Golden et al., 2016) which are essential for cognitive function and development, oxygen transport, hormone and metabolism regulation, growth and immune system function.

Protein contents of the dishes ranged from 5.25g/100g in *okurufulo* to 7.03g/100g in *Amafulo*to. This is small when compared to the 13 – 19 g/day recommended by WHO for this age group. Adequate protein intake in early life has been shown to positively impact on the height and weight of children 3 to 10 years of age [17]. A study conducted in Ghana by Ghosh et al., [18] also found an association between quality protein intake and the risk of being stunted. Protein also contributes to healthy immune system, improvement of satiety and appetite control [19].

Fat content of the dishes ranged from 8.30g/100g in *Burufulo* (the least) to 17.64 g/100g in *Amafulo*. These values were less than those obtained from other studies with similar ingredients and preparation such as "*Mgbam*" (36.35±2.32%) and "*Nduduagworagwo*" (18.75 ± 0.06%) as reported by Amadi et al., [20] and Duru et al., [21], respectively. The finding in this study is within the range of value reported for "*uha soup*" (10.74 ± 0.05%) by Obiakor, Okeke, Obioha and Onyeneke, (2014). *Amafulo* is particularly high in fat because palm fruit extract, (palmoil) (*Elaeisguineensis*) is used in its preparation. Palmoil is a good source of beta-carotene, it boosts the immune system, improves eyesight, improves neurological development and brain function especially in early childhood and reduces toxins in the body [22]. This is why it is widely accepted and included in most Nigerian diets. Dietary fat has been so criticized that its advantages are sometimes ignored. The fact that children and adults need fat in their diets cannot be overemphasized. Dietary fat also supplies essential fatty acids (EFA) and helps in the absorption of fat-soluble vitamins A, D, E and K.

Crude fibre content of the dishes ranged from 0.53 ± 0.04 g /100g in *odorfulo* with *eba* to 5.13 ± 0.04%/100g in *Amafulo*. Fibre is essential in the diet of children to prevent constipation though when consumed in excess can irritate their bowel, hence it should be given to them with [13]. However, when compared with the values as recommended by WHO (19g/day for ages 1 – 3 and 25g/day for 4 -y 6 year olds), the values obtained in this study are too small, making it inadequate in providing the required levels. According to USDA [23], children over two years of age should increase dietary fibre intake to an amount equal to or greater than their age; that is their age + 5 g/day. This increases from 8 g/day at age 3 years to 25 g/day by age 20 years. This range is considered safe even for children and adolescents with marginal intakes of some vitamins and minerals.

Carbohydrate content of the foods was low across all foods analysed when compared with the 130g/day as recommended by WHO for this age group. The values ranged from 6.92g/100g in *burufulo* as the highest to 0.04g/100g in *okurufulo as* the least. This was because emphasis is on the quantity of soup which always almost doubles the *eba* or *fufu*. The carbohydrate in *burufulo* is attributed to its main ingredient which is yam (*dioscoreaspp)* from the root and tubers food group. The carbohydrate contents of most of these foods (apart from *onunu* and *burufulo*) were mainly from the *"garri* and *fufu"* eaten with the soup and the cocoyam used in thickening the soup. Preschool children like all other children are naturally inclined to be very active hence the need for constant supply of energy especially from carbohydrates because it is the body's preferred source of energy used to support bodily mechanisms and physical activity [14].

4.3 The Micronutrient (vitamin A, Folate, Iron, Iodine, Zinc, Folate and Calcium) Content of the Identified Frequently Consumed Traditional Dishes

Amafulo with *eba*" (244.929g ± 4.02) was the only food that met the recommended dietary allowance for vitamin A for the age group under study (200-400 mcg daily) [24]. This might be due to lack of nutrition education about food preparation and combination of the right ingredients. Similar study was conducted on three indigenous foods consumed by Ngwa people of Abia state; only *akidi* had a vitamin A content of 17.97 ± 0.01mg/100g, while vitamin A was not detected in "*Ofe achara"* and "*akara-igboro"* [25].

All dishes analysed were good sources of zinc, iron, and calcium because they exceeded the recommended allowance which is 3 – 5 mg/day(zinc), 7 – 10 mg/day(iron) and 500 – 800 mg/day (calcium), respectively. This makes them suitable for people of all ages especially the preschoolers who are at a crucial developmental stage. These figures were grossly higher than the ones found in some traditional dishes consumed in Nsukka (Eastern Nigeria) as reported by Davidson et al., [26]; with zinc content ranging from 0.1 mg/100 g in "*okpa"* to 0.4 mg/100 g in "*Igbangwu*" while iron content

ranged from 2.0 mg/100 g in "*okpa*" to 2.1 mg/100 g in "*Ayaraya ji*. Similar analysis carried out on twenty-five (25) local foods frequently consumed in Nigeria showed that the top three dishes with high iron contents were rice with beans (24.01 mg/100 g), yam porridge (22.21 mg/100 g) and *eba* with *okazi* (19.55 mg/100 g) [27] Zinc was highest in *eba* with *okazi* (8.31 mg/100 g), rice with beans (7.39 mg/100 g) as well as *waina* (6.06 mg/100g) (2.19 mg/100 g) [27].

The high calcium content of some of these dishes might be linked to the seafoods (fish, periwinkle, prawns, clamps, crayfish) used in preparing these dishes. A similar study conducted on traditional foods consumed by the Ngwa people of Abia State had calcium content range of 49.03mg/100g in *ofeachara* mixed with *mgbam* and *garri* to 7.92mg/100g in *akidi*. The calcium in "*ofeachara* mixed with *mgbam* and *garri*" could be likened to the constituents of the soup - stockfish and the "*achara*" used for the preparation of the dish [25]. Another study conducted by Kayode et al., [28] on the micro nutrient content of some selected indigenous soups in Nigeria reported different concentration of calcium. In the south-south region, "*Afang*" soup was observed to have the highest concentration of calcium (850±5.00 mg/100 g) with "*edikang-ikong*" having the lowest concentration (120±2.52 mg/100 g). In the South-East, very low concentration of calcium was observed in "*Egusi + ugu*" (4.00±0.31 mg/100 g), while "*onugbu*" had the highest concentration (320±1.15 mg/100 g). In the Southwest zone, "*soko*" had the highest concentration of calcium (500±1.15 mg/100 g), "*gbegiri*" had the lowest (75.0±1.52 mg/100 g). Northern region recorded groundnut vegetable soup as having the highest concentration of calcium (190±2.64 mg/100 g), while beans vegetable and groundnut had the least values of calcium at the same concentration of 90.0±1.15 mg/100 g. The recommended intake for preschool children is 500-800 mg/day [29].

The folate content of all foods analysed were very low in comparison with recommended values (150 – 200 mcg). This is an indication of poor consumption of fruits and green leafy vegetables which are known to be good sources of folate. Another reason could be that most of these traditional leafy green vegetables (TGLV) are actually consumed but the preparation process of cutting and washing them before they are cooked causes leaching of all the folate contents as opined by Delchier et al., [30]. Overcooking vegetables can also destroy its folate content. Folate is essential in synthesis of amino acids, aids the production of red blood cells and facilitates quick cell growth in children. Other traditional foods analysed in similar studies also had low folate levels; 10.95 mcg/100g (Ukam, et al., 2020)), 3.06 mcg/100g Aburime et al., [31] and 3.1 mcg/100g - 18.7 mcg/100g [32].

Iodine content of foods in this study ranged from 4280±360mcg/100g (the least) in *onunu* with catfish pepper soup to 11340 ± 1070 mcg/100g (the highest) in *ede* soup with *ogbolo.* The iodine content of these foods exceeded the recommended values – 90 mcg/day. The high iodine content can be attributed to the seafoods used in preparing most of these foods in this study. Seafoods have been reported to be high in iodine. This implies that iodine deficiency may not be a problem in the study area. A study on twenty three frequently consumed foods in Zaria metropolis reported lower iodine content of foods ranging from 62.06mcg/100g in fried beans with pap to 2056.23mcg/100g in *tuwon masara* with dry okra sauce [33]. Another study conducted in Ijebu North Local Government Area of Ogun State, Nigeria also reported that the iodine content of the fruits and vegetables significantly varied with the highest content observed in plantain *(M. paradisc*) 258.83 ± 11.43 mcg / 100 g to 2.43±0.01mcg / 100 g in grapes *(Citrus paradise*) among the six fruits analysed, while among the five vegetables analysed tete *abalaye* (*Amaranthus hubridus*) had the highest iodine value of 58.36 ± 1.88 mcg/100g and the least value was observed in *Ugu* (*Teleferia occidentalis*) 23.94 ± 1.88 mcg/100g [34],[35-38].

5. CONCLUSION

Most of the foods consumed were plant based, similar in ingredients and accompanied with animal proteins. Boiling was the most used method of cooking food for preschool children. It makes the food softer and easy to chew on by the preschool children. The frequently consumed traditional dishes analysed contained adequate amounts of energy, macronutrients and micronutrients that are of public health concern to preschool children except folate which was much lower than recommended reference values. Calcium in *burufulo* was also less than the reference value (800 mg).

6. LIMITATION OF THE STUDY

Due to limited funds, only 8 identified frequently consumed dishes were assessed in the study as it was self-funded by the researcher.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT AND ETHICAL APPROVAL

Ethical approval for the study was obtained from Rivers State Ministry of Health (MH/PRS/391/VOL.2/717), while informed consent in writing was obtained from the mothers/ caregivers who participated in the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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