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*Full Length Research Paper*

# Energy and nutrient contents of "waterfufu and eru"

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**Because of persistent reports of malnutrition in some parts of Cameroon, a popular Cameroonian food, "waterfufu and eru" was analyzed for its energy value and nutrient content in order to determine to what extent it satisfies recommended dietary allowances (RDA). Results showed that average serving size of the dish was 409 g. This amount provided 601 kcal of energy, 281 g of moisture, 82 g of carbohydrate, 30 g of lipids, 11 g of protein and 5 g of ash on fresh weight basis. Micronutrients were found to be 1402 mg iron and 123 mg zinc. After due adjustment for absorption and bioavailability and considering the one serving size, constituted one of a three meal/day regime, although there was no significant difference (P > 0.05), lipid, zinc and iron contents of the dish satisfied RDAs of all groups of consumers while energy value, carbohydrate and protein contents did not. This suggested that dependence of communities on this diet for supply of their daily needs may partly be responsible for the reported prevalence of malnutrition in these areas. It was suggested the food be improved upon through fortification and/or supplementation with the necessary elements.**

**Key words:** Malnutrition, Cameroon, "waterfufu and eru", RDAs.

## INTRODUCTION

"Waterfufu and eru" is a traditional dish popularly eaten in Cameroon and neighbouring Nigeria. It is made up essentially of a cooked cassava (*Manihot esculenta* Crantz) dough ("waterfufu") and a vegetable soup ("eru") whose major component is "eru" (*Gnetum africanum* Welw) leaves. The two components of the dish are prepared separately but served together (Abia, 2003).

Previously the dish was associated with a particular tribe (the Banyangs) as it was their staple meal. But in recent years, almost all ethnic groupings, especially those from the South West and North West Provinces have learned to cook and eat "waterfufu and eru". Its popularity has spread to attain national dimensions (Ewane, 2001).

The dish forms a regular part of the menu in many households, parties, occassions and local restaurants, particularly in the forest zones of Cameroon. The social, cultural and economic value of eru cannot be overstated (Ewane, 2001; Abia, 2003). In addition, 'eru' is one of the commonest vegetables eaten in Cameroon today (Ewane, 2001). In some communities, it is not uncommon that the dish constitutes the three meals of the day in some households (Abia, 2003). Because of the popularity and high frequency of consumption of the dish in some parts of the country, there is a need to know what contribution it makes to the well being of its consumers especially as malnutrition continues to be reported in these areas (Numfor and Noubi, 1995; Horemans and Jallow, 1997; IFRC, 2007). Malnutrition affects every 1 in 5 children in Cameroon, and was reported to have increased by 5.9% from 1991 (15.1%) to 1998 (21.0%), contrary to the country's 1991 goal; to reduce malnutrition by 50% by the year 2000 (UNICEF, 2002; ANB-BIA, 2002). More recent-ly, according to IFRC, (2007), the prevalence of malnutri-tion for the under fives stands at 27% and is most likely to increase. Horemans and Jallow (1997), documented that there are nutritional imbalances or deficiencies (in ener-gy, protein and iron) particularly in the forest regions of Cameroon. Similarly, Ifeyironwa (2000), reported high level of anemia due to iron deficiency in Cameroon. Des-pite the apparent and reported malnutrition in the South West Province of Cameroon (Horemans and Jallow, 1997), no study has been documented on the impact of the popular diet "waterfufu and eru" on the nutrition and health of its consumer population. Therefore, this paper reports the nutritive value of the dish and within estimated limits of absorption, the extent to which it satisfy the recommended daily energy and nutrient requirements of

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**Table 1A.** Percentage contribution of "waterfufu and eru" to RDAs of children (7-10 years) and P- values.

| Issue | Lipid (g) | Protein(g) | Carbohydrates (g) | Zinc (mg) | Iron (mg) | Energy Value (Kcal) |
|---|---|---|---|---|---|---|
| **Diet** | 25.8 | 9.6 | 69.8 | 6.2 | 70.1 | 511.4 |
| **RDA** | 53.0 | 34.0 | 309.0 | 10.0 | 23.0 | 1900.0 |
| **%RDA** | 48.7 | 28.2 | 22.6 | 62.0 | 304.8 | 26.9 |
| **P-value** | 0.4400 | 0.7863 | 0.5363 | 0.1995 | - | 0.7275 |

three categories of its consumers namely children 7 - 10 years, adult females 19 - 50 years and adult males 19 - 50 years.

## MATERIALS AND METHODS

The research was carried out in the South West Province of Cameroon based not only on the apparent and the reported malnutrition in the province (Horemans and Jallow, 1997) but also due to the high dependence on the diet, "waterfufu and eru" (Abia, 2003).

Food samples were purchased randomly from amongst some previously surveyed restaurants in 5 communities (Limbe, Tiko, Buea, Muyuka and Kumba) in the province, labeled and carried to the Chemistry Analytical laboratory of the Institute of Agricultural Research for Development (IRAD), Ekona Regional Centre, Buea, South West Province Cameroon where the average normal serving seize was determined and the samples processed for subsequent analyses.

The analyses included determination of moisture content by drying samples in a draught oven at $105^{o}$ C until a constant weight was obtained. On dry weight basis, Lipid content was obtained by hexane extraction using soxhlet apparatus and later concentrated using rotavapour and allowed overnight for complete evaporation of the solvent, after which weight was taken.

Total nitrogen content was determined using an adapted colorimetric method of the analytical chemistry laboratory of IRAD, Ekona, Buea (modified AOAC, 1990): 0.03 g of re-dried samples were placed in to separate 100 ml tecator tubes, followed by addition of a quarter fraction of kjeldahl tablet, 6 drops of distilled water, and 2 ml of concentrated sulphuric acid. The contents of the tubes were swirled gently for a few seconds to mix. The tubes were then arranged in a rack and the rack was placed in a Tecator Block Digestor (maintained in a fume cupboard) and its temperature raised gradually to $370^{o}$ C and let to digest for 70 min after which the digest was let to cool in the fume hood. Thereafter, 50 ml of distilled water was added into each tube, swirled gently, its content made up to the 100 ml mark with distilled water, re-swirled gently and allow-ed to stand overnight for colorimetric determination of nitrogen. For colorimetric determination of nitrogen, 1 ml of each sample digest was pipetted into a fresh test tube and added 6 ml of buffer solution (50 g of sodium potassium tartrate and 26.8 g of di-sodium hydro-gen phosphate was dissolved in distilled water. 54 g of sodium hydroxide was dissolved in the above and made up to the 1000 ml mark of the volumetric flask with distilled water), 4 ml of sodium nitroprusside-sodium salicylate (150 g of sodium salicylate and 0.3 g of sodium nitroprusside were dissolved in distilled water and made up to mark of a 1000 ml volumetric flask), and 1 ml of sodium hypochloride solution or bleach solution (3 ml of commercial hypo-chlorite solution (10 - 12% Cl) was diluted in distilled water to 100 ml). These tubes were shaken to mix and allowed to stand at ambient temperature for 45 min for complete colour development to occur. Thereafter absorbance was read at 650 nm and the percentage nitrogen calculated as: Nitrogen (%) = Standard Factor (F) x $A_{650nm.}$ The standard factor (F = 12.081) is a value calculated from the amount of dry sample used and the volumes of the standards used for colorimetric determination. Hence the total protein (%) was obtained by multiplying total nitrogen (%) by 6.25 (standard converting factor from nitrogen (%) to protein (%),

Total carbohydrate (and fibre) content of the dish was determined by difference (subtracting the sum total of lipid, protein and ash from total dry matter content), meanwhile ash content was determined by incineration in a muffle furnace at 550 °C for 4 h, allowed to cool and weight taken. The micronutrient contents analyzed included zinc, and iron, which are currently a major concern in Cameroon and the developing world in general (Barbara, 2000; MI and UNICEF, 2004; Hotz and Brown, 2004), both using atomic absorption spectrophotometer (AAS).

Considering that due to anti-nutritional factors as well as body stores of each of the nutrient, not all the amount of the food consumed may be assimilated, assimilability of each nutrient in the diet, "waterfufu and eru" was estimated based on the dietary components (Latham, 1997). They were then compared with the Food and Agriculture Organization (FAO)'s recommended dietary allowances (RDAs) (Latham, 1997) of children 7 - 10 years, adult females 19 - 50 years and adult males 19 - 50 years (by multiplying the ratio of each nutrient content to its corresponding RDA by 100, so as to express the adequacy of each nutrient as a percentage of RDA it provides, and further statistically concluding whether the contribution made to RDA is significantly different from the requirement or not), after which some necessary recommendations were made.

## RESULTS

The "waterfufu" component of the dish which is a product of a starchy staple cassava tubers, is undoubtably the major source of carbohydrates, while the "eru" soup - which is a combination of shredded dark green eru leaves and other ingredients (pepper, red palm oil, crayfish, magi and cowskin mainly), is the ultimate source of lipid, protein and the minerals zinc and iron. Considering that eru (*Gnetum*) leaves, a dark green leafy vegetable, forms about 85% of the quantity of "eru" soup, it is most probably responsible for the rich micronutrient and even protein contents of the soup (Grivetti and Ogle, 2000).

Table 1A, 1B and 1C respectively), present -within the estimated limits of assimilability- the extent (percentage) to which nutrient contents in the whole diet contribute to to which nutrient contents in the whole diet contribute to the recommended daily energy and nutrient requirements of major consumer categories (children 7 - 10 years, adult females and males 19 - 50 years), as well as their p-values. On the basis that "waterfufu and eru" form one of three meals per day in the forest regions of Cameroon a one third contribution or more ( 33.33%) of a nutrient a

**Table 1B.** Percentage contribution of "waterfufu and eru" to RDAs of adult females (19-50 years) and P-values.

| Issue | Lipid (g) | Protein (g) | Carbohydrates (g) | Zinc (mg) | Iron (mg) | Energy Value (Kcal) |
|---|---|---|---|---|---|---|
| **Diet** | 25.8 | 9.6 | 69.8 | 6.2 | 70.1 | 511.4 |
| **RDA** | 62.0 | 49.0 | 359.0 | 12.0 | 48.0 | 2210.0 |
| **%RDA** | 41.6 | 19.6 | 19.4 | 51.7 | 146.0 | 23.1 |
| **P-value** | 0.6596 | 0.4109 | 0.4030 | 0.3650 | - | 0.5960 |

**Table 1C.** Percentage contribution of "waterfufu and eru" to RDAs of adult males (19 - 50 years) and P-values

| Issue | Lipid (g) | Protein (g) | Carbohydrates (g) | Zinc (mg) | Iron (mg) | Energy Value (Kcal) |
|---|---|---|---|---|---|---|
| **Diet** | 25.8 | 9.6 | 69.8 | 6.2 | 70.1 | 511.4 |
| **RDA** | 81.0 | 55.0 | 470.0 | 15.0 | 23.0 | 2895.0 |
| **%RDA** | 31.9 | 17.5 | 14.9 | 41.3 | 304.8 | 17.7 |
| **P-value** | 0.9519 | 0.3301 | 0.2405 | 0.6702 | - | 0.3375 |

to its recommended daily allowances was considered satisfactory or adequate.

Hence lipid, zinc and iron contents of the diet were observed to be in adequate amounts as each satisfies more than one third of their respective nutritional needs of the major consumer groups, while protein, energy and carbohydrate did not provide up to one-third of the RDAs of any of the considered population. However, no statistical difference ($P > 0.05$) was observed in either case. Although failure to satisfy the recommended dietary allowances does not in every case mean deficiency, however it is an indication of the likely hood and that the further contributed amount of any nutrient is below the RDA of a target category, thus deficiency is most likely.

## DISCUSSION

A fundamental strategy to ensure the well-being of a community with frequently reported malnutrition is the food-based approach which involve finding out the role of popular foods on the nutrition and health of its consumers. This was done by assessing the energy value and nutrient contents of a popular food ("waterfufu and eru") in Cameroon, whose communities in the forest zones in particular, highly depend upon. Thereafter, estimated assailable nutrient amounts were compared with the RDAs of major categories of consumers, and necessary conclusions and recommendations made.

The observed energy value and nutrient contents of the "waterfufu and eru" were obvious based on earlier reports on their respective raw material contents: cassava and green leafy vegetables (Bokanga et al., 1990; Oshidi, 1992; Mialoundama, 1993; Numfor and Noubi, 1995; Ejoh et al., 1996; Okafor et al., 1996; Chavez et al., 2000; Grivetti and Ogle, 2000; Danso et al., 2001, Sango, 2007) . Furthermore, it corroborates with the report of Abia, (2003), who reported that eru leaves in eru soup generally contributes at least 60% of each of the nutrients in the soup. Thus the whole diet, "waterfufu and eru", is balanced in terms of the various nutrients. Its energy value and nutrient content can be constituted into a food value table amongst others and made to the awareness of the public to probably appropriate diets of the population.

However, with the knowledge that not all that is eaten is bio-available, the nutrient contents were adjusted for assimilability based on the dietary components: starchy roots, vegetables and little -or in most cases no- animal protein. Thus, assimilability factor of each macronutrient (lipid, protein and carbohydrate) was similar to the factors of Latham (1997), and that of the micronutrients (zinc and iron) correlated with those of WHO, (1996) and Latham (1997) respectively.

The comparison on table 1 provides relevant information which probably serves as an indicator of the inadequacy of the diet and the risk of nutritional pathology amongst individuals who depend predominantly on the food. It reveals that, considering the diet as one of three meals of a day –although it is not uncommon that it is consumed as the three meals of a day in some parts of the forest zones in Cameroon (Abia, 2003)-, despite its seemingly balanced nature it does not in all cases satisfy the RDAs of the major consumer populations. These corroborates with the findings of Horemans and Jallow (1997). Similarly, protein-energy malnutrition is very like probably due to dependence on the diet which is predominantly made up of starchy staple and very little animal protein (Numfor and Noubi, 1995).

Nevertheless, giving that the contributions made by the diet to RDAs (whether they satisfactory or not) are not significantly different from the assumed one third part (33.33 %) of RDA of each nutrient content, and also due to the fact that RDAs are a range of safe values and not requirements, failure to provide recommended amounts of some nutrient contents is not conclusive of deficiency. That not withstanding, failure of a diet to provide the RDA

of its consumers is a vital indication of risk of nutritional deficiency and synergistically infections. Thus, the further the nutrient contents are below the RDA, the higher the risk of malnutrition and associated infections. Therefore, the apparent and reported malnutrition in the Province may be associated with the predominant dependence on this popular food, “waterfufu and eru” for proper nutrition and health.

## Conclusion

“Waterfufu and eru” contain the necessary nutrients. Energy and nutrient contents of a typical serving of the dish in restaurants in the forest zones of Cameroon does not in all cases satisfy the recommended daily energy and nutrient allowances of major categories of consumers. Though, there is no significant difference ($P > 0.05$) between the amount of nutrients provided and the RDA for these nutrients, nutritional imbalances or deficiencies are still very likely to occur in communities which depend predominantly on “waterfufu and eru”.

## Recommendation

Further studies on the absorption and bioavailability of the nutrients, including Vitamin A of “waterfufu and eru” are necessary. To meet protein allowances, inter-alia, more meat and less cow skin (“nkanda”) should be used in the “eru” soup, and/or diet fortification and supplementation, measures to conserve nutrients during processing and preparation, as well as the findings of this study should be made to the awareness and understanding of the population.

### REFERENCES


Abia WA (2003). Energy value and nutrient content of “waterfufu and eru” (a popular Cameroonian food). M.Sc. research Thesis, Faculty of Science, University of Buea, Cameroon.

ANB-BIA (African News Bulletin) (2002). Cameroon: Children under threat from Malnutrition, ANB-BIA supplement issue/edition Nr p. 442.

AOAC (Association of Official Analytical Chemists) (1980). Officail methods of Analysis. Washington D.C. 13th edition.

Barbara UA (2000). Overcoming micronutrient deficiencies in developing countries: Is there a role for agriculture? Food and Nutrition Bulletin. The Unite Nations University. 21(4) :357-359.

Bokanga M, O’Hair S, Narayanan R, Steinkraus K (1990). Cyanide detoxification and Nutritional changes during cassava (Manihot esculenta Crantz) fermentation. In: Aoureler, R. editor, Proceedings of the 8th Symposium of the International Society of Tropical Root Crops. Bankok, Thialand.

Chavez A, Bedoya M, Sanchez T, Iglesias H, Cebolles H, Roca W (2000). Iron, Carotene, and ascorbic acid in cassava roots and leaves. Food and Nutrition Bulletin. 21 (4): 410-413.

Danso K, Serfor-Armah Y, Nyarko B, Osae S, Osae K (2001). Determination of some mineral components of cassava (Manihot esculenta Crantz) using instrumental neutron activation analysis. J. Radioanalytical and Nuclear Chem. 250(1): 139-142.

Ejoh A, Tchouanguep M, Fokou E (1996). Nutritional composition of the leaves and flowers of Colocosia esculenta and the fruits of Solanum melongena. Plant food for human nutrition, 49: 107-112.

Ewane JS (2001). The Importance of Community Involvement in Conservation. BGCI Plants for The Planet.

Grivetti LE, Ogle BM (2000). Value of Traditional Foods in Meeting Macro- and Micronutrient Needs: The Wild Plant Connection. Nutr. Res. Reviews. 13(1):31-46.

Horemans B, Jallow A (1997). Report of the Workshop on Gender Roles and Issues in Artisanal Fisheries in West Africa, Lomé, Togo, 11-13 December 1996. Cotonou, Benin, Programme for the Integrated Development of Artisanal Fisheries in West Africa, IDAF/WP/97. p. 47.

Hotz C, Brown K (2004). Assessment of the Risk of Zinc Deficiency in Populations and Options for its Control. Food and Nutrition Bulletin. 25(1): 194-195.

Ifeyironwa F (2000). Micronutrient Interventions: Options for Africa Food and Nutrition Bulletin. 21(4): 532-537.

IFRC (International Federation of Red Cross and Red Crescent Society) (2007). Cameroon: population movement, DREF Bulletin no. MDRCM004.

Latham, M. (1997). Human nutrition for the developing world. FAO, Food and nutrition series, No. 29. FAO of the United Nations, Rome.

Mialoundama F (1993). Nutritional and Socio-economic value of Gnetum leaves in central African Forest. Tropical Forests, people and food: Biocultural interactions and applications to development. Parthenon Publishing Group. Carnforth, United Kingdom. pp. 177-182.

MI (Micronutrient Initiative) and UNICEF (United Nations Children Fund) (2004). Vitamin and Mineral Deficiency, A Global Progress Report. Adamson PP, LA. Oxfordshire, UK.

Numfor F, Noubi L (1995). Effect of full-fat soya bean flour on the quality acceptability of fermented cassava flour. Food and Nutrition Bulletin. 16 (3): 241-244.

Okafor J, Okolo H, Ejiofor M (1996). Strategies for enhancement of utilization potential of edible woody forest species of south-eastern Nigeria. In : Van der Maesen, L. et al., editors, The Biodiversity of African Plants , Kluwer, the Netherlands. pp. 684-695.

Oshidi A (1992). Comparison of protein, minerals and vitamin C content of some dried leafy vegetables. Parkistan J.Sci. industrial res. 35 :267-269.

Sango BA (2007). Micronutrient (Provitamin A, Iron and Zinc) Contributions from some African Leafy Vegetables to Diets in Fako Division of Cameroon”. Masters Thesis submitted to faculty of Science, University of Buea, Cameroon.

UNICEF (United Nations International Children’s Education Fund), (2002). Commitment 6: To reduce severe and moderate malnutrition of under –5 children to one half of the 1990 rate by 2000. World development indicators 2001 for approximate 11990 data. UNICEF website 2002 (http://www.childinfo.org/) for recent data.

WHO (1997). Third report on the world nutrition situation. United Nations Administrative committee on Coordination / Sub-committee on Nutrition. CACC / SCN), Geneva.

WHO (1996). Trace elements in Human Nutrition and Health. Geneva.