

Micronutrient Content of Traditional Complementary Foods

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Abstract

A study was conducted in Abeokuta the capital city of Ogun State situated in the southwest area of Nigeria. A questionnaire, used for the study, sought background information about the children, their parents and child feeding practices. A total of 150 correctly filled validated questionnaires were received from the lactating women. Four most frequently used traditional complementary foods (paps from both white and yellow maize varieties, millet and sorghum) out of the eight traditional complementary foods used by respondents in the study area were chosen for standardization and analysis. The iron, zinc and calcium contents were determined. Data from questionnaire were analyzed using descriptive analysis. The variations in micronutrient contents of the different cereal pap were determined using ANOVA. Almost half of the lactating women (42 percent) added crayfish to the pap. Micronutrient values of complementary food used by the lactating women were as follows, white corn pap, 14.23mg iron, 2.80mg zinc and 360mg calcium; yellow corn pap, 13.95mg iron, 2.90mg zinc, and 270mg calcium; sorghum pap, 14.31mg iron, 2.60mg zinc, and 280mg calcium; millet, 14.43mg iron, 3.00mg zinc, and 390mg calcium. Zinc content of the different cereal paps studied appears to be adequate. Iron contents of the cereal paps were found inadequate even with the addition of crayfish. Also the different cereal paps did not meet calcium requirements from complementary foods at all levels of breast milk intake common in developing countries. Promotions on enrichment strategies designed to improve the nutrient intake of infants should recommend high level of breast milk intake even for older infants and the addition of chicken liver instead of crayfish when mothers choose to use traditional complementary foods.

Keywords: Micronutrient, complementary foods, cereal pap, iron, zinc, calcium

Introduction

Micronutrients are those vitamins and minerals needed in very small amounts that must be supplied by a variety of foods in the diet (Probart 2003). They are the essential vitamins and minerals required by human beings to stimulate cellular growth and metabolism (Kennedy et al. 2003). Infancy is probably the period of life when nutritional demands are greatest, since weight triples and length doubles during the first year of life. Such rapid growth means that large amounts of minerals are required (Milner 1990). Iron, zinc, and calcium are called “problem nutrients” because they are difficult to supply from diets commonly offered to young children in low-income populations (Brown 1988). Complementary feeding is referred to as the period during which foods or liquids are provided along with continued breastfeeding (ACC/SCN 2001). It is recommended that all infants 6 to 9 months of age be breastfed and also receive complementary foods (WHO 2002). Studies have shown that by 6 months or less, only 17 percent of mothers in Nigeria are exclusively breastfeeding their infants, and between 6 and 9 months, 63 percent of mothers in Nigeria have introduced complementary foods while continuing breastfeeding (ACC/SCN 2004).

Cereal pap (ogi) is a Nigerian infant food (Akinrele 1967). It is known by different names in different regions of the country. It is a fermented cereal porridge that can be made from corn, sorghum, or millet. The cereal is fermented for a period of three days in cold water (30-32°C), ground and sieved by adding tap water to separate the husk of the cereal. The resultant paste is cooked by adding boiling water and stirring. Because of the frequency with which cereal paps are consumed by infants, several studies have been undertaken to define the composition of this fermented cereal porridge (Akinrele and Bassir 1967, Banigo and Muller 1972, Oguntona and Akinyele 1995). However, to our knowledge, no study has been undertaken to define the micronutrient composition of the prepared cereal pap using data collected from mothers.

Data on micronutrient quality of cereal (ogi) is essential to better manage the diets of infants and, therefore, their nutritional status. Thus, the aim of this study was to determine the most commonly used cereal in the preparation of ogi in the study population and to provide information on the iron, zinc, and calcium content of the cereal pap made by the lactating women.

Materials and methods

This study was conducted in Abeokuta, the capital city of Ogun State, which is situated in the southwest area of Nigeria. Abeokuta was chosen because lactating women from various areas visit it for medical care. A structured, questionnaire was validated by lactating women that are not part of the study group and used for the study. The questionnaire was administered to every lactating woman who cooperated with the researcher on each study day. The questionnaire

sought background information about the children and their parents, which included age, sex, ethnic origin, marital status, religion, educational level, occupation, income, household size, birth position of the children, and information on child feeding. The data on child feeding included the complementary food used, its method of preparation, and quantities of ingredients used in the recipe preparation. A total of 150 correctly completed, validated questionnaires were received from all lactating women attending postnatal clinics in all five primary health centers in Abeokuta South Local Government Area. Each health center was visited once during clinic days by one of the researchers, and all lactating women who were present and willing to participate in the study were sampled. Refusal rate was low: only one out of every 20 lactating woman failed to cooperate.

Preparation of cereal pap

Four of the most frequently used traditional complementary foods (Paps from both white and yellow maize varieties, millet, and sorghum) out of the eight traditional complementary foods used by respondents in the study area were chosen for standardization and analysis. The ingredients used in the preparation of the complementary foods were purchased from local markets where the lactating women shopped. The processing of the cereal to paste was done according to Steinkraus (1983). The paste was prepared using the means described in the recipes from all the lactating women who used traditional complimentary food. Amounts of each ingredient used for the standardized recipe were then calculated. Quantities were obtained from the women with the aid of common kitchen measures, cups, and spoons used for feeding babies. These have been made popular by nurses during postnatal clinics. The standardized recipes were prepared using the following ingredients: 50g of cereal paste, 5g of ground dry crayfish (*Penaeus notialis*), and 150ml water. Crayfish (*Penaeus notialis*) was included because it was added to the cereal pap by 42 percent of the lactating women. Optional ingredients that had a percentage usage of less than 40 percent were not included because, when considered individually, the percentage of each ingredient was not significant.

The preparation was performed in the laboratory kitchen of the Department of Nutrition and Dietetics, University of Agriculture, Abeokuta. The products were then exposed to sensory evaluation in the department. This was done to assess the acceptability of the standardized recipes. Ten panelists from among the staff of the University of Agriculture, Abeokuta, who were familiar with the recipes, were chosen. The panelists filled out questionnaires after each session. They evaluated attributes such as taste, flavor, color, and appearance of the complementary foods. All of the consumer tests were carried out in the early afternoon. The temperature and size of the samples were uniform. The testing area was clean and odor free, with white walls and uniform illumination from fluorescent lighting. The panelists were independent of each other and free of distractions. The evaluation scores were rated from five to one according to the level of acceptance or rejection of the complementary foods (ASTM 1968). The

acceptance level for this study was three. All recipes had a mean acceptability level of three and above, so the complementary foods were accepted for analysis. The samples were cooled to room temperature after preparation and stored in the refrigerator (-20°C) prior to analysis. The iron, zinc, and calcium contents were determined in triplicate by atomic absorption spectrophotometry using a Philips PU 9100X atomic absorption spectrophotometer (AOAC 1990). Data from the questionnaire were analyzed using descriptive analysis. The variations in micronutrient contents of the different cereal paps were determined using ANOVA.

Results and discussion

Respondents from this study were women under 30 years of age, and their infants were mostly between 6 and 9 months old. The popularity of traditional complementary food as recorded by Akinrele and Bassir (1967) is seen in this study (Table 1). ACC/SCN (2001) identified income as a limiting factor in the use of commercial complementary food. However, other factors such as culture may also have contributed since a majority (88 percent) of the lactating women who earn above N7,500 naira/month (the minimum wage for civil servants in Nigeria) prefer the use of traditional complementary food to commercial ones.

Only 10 percent of the women fed their infants complementary foods such as Amala and Ewedu (yam flour pudding with relish), Bean pottage (without the coat), Moin-moin (steamed bean cake) (Table 2). The majority fed pap prepared from cereals such as millet, sorghum, and maize. Steinkraus (1983) recorded that maize was commonly used in the south of Nigeria, while millet and sorghum were used in the northern areas of the country. Results from this study showed that sorghum pap was preferred by 42 percent of the women to other types of pap made from either millet, yellow, or white maize varieties. This may be due to the influence of Kwara state, which is on the boundary between the north and southwest of Nigeria.

During the preparation of the cereal pap, lactating women (i.e., those who use cereal pap as complementary food for their infants) added various ingredients to the pap. This may be attributed to the talks given by nurses during postnatal clinics. Ingredients added to the pap by the lactating women include ground crayfish (42 percent), egg (6.7 percent), sugar (6.0 percent), milk (18.0 percent), etc. (Table 3). The most popular ingredient used by the lactating women was dried ground crayfish.

The micronutrient content of the different cereal pap is shown in Table 4. Values recorded here for calcium and zinc are much higher than those recorded by Prentice et al. (1993) and Prentice and Paul (1990), who studied mineral density of some Gambian foods. This may be due to the addition of crayfish. The Administrative Committee on Coordination /Subcommittee on Nutrition (2001) reported that adding locally available animal products to the usual cereal could improve the quality of complementary foods fed to young children in developing countries. The

pap made from millet had the highest micronutrient value, but unfortunately this cereal was used least in the production of pap.

The four types of cereal pap analyzed were compared with estimated daily amounts of nutrients needed from complementary foods at different level of breast milk intake (Brown et al. 1998); this is shown in Tables 5 and 6. When at a low level of breast milk intake and fed white corn pap, yellow corn pap, sorghum pap, or millet pap, infants aged 6 to 8 months may have adequate zinc intake but a low iron and calcium intake. At an average level of breast milk intake, infants consuming white corn pap and millet pap may have an adequate intake of calcium and zinc but a low intake of iron. Sorghum pap and yellow corn pap could provide adequate zinc intake but a low intake of calcium and iron. At a high level of breast milk intake, infants consuming any of the four cereal paps may have an adequate intake of calcium and zinc but a low intake of iron. This may mean that at any level of breast milk intake, iron consumption among infants fed any of the cereal paps may be low. Calcium intake may be low for infants whose breast milk intake is low and who are consuming yellow corn pap or sorghum pap.

For older infants between the ages of 9 and 11 months who are on a low level of breast milk, the consumption of any of the four cereal paps may not be adequate in calcium and iron. At a high level of breast milk intake however, the four cereal paps may be adequate in calcium and zinc content but not in iron.

Conclusion

It is difficult to meet all of the micronutrient needs of infants and young children through home-based foods (ACC/SCN 2001). A study on different complementary foods used in developing countries showed that most of them could supply enough energy and protein, none had enough iron, but a few had enough zinc (Gibson 1994). Zinc content of the different cereal paps studied appears to be adequate. Iron content of the cereal paps was found inadequate, even with the addition of crayfish. This may be related to the high level of iron deficiency (27.5 percent) found among children under age five in Nigeria (Maziya–Dixon et. al. 2004). The different cereal paps also did not meet the calcium requirement from complementary foods at all levels of breast milk intake common in developing countries. This may explain the findings of Lartey et al. (1999), who found no improvement in growth or micronutrient status of Ghanaian children (6 to 12 months) who were given fermented maize porridge with dry fish powder.

Food-based approaches have received strong support as a sustainable means of meeting the nutritional needs of population groups (FAO/WHO 2002). Animal products are the only foods that can supply more iron, zinc, and calcium into the diets of young children (ACC/SCN 2001), however not all possess enough nutrient densities to meet the requirements. The addition of chicken liver is known to result in great increases in iron and zinc content of maize-based

complementary foods (Perlas and Gibson 2005). Promotions on enrichment strategies designed to improve the nutrient intake of infants should recommend a high level of breast milk intake even for older infants and the addition of chicken liver instead of crayfish when mothers choose to use traditional complementary foods. This strategy may be practical and affordable since traditional rearing of chickens is a common practice.

This information should be helpful for nutrition educators who work with or plan to work with populations in Nigeria or with participants who are similar to the Nigerian population described in this article. The opportunity may even present itself in the United States when working with emigrants and refugees. Understanding that it is difficult to meet all of the micronutrient needs of infants and young children through home-based foods will help when working with these mothers who have practiced traditional food-based approaches to feeding their families and need to learn new foods and practices.

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[Table 1: Personal characteristics of respondents](#)

[Table 2: Type of traditional complementary food used](#)

[Table 3: Additional ingredients used in the preparation of cereal pap \(ogi\)](#)

[Table 4: Micronutrient content of the cereal pap](#)

[Table 5: Evaluation of micronutrient content of traditional complementary foods using estimated daily amounts of nutrients needed from complementary foods for infants aged 6-8 months and usual breast milk intake in developing countries](#)

[Table 6: Evaluation of micronutrient content of traditional complementary foods using estimated daily amounts of nutrients needed from complementary foods for infants aged 9-11 months and usual breast milk intake in developing countries](#)