

NUTRIENT COMPOSITION OF CEREAL BASED ORAL REHYDRATION SOLUTIONS FOR MANAGEMENT OF DIARRHOEA IN INFANTS

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ABSTRACT

This study evaluated the nutrient composition of two cereal, millet and sorghum, based oral rehydration solutions. The test solutions were made from 50g of millet and sorghum each. The nutrient composition of the solution was determined using proximate analysis. The result showed that the mothers were aware of the salt sugar oral rehydration solution. However 57.7% did not know the proportion of the sugar and salt used in the preparation. These mothers had very little knowledge of any other substitute used in diarrhoea treatment. Most of the respondents (75.3%) consumed millet or sorghum. Sixty five percent gave millet or sorghum to their children as either a drink or porridge. The result of the sensory evaluation showed that the sorghum oral rehydration solution was more acceptable than the millet solution. The proximate analysis showed that the millet oral rehydration solution provided 170.2kcal of energy and 8.76% protein per litre, 0.8mg potassium per 100g and 22mg of sodium per 100g. The sorghum oral rehydration solution provided 170.2kcal of energy and 8.76% protein per litre, sodium 32mg/100g and potassium 1.4mg/100g.

Keywords: Cereal, Oral rehydration solution, Nutrient content, Acceptability

INTRODUCTION

Diarrhoea is one of the major causes of infants and young children mortality and morbidity in developing countries (WHO, 1998). About 4 million cases of diarrhoea are recorded every year with 2.2 million of the deaths mostly among children under the age of five in the developing countries and a significant cause of malnutrition in children (WHO/UNICEF, 2000). The effects and result from acute diarrhoea disease often depend on the nutritional status of the individual and the diet adopted during the illness (WHO, 2004).

Diarrhoea has been found to worsen the nutritional status of the individual due to vomiting, restricted diet and reduced food intake (Tomkins, 1981; WHO, 2004). World wide interest in the proper management of diarrhoeal disease in infants has led to the provision of the WHO/UNICEF glucose based oral rehydration solution. This has helped to reduce the number of deaths in 1970s from 5 million children world wide each year to just over 1 million by the beginning of the 21st century (WHO, 2004). However, this solution is only available in hospitals and health centers which are sparsely located in most rural areas of the developing countries. The alternative which is sugar salt oral rehydration therapy (ORT) has considerably reduced the morbidity and mortality of diarrhoeal diseases. However diarrhoea continues to

have a devastating effect on children in the developing countries (WHO, 2004). This home based sugar salt solution, has been found to be inconsistent as it does not provide the necessary glucose and electrolytes for optimum absorption. Furthermore, this therapy is not readily available in many rural homes in Nigeria due to the high cost of sugar.

There is therefore a need for an available, cheap, effective and acceptable oral rehydration solution (ORS) for diarrhoeal management in the rural communities. The alternative is the cereal based oral rehydration solution, which has been shown to be effective in replacing lost fluid, contribute to the nutrient intake of the patients, easily available, cheap, familiar and more acceptable (Molla *et al.*, 1989; Kenya *et al.*, 1989). Several authors have used different cereals in the preparation of cereal-based oral rehydration solution. These include rice (Ramadas *et al.*, 1985; Chowdury *et al.*, 1991) maize, mash potatoes and rice (Molla *et al.*, 1989). These author indicated that the sugar derived from starch hydrolysis tend to draw less fluid out of the body into the gut compared with a similar amount of simple sugar. Ramadas *et al.* (1985) indicated that the hydrolysis of starch releases glucose gradually which is absorbed rapidly and cereal ORS can be advantageously used in relatively large amounts without the risk of inducing osmotic diarrhoea. Cereal based ORS is more of food with some quantity

of salt (1 teaspoonful) and water (1 litre) component as that of the glucose-based ORS, while 20 g and 30 g of glucose and sucrose is replaced with 50 g of cereal flour. In addition, cereal-based ORS is available, cheap, effective, palatable and acceptable to patients.

The objective of this study was to assess the nutrient content, knowledge, acceptability and accessibility of cereal-based ORS for children with diarrhoea who are 6 – 24 months old.

MATERIALS AND METHODS

Procurement and Processing of the Raw

Materials: The study involved the preparation of cereal-based ORS using sorghum and millet grains. Millet and sorghum grains were purchased from local market in Nsukka, Enugu State, Nigeria. The grains were handpicked by removing the stones and foreign materials. They were soaked for 6 hours, degermed and dehulled and soaked for further 6 hours, dried, milled and sieved to produce fine flour.

Preparation of the Cereal Based Oral

Rehydration Solution: 50 g each of millet and sorghum flour were boiled separately in a litre of water with 3 g of salt added to each solution. The solutions were allowed to boil for 10 minutes, cooled and scooped into bowls for sensory evaluation and chemical analysis.

Chemical Analysis: Samples of millet and sorghum flour were analysed for moisture content, fat, crude fibre, crude protein, ash and energy value. Millet and sorghum salt solutions were analyzed for minerals, iron, calcium, potassium, phosphorus, magnesium and zinc using standards analytical methods. The moisture content of the sample was determined using the hot air oven method (AOAC, 1995). The ash content, fat was done by extraction method using soxhlet extractor; crude protein was determined using semi-micro kjehdahl procedure (AOAC, 1995). Crude fibre and energy were determined using standard methods.

Sampling Size and Population: A total of 150 mothers were purposively selected from Nsukka metropolis, Enugu State, to determine the accessibility and use of these cereals in their homes. A 20-men panel, which consisting of mothers, were used for sensory evaluation, which include colour, flavour, taste and overall acceptability.

RESULTS

The nutrient composition of the two cereal based ORS revealed that sorghum-ORS was more energy dense (170.20 kcal) than the millet- ORS (162.14 kcal) (Table 1).

The distribution and consumption of cereals by the respondents indicated that rice was the most consumed cereal (74 %) and millet was the least (0.7 %) (Table 2). However, 35.3 % of the families consume one type of cereal three times per week.

The frequency and percentage of consumption of sorghum and millet per week and the form it is being consumed revealed that 75.3 % of the families consumed millet/sorghum daily (21.2 %). Porridge (57.5 %) was the preferred form of consumption of these cereals. Other form of consumptions was as drink (45.1%). Sorghum-ORS was more acceptable than the millet-ORS (Table 4). However, the colour of millet-ORS was preferred.

Table1: Nutrient composition of 1 litre of the millet-ORS and sorghum-ORS

| Nutrient composition | Millet-ORS | Sorghum-ORS |
|----------------------------------|------------|-------------|
| Energy (kcal) | 162.14 | 170.20 |
| Proximate composition (%) | | |
| Moisture | 11.20 | 11.41 |
| Protein | 7.88 | 8.76 |
| Fat | 2.0 | 2.0 |
| Carbohydrate | 76.12 | 74.33 |
| Crude fibre | 1.80 | 2.0 |
| Ash | 1.0 | 1.5 |
| Minerals (mg/100g) | | |
| Sodium | 22 | 32 |
| Calcium | 11.43 | 12.86 |
| Potassium | 0.8 | 1.4 |
| Magnesium | 29.85 | 33.58 |
| Zinc | 2.75 | 2.46 |
| Iron | 3.42 | 4.65 |
| Copper | 0.60 | 0.28 |

Table 2: Frequency and percentage consumption of cereal products per week by families in Nsukka metropolis

| Most consumed cereal | Frequency | Percentage |
|---------------------------------|------------|------------|
| Rice | 111 | 74 |
| Maize | 28 | 18.7 |
| Wheat | 3 | 2 |
| Millet | 1 | 0.7 |
| Sorghum | 7 | 4.6 |
| Total | 150 | 100 |
| Frequency of consumption | | |
| Once | - | - |
| Twice | 48 | 32 |
| Thrice | 53 | 35.3 |
| 4-6 times | 19 | 12.7 |
| Daily | 30 | 20 |
| Total | 150 | 100 |

Table 3: Frequency and percentage of consumption of sorghum/millet per week and form consumed by families in Nsukka metropolis

| Consumption of millet/sorghum | Frequency | Percentage |
|---------------------------------|------------|------------|
| Yes | 113 | 75.3 |
| No | 37 | 24.7 |
| Total | 150 | 100 |
| Frequency of consumption | | |
| Once | 40 | 35.4 |
| Twice | 25 | 22.1 |
| Thrice | 23 | 20.4 |
| 4 - 6 times | 1 | 0.9 |
| Daily | 24 | 21.2 |
| Total | 113 | 100 |
| Form of consumption | | |
| Porridge | 62 | 54.9 |
| Drink | 51 | 45.1 |
| Total | 113 | 100 |
| Fed to children | | |
| Yes | 65 | 57.5 |
| No | 51 | 42.5 |
| Total | 113 | 100 |

Table 4: Organoleptic attributes and general acceptability of millet-ORS and sorghum-ORS by families in Nsukka metropolis

| Types of ORS | Organoleptic attributes | | | General Acceptability |
|--------------|-------------------------|-----------|-----------|-----------------------|
| | Colour | Flavour | Taste | |
| Millet-ORS | 3.72±0.31 | 2.93±0.22 | 2.47±0.31 | 2.73±0.25 |
| Sorghum-ORS | 2.4±0.25 | 3.25±0.23 | 2.87±0.31 | 3.25±0.35 |

DISCUSSION

New interest has developed in the use of home based cereal oral rehydration solution (ORS) in the management of diarrhoeal diseases. The WHO / UNCEF glucose based ORS has a constant composition and provides the necessary glucose and electrolytes for optimum absorption, however, these are imported and unavailable. The sugar-salt ORS has inconsistent proportion and do not provide optimum glucose and electrolyte absorption (Ramadas *et al.*, 1985).

The nutrient composition of the cereal based-ORS showed that sorghum-ORS was more nutrient dense than millet-ORS expect in zinc and copper. The energy and the protein content of millet-ORS (162.14; 7.88 %) and sorghum-ORS (170.20 kcal; 8.76 %) contribute 5.1 % and 6.6 % of recommended energy allowance respectively of infants. Analysis of the cereal based ORS showed that they contain several minerals and electrolytes. These contribute to the improvement of children nutritional status as most of the nutrients are lost during diarrhoea episode. Studies with children have shown that cereal based ORS resulted in substantial reduction in stool output in the first 24 hours compared to the standard ORS (Molla *et al.*, 1990). Study by Murtaza *et al.* (1987) revealed that diarrhoea infants who were treated with rice-ORS had

significant reduction in fluid losses and more rapid weight gain than infants who received glucose-ORS. Ramadas *et al.* (1985) showed in his study that cereal-ORS reduced vomiting, stool output and duration of the diarrhoea. Kenya *et al.* (1989) showed in their study that infants who were treated with maize-ORS were successfully rehydrated within 24 hours compared to those who received glucose-ORS. Chowdury *et al.* (1991) compared the acceptability of rice-ORS to glucose-ORS and revealed that the mothers unanimously agreed that rice-ORS stopped the diarrhoea more quickly than glucose-ORS. These mothers, the authors indicated can prepare and use cereal-ORS quite easily to treat dehydration and this method will increase the utilization of oral rehydration therapy in rural homes.

The result of this work also showed that the mothers consumed these cereals either as a drink or porridge and the babies were fed with it. This would be easier for the mothers as they are familiar with the cereals and they can easily use it as a rehydrating solution. These cereals are accessible, easy to make and affordable. The organoleptic study showed that the sorghum was more acceptable by mothers than the millet-ORS. However most of the mothers consumed either millet or sorghum and were fed to their babies.

In conclusion the result of the study showed that the cereal-based ORS prepared from millet and sorghum flours contributed varying degrees of nutrients to patients' nutrient intake. There is a possibility that this will improve the nutritional status of patients with diarrhoea. The cereal-based ORS is easily available and accessible to the mothers. They are easy to prepare compared to the sugar salt solution that requires the knowledge of the right amount of salt and sugar to be added. Furthermore, there is the problem of available clean water to use in the preparation of the sugar salt solution, which may further complicate the problem of diarrhoea in these infants. The sorghum-ORS was more acceptable by the mothers than the millet-ORS. However, both cereals were used by the mothers in their homes and are given to the infants in the form of drinks and gruels. This may be an alternative to the sugar/salt solution or the glucose solution.

REFERENCES

- CHOWDURY, O. B., KARIM, A. M., RHODE, F., AHMED, J. and ABED, F. H. (1991). Oral rehydration therapy: A community trial comparing the acceptability of home made

- sucrose and cereal based solution. *World Health Organization Bulletin*, 69: 228 – 234.
- KENYA, P.R., ODERGO, H. W., OURDO, G., WAWA, K., MUTTUNGA, K., MOILA, A., GREENOUGH, W. B. and JUMA, P. (1989) Cereal-based ORS. *Archives Disease of Children*, 64(7): 1032 – 1035.
- MOLLA, A. M., RAHDE, J. and GREENOUGH, W. B. (1989). Turning off the diarrhoea, role of food and ORS. *Journal of Paediatrics Gastro Nutrition*, 8: 81 – 84.
- MOLLA, A. M., NATH, S. K., KHATUN, M. (1990). Food based ORS for acute childhood diarrhoea. *Lancet*, 86: 429 – 431.
- MURTAZA, A., ZUFFIGIA, I., KHAM, S. R., LINDLAND, B., SAHLGREN, B. A. and APERIA, A. (1987). The benefits of the very early introduction of powdered rice and edible seeds in the ORS during the treatment of acute infectious diarrhoea of infancy. *Acter-Paediatric-Scan*, T6: 861 – 864.
- RARNADAS, D., VAN SIDEUDAN, S. and BLACK, K., (1985) Rice flour based ORS for diarrhoea disease. *Tropical Document*, 18: 127 – 129.
- TOMKINS, A. (1981). Nutritional status and severity of diarrhoea among pre school children in rural Nigeria. *Lancet*, 1: 860 – 862.
- WHO (1998). Management of the patients with diarrhoea: Program for control of diarrhea diseases. World Health Organization, Geneva.
- WHO/ UNICEF (2000). Global water supply sanitation assessment. Report WHO/UNICEF, Geneva.
- WHO (2004) "Diarrhoea" what every family and community has a right to know about diarrhoea facts for life. WHO document. Geneva.