

Staple Food – Based Oral Rehydration Solutions

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INTRODUCTION

Diarrhea is still one of the major killers of children under five in the Central Highlands of Irian Jaya. One of the causes of this high mortality is related to the delay of the treatment for the dehydrated children.

To overcome this problem, Sugar Salt Solution (SSS) and even WHO-UNICEF Oral Rehydration Salt Solution (ORS) have been used for home-based treatment for early diarrhea with or without dehydration. Unfortunately, these solutions do not shorten the duration of diarrhea and/or decrease stool's volume and do not encourage parents to rely on these solutions only⁽¹⁻⁶⁾.

Rice-based oral rehydration solution was developed in some countries and the benefits of this solution have been proven by several studies⁽¹⁻⁶⁾. Unfortunately, rice is a luxurious thing and not always available for the people in the Central Highlands of Irian Jaya where sweet potato, banana, sago and corn are their staple foods.

Developing staple food-based oral rehydration solutions in the Central Highland will benefit the community.

MATERIALS AND METHODS

Preparation of the materials

Sweet potato (*Ipoema batatas*) and banana (*Musa domestica*) were peeled, then sliced very thin and dried under the sun for 4 hours. The dried slices of sweet potato, banana and corn were pounded with a simple wood mortar. The powder produced was dried again under the sun for 4 hours. The powder yielded from sweet potato, corn and banana were 19.2%, 20.8% and 18.2%, respectively.

Fifty grams of each powder boiled and stirred with distilled water for about 20 minutes [added until 1 liter of solution] and cooled in the air. Then all the samples were centrifuged, using

Heuich EBA 3S in 1000 rpm for 5 minutes. The supernatants were taken and two samples were prepared from each kind of powder.

Measurement of Sodium, Potassium and Glucose

1) Sodium and Potassium (Flame photometer method)

A standard solution (140 mmol/l of Sodium and 5 mmol/lof Potassium) was prepared (4 ml distilled water and 200 µl standard solution).

Two samples of 200µl materials each were added into 4 ml distilled water. As the concentration of sodium was low, the solution was not diluted further. But, for potassium measurement, dilution of 2 times was made.

The concentrations of sodium and potassium were examined by a 400 flame photometer [Corning Medical, England], with Acetylene gas pressure 1 kg/cm².

2) Glucose (GOD-PAP method [Boehringer Mannheim])

A standard solution was made (100 µl standard solution and 23 ml Reagent Glucose). Two samples of 10µl materials each added to 2.5 ml Reagent Glucose. All the materials were warmed at 37°C for 15 minutes in Waterbath model YB-131 (American Scientific Products). All materials absorbences were examined on Spectronic 21, (Bausch & Lomb) with filter 610 nm.

RESULTS

The concentrations of sodium, potassium and glucose in each sample were quite similar, except of the concentration of glucose in sweet potato (yellow). Banana has the highest sodium in the solution, and the potassium was not much different. Corn has the lowest sodium and potassium concentration.

Compared with the WHO-UNICEF Oral Rehydration Salt solution, all the staple food-based Oral Rehydration Solutions are hyponatremic, hypokalemic, and hyperglycemic (except yellow sweet potato, which is a hypoglycemic solution). Unfortunately,

the osmolarity of the solution were not examined so comparisons could not be made with the WHO-UNICEF ORS (**Table 1**).

Table 1. Concentrations of Sodium, Potassium and Glucose

Staple Food	Sodium (Mmol/l)	Potassium (Mmol/l)	Glucose (mg %)
Sweet potato, white	15.6 – 23.7	9.8 – 11.6	174 – 175
Sweet potato, yellow	28.0 – 37.3	8.7	47 – 49
Corn	9.3	3.7	112 – 113
Banana	37.3 – 46.6	7.5	168 – 171
WHO-UNICEF Oral Rehydration Salts ^(7,8)	90	20	111
Rice Flour Solution ⁽³⁾	1.4	2.0	

DISCUSSION

The sodium content of the solutions examined in this study did not differ very much from the concentration of sodium in Sugar-Salt Solution and was in the safety range of oral rehydration therapy used for home-treatment⁽²⁾. Compared with a study of Rice Flour Solution⁽³⁾, the sodium content in banana, corn and sweet potato solutions are higher. It means that the risk of hyponatremia with sweet potato, corn or banana solutions will be less than that of Rice-based Oral Rehydration Solution and the risk of hypernatremia is lower than WHO-ORS⁽⁸⁾.

The glucose content in corn is acceptable according the glucose content of home-made Sugar-Salt Solution and WHO-UNICEF ORS^(2,7,8). The other solutions have higher glucose content and this might be related to an increase of osmolarity⁽⁶⁾. Unfortunately, osmolarity of these solutions were not examined. Although glucose (monosaccharides and disaccharides) increased the osmolarity, starch in its polymeric form was found in the solution which decreased the osmolarity⁽⁶⁾, so the osmolarity might not be so high in these solutions. The high content of glucose in the solutions (except yellow sweet potato and corn) does not discourage the use of these solutions as the maximum glucose that can be absorbed in acute diarrhoea is around 2%. If the concentration was over 2%, it may cause osmotic diarrhoea⁽²⁾.

Besides those materials, the solutions could have some amount of protein, dipeptides, neutral amino acids or hydrolysed proteins which help to couple and to enhance the absorption of natrium and then, osmotically, water flow in the same direction⁽¹⁾. All of the contents found in the study of these solutions made

these staple food-based oral rehydration solutions suitable to be used as home-treatment of diarrhoea with or without dehydration.

Although preparing powders from the staple food are time-consuming, the benefit of preparing the powder does not only lie in using the powder as a home-based oral rehydration solution, but also can be used as the weaning food for babies in the Central Highland of Irian Jaya.

A further study is needed to assess the impact of these staple food-based oral rehydration solutions use in the treatment of dehydration among children under five in the highlands of Irian Jaya.

CONCLUSION

The staple food (sweet potato, corn and banana)-based oral rehydration solutions have quite similar contents of minerals and glucose as in Sugar-Salt Solution, Rice-based Oral Rehydration Solution and WHO-UNICEF ORS.

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