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A comparison of bottle tops, teaspoons and WHO glucose-electrolyte packets for home made oral rehydration solutions in The Gambia

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Summary

Three methods of preparation of oral rehydration solution were taught to Gambian mothers and the sodium concentration and osmolality of the solutions prepared were estimated. Most of the solutions made up using WHO glucose-electrolyte mix had a satisfactory sodium content (70 to 120 mmol/l) and osmolality (200 to 350 mosmoles/kg). Of the sugar and salt mixtures using a teaspoon as a measure, 17% were hypertonic (>120 mmol sodium/l) and 24% were hyperosmolar (>350 mosmol/kg). Nearly all the sugar and salt solutions prepared using a soft drink bottle top as a measure had sodium contents of 30-88 mmol/l and none was hyperosmolar. We suggest that wider trials of this simple, widely available measure are indicated.

Introduction

The introduction of glucose electrolyte oral rehydration solution (O.R.S.) may drastically reduce mortality from diarrhoeal disease (RAHAMAN *et al.*, 1979). It may even improve the nutrition of children with diarrhoea when combined with dietary measures (International Study Group, 1981). Unfortunately

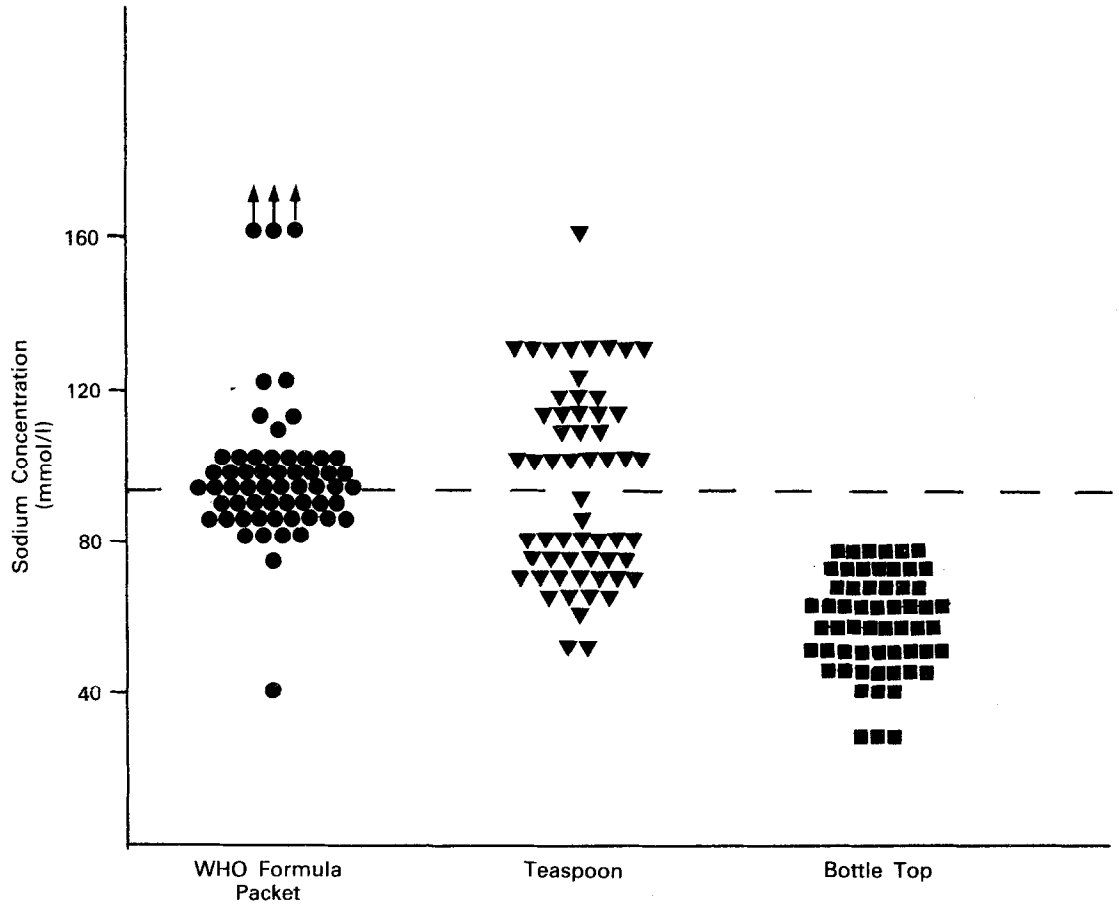

Fig. 1. Sodium concentrations of Oral Rehydration Solutions (mmol/l) prepared by three methods in The Gambia. The interrupted horizontal line indicates the sodium concentration when WHO formula solution is correctly prepared (90 mmol/l).

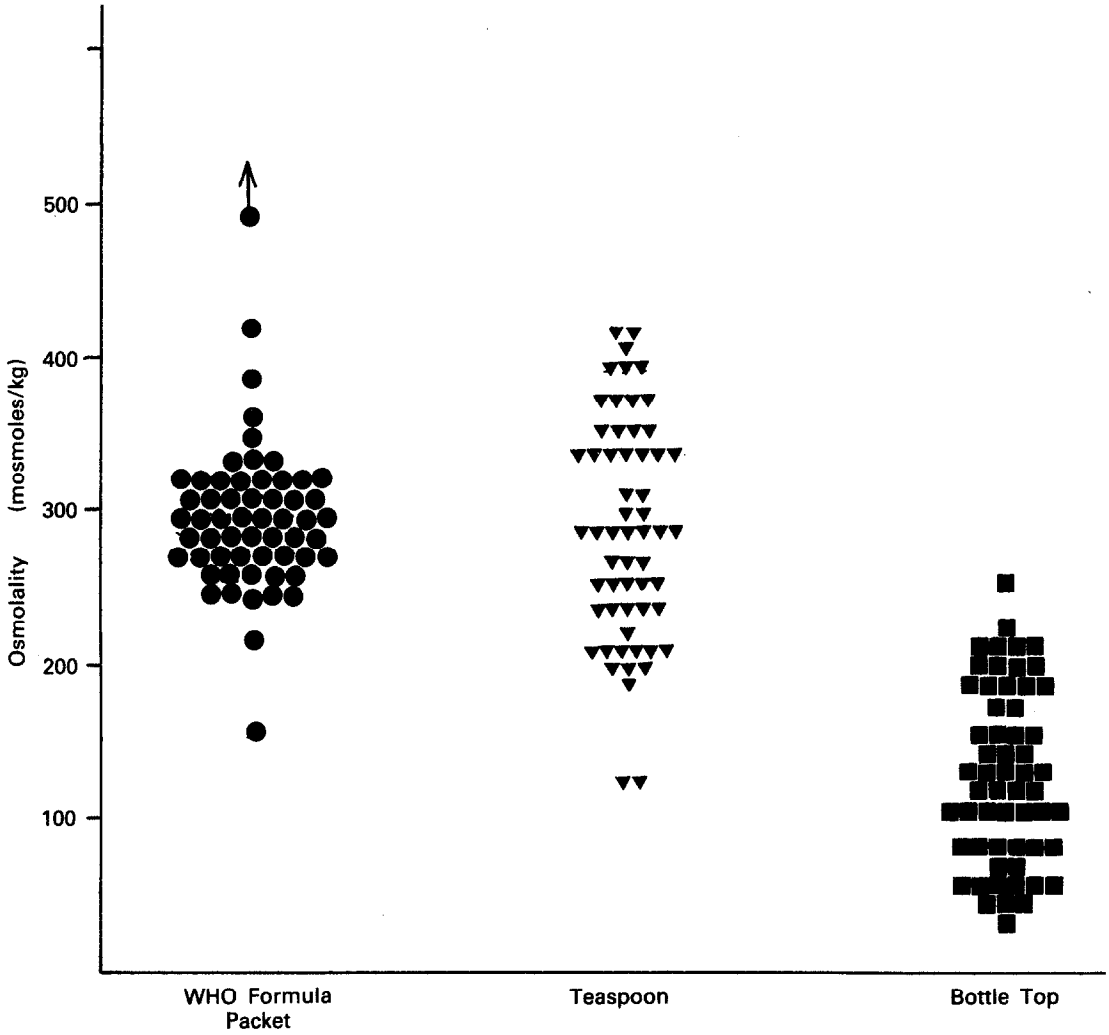

Fig. 2. Osmolality of Oral Rehydration Solutions (mosmoles/kg) prepared by three methods in The Gambia.

Table I—Three methods of preparing Oral Rehydration Solution (O.R.S.) in The Gambia

Method	Salt Measure	Sugar Measure	Water Measure
A	WHO Formula Packet*		1000 ml**
B	1 Level Teaspoon	8 Level Teaspoons	3 Soft Drink*** Bottles (900 ml)
C	1 Level Bottle Top	8 Level Bottle Tops	3 Soft Drink*** Bottles (900 ml)

* WHO Formula contains 3·5g Sodium chloride, 2·5g Sodium bicarbonate, 1·5 Potasium chloride, 20g Glucose.
** A litre bottle originally containing locally produced cooking oil.
***Julpearl is a soft drink manufactured locally and widely distributed throughout The Gambia.
O.R.S. made up by the authors using method C produced a sucrose concentration of 2·6 g/l (76 mmol/l), a sodium concentration of 75 mmol/l and an osmolality of 225 mosmoles/kg.

packets of WHO formula glucose-electrolyte mix may not be widely available for the treatment of diarrhoea in some developing countries. In the last few years there has been considerable effort to popularize the use of oral sugar-salt rehydration solutions in the home (CHURCH, 1972). Plastic spoons have been used successfully to prepare sugar-salt solutions of appropriate concentration (HENDRATA, 1978). Five ml teaspoons also produce reliable solutions (LEVINE *et al.*, 1981) but most rural Gambian families do not

possess a teaspoon and an alternative measure was therefore considered. Many families, even in remote rural areas, have access to a commercially manufactured soft drink which is bottled in The Gambia. The use of this measure, i.e. the bottle and its top, was therefore evaluated in making a simple oral rehydration solution in the home.

Methods

58 mothers of children with diarrhoea in Bakau, a peri-urban area of The Gambia, were given instructions in how to make up O.R.S. using the three regimes shown in Table I. The instructions were given by field workers who had no formal medical training but had been taught in O.R.S. techniques by a community physician. The mothers then made up the fluid in their own homes and a sample was collected the following day. Samples were stored at −20°C to prevent hydrolysis of sugar before analysis for osmolality (Osmometer, Wescor Inc.) and sodium content (Flame photometer, Instrumentation Laboratory Ltd).

Results

Sodium concentration

51 of 58 (88%) of samples made up from the WHO formula packet were in the range 80 to 120 mmol/l but in 9% sodium concentration was high (>120 mmol/l) (Fig. 1). 29 of 58 (50%) of the samples made with a teaspoon were in the range 80 to 120 mmol/l but sodium concentration was above 120 mmol/l in 17%. All the samples made with bottle tops as a measure had a sodium concentration of less than 80 mmol/l.

Osmolality

51 of 58 (88%) of samples made up from the WHO formula packet were in the range 250 to 350 mosmol/kg (Fig. 2). 28 of 58 (48%) of the samples made with a teaspoon were in the range 250 to 350 mosmol/kg but 24% were hyperosmolar. All except one of the samples made with a bottle top had an osmolality of less than 250 mosmol/kg.

Discussion

The value of complete formula for oral rehydration solution in the management of acute diarrhoea is already proven although there is still debate about the optimum concentration of sodium. In areas such as The Gambia where bottle feeding is rare the risk of hypernatraemic dehydration is low and 90 mmol/l is probably safe.

Most mothers were accurate in making up O.R.S. using packets although three mothers made up excessively concentrated solutions. They had evidently not understood clearly how to use the cooking oil bottle as a litre measure despite careful explanation. There is no immediate prospect of the domestic litre container becoming widely available in rural Gambia in adequate quantities. A previous study has emphasized the value of teaspoons as measures (LEVINE *et al.*, 1981) but we found an unacceptably high proportion of solutions prepared in this way had dangerously high sodium levels, probably due to variation in teaspoon size. In any case teaspoons are largely unavailable in rural areas of The Gambia. Fortunately, bottle tops and bottles are widely available even in the more remote villages of The Gambia. The satisfactory sodium content achieved with this measure was encouraging although the low osmolality may indicate insufficient addition of sugar. This may have been due to sugar sticking to and accumulating on fluted sides of the bottle top. Nevertheless concentrations achieved would be sufficient to stimulate absorption of sodium and water. This pilot study suggests that bottles and bottle tops provide a useful means of making-up simple sugar-salt solutions in the home in this community. Such techniques, using locally suitable measures, deserve trials in different areas in order to find appropriate and accurate ways of making a simple domestic oral rehydration solution.

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Note added in proof: Preliminary results of an assessment of the O.R.S. made up by village mothers after being instructed to pay more attention to accuracy, especially for sugar, show that they nearly all made a solution in the range 18 to 26 g/l of sucrose, 40 to 85 mmoles/l of sodium and an osmolality of 200 to 280 mosmoles/kg.