

## Original Article

# Focused gut-mucosal nutrition for diarrhoeal disease: improved nutrient therapy

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The main substrates fuelling ion absorption in the mucosa of the small intestine and large intestine are respectively glutamine and short-chain fatty acids. Measurements now reported showed that derivation of both glutamine and fibre for short-chain fatty acid production can be achieved from a single foodstuff – macerated groundnuts. Macerated groundnuts may be more suitable as an additive in oral rehydration solutions for promoting ion absorption than other agents that are low either in glutamine or fibre, such as rice water or resistant starch.

**Key words:** glutamine, groundnuts, oral rehydration solution, short-chain fatty acids.

## Introduction

Controversy remains concerning the most efficacious caloric additive for oral rehydration solutions (ORS) to promote ion absorption in severe diarrhoea.<sup>1</sup> Small intestinal epithelial cells are mainly fuelled by glutamine, which strongly promotes jejunal absorption of sodium.<sup>2–4</sup> The colonic mucosa is mainly fuelled by short-chain fatty acids (SCFA) derived by fermentation of fibre and these stimulate sodium absorption in the colon.<sup>2</sup>

As glucose does not strongly promote mucosal ion absorption, alternative metabolic substrates have been sought. The addition of rice water, rice water and glycine or amylase-resistant starch usefully promotes ion absorption in diarrhoeal conditions.<sup>5–7</sup> A single foodstuff that provides both glutamine, as well as dietary fibre for fermentation to fuel small and large intestinal mucosa, has not been used in ORS.

## Aim and purpose

The case for the combined use of glutamine and a suitable source of fibre for SCFA is strengthened by observations that the diarrhoeal effect of cholera toxin is dampened by glutamine in the small intestine and by SCFA in the large intestine.<sup>4,8</sup> Preferably, glutamine and dietary fibre should be supplied in a single foodstuff. A suitable food item which is readily found in countries with a high incidence of diarrhoea and which is available at a low cost are groundnuts. With the aim of utilising macerated groundnuts in ORS, the content of glutamine and dietary fibre of groundnuts, rice, and rice water was measured and compared.

## Method and results

Groundnuts and rice were obtained from commercial sources and ground with a pestle and mortar. Aliquots of ground foods were subjected to protein extraction with perchloric acid (20%), neutralised and hydrolysed by the enzymatic

action of glutaminase to yield glutamate. Glutamate was measured enzymatically and the glutamine content was the difference between before and after glutaminase action.<sup>9</sup>

Total dietary fibre of each food was determined by the method of Prosky *et al.*<sup>10</sup> with the exception of rice water because the fibre content was too low to measure. Results are given in Table 1. Groundnuts have 50 times more glutamine than rice water and contain, depending on processing, 4–25 times more dietary fibre than whole rice. The glutamine and fibre content of groundnuts is vastly superior to the levels found in rice water.

## Discussion

The advantage of a natural food source over commercially derived substrates for ORS is that they are readily available

**Table 1.** Total dietary fibre (TDF) and glutamine content of groundnuts, rice and rice water

Foodstuffs	TDF* (g/100 g)	Glutamine <sup>†</sup> (µm/gm)
Groundnuts, no skin, roasted	9.8	1.78 ± 0.05
Groundnuts with skin, raw	11.0	1.4 ± 2.3
Rice, white	0.4	0.17 ± 0.02
Rice, brown	2.7	0.21 ± 0.03
Rice, water <sup>‡</sup>	–	0.03 ± 0.02

\* Average of duplicate determinations from one batch, <sup>†</sup>mean ± SE of four estimations, <sup>‡</sup>fibre content was too low to measure.

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in local communities at little extra cost. Amylase-resistant starch and glutamine are only commercially available. Adding glutamine as a pure substance can result in the problem of storability, as the release of ammonia may occur at room temperature<sup>4</sup> thus necessitating refrigeration which is not often available. Groundnuts, apart from glutamine and fibre, also contain unsaturated fats necessary for nutritional repletion. The use of fermentable fibre in the colon improves absorption in diarrhoeal conditions.<sup>7</sup> On the basis of current results, the use of groundnuts in a macerated form in ORS appears an ideal form of nutrient therapy in diarrhoeal conditions and is worthy of a randomly controlled trial.

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