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## Processes involved in developing palatable micronutrient-rich snacks for a pre-conceptional and intra-pregnancy intervention trial: The Mumbai Maternal Nutrition Project

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Observational data suggest that suboptimal maternal micronutrient status as a result of poor-quality diets before and during pregnancy impairs fetal growth and development<sup>(1)</sup>.

The objective of the current study was to develop palatable food supplements produced from locally-available vegetarian ingredients that would improve the quality of the diet of young Indian women living in Mumbai slums. The supplements were to be used as a daily intervention in a currently-ongoing randomised controlled trial testing the hypothesis that 'enhancing the micronutrient content of women's diets before and during pregnancy would improve fetal growth and development of their offspring'.

A vehicle in the form of a cooked snack food, prepared by kitchen staff recruited from the local slum community in a low-tech kitchen, was developed. The snack was distributed to women 6 d/week and was designed to provide supplementary green leafy vegetables (GLV), fruit and milk. Samples of the snacks were chemically analysed to measure target levels of nine 'marker' nutrients. Acceptability of the snack was assessed by holding sensory evaluation sessions with project staff and trial participants assigning scores to the snacks based on taste, texture and appearance. As an objective measure of acceptability the women's compliance with consuming the intervention was recorded on a daily basis by project health workers throughout the trial and these data were used to assess the uptake of each snack as the trial progressed.

Results of sensory evaluation, objective compliance assessment and nutrient analyses were used to develop a vehicle that met the requirements for improving micronutrient intake, while at the same time being palatable and acceptable to the women. Over the course of the trial a variety of recipes were distributed to the women to prevent monotony. Acceptability and some target micronutrient levels were achieved using combinations of fresh GLV, dried fruits and milk powder. All snacks contained  $\geq 25$  g one or more of a variety of fresh locally-sourced GLV e.g. coriander (*Coriandrum sativum*), colocasia (*Colocasia esculenta*) or radish leaf (*Raphanus sativus*), 12 g milk powder and  $\geq 4$  g dehydrated fruit. In addition, the snacks contained binding ingredients such as chickpea (*Cicer arietinum*) flour or jowar (sorghum) flour. Mean micronutrient levels of the final product (per 60 g serving) were:  $\beta$ -carotene 123 retinol equivalents; folate 68  $\mu$ g; riboflavin 0.14 mg; Fe 4.9 mg; Ca 195 mg; vitamin B<sub>12</sub> 0.24  $\mu$ g. These values are between 12% and 43% of the UK estimated average requirements<sup>(2)</sup>. Target vitamin C levels were not achieved.

It has been demonstrated that it is possible to develop palatable culturally-acceptable and safe micronutrient-rich food supplements using a 'low-tech' approach, a local work-force and locally-available fresh and dehydrated ingredients. The effect of these supplements on the nutritional status of the mothers and the health outcomes of their babies is yet to be reported.

1. Rao S, Yajnik CS, Kanade A *et al.* (2001) *J Nutr* **131**, 1217–1224.

2. Department of Health (1991) *Dietary Reference Values of Food Energy and Nutrients for the United Kingdom. Report on Health & Social Subjects no. 41*. London: The Stationery Office.