Sodium hexametaphosphate (SHMP) as a stabilizer of double fortified (iron and iodine) salt does not alter the calcium and phosphorous homeostasis

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1. INTRODUCTION

Iron deficiency anemia (IDA) and iodine deficiency disorders (IDD) are two major nutritional problems that often co-exist in many parts of the world. The iodization of edible salt is a very effective strategy in reducing the prevalence of IDD. Salt has also been successfully tested in India as a fortification vehicle to improve iron status. We at the National Institute of Nutrition developed a common salt fortified with iron and iodine (Double Fortified Salt - DFS) to tackle the twin problems of IDA and IDD. Simultaneous fortification of salt was made possible with the inclusion of a chelating agent, SHMP at 1% level. The bioefficacy and safety of DFS has been established through a series of laboratory studies [1,2].

The stabilizer, SHMP belongs to a group of linear polyphosphates with the formula $Na_{15}P_3O_{40}$ - $Na_{20}P_{18}O_{55}$ which is an approved food additive [3]. This being a polyphosphate and its daily consumption as a component of DFS, doubts were raised about its influence on calcium (Ca) and phosphorous (P) homeostasis. The aim of this part of a large scale study on the impact of DFS in school children, was to investigate the effect of daily consumption of SHMP through DFS on Ca and P metabolism.

2. MATERIALS AND METHODS

A double-blind study carried out for a period of 2 years among residential school children, in the age group of 6-18 years drawn from four schools, two boy's and two girl's (n=800). One each from these schools were randomly allotted to the experimental group (DFS) and the other to control group (IS). The DFS and IS were used every day in the cooking medium as the source of salt and provided 1000 ppm of iron and 40 ppm of iodine and 40 ppm of iodine, respectively. At the end of the study period, random urine samples from 10% of the children and blood samples from boys were collected. Urinary excretion of Ca, P and creatinine and serum levels of Ca, P and alkaline phosphatase were estimated by standard procedures.

3. RESULTS

The urinary levels (mean±SE) of Ca in DFS group (327±44.9 in boys and 232±27,7 mg/g creatinine in girls) were not different from those of IS fed group (361±51.5 in boys and 394±77.6 in girls). The phosphorous excretion in urine were also similar in DFS (168±42.1 in boys and 223±40.0 in girls) and IS (128±20.1 in boys and 262±39.2 mg/g creatinine in girls) fed group. No changes were noticed in the serum Ca (7.1±0.18 in DFS vs. 7.2±0.2 mg/dL in IS) and P (6.0±0.27 in DFS vs 6.4±0.34 mg/dL in IS)

and alkaline phosphatase (145±21.2 in DFS and 169±14.3 IU/L in IS) in boys of DFS and IS fed groups. In addition, no undesirable features were reported with the use of DFS and IS in children.

4. DISCUSSION

Inorganic polyposphates such as SHMP are extensively used in food industry for various purposes [3]. Addition of SHMP to common salt fortified with iron and iodine has been shown to stabilize both these nutrients. The bioeffect and safety of long-term feeding of DFS containing SHMP at 1% level has been demonstrated in rats [1]. The same study also provided evidence for the lack of influence on Ca and P metabolism.

In the present study daily consumption of DFS for a period of 18 months as the source of salt in the cooking medium did not show any evidence of imbalance in Ca and P homeostasis. With an average daily intake of about 10 g of salt, the DFS with 1% SHMP would provide 35 mg of P which is insignificant in a total daily intake of 30 mg P per kg body weight (1.2 g for a 40 kg adolescent boys or girls). It is obvious from the data that this amount of P has not altered the P and Ca metabolism. This is supported by our earlier study in rats [1] and recent data of no adverse complaints due to consumption of DFS in a community [4].

It may be concluded that consumption of DFS containing 1% SHMP for 18 months does not influence calcium and phosphorous homeostasis and is safe.

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