# Application of TXRF in Assessing Trace Elements in Formulated Indigenous Infant Flour

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## Introduction

Dietary trace elements are required for promotion of good health, growth and developmental development of an infant. At the age of six months, breast milk cannot sufficiently meet the dietary trace elements requirements of an exclusively breastfed infant. As a result, complementary food which are relatively high in energy and nutrients density should be provided [1]. Furthermore, at the age of nine months these foods should be able to provide 97% of dietary iron, 86% of dietary zinc, 50% of dietary copper and 75% to 95% of dietary manganese [2].

Cereal based complementary infant foods do not provide most of the essential nutrients for growth and development of children. For instance, maize flour often fail to meet the nutritional needs of an infant due to its poor nutritive values [3]. Even though the use of cereal-legume based foods may be used to improve nutrient density and improved nutrient intake among the rural and poor urban infants, such plant based foods do not meet the total daily need of iron and zinc requirements for infants [1]. Nevertheless, when these legume-cereal base complementary infant foods are judiciously selected and combined in desirable pattern, then they could provide the essential nutrients including trace elements [4]. In this research, the levels of iron, zinc, copper and manganese in formulated indigenous complementary infant flour collected from selected rural areas in Kenya was evaluated. The bioavailability and daily intake of these elements was then estimated using data from literature.

## Materials and methods

### a. Sampling

A total of twenty eight (28) samples of complementary porridge flour for children between age of six (6) months and twenty four (24) months were collected from Sega, Turbo and Bomet region.

### b. Sample preparation

Wet digestion is done in an open system using ANAAAR nitric acid was used to extract the trace elements from the sample matrix. The analytical procedure was validated by subjecting certified reference material NIM-GBW 10017 to the same analytical procedure. For each digested sample, three aliquots were prepared 100 µl of Cu as internal standard (2 ng µl⁻¹) was added to 100 µl of each aliquot and stirred. 10 µl of each sample was then pipetted onto a quartz carrier and dried on a hot plate at 60°C for approximately 3 minutes.

### c. Experimental Setup

Measurements were performed on a S2-PICOFOX TXRF spectrometer which operated at 50 kV, 1 mA and fitted with an Mo anode. Ni/C multilayer monochromator and Peltier cooled Si drift detector with a resolution of 145 eV at Mn Kα line.”

## Results and Discussion

### a. Validation of analytical procedure

The p-values at 95% confidence level for elements of interest were greater than 0.05. Therefore the experimental values were not significantly different from the certified values. In addition, the biases of the experimental values from the certified values were below 10% for all the elements of interest.

### b. Trace element concentration

The levels of Mn, Fe, Cu and Zn varied significantly as shown in table 2.

### c. Estimation of daily intake of the trace elements

The daily intake of Mn, Cu, Fe and Zn from these indigenous complementary infant flour for infants aged 9-11 months was calculated based on Brown et al [2] assumptions that:

1. Breast milk was of average volume and composition;
2. Infants received three feedings of each complementary food per day as well as breast milk; and
3. On Gripsholm et al [3] assumptions that:
4. The amount of food consumed per feeding was 250g and infants received three feedings of complementary food per day.
5. The complementary foods were able to provide 50% of the estimated need for Cu and Mn and 100% of the need for Fe.

## Conclusion

The concentration of manganese in most of samples that had finger millet as one of the ingredient were far much above the tolerable upper limit. The estimated daily intake of Mn was highest in samples from Bomet with a maximum of 15 mg.

Iron levels in most of samples were below the recommended daily intake. However, samples from Sega which had Soya and/or groundnuts and considered to be a good source of iron [6], as one of the ingredients had higher levels of Fe.

Zn concentrations were highest in samples from Sega, where the tolerable upper intake limit of 5 mg/day was exceeded in six out of nine samples. This samples had soya, considered to be good source of zinc [6].

### Reference


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