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Vitamins and Minerals in Fortified Maize Flour Compliance

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Introduction

Due to their inability to obtain enough of the key minerals and vitamins they need each day, more than 2 billion individuals worldwide have micronutrient deficiencies. Programs fortifying foods have been put in place to help lower the incidence of vitamin deficiencies. These initiatives include iodizing salt, fortifying milk with vitamin D and calcium, and fortifying juices with vitamin D. Following dietary fortification, illnesses like iodine deficiency diseases, rickets, beriberi, and pellagra that were a major global issue in the early 20th century have considerably decreased [1].

Description

Deficits in vitamin A, iron, folate, vitamin B12, iodine, and zinc are said to be of concern to the public's health. According to the most recent micronutrient census, vitamin A deficiency among preschoolers is prevalent at 52.6%, and iron deficiency is prevalent among pregnant women at 36.1%. Zinc deficiency affects pregnant women at a rate of 83.3% and non-pregnant women at a rate of 82.3%. Folate deficiency affects pregnant women at a rate of 32.1% and non-pregnant women at a rate of 30.9%. B-group vitamins, vitamin A, iron, and zinc are added to flours. Salt is iodized, and vegetable oils and fats are vitamin-enriched. A higher level of assurance that the food will supply a consistent source of micronutrients beneficial to public health is provided through mandatory fortification. Through the food safety division of the Ministry of Health, programmes like salt iodization, milk fortification with vitamin D, rice fortification with vitamin A, iron, and zinc, and folic acid fortification of wheat flour and maize flour have demonstrated their ability to lower the prevalence of micronutrient deficiencies in populations [2].

The staple foods chosen for mandated fortification are maize flour, wheat flour, and vegetable oils. This choice was made based on the fact that they were widely consumed across all population quintiles. Due to the modern technology utilised in processing, centralised large-scale processing of maize, wheat, and vegetable oils also makes it simple to conduct fortification programmes. Along with the dietary components, it also includes a number of B-group vitamins and important minerals. fibre. However, it is a poor source of folate and iron and is deficient in vitamin B12. Before wet or dry milling, the grains must be cleaned and condition before being ground into maize flour. The degerming and dehulling steps in the procedure result in the loss of the majority of the vitamins and minerals, which are mostly found in the bran. Through fortification, these micronutrients can be replaced without degrading the flour's quality or acceptability. While vitamins are added either as antioxidants or in encapsulated forms to improve their stability, minerals are provided in the most soluble forms that do not impact the flavour and odour of the fortified food. Generally speaking, fortificants used in premixes of micronutrients are chosen based on their bioavailability and stability. Because antioxidants and encapsulated vitamin forms can endure challenging environmental conditions, fortified foods retain vitamins more effectively. The most stable forms of vitamins A, Folate, B2, and B3 are retinol palmitate, folic acid, riboflavin, and niacin amide, respectively. The most soluble and bioavailable forms of iron and zinc utilised in premixes for flour fortification are zinc oxide and zinc oxide. According to research, minerals have a higher capacity for retention since they are more stable than vitamins. Compared to vitamins, which can lose up to 90% of their potency at the greatest temperature and humidity, iron and zinc have high stability during storage at high temperatures and high humidity for 12 months [3]. Processing, distributing, and storing. Foods that have been fortified are subjected to physical and chemical elements like heat and moisture. Due to inadequate retention capacity and subsequent non-compliance with fortification guidelines, these factors affect the stability of vitamins.

Since it is considered that all packaged flour bearing the fortification mark includes micronutrients that meet certain standards, eating such flour should have the desired health effects. All commercial maize mills are required by law to fortify their flour in accordance with the established legal criteria, however the compliance and stability of the micronutrients used for fortification are not well documented. For the flour fortification programme to be implemented successfully, ongoing surveillance and monitoring are required. This study's goal was to evaluate the stability of vitamins and minerals in fortified maize flour and their compliance status. by industrial mills within.

The study comprised two parts: gathering samples of maize from grocery stores and maize flour premixes from industrial mills, and lab testing of the samples to ascertain the pertinent micronutrient levels. The levels of the legal requirements were then compared to these. A fresh sample of suitably fortified maize flour was also taken at the production site, and the ability of the added vitamins to remain stable over a period of six months under typical storage conditions was principally observed. Based on the former provinces, the nation was divided into six regions. We identified and calculated the dispersion of commercial maize mills that have initiated flour fortification initiatives in these areas. Following that, two regions from various climate zones were chosen based on the percentage proportion of consumers' significant reliance on industrially milled maize flour and fortifying mills. These two regions were the Coast Region and Nairobi/Central Region. Brands of fortified maize flour from various sectors of the market were randomly sampled at retail locations. A total of came from the coastal region [4].

While premixes were taken from two commercial mills in the Nairobi/Central region, a fresh sample was also obtained from a commercial maize miller in Nairobi. Date of sampling, sample source, mill name and address, brand name, date of manufacturing, and expiration date are all details acquired during sample collecting. After being delivered to the lab, the samples were kept there in a cool, dry environment until analysis labelled in triplicate with special sample codes and placed in brown khaki bags. This was done to simulate how flour is typically packaged. Before analysis, the samples were condition using saturated sodium bromide solution at and relative humidity. These processes were designed to eliminate any variation that might lead to variations in the micronutrient levels of the flours. Two of the samples were kept in the cold room as a reference, while one was used for the micronutrient analysis. The purpose of storing reference samples at low temperatures was to improve the flour's ability to retain vitamins.

Fresh samples were taken out of their original packing, placed in brown khaki bags, and triple-labeled with various sample codes. The recent examples were marked and prepared at and in their customary khaki bags, from which a sample for analysis under both conditions was taken at Time 0. Saturated

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sodium bromide and sodium chloride solutions were used to create the necessary conditions. Micronutrient contents for the two storage settings were examined at baseline and then every month after that retinol, a form of vitamin A, was established with changes. Two grammes of precisely weighed sample were put to 50 millilitre centrifuge tubes. After that, 5mL of ascorbic acid-containing 100% ethanol was added. The tubes were stoppered, stirred, and then placed in an 80 °C water bath for 20 minutes. To achieve thorough fat digestion, tubes were shaken on occasion. After saponification, flowing water was used to cool the tubes.

Hexane containing 0.01% BHT was then introduced tubes were stoppered and vortexed for one minute, then let to stand for two minutes before another one-minute vortex. After adding around 5 mL of cold water, the tubes were flipped over ten times and centrifuged at 10,000 rpm for ten minutes. A rotary evaporator was used to evaporate around 10mL of the upper organic layer at 40°C while it was vacuum-sealed. After being dissolved in 1mL of methanol, the residue was filtered through a syringe. For the riboflavin examination, flour samples were made with a few minor adjustments. In centrifuge tubes, a portion of the sample was precisely weighed in triplicate, labelled, and diluted with acetic acid solution. The sample underwent vortexing for 1 minute, then stood for 1 minute before vortexing once more for 2 minutes. Following that, the samples were centrifuged at 10,000 rpm. Through syringe filters, the supernatant was filtered. Reverse-phase analysis was used to examine the materials. A photodiode array detector was used to keep track of the column eluent [5].

With a few minor adjustments, vitamin B3 and B9 concentrations were determined. The sample was carefully weighed and labelled into three centrifuge tubes in triplicate. Amount of acidified deionized water was added, and then maize flour was overworked for two minutes. After then, the mixture underwent a 10-minute centrifugation. Carefully removing and filtering through the supernatant. Reverse-phase was used to analyse the samples, and the column's eluent was observed using a photodiode array detector operating at 282 nm. for nicotinamide and folic acid. To minimise contamination, quality assurance methods and safety measures were used to guarantee the accuracy of the findings. To remove any trace metal contamination, glassware was properly cleaned in alkaline detergent, immersed in nitric acid for 48 hours, then completely rinsed in distilled water before use. Plastics were carefully rinsed in distilled water after being soaked in detergent. Every reagent was of analytical quality. For dilutions, deionized water was employed. Vitamin analysis samples were shielded from light while being prepared. The sample manipulations were carried out under low light with opaque centrifuge tubes. The filtrates underwent simultaneous deep-freeze storage and analysis.

Conclusion

The samples were examined in triplicate. The average and standard deviation in each situation were calculated. The amounts of maize flour fortification were compared to the micronutrient concentrations. For samples whose levels of the relevant micronutrient fell within the specified range for vitamin A, vitamin B2, vitamin B3, vitamin B9, iron, and zinc, compliance was deemed to have occurred. A p-value of 0.05 is regarded statistically significant when comparing the micronutrient content of the samples to the minimum and maximum values provided by the standards.

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