

# Determination of Micronutrient Contents in Foods of Children Aged 6 to 24 Months with Moderate Acute Malnutrition (MAM) in Mayahi Department of Niger

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## ABSTRACT

More than a third of children under five year are malnourished: they are stunted, wasted, or lack iodine, vitamin A or iron. These forms of malnutrition, often irreversible and potentially fatal, are deeply rooted in poverty and underdevelopment to the point of compromising the sustainable development of the populations concerned. In order to contribute to the fight against micronutrient deficiencies we decided to study the micronutrient composition of the various meals consumed by children with MAM from 6 to 24 months in the Maradi region, Mayahi department in the Niger. 20 different types of meals were collected from households and analysed by Association of Official Analytical Chemists methods. The results of this work indicate that the determination of minerals made it possible to understand that foods are generally low in micronutrients except sodium which is a very accessible mineral element. Large-scale fortification combined with the prevention and treatment of infectious diseases can dramatically decrease micronutrient losses and reduce micronutrient deficiencies among vulnerable groups including infants.

**KEYWORDS:** *Micronutrient, malnutrition, children, Niger*

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## I. INTRODUCTION

Globally, more than a third of children under five year are malnourished: they are stunted, wasted, or lack iodine, vitamin A or iron. These forms of malnutrition, often irreversible and potentially fatal, are deeply rooted in poverty and underdevelopment to the point of compromising the sustainable development of the populations concerned (WHO, 2000). In 2012, several Sahelian countries in Africa (Niger, Mali, Mauritania, Chad) and countries in the Horn of Africa (Ethiopia, Somalia, Djibouti and Eritrea) were severely affected by a food and nutrition crisis. The number of children under five year affected by severe acute malnutrition has been estimated at more than one million children and more than five million respectively in these two areas, thus

increasing the risk of child death. According to the FAO in 2009, in Niger, the diet is very largely based on cereals, mainly millet and sorghum, to which are added tubers, mainly cassava. The high prevalence of malnutrition is associated with severe micronutrient deficiencies. In order to contribute to the fight against micronutrient deficiencies we decided to study the micronutrient composition of the various meals consumed by children with MAM from 6 to 24 months in the Maradi region, Mayahi department in the Niger.

## II. Material and methods

### 2.1. Materiel

The material used for the study consisted of ready-made meals, intended for consumption by children

attending health care centers in the department of Mayahi. A technical sheet is used to identify the samples. It includes information on the date, time, place of collection, and the nature of the sample.

## 2.2. Methods

### 2.2.1. Study site

The study was carried out at the level of the two (2) health care center out of the five of the department of Mayahi in the region of Maradi. In fact, the 24-hours recall study carried out in the 5 CSIs in 2016 revealed

that children have identical eating habits and consume the same types of food.

### 2.2.2. Sampling

20 women were randomly selected from these two health care center and food collected at their homes. With the support of community intermediaries, 20 different types of meals were collected from households, put in sterile food bags, placed in a cooler containing ice and sent to the Laboratory in Niamey for analysis. Table 1 provides information on the number and type of meals, and raw materials.

**Table 1: Different types of meals analysed**

Number	Local Meal Name	Traducted Name	Raw materials and ingredients
1	Awara	Bean cake	Bean
2	Galette de Mil	Millet Cake	Millet
3	Beignet de Farine	Flour Donut	Wheat
4	Beignet du Mil	Millet Donut	Millet
5	Beignet de Niébé	Bean Donut	Bean
6	Riz et Haricot	Rice et Bean	Rice et Bean
7	Couscous du riz et Moringa	Rice couscous and Moringa	Rice et Moringa
8	Spaghetti	Spaghetti	Wheat
9	Boulette de Niébé	Cowpea dumpling	Bean
10	Couscous du riz et Niébé	Rice couscous and Bean	Rice et Bean
11	Pate du riz et sauce Baobab	Rice paste with Baobab sauce	Rice
12	Riz simple et Sauce Baobab	Rice pate with Baobab sauce	Rice
13	Couscous du mil	Millet Couscous	Millet
14	Pate Sorgho et sauce Baobab	Sorghum paste with Baobab sauce	Sorghum
15	Pate de sorgho et sauce Gombo	Sorghum paste with Okra sauce	Sorghum
16	Grand beignet de Farine	Large Flour Donut	Wheat
17	Bouillie de Mil « lisse »	Millet porridge "smooth"	Millet
18	Bouillie de Mil	Millet porridge	Millet
19	Boule du Mil	Millet ball	Millet
20	Boule du Mil avec lait	Millet ball white milk	Millet

### 2.2.3. Study period

The study ran from September 01<sup>st</sup> to November 30<sup>th</sup>, 2018.

### 2.2.4. Analysis methods

For each sample the contents of Calcium, Iron, Potassium, Sodium and Zinc are determined. In practice the samples are mineralized, the extracts are prepared and the reading is made by atomic absorption and the calculation of the different values using a calibration curve (AOAC, 1990; IITA, 1984).

### 2.2.5. Data processing and analysis

The data collected are processed by SPSS Version 20 software and analyzed using a one-way analysis of variance (ANOVA) at the significance level set at  $p = 0.05$ . The means of each of the results of the nutritional composition analyzes are obtained from three replicates.

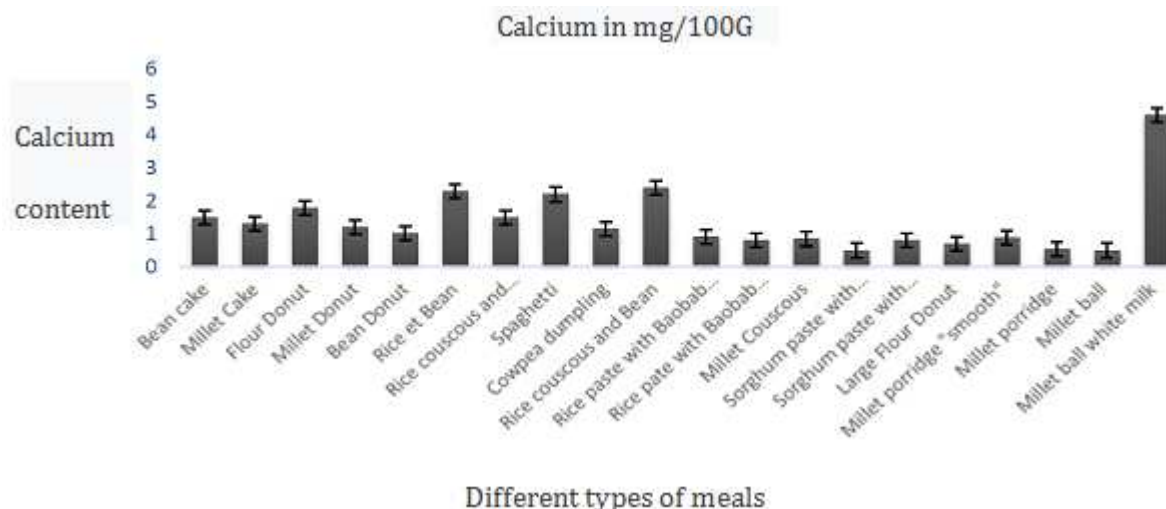
## III. Results and Discussion

### 3.1. Results

#### Mineral content of the meals sampled

##### ➤ Calcium

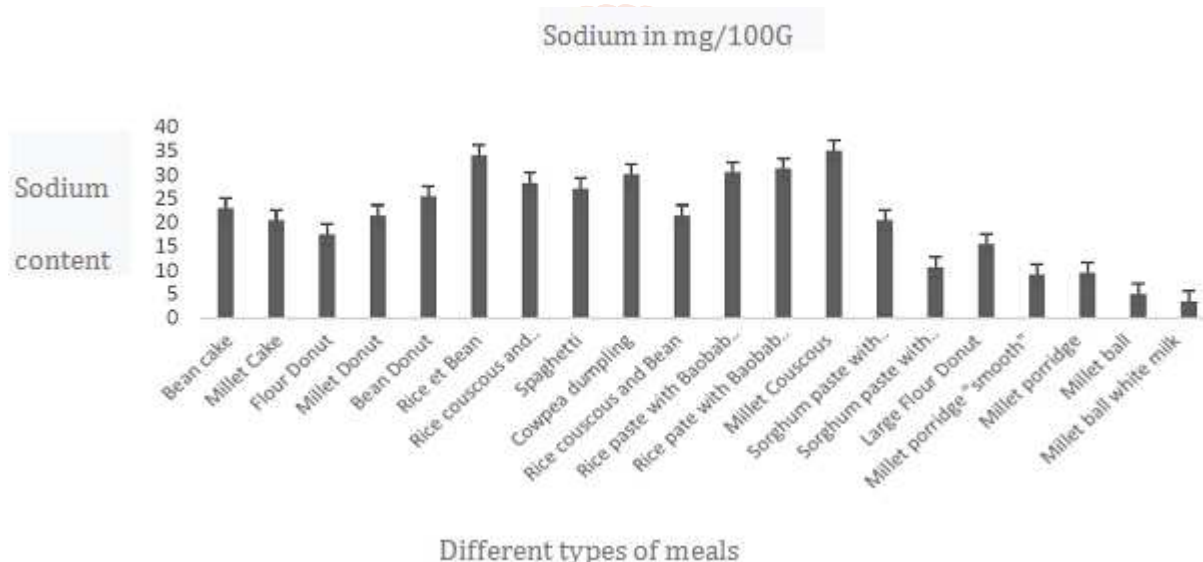
The calcium contents of the various meales are represented in figure 1. It is noted that ball with milk is the meal rich in calcium with a content of 4.6 mg per 100 g of the product. It is followed by couscous of rice with moringa and rice with beans with respectively 2.3 mg and 2.2 mg per 100g. The paste made from sorghum has the lowest calcium content at 0.5mg per 100g.



Different types of meals  
**Figure 1: Calcium content in foods.**

➤ **sodium**

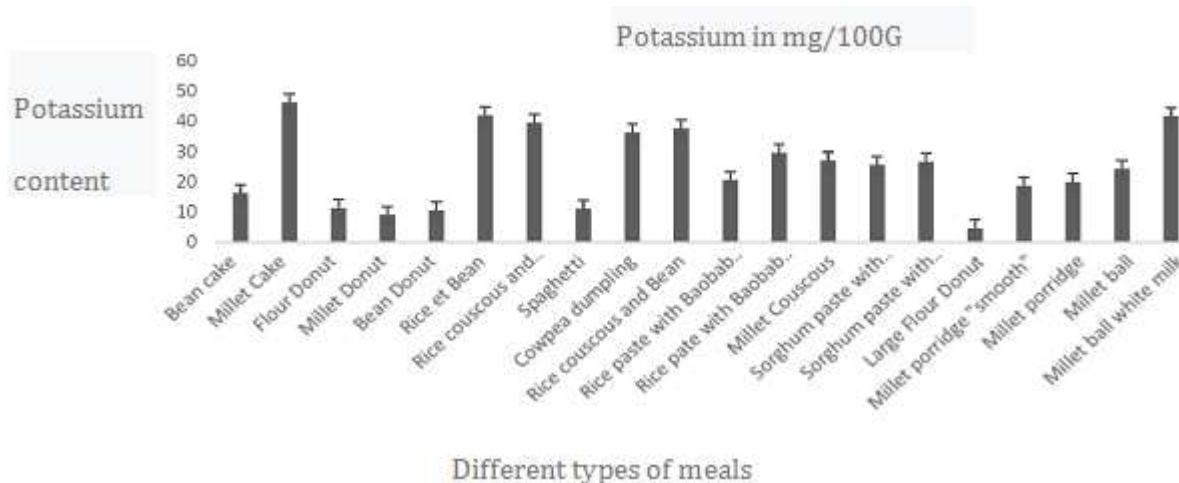
Figure 2 shows the sodium content of the different meals. Sodium has been found in all meals. However, this content the meals couscous of Millet and rice with beans are the highest with respectively 35.1 mg and 34.11 mg per 100g. Balls and porridge have the lowest sodium content.



Different types of meals  
**Figure 2: Sodium content in foods.**

➤ **Potassium**

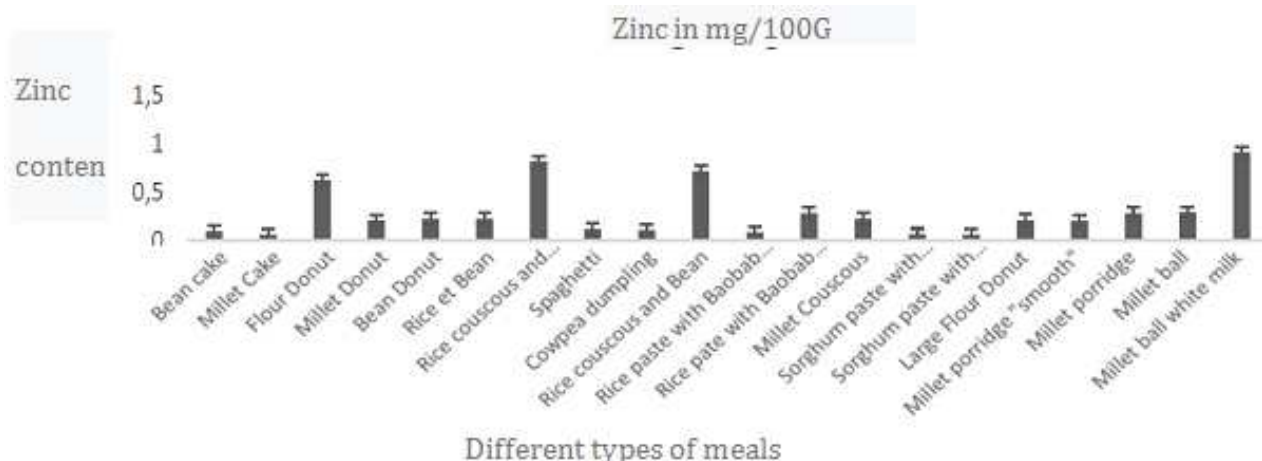
From figure 3 we note that the millet cake, the bean rice, the ball with milk have high potassium contents with respectively 46.2, 41.8 and 41.6 mg per 100g. The large flour donut has the lowest potassium content with 4.5 mg per 100g.



Different types of meals  
**Figure 3: Potassium content in foods**

➤ **Zinc**

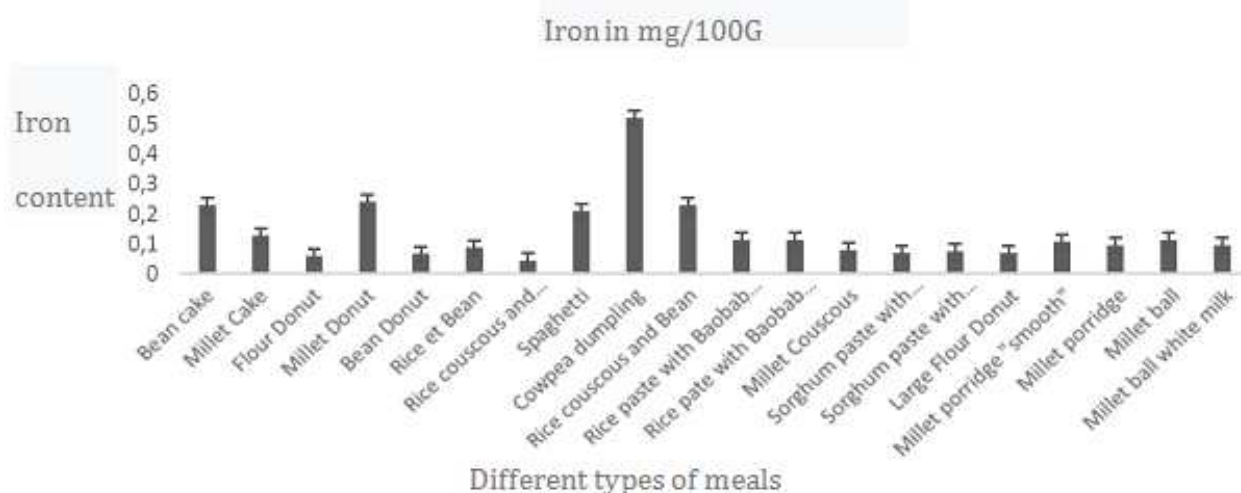
The zinc contents of the different meals vary from 0.05 to 0.91 mg per 100g. These values are respectively for the sorghum paste and the ball with milk. Figure 4 below gives us more details.



**Figure 4: Zinc content in foods**

➤ **The iron**

The figure number 5, represents the iron content of food. Analysis of the latter shows us that cowpea balls have the highest iron content with 0.52 mg per 100g followed by millet donut with 0.24 mg per 100g. The lowest amount of iron is found in couscous of rice and Moringa with a value of 0.04 mg per 100ml.



**Figure 5: Iron content in foods**

**3.2. Discussion**

Our objective was to characterize the foods of children with MAM in the department of Mayahi. The results obtained show overall that cereals are the raw materials most used for the preparation of meals. These results are similar to those found by the NGO acSSAR Sahel Vert in 2008 which found that cereals constitute the daily diet of the Nigerien population (75% to 85%).

Minerals are essential components of a quality diet and have profound effects on health. (FAO, 2016).

The results of the study showed us that the millet ball with milk is the most calcium-rich meal with a content of 4.6 mg per 100g of the product. This could be explained by the presence of milk in the ball of millet. Indeed, according to Gaucheron, (2004), the components of milk are made up of salts, enzymes,

vitamins and trace elements. Its richness in calcium (1043-1283 mg / kg) and phosphorus make milk a food very suitable for the growth of young children. The highest amount of iron is found in cowpea balls with 0.52 mg per 100g followed by millet donut with 0.24 mg per 100g. These low iron contents are probably due to the absence of foods rich in iron such as meat and eggs in these foods. In addition, the transformations of these foods before their cooking have a negative effect on the mineral content, especially the husking.

Potassium, for its part, is essential for the smooth functioning of the body. According to the results of the analyzes, we note that the millet pancake, the bean with rice, the ball with milk have high potassium contents with respectively 46.2, 41.8 and 41.6 mg per

100g. For the millet pancake, this high content could be explained by the addition of *Cerathoteca sesamoïdes* (Yodo in local language) during the preparation. Rice with beans and the ball with milk, are foods prepared from two raw materials. This could be the cause of their high potassium content. It is also important to note that the availability of potassium is very high in legumes and cereals (Thierry, 2018).

According to Matin et al in 2001, in food, sodium is generally present in the form of sodium chloride, i.e. salt: 1 g of salt will give 400 mg of sodium. It is essential for the transmission of nerve impulses and for muscle contraction. Its concentration in the blood and interstitial fluid conditions the amount of water present in the cells and the blood volume (Martin, 2001).

Figure 2 shows that this element is present in all foods in significant amounts. This is the case with millet couscous and bean and rice with 35.1 and 34.11 mg per 100g respectively. This is mainly due to the addition of salt during their preparation in order to improve their flavor. Foods for children under 3 years old should be minimally salty, so as not to overload their immature kidneys in the first months of life and to avoid forming their taste into very salty flavors. It appears that the blood pressure of children depends at least in part on salt intake (Mosser, 2005).

The sugary foods eaten are those with the lowest sodium content, such as porridge and ball. Zinc is important for many functions. It supports growth and development during pregnancy, childhood and adolescence. However, zinc deficiency can cause loss of appetite, growth retardation and disruption of immune function. In more severe cases, hair loss, diarrhea and delayed sexual maturation can be observed. (U.S. Department of Health and Human Services, 2012). According to the results of our analyzes, the zinc contents of the different meals vary from 0.05 to 0.91 mg per 100g. The ball with milk is the most zinc-rich meal with the highest value (0.91 mg per 100g). The presence of milk in this food would probably justify this high value compared to other foods.

#### IV. Conclusion

The results of this work have provided data on the composition in minerals (Calcium, Iron, Potassium, Sodium and Zinc) of foods. The results indicate that the determination of minerals made it possible to understand that foods are generally low in micronutrients except sodium which is a very accessible mineral element. Large-scale fortification combined with the prevention and treatment of infectious diseases can dramatically decrease

micronutrient losses and reduce micronutrient deficiencies among vulnerable groups including infants. This work prompts a more in-depth study leading to the development of the food composition table specific to Niger.

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