

## EVALUATION OF THE INFLUENCE OF NATURAL FERMENTATION ON THE MINERAL COMPOSITION OF ZARMARKÉE SEED, SESBANIA SPP

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### ABSTRACT

*The seeds of Zarmarkée, sesbania spp collected from the premises of Nigerian Stored Products Research Institute, Kano were analyzed for their mineral components to assess their nutrient value for animals and humans. The mineral analysis of the raw flour prepared by grinding the dried seeds gave the following results in mg/100g of sample: 14.96Fe; 15.38Zn; 2.33Cu; 0.998Pb; 0.083Ni; 0.00Cd; 16.44P; 36.58Na; 631.76K and 122.14Ca. Correspondingly, mineral analysis of the fermented sample of the flour prepared from the fermented seed resulted in the following: 11.83Fe; 9.05Zn; 1.45Cu; 0.53Pb; 0.00Ni; 0.00Cd; 9.761P; 22.901Na; 503.82K and 166.25Ca. The order of nutritive mineral elements depending on their content in (mg/100g) was K > Ca > Na > P > Zn > Fe > Cu > Pb > Ni > Cd in raw, while the order in fermented sample was K > Ca > Na > Fe > P > Zn > Cu > Pb > Ni = Cd. The investigation revealed that both the raw and fermented Zarmarkee seed flour samples were good supplier of mineral matter, particularly potassium, Calcium, Sodium, Phosphorus, Zinc, Iron and Copper which were in abundance. The major findings of the study was that natural fermentation, a biological food process is seen to have a considerable reduction effect on all the mineral elements (Fe, Zn, Cu, Pb, Ni, Cd, P, Na, and K) understudied, especially in the fermented sample, except for calcium element level which increased considerably through the process. Hence, the raw seed sample provided good profiles of the mineral elements.*

**Keywords:** Zarmarkée seeds; Raw and Fermented; Minerals elements; Legume

### INTRODUCTION

In developing countries like Nigeria, Legumes are probably the second most important source of food next to cereal grains and are consumed worldwide as a major source of protein. Thus, legumes are good supplements in areas where the staple food is high in carbohydrate but low in protein Onwuraforet al., (2014) and Aremuet al.,(2007). The seed of Zarmarkée, one of the non-popular legumes in the world which is scientifically designated to be called Sesbaniaspp natively known as Zarmarkée in Hausa, is an important agroforestry species. Duke, (1983) reported, that the Genus is within the family Leguminosea and therefore they have the ability to improve soil through the fixation of atmospheric nitrogen. Sesbansppis common throughout the northern part of Nigeria where it is seen growing on the dikes between moringa plantations, along roadsides and in backyard vegetable gardens. Although, known to Hausa and Kanuri peoples, as one of the materials

incorporated in the production of gun powder for local guns used for hunting (MallamHaruna;personal communication, 2014), no further usage is recorded as reported by the Royal Botanic Gardens, Kew (K) (Deshpande, 1992).

In our earlier study on the proximate composition of Zarmarkee seed flour, investigation suggested that, compared to other legumes of the same family, both raw and fermented seed flour of Zarmarkee had a better nutritional profile in terms of protein and ash content which signals a viable natural protein supplement of improved nutritive value that can be used in combating the menace of malnutrition in both infants and lactating mothers as well as in food composite formulation. Hence, both raw and fermented sample would contribute immensely to good nutritional status and good health for both man and livestock when consumed, only that much work has not been done on the grain to validate the safety of the seeds for human

consumption (Ishola *et al.*, 2018). Natural fermentation, is a biological process known to improve food digestibility, nutritional quality, as well as impacts unique flavor, and capable of modifying textural/rheological properties of food samples subjected to it, especially the cereals and legumes (Lawal *et al.*, 2009). In Nigeria for instance, some legumes such as cowpea, bambara groundnut and soya bean has been fermented for complementary food. However, the mineral properties and the effect of natural fermentation of Zarmarkee seed have not been investigated. Therefore, the objective of this research study was to determine mineral composition and compare the effects of natural fermentation method on the mineral compositions of both raw and fermented Zarmarkee seed flour for future reference.

## **MATERIALS AND METHODS**

### **Collection of samples**

Zarmakee grains were self-grown and harvested from the premises of Nigerian stored products Research Institute, (NSPRI) Kano Zonal Office, Hadejia Road in Kano State, Nigeria.

### **Methods**

The grains were properly dried after harvested and mixed together before it was prepared for the analysis proper.

### **Preparation of dry milled flour from Raw Zarmarkee.**

Zarmarkee grains were washed by mixing the sample with distilled water at a ratio of 1:2 w/v, drained and were allowed to dry. The dried grains were milled, sieved and packaged.

### **Preparation of dry milled flour from fermented Zarmarkee grains:**

#### **Fermentation of the Sesbania sp:**

Natural fermentation was carried out by mixing the sample with distilled water at a ratio of 1:2 w/v. The sample was withdrawn at period of 72 h. After the fermentation period each sample was transferred to an aluminum dish and air dried under shield for 1hr. Dried

samples were finely ground, sieved and stored in polyethylene bags at 4°C for subsequent analysis. Oladunmoye, (2007)

The Zarmarkee grains were washed steeped for 72 hours and the water is drained. The fermented grains were dried, milled, sieved and packaged. Eka, (1980).

### **Mineral analysis of the samples**

#### **Sample Preparation**

The harvested grains were dried and milled into powdery form. A wet ashing method was employed for the analysis as enumerated below. One gram powdered dry samples were weighed into digestion flask. 3 mL of 65% HNO<sub>3</sub> and 5 mL of 35% H<sub>2</sub>O<sub>2</sub> was added to the samples and allowed to react overnight. The following morning the digestion flask were placed into a digestion block and carefully heated at 450°C until clear solutions were obtained. Care was taken to ensure that the samples did not dry. A mixture of 3 mL 65% HNO<sub>3</sub> and 9 mL 37% HCl was added and gently heated until a small volume of acid remained. The residue was filtered and solutions were precisely transferred to 100 mL pyrex standard flasks and made to volume with distilled-deionized water. Its concentrations were analyzed using Atomic Absorption Spectrophotometer manufactured by Buck Scientific model 210 VGP. (AOAC, 2010)

#### **Mineral determination:**

Atomic absorption spectrophotometer was used to evaluate the mineral contents. The mineral analyzed includes, Iron, Calcium, Magnesium, Phosphorus, Zinc, Sodium, Lead, Cadmium, Nickel and Potassium. (Jimoh and Oladiji, 2005), (Iqbal, Amjad, et al., 2006), (AOAC, 2010).

#### **Statistical analysis**

Determinations were carried out in triplicates and the results obtained from the minerals analyses were subjected to statistical analysis using Independent-Sample T-test and the least significant differences were calculated using SPSS version 16.00 Software. Significance was accepted at  $p < 0.05$  levels.

### 3. RESULTS AND DISCUSSION

**Table 1** Mineral composition of raw and fermented *Zarmarkee seeds*.

<b>Mineral</b>	<b>Raw (Mg/100g)</b>	<b>Fermented (Mg/100g)</b>
Iron(Fe)	.....	11.82 ± 0.01
Zinc(Zn)	15.36 ± 0.01	9.04 ± 0.02
Copper(Cu)	2.31 ± 0.02	1.43 ± 0.02
Lead (Pb)	1.00 ± 0.01	0.51 ± 0.02
Nickel (Ni)	0.08 ± 0.01	0.00 ± 0.00
Cadmium (Cd)	0.00 ± 0.00	0.00 ± 0.00
Phosphorus (P)	16.42 ± 0.02	9.72 ± 0.02
Sodium (Na)	36.55 ± 0.02	22.88 ± 0.02
Potassium (K)	631.75 ± 0.01	503.81 ± 0.01
Calcium (Ca)	122.12 ± 0.02	166.18 ± 0.02

*All data were mean ± standard deviation of triplicate determinations*

The mineral contents of the sample were high (Table1). The sample was high in Iron, Zinc, phosphorus, Sodium, Calcium and potassium, but low in Copper, Nickel and Cadmium was not detected. The Raw sample was good sources of all the minerals under consideration (Fe, Zn, Cu, Pd, Ni, Cd, P, Na, K, Ca). The calcium and potassium levels were significantly higher in the flour produced from the Zarmarkee seed, and this signals elevated blood pressure reduction property of Zarmarkee seeds. The high potassium content in the Zarmarkee seed sample also makes it valuable not only as a raw material for indigenous soap industries but also in the treatment of soils for acidity. The value of calcium comparatively improved through fermentation process from (122.14mg/100g to 166.25 mg/100g) for raw and fermented sample respectively. Calcium values in the sample is relatively higher compared to its value in other legumes such as lima bean (90mg/100g), Lathyrus peas (110mg/100g) and Bambara groundnut (85mg/100g) Apata, (1994), and (Legumes in Human Nutrition, FAO, 1982). Calcium and phosphorus are very important in the formation of strong bones and teeth, for growth, normal nerve and muscle action, blood clotting, heart function and in energy metabolism of the cells (Trimmer, 1994; Roth and Townsend, 2003; Rolfe et al., 2009). The iron level of both samples were higher than the values recorded for dry guinea corn leaf extracts (1.2

mg- 2.1 mg/100g, Adepoju, 2007; 2008) and fresh and roasted Dacryodesedulisfruit (7.0 mg and 3.0 mg/100mg respectively (Adepoju and Adeniji, 2008). The samples can be good sources of non haem iron if bioavailable, as iron of plant origin is poorly absorbed in the body (Roth and Townsend, 2003). Zarmarkee meal could be a possible antagonist to fat indigestion congestion and to some toxic metals, especially lead and cadmium absorption and utilization in humans in future (Gupta, 1987). Being rich in macro minerals, it could be formulated into instant flours for convalescence and in the formulation of baby foods as these categories of humans require high levels of minerals for growth and repair. Oboh, (2006), (Ayoola and Adeyeye, 2009).

### CONCLUSION

The study revealed that both the raw and fermented seeds samples of Zarmarkee were highly rich in minerals and could turn out to be an excellent Iron, Zinc, Phosphorus, Sodium, potassium and Calcium food source and supplement, a viable staple for bone and skeletal development, cell permeability regulation, anti-malnutrition and body pH maintenance, if adequately explore. Though, anti-nutritional property of the grains needs to be established. Also, natural Fermentation, a biological food process had a considerable reduction

effect on all the mineral elements (Fe, Zn, Cu, Pb, Ni, Cd, P, Na, and K) understudied, except for calcium element level which increased considerably through the process. The research concludes that the grain has good mineral profiles that is worthy of being considered as a reliable future supplement to improve the nutritional value of both human and animal diet in the nearest future.

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