# EFFECT OF BOILING ON THE MICRO AND MACRO MINERAL COMPOSITION OF MORINGA (*Moringa Oleifera*) SEEDS

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## ABSTRACT

*This study evaluated the effect of boiling as a processing method on the micro and macro mineral composition of Moringa oleifera seeds as potential livestock feed. Moringa oleifera seeds were collected from Ungwan Musa, Kafanchan in Jama'a LGA of Kaduna State, Nigeria. The seeds were weighed and divided into seven (7) portions of 100g each. The first portion was left raw as treatment control, while the second, third, fourth, fifth, sixth and seventh portion were boiled for 10, 20, 30, 40, 50 and 60minutes respectively. Thereafter the micro and macro mineral compositions were evaluated in the laboratory and the results obtained were analysed using simple descriptive statistics. The results showed a decline in both macro and micro elements with successive increase in boiling duration (from 10-60mins). For Macro minerals; Sodium, Potassium, Calcium, Phosphorus and Magnesium, a declined by 1.5%, 0.9%, 0.47%, 1.08% and 1.87% respectively was recorded. Micro minerals; Iron, Copper, Manganese and Zinc decreased by 1.19%, 2.37%, 0.22% and 2.27% respectively. At 60 minutes boiling duration, Copper recorded the highest decline (2.37%), hence it was concluded that boiling Moringa oleifera seeds for 10-60minutes has no deteriorating effects on its macro and micro mineral compositions because all mineral elements considered were still within recommended amount to be fed as livestock feed.*

**Keywords:** *Moringa oleifera*, Boiling, Macro and Micro Minerals.

## INTRODUCTION

The rising cost of feeds and feedstuff in the livestock industry is a major source of concern for the industry and has remained a serious obstacle to meeting the demands of animal protein in developing countries like Nigeria. Cost of feeding has been estimated to account for about 70% of total production cost in broiler production (Adejinmi, 2000).

Livestock feed cost in developing countries is a continuing challenge. The high and increasing prices of animal feeds have compelled researchers in developing countries to direct their attention towards utilization of non-conventional feed stuff, with particular emphasis on protein substitutes (Gaia, 2005). *Moringa oleifera* Lam is one of the 13 varieties of Moringaceae, which is native to India, Red Sea and parts of Africa including Madagascar, of these, *M. oleifera* is the most widely known variety (Price, 2007). *Moringa oleifera* is among those plants that can be integrated with livestock production to increase feed quality and availability because it is a good source of cheap protein supplement to improve digestibility of other diets. All plant parts can be used to feed livestock.

Food processing transforms raw foods to edible forms. It also increases shelf-life, digestibility, flavor, nutritive value among other benefits. Various foods presuppose different processing techniques depend on the needs and end products required (Okokon, 2004). Boiling as a processing method is known to bring about high complex reactions without having direct effect on nutritional value of food (Umeh and Bassir, 1977). Therefore the aim of this study was to determine the effect of cooking time on the micro and macro mineral composition of *Moringa oleifera* seeds grown in Ungwan Musa, Jama'a Local Government Area of Kaduna State, Nigeria.

## MATERIALS AND METHODS

### Collection and Preparation of Samples

The seeds were collected from Ungwan Musa, Kafanchan in Jama'a Local Government Area of Kaduna State, Nigeria. The seeds were sorted and divided into seven (7) samples of 100g each at the Kaduna State University Animal Science laboratory using a 250kg manual weighing scale (spring balance).

**Processing of samples**

A sample of 100g was weighed, grinded into powder, sealed in a polythene bag and tagged "0" (Raw Moringa Seeds) as the treatment control. The remaining six (6) samples each containing 100g of matured Moringa Seeds were emptied into a boiling water. Clean water was used to boil the Moringa seeds. One hundred grams of Moringa seeds was collected at every 10mins interval. The last 100g of Moringa seeds was collected after 60mins of boiling. Six (6) samples in all were collected separately from the boiling water, drained, sundried for 5hours and grinded into powder. The six (6) samples were sealed in individual polythene bags and tagged 10, 20, 30, 40, 50 and 60 representing samples boiled for 10, 20, 30, 40, 50 and 60mins respectively.

**Laboratory Analysis**

The processed Moringa (*Moringa oleifera*) seeds were taken to the Department of Nutrition and Dietetics, Kaduna State Polytechnic for analysis. Samples were analysed to determine the effects of boiling duration on micro and macro mineral composition. The mineral contents including sodium, potassium, and calcium was determined in EPC (Extracted Pomace Cake) using flame photometry while magnesium, iron, copper, manganese and zinc contents were determined by atomic absorption spectroscopy according to A.O.A.C. (2010). A standard colorimetric method was applied for phosphorus as mentioned by Borah *et al.* (2009).

**Statistical Analysis**

All data collected on macro and micro mineral compositions were analysed by simple descriptive statistics. The percentage change of each treatment was calculated using the formula:

$$\%\ change\ = \frac{C - V}{C} \times 100$$

Where C = Value of Control (Raw), and V = Value for each Treatment.

## RESULTS AND DISCUSSION

Table 1: Effect of Boiling Duration on the Mineral Composition of *Moringa oleifera* Seeds

| Parameters | Boiling durations in minutes | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 10 | 20 | 30 | 40 | 50 | 60 |
| Macro Minerals | | | | | | | |
| Sodium mg/100g | 1470.00 | 1468.00 | 1466.00 | 1460.00 | 1455.00 | 1450.00 | 1448.00 |
| Potassium mg/100g | 1273.00 | 1272.00 | 1270.00 | 1268.00 | 1266.00 | 1264.00 | 1261.00 |
| Calcium mg/100g | 254.00 | 254.00 | 253.00 | 253.80 | 253.50 | 253.30 | 252.80 |
| Phosphorus mg/100g | 738.00 | 738.00 | 737.00 | 736.60 | 736.40 | 736.00 | 730.00 |
| Magnesium mg/100g | 64.20 | 64.18 | 64.10 | 64.00 | 63.50 | 63.20 | 63.00 |
| Micro Minerals | | | | | | | |
| Iron mg/100g | 185.20 | 185.00 | 184.60 | 184.60 | 184.50 | 184.00 | 183.00 |
| Copper mg/100g | 7.60 | 7.60 | 7.54 | 7.50 | 7.47 | 7.45 | 7.42 |
| Manganese mg/100g | 91.60 | 91.60 | 91.60 | 91.58 | 91.50 | 91.46 | 91.40 |
| Zinc mg/100g | 57.30 | 57.30 | 57.20 | 57.00 | 56.80 | 56.50 | 56.00 |

0 = the raw *Moringa oleifera* seed sample which signifying control, while 10, 20, 30, 40, 50 and 60 = boiling time for *Moringa oleifera* seeds in minutes.

The effect of boiling duration on the mineral composition of *Moringa oleifera* seeds is given in table 1. Macro and Micro minerals were slightly reduced with increase in cooking time contrary to the report of Mbah *et al.,* (2012) who recorded an increase in the amount of Calcium, Iron and Zinc in *Moringa oleifera* seeds boiled for 10, 20 and 30mins. David (2018) also reported a decrease in the amount of both macro and minor minerals when *Moringa oleifera* seeds were boiled for 30minutes. The values for both macro and micro minerals of Raw *Moringa oleifera* seeds recorded were similar to that given by Barakat and Ghazal, (2016). At 60mins boiling duration, the values of Ca, Na, K, and P (1448mg/100g, 252.8mg/100g, 1261mg/100g and 730mg/100g respectively) were all within the amount recommended for both Layers and Broiler birds as reported by Van der Klis and Vinyeta, (2015). The Iron concentration was found to be 183mg/100g for *Moringa oleifera* seeds boiled for

60mins. Iron is essential for haemoglobin formation and its deficiency leads to anaemia (Turan *et al.* 2003). The value of Magnesium contained in the raw *Moringa oleifera* seeds (64.20mg/100g) was lower compared to the value (677.00mg/100g) for *Moringa oleifera* leaf given by Sodamade *et al.* (2013). Magnesium is very important in calcium metabolism in bones and also involved in prevention of circulatory diseases and also helps in regulating blood pressure and release of insulin.

Table 2: Percentage Change in the Level of Mineral Composition of *Moringa oleifera* Seeds at Different Boiling Time.

| Parameters | Percentage change due to different boiling time | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 10 | 20 | 30 | 40 | 50 | 60 |
| Macro Minerals | | | | | | | |
| Sodium | - | 0.14(-) | 0.27(-) | 0.68(-) | 1.02(-) | 1.36(-) | 1.50(-) |
| Potassium | - | 0.08(-) | 0.24(-) | 0.39(-) | 0.55(-) | 0.71(-) | 0.94(-) |
| Calcium | - | - | 0.39(-) | 0.07(-) | 0.19(-) | 0.28(-) | 0.47(-) |
| Phosphorus | - | - | 0.14(-) | 0.19(-) | 0.21(-) | 0.27(-) | 1.08(-) |
| Magnesium | - | 0.03(-) | 0.16(-) | 0.31(-) | 1.09(-) | 1.56(-) | 1.87(-) |
| Micro Minerals | | | | | | | |
| Iron | - | 0.11(-) | 0.32(-) | 0.32(-) | 0.38(-) | 0.65(-) | 1.19(-) |
| Copper | - | - | 0.79(-) | 1.32(-) | 1.71(-) | 1.97(-) | 2.37(-) |
| Manganese | - | - | - | 0.02(-) | 0.11(-) | 0.15(-) | 0.22(-) |
| Zinc | - | - | 0.18(-) | 0.52(-) | 0.87(-) | 1.40(-) | 2.27(-) |

(+) = % increase, (-) = % decrease.

Table 2 shows percentage change in mineral composition of *Moringa oleifera* seeds boiled at different durations. At 10mins boiling time, Potassium, Magnesium and Iron reduced by (0.08%, 0.03% and 0.11% respectively), this shows that these mineral elements are easily leached out compared to other mineral elements (Calcium, Potassium, Copper, Manganese and Zinc). It also reveals that Manganese was the most attached mineral element which was reduced by 0.02% at 30mins boiling time. At 60mins of boiling, Manganese recorded the lowest depletion (0.22%) and Copper had the highest depletion (2.37%) at the same 60mins.

## CONCLUSION AND RECOMMENDATION

From the results obtained in this study, it was concluded that increasing boiling time from 0 to 60 minutes led to reduction in the concentration of mineral elements in *Moringa oleifera* seeds. The major mineral elements; Sodium, Potassium, Calcium, Phosphorus and Magnesium were lost by 1.5%, 0.94%, 0.47%, 1.08% and 1.87% respectively while the micro mineral elements; Iron, Copper, Manganese and Zinc were lost by 1.19%, 2.37%, 0.22% and 2.27% respectively. *Moringa oleifera* seeds boiled within the range of 10-60mins remain a good source of minerals because the elements considered were still within recommended amount to be fed as livestock feed and therefore a good source of livestock feed. Further research could be made in this area in order to evaluate other minerals which were not considered in this experiment and subsequently followed by a feeding trial to test for acceptability of the feedstuff and other parameters.

**REFERENCES**

Adejinmi, O.O., Adejinmi, J.O. and Adeleye, I.O.A. (2000). Replacement value of fish meal with soldier fly larvae meal in broiler diets, *Nig. Poult. Sci. J.* (1):52-60

A.O.A.C. (2010) Official Methods of Analysis. 18th Edition, Association of Official Analytical Chemists, Washington DC.

Barakat, H. and Ghazal, G.A. (2016). Physicochemical Properties of Moringa oleifera Seeds and Their Edible Oil Cultivated at Different Regions in Egypt. *Food. Nutr. Sci*. **7**, 472-484.

Borah, S., Baruah, A., Das, A. and Borah, J. (2009) Determination of Mineral Content in Commonly Consumed Leafy Vegetables. *Food Analytical Methods*, 2, 226-230. http://dx.doi.org/10.1007/s12161-008-9062-z

David D. J. (2018): Effect of different Processing methods on the proximate, anti-nutrients and mineral composition of *Moringa oleifera* seed. A project Submitted to the department of Animal Science, Kaduna State University (Unpublished).

Gaia, S. (2005). Wonder tree 100 facts moringa fact 04 exceptional animal feed moringa as livestock feed & pet food. Moringa Mission Trust. Available at: http://gaiathelivingplanet.blogspot.com/2005/06/wondertree-100-facts-moringa-fact-04.html (Accessed 31 October 2013)

Mbah, B., Eme, P., Ogbusu, O., (2012). Effect of cooking methods (boiling and roasting) on nutrients and anti-nutrients content of Moringa oleifera seeds. *Pak. J. Nutr*. 11, 211–215.

Okokon, J., (2004). Evaluation of indigenous foods commonly eaten in Eha-mufu community in Enugu state. *Nig. J. Nat. Prod. Med*., pp: 319-342.

Price, M.L. (2007). The Moringa Tree. Echo Technical Note. Available at: http://chenetwork.org/files_pdf/Moringa.pdf (Accessed 06 November 2013).

Sodamade A, Bolaji O.S, Adeboye O.O. (2013) ProximateAnalysis, Mineral Contents and Functional Properties of *Moringa oleifera* Leaf Protein Concentrate. *IOSR J. Int. Sci. Res. E-ISSN; 2278-5736. 4(6):47-51.*

Turan M, Kordis S, Zeyin H, Dursan A, Sezem Y. (2003) Macro and Micro minerals content of some wild edible leaves consumed in eastern Anatolia Tailors and Francis.129-130.

Umeh, L.B. and O. Bassir, 1977. Nutrient changes in some traditional Nigeria food during cooking. Part I vitamin changes. *Fd. Chem*., 2: pp 195.

Van der Klis J. D. and Vinyeta E. (2015) Nutrient requirement in poultry: Critical review of actual recommendations of FEDNA (2008) and suggestions for modifications. ResearchGate Book.