

Assessment of Antinutrients and Minerals Content of Some Boiled and Unboiled Spices Commonly Consumed in South-Western Nigeria

Amodu S. O., Adeyemo A. I*, Ejidike B.N.

Department of Ecotourism and Wildlife, Federal University of Technology, P.M.B 704, Akure, Ondo State, Nigeria

*Corresponding author

Abstract: Anti-nutrient and mineral contents of boiled and unboiled selected spices; moringa (*Moringa oleifera*) marugbo (*Clerodendrum volubile*), cotton seed (*Gossypium hirsutum*) and pepper soup spices) were determined using standard procedures. The anti-nutrients properties examined were tannin, phytic, oxalated and saponin. Values recorded for tannin were 0.18, 0.37, 0.68 and 0.29 (%) for moringa, marugbo, cotton seed and pepper soup spices respectively. Phytic acid values (mg/g) were obtained for moringa, marugbo, cotton seed and pepper soup spices were 1.98, 0.82, 1.24 and 1.45 respectively. The values obtained for tannin dropped from 0.18 to 0.14% for moringa, 0.37 to 0.13% for marugbo, 0.68 to 0.25% for Cotton seed and 0.29 to 0.17% for Pepper soup spices. Similarly phytic acid diminished from 1.98 to 1.03mg/g, 0.82 to 0.00mg/g, 24 to 0.45mg/g and 1.45 to 0.82 mg/g for moringa, marugbo, cotton seed and pepper soup spices respectively. Minerals examined in all spices showed lower values for the boiled spices. Sodium (mg/100g) for unboiled and boiled spices were 7.02 and 4.3 for moringa, 3.92 and 3.19 for marugbo 24.99 and 15.99 for cotton seed and 38.03 and 21.83 mg/100g for pepper soup spices. Other minerals (potassium, calcium, magnesium and iron) examined in this work followed the same trend. The results showed that boiling employed in this study reduced the anti-nutrients content of the spices while the minerals were not affected. This work showed that boiling is still the cheapest method to reduce the anti-nutritional factors in foods.

Keywords: Anti-nutrient, minerals, spices, boiling, moderated

I. INTRODUCTION

Green leafy vegetables are those herbaceous plants whose part or parts are eaten as supporting food or main dishes and they may be aromatic, bitter or tasteless (Liu, 2003). According to Federal Department of Rural Development (2006), vegetables are the cheapest and most available sources of important proteins, vitamins, minerals and essential amino acids. In addition, they contain anti-nutrients, which reduce their bioavailability (Liu, 2003). Vegetable are either eaten raw or processed. Any method selected for processing vegetables, should be such that does not adversely affect the colour, flavour, texture and nutritional value, especially vitamins and minerals. These vegetables which suggests that it requires special processing to prevent decomposition and loss. These processing methods either change the nature and constituents of these vegetables either positively or negatively. Their nutritive importance lies in being sources of

minerals and vitamins. Spices in general, supply nutrients like iron vitamin A, thiamin, riboflavin and ascorbic acid (Ihenkoroye and Ngoddy, 2010; Meyer, 2012). But they also contain anti-nutrients which negatively interfere with normal metabolic processes (Binita and Khetarpaul, 2012). For example oxalic acid binds on calcium as insoluble calcium oxalate making it unavailable for body building.

High oxalate diet increases the risk of renal calcium absorption (Osagie and Offong, 2011). Phytic acid (inositol hexphosphate) forms insoluble salts with calcium, zinc iron and magnesium rendering the elements biologically unavailable for absorption in the body, Although saponin is not harmful to warm-blooded animals but it causes hemolysis of red blood cells when injected into the blood stream (Umaru, *et al.*, 2007). Tannin precipitates certain proteins and also combines with digestive enzymes rendering them unavailable for digestion (Abara, 2003; Binita and Khetarpaul, 2012).

The study of anti-nutrients is relatively a virgin area, though some 1000 bioactive non-nutrient plant compounds have been identified, a large number remain unknown and the full range of their health benefits still unfolding (Liu, 2003). There are many useful and in-expensive ethnic spices grown in the south west Nigeria whose anti-nutrients and minerals are yet to be sufficiently studied. This study was aimed at evaluating the effect of boiling on the anti-nutrients and mineral composition of selected ethnic spices commonly consumed in south western Nigeria.

II. MATERIALS AND METHODS

The vegetables used for this study were moringa seeds (*Moringa oleifera*), marugbo (*Clerodendrum volubile*), cotton seed (*Gossypium hirsutum*) and pepper soup spices. They were purchased from "Shasha" market, Akure, Ondo State, Nigeria.

Sample Preparation

The freshly harvested vegetables were physically examine for the presence of extraneous

matters. After, they were destalked manually, washed with clean cold water and divided into

two parts. The first part was sliced and soaked in cold water, while the second part was sliced and boiled at a temperature of 55°C for 2 minutes. The samples were drained, air-dried and then ground into a uniform powder with a kitchen blender. Portions of these were weighed out and used for the various analyses.

Determination of Tannin

This was done using the Folin-Dennis method as describe by AOAC (2005). 1 gramme of each sample was dispersed in 10 ml distilled water and agitated. This was allowed to stand for 30 minutes while being shaken every 5 minutes. After, it was centrifuged and the supernatant obtained. Two point five millilitres of this supernatant liquid was put in a 50ml standard flask. In the same way 2.5ml of standard tannic acid solution was put in a 50ml standard flask. One ml of Folin-Denis reagent was measured into each flask followed by 2.5ml of saturated Na₂CO₅ solution. Each flask was made to mark with distilled water and allowed to stand for 90 minutes at room temperature. The absorbance of each solution was measured at 250 nm in an electronic spectrophotometer set at zero with the reagent blank.

$$\text{Tannin (\%)} = \frac{\text{AsXCstdX } 100 \text{ xVv}}{\text{Astd.XWVv}} \quad (1)$$

Where:

As = Absorbance of sample

Cstd = Concentration of standard solution

Astd = Absorbance of standard

Vv = Total volume of supernatant

V = volume of supernatant used

W = weight of sample used

Determination of phytic acid

This was undertaken in accordance with AOAC method (2010). 4 gm of ground sample was weighed and soaked in 100ml of 2% HCl for 3 hours and filtered. 25 ml of filtrate was transferred to 100ml conical flask, 5ml of 0.3%

ammonium thiocyanate (NH₄ SCN) solution was added as indicator. It was then titrated against standard FeC₃.

$$\text{Phytic acid \%} = \frac{\text{TX } 8.24 \times 100}{\text{Weight of sample}} \quad (2)$$

Determination of Saponin

The method of Obdoni and Ochuko (2001) was used for the determination of saponin in the samples.

Determination of Oxalate

The methods of AOAC (2005) was adopted in this determination 1.5H₂SO₄ was added and stirred intermittently with a magnetic stirrer for about 1 hour. After, it was filtered on a whatman No. 2 paper. 25ml of the filtrate was transferred into 250ml conical flask and titrated hot (80-90° C) with 0.1N KMnO₄ solution until a faint colour appears which persists for at least 30 seconds.

$$\text{Oxalate mg/g} = \text{Titre value} \times 0.9004$$

Determination of Mineral Content

The mineral were analysed from the solution obtained by first dry ashing (Obdoni and Ochuko, 2001). 2 gm of each sample was put in a crucible and placed inside a muffle furnace maintained at 500° C for 5 hours to ash completely after which it is was cooled in a desiccator. The cooled ash was dissolved in 10ml HCl and filtered through a filter paper in a funnel into 100ml volumetric flask and was made to mark with distilled water. The solution was aspirated into the Buck type atomic absorption spectrophotometer (model 210) to determine calcium, magnesium and iron. Sodium and potassium was determined using Buck flame photometer (model PFP-7). Phosphorus was determining by the vanado-molybdate method as described by Pearson (1976)

III. RESULTS AND DISCUSSION

Results of the anti-nutrient analysis of the unboiled spices sample, namely: moringa (*Moringa oleifera*), marugbo (*Clerodendrum volubile*), cotton seed (*Gossypium hirsutum*) and pepper soup spices were as presented on Table 1.

Table 1: Anti-nutrient constituents in selected unboiled spices

	Anti-nutrients values			
	<i>Moringa oelifera</i>	<i>Clerodendrum volubile</i>	<i>Gossypium hirsutum</i>	Pepper soup spice
Tannin (mg/g)	0.18	0.37	0.68	0.29
Phytic (mg/g)	1.98	0.82	1.24	1.45
Oxalate (mg/g)	0.24	0.43	0.27	0.49
Saponin (mg/g)	1.31	3.64	5.49	2.55

Four anti-nutritional factors were determined namely, tannin, phytic, oxalate and saponin. Values recorded for tannin (%) were: 0.18, 0.37, 0.68 and 0.29 for moringa, marugbo, cotton seed and pepper soup spices respectively. Ogbe and John (2012) reported tannin of 21.19% for *moringa*. The values

recorded in this work are lower than the lethal value of 5% and above reported by Aje *et al.* (2010). Phytic value (mg/g) recorded for moringa, marugbo, cotton seeds and Pepper soup spices were: 1.98, 0.82, 1.24 and 1.45. These values are lower than values of 2.5% reported for *Moringa* by Ogbe and John

(2012). Oxalate values of 0.24mg/g, 0.43mg/g, 0.27mg/g and 0.49% reported for Moringa by Ogebe and John (2012) are far below the lethal level of 2.5g in man (Meyer,2012). Saponin in mg/g recorded for moringa, marugbo and cotton seeds and Pepper soup spices were: 1.31, 3.64, 5.49 and 2.55. The value of 1.31mg/g obtained for moringa in this work compares favourably with the value of 1.48mg/g reported by Aje *et al* (2010). Saponins are steroids or triterpenoid glycosides, which

are characterized by their bitter or astringent taste, foaming properties and their haemolytic effect on red blood cells (Osagie and Offong, 2011), they are widely distributed in plants and have been shown to possess the beneficial effect of lowering cholesterol in the body (Price *et al.*, 2010, Olagbemide and Philip, 2014). The results of the anti-nutrient analysis of the boiled spices were as shown in Table 2.

Table 2: Anti-nutrient constituents in selected boiled spices

	Anti-nutrients				value	
	<i>Moringa oleifera</i>	<i>Clerodendrum volubile</i>	<i>Gossypium hirsutum</i>	Pepper soup spices		
Tannin (mg/g)	0.14	0.13	0.25		0.17	
Phytic (mg/g)	1.03	N.D	0.45		0.82	
Oxalate (mg/g)	0.09	0.21	N.D		0.23	
Saponin (mg/g)	0.44	0.73	1.25		0.67	

In all cases value obtained were lower than values given by the unboiled spices. This finding converges with the verdict of Enechi and Odunwodu (2003) that boiling in hot water reduces the ant nutrient of plant products. For example values obtained for tannin in percent decreased from 0.18 to 0.14, 0.37 to 0.13, 0.68 to 0.25, and 0.29 to 0.17 for moringa, marugbo ,cotton seedsand Pepper soup spices respectively. Values for phytic acid, oxalate and saponnin followed the same trend (Table 1 and 2) indicated that boiling diminishes

the anti-nutrients factors in spices. Table 3 and 4 show the value obtained for minerals in the unboiled and boiled spices samples. Minerals determine in all spices samples indicated lower values for the boiled (Abara, 2003). Sodium values for unboiled and boiled decreased from 7.02/100 to 4.3mg/100g for *moringa*, 3.92/100 to 3.19mg/100 for marugbo 24.99/100 to 15.79mg/100g for cotton seeds and 38.03/100 to 21.83mg/100g for Pepper soup spices.

Table 3 Mineral contents of unboiled selected spices

Spices	Na	k	Ca	Mg	Fe	p
	(mg/100g)	(mg/100g)	(mg/100g)	(mg/100g)	(mg/100g)	(ppm)
<i>Moringa oleifera</i>	7.02	4.0	1.01	1.99	7.00	0.06
<i>Clerodendrum volubile</i>	3.92	9.64	6.05	4.02	9.41	1.36
<i>Gossypium hirsutum</i>	24.99	12.99	8.03	4.00	5.10	0.69
Pepper soup spices	38.03	32.00	11.04	12.02	5.97	0.15

Table 4: Mineral contents of boiled selected spices

Spices	Na	k	Ca	Mg	Fe	p
	(mg/100g)	(mg/100g)	(mg/100g)	(mg/100g)	(mg/100g)	(ppm)
<i>Moringa oleifera</i>	4.3	1.50	0.74	0.66	0.52	0.50
<i>Clerodendrum volubile</i>	3.19	7.61	3.23	2.81	7.24	1.26
<i>Gossypium hirsutum</i>	15.79	7.29	4.87	3.61	0.29	0.53
Pepper soup spices	21.83	15.10 0.11	8.82	7.46	0.25	

The other mineral namely; potassium, calcium, Magnesium, iron and phosphorus were observed to follow the same trend, for example the value of 0.69ppm recorded for phosphorous in Cotton seed before boiling decrease to 0.53ppm after boiling. This reduction was caused by the heat (Muntro and Basir, 2010). The results of the mineral composition revealed that boiled processing adopted was able to retain the mineral

contents. It could be inferred from the results of the anti-nutritional composition of the wild *moringa*, *marugbo*, cotton seed and pepper soup spices samples that boiling method employed was able to reduce the anti-nutritional composition of the spices significantly (Liu, 2003).

VI. CONCLUSION

The study showed that boiling method employed, was able to reduce the anti-nutritional composition of the spices, while retaining the minerals composition, except for phosphorous in cotton seed that was decrease after boiling. In order to strike a balance between the retention of minerals and reduction of anti-nutritional factors in spices, boiling method should be used for optimal result. In future, bioengineering may throw up new spices with higher levels of beneficial anti-nutrients which may help negate the losses caused by processing. However, further studies should be carried out to determine the effect of extension in processing length / time on the mineral and anti-nutritional composition of wild spices subjected to different processing methods.

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