CHEMICAL COMPOSITION OF RAW AND WATER-SOAKED *MORINGA OLEIFERA* SEEDS

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Abstract
Moringaoleifera pods were harvested and the seeds removed, cleaned and soaked in water (200g/litre) for 1, 2 and 3hr respectively. The un-soaked seeds served as control. The seeds were then drained, dried and ground into powder and analysed for chemical constituents, using the methods of AOAC and spectrophotometric Folin-Denis. The un-soaked seeds (T1) had the highest dry matter (95.80%), ether extract (14.10%) and ash (5.15%) which was significantly different ($p<0.05$) from other treatments. However the seeds soaked for 3hr (T4) had the highest crude protein (36.08%) and crude fibre (12.55%) values while un-soaked seeds (T1) had the least value (35.04%) for crude protein. Soaking the seeds for 3hr reduced phytochemicals (0.03%, 0.43% ,0.05% ,3.70% ,and 0.93% for Alkaloids, Saponins ,Phenols ,Phytates and Cynogens respectively) and minerals (0.34% ,0.53% ,179.35mg\kg for Phosphorus ,Potassium and Iron respectively) constituents which was significantly different ($p<0.05$) from other treatments .There were no significant differences ($p>0.05$) on Calcium and Magnesium values. Results of the study showed that soaking moringa seeds for 3hr was effective in increasing the crude protein and minerals there by reducing the phytochemical concentrations of M.oleifera seeds powder,

Key words: *Moringaoleifera, Raw,* Soaking, Processing,Chemical compositions

Introduction

Plant seeds contain various natural constituents which can affect their nutritional quality when they are used as feed resources. Some of these compounds are proteins which inhibit specific enzyme activities, for example protease and amylase inhibitors (Liu and Markakis, 1987). Others are haemaglutinins, saponins, tannins and anti-vitamins (Liener, 2009). Makkar and Becker (2009) reported the presence of phytic acid which interferes with mineral element absorption and utilisation, and reacts with proteins to form complex product which have inhibitory effect on protein digestion. Although heat treatment will effectively eliminate some of these undesirable substances, the application of other processes such as soaking, autoclaving, decorticating and germination have also been effective in reducing them (Babar *etal*., 1988, Bressani and Sosa, 1990; Carlini and Udedibie, 1997 and Amusa, 2011). Most importantly, there is less functional as well as nutritional damage to the protein which results from excessive heat treatment when soaking is applied. However, soaking of lentil seeds in water for 24hr decreased trypsin inhibitor activity (Batra *et al.*, 1996). Soaking of lima bean in water for 2 days decreased the tannin and phytic acid activity by 65% (Ologhobo *et al.*, 2006). Makkar and Becker (2009) recommended that *M. oleifera* seed soaked in water above 30 minutes increased the crude protein as well as reduce the phytochemical contents. In this study, processing and chemical compositions of *Moringa oleifera* seeds soaked in water for 1-3 hours were investigated

Materials and Methods

Moringaoleifera seeds were harvested at Logun village, Egbeda, Ibadan. The seeds were cleaned and soaked in water at 1kg/5litres for 1, 2, and 3 hours respectively. A fourth group was not soaked (raw) which was the control. The soaked seeds including the raw were sun dried for 3 days milled into a fine powder to ensure homogeneity before taking homogenous samples to the laboratory for chemical analysis of proximate and phytochemicals constituents in Department of Animal Science, University of Ibadan in a Completely Randomized Design (CRD) where each treatment was in triplicate.

Chemical analysis of *Moringa oleifera* seed

Proximate and mineral compositions of the seeds were determined by the methods of AOAC (1990). Alkaloids were determined by Harborne (1973), saponins (Obadoni and Ochuko, 2001), phenols by spectrophotometric. Phytic acid was determined according to an indirect colorimetric method of Wheeler and Ferrel (1971). Cyanogens were determined by the method described by Knowles and Watkins (1950). Glucosinolates levels evaluated using Buljet's reagent as described by El-Olemy *et al.* (1994).

Results

Proximatecomposition

Proximate composition of the raw and water-soaked *Moringa oleifera* seeds are presented in

Table 1. Treatment 1(control) had the highest dry matter, Ether extract and Ash contents which were numerically different from other treatments while treatment 4 (3hours water-soaked) obtained the highest value on crude protein and crude fibre which was significantly different from other treatments. Treatment 2 (1hour water-soaked) had the highest value on Nitrogen free Extract while treatment 3 (2hours water-soaked) had the lowest NFE which was significantly different from others.

Phytochemicals

The levels of anti-nutritional factors in raw and different hours of water-soaked *Moringa oleifera* seeds are presented in Table 2. Treatment 1 (control) obtained the highest values of 0.37, 1.17, 0.06, 4.43, 1.37 and 66.25 µ/mg for *alkaloids*, *saponins*, *phenols*, *phytates*, *cyanogens* and *glucosinolates* respectively, which was significantly different from other treatments, while treatment 4 (3 hours water-soaked), had the least values except for *glucosinolates* where treatment 3 (2 hours water-soaked), had the least values of 51.83 (µ/mg).

Discussion

The result obtained in this study suggests a fairly high concentration of proximate components in the processed *M. oleifera* seeds. As the soaking time increased, the values of crude protein, and crude fibre also increased, this is in line with Makkar and Becker (2009) who recommended that *M. oleifera* seeds soaked in water showed increased crude protein value. This increment will be as a result of a possible fermentation that took place during hours of soaking and 3 days sun drying which is also in line with Ologhobo *et al.*, (2006) who reported increment in crude fibre on processed lima bean varieties. Increasing soaking time decreased ether extract, dry matter and ash, which implies that the soaking hours had effect on the *M. oleifera* Seed which is in line with Makkar and Beckar (2009). Among the different soaking hour methods studied. Three hours of soaking in water was effective in eliminating anti nutritional factors of *M. oleifera* Seed. Such water-soaked destruction has been reported for several seeds including Jack bean (Babar, 1988), soyabean (Batra *et al.*, 1996), lima bean (Ologhobo *et al.*, 2006), *Moringa oleifera* (Makkar and Becker, 2009), Jack bean (Amusa 2011) observations on *alkaloids* and *Saponins*, however, indicated significantly decreased in values on the dietary treatment than the control. The *phyticacid* content of *Moringaoleifera* Seed was significantly reduced only upon 3 hours water-soaked. Liu and Markakis (1987) had attributed the decreased in *phyticacid* loss upon soaking in water for 48 hours to the complexing of inositol hexaphosphate with Ca and Mg to form insoluble phytates which could be extracted only with dilute acids. This possibly explains the decrease in *phyticacid* loss on soaking in water. *Cyanogens* and *Glucosinolates* values were also decreased significantly as the soaking time increases; this would be consistent with the observation with respect to lima bean where hydrogen cyanogens were reduced with different processing methods (Ologhobo *et al.*, 2006; and Makkar and Beckar, 2009). There were no significant differences on the values of phenols but numerically there were slightly reductions in treatments 3 and 4 which indicate that *tannic* acid however, must have been lost through increased hours of soaking of a small fraction of hydrolysable *phenolic* compounds located in the seed coats of *M. oleifera.* Some amount of polyphenols have been found in soaking and cooking waters of *M. oleifera* seed, indicating that large amounts of polyphenols could be eliminated by discarding washing and cooking waters (Makkar and Becker, 2009 and Liener, 2009). The actual amounts ingested will thus depend on how seeds are processed and consumed. Mineral contents of the processed seeds reduced as the soaking time increased, this is in line with Ogbe *etal.* (2012), who reported decreased in the values of different processing methods of *Moringaoleifera* leaf and seed powder which could be as a result of solubility of minerals in the water.

Conclusion and Application

Moringa oleifera seed soaked in water for 3 hours gave the highest value on crude protein and lowest values in anti-nutritional factors and mineral compositions. This suggests that *M. oleifera* seedsoaked in water for 3hr will effectively increase in crude protein, reduce in phytochemical concentrations and could serves as protein source in poultry diets.

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Table 1: Proximate composition of raw and water-soaked *Moringa oleifera*

PARAMETERS (%)	T1 (Raw)	T2 (1Hour)	T3 (2Hours)	T4 (3Hours)	SEM
Dry Matter	95.80[a]	92.38[a]	90.70[b]	91.34[b]	8.63
Crude Protein	35.04b	35.25b	35.73[b]	36.08a	0.91
Crude Fibre	10.20[b]	11.60[a]	11.95a	12.55[a]	0.54
EtherExtract	14.10[a]	11.97[b]	11.96[b]	11.92[b]	0.04
Ash	5.15	5.09	5.00	5.07	0.50
Nitrogen free extracts	35.15[b]	36.09[a]	35.36[b]	34.38[b]	5.19

[aba a,b,c]**Values with the same superscri pts were statistically similar (p<0.05)**

Source: Akangbe *etal.*(2015)

Table 2: Phytochemical contents of raw and water soaked *Moringa oleifera seeds*

Parameters (%)	T1 (Raw)	T2 (1Hour)	T3 (2Hours)	T4 (3Hours)	SEM
Alkaloids	0.37[a]	0.20[ab]	0.11[b]	0.07[c]	0.09
Saponins	1.17[a]	0.68[b]	0.52[b]	0.42[c]	0.14
Phenols	0.06	0.06	0.05	0.05	0.01
Phytates	4.43[a]	4.32[a]	3.86[b]	3.70[b]	0.45
Cyanogens	1.37[a]	1.18[a]	0.93[b]	0.93[b]	0.13
Glucosinolates (µ/mg)	66.25[a]	59.49[b]	51.83[b]	53.41[b]	2.08

[a,b,c]Values with the same superscripts were statistically similar (p<0.05)

Source: Akangbe *etal.* (2015)

Table 3: Mineral compositions of raw and water-soaked *Moringaoleifera* seeds

Parameters (%)	T1(Raw)	T2(1Hour)	T3(2Hours)	T4(3Hours)	SEM
Calcium	0.43	0.42	0.46	0.43	0.04
Phosphorus	0.42[a]	0.37[b]	0.35[b]	0.34[b]	0.08
Potassium	0.65[a]	0.57[b]	0.58[b]	0.53[b]	0.10
Magnesium	0.44	0.46	0.44	0.42	0.07
Iron (mg/kg)	190.30[a]	194.34[a]	184.57[b]	179.35[b]	62.84