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Effect of Soaking Process on Chemical Characteristics and Anti Nutritional Factors of some Moringa Seed Varieties

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ABSTRACT

Moringa seeds have high medicinal and value nutritional. This is mainly to the large stock of biologically active ingredients in seeds. With the global shortage of food grains, the incidence of nutritional deficiency diseases and the ever-increasing population, Moringa in particular will certainly provide a good alternative to make up for the food shortage. This research aimed to study the effect of soaking process in water and in NaOH 0.5% solution on the Moringa seeds. Gross chemical composition, minerals, anti nutritional and fatty acid of M. *oleifera* and *peregrina* seeds were investigated. In general, Soaking has a significant ($p < 0.05$) effect on the gross chemical of M. *oleifera* M. *peregrina* seeds. There is a large variation in minerals value both of raw and soaked *Moringa oleifera* and *Moringa peregrina* kernels. Results revealed that crude extract obtained from both of raw *Moringa* (*oleifera* and *peregrina*) seeds showed that there was a significant difference in anti-nutritional content before and after soaking. The aqueous soaking treatment was more effective than soaking with alkali solution NaOH 0.5% to remove anti nutritional factors. Furthermore, fatty acid oleic (C18:1) represented the highest proportion of fatty acids. Results indicated that soaking processes caused a significant decrease in total unsaturated fatty acids content, accompanied by an apparent increase in the total saturated fatty acids of M. *oleifera* and *Peregrina* seeds.

Keywords: Moringa seeds, Detoxification, Minerals, Antinutritional factors, Fatty acid.

INTRODUCTION

Moringa oleifera and peregrina belong to the family Moringaceae which contains around 13 species Anwar et al. (2007); and Janick and Paull (2008). It is native to African and Asian countries, particularly Indian subcontinent, Philippines, Cambodia, Central, North and South America, and the Caribbean Islands Somali et al. (1984). M. oleifera has several common names such as horseradish tree, drumstick tree, and many other names Morton (1991).

Moringa is called the Miracle tree as it can decrease the malnutrition Daba (2016); Haldar and Kosankar (2017). Moringa is a good source of phytochemicals, vitamins, and minerals; therefore, it has a potential application in functional food preparation Abdull Razis, et al. (2014); Milla et al. (2021); and Okiki et al. (2015). Many applications in food preparation have been investigated, like cakes, Kolawole, et al. (2013), meats Qwele, et al. (2013), biscuits Ajibola, et al. (2015), and sandwiches Milla et al., (2021).

Although, researchers have reported that the Moringa have high nutritional value; high amount of Moringa, may affects the sensory characteristics of its products Milla et al. (2021). Almost every part of Moringa tree (seeds, leaves, root, and flower) can be applied to different ways of food preparations Haldar and Kosankar (2017). Many parts of the plant show pharmacological properties, recognized by the scientific community. An extensive literature survey on Moringa suggested that Ancient Egyptians used Moringa oil because of its cosmetic value, which helps in human skin preparation Khan, et al. (2017). Moringa seeds have therapeutic characteristics increase the health benefits and the pharmacological potentials including: antimicrobial, antioxidant, antidiabetic, antitumor, antihypertensive, anti-inflammatory and cardio-protective properties Abdulwaliyu et al. (2019); and Dzuvor et al. (2021).

On the other side, the Moringa seeds boast high nutritional value, which is attributed to its significant biologically active components, such as flavonoids, phenolic acids, saponins, tannins, isothiocyanate, vitamins, and minerals; however, some of these components are considered as antinutritional factors. Some other phytochemical constituents have been reported to interfere with protein digestion and normal metabolism, which inhibit the growth performance, and decrease the body weight when used as food for animals Igwilo et al. (2010); Annongu et al. (2014); and Dzuvor et al. (2021).

Despite many studies have been applied to determine the level of the anti-nutritional factors of Moringa seeds and their effect on food utilization and growth performance, a lot of research still needed to enhance the Moringa seeds applications on a wide commercial scale. Therefore, the present study was applied to eliminate the bitterness of the Moringa seeds, to reduce their antinutritional factors, and in the meantime to improve their acceptable sensory characteristics by efficient, safe, and low expensive approaches.

MATERIALS AND METHODS

Materials:

Moringa oleifera cultivar seeds were obtained from a commercial market (Haraz Company for herbs and seeds

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trading), Cairo City. But the M. peregrina cultivar was obtained from the Aswan botanical garden.

All analytical grade reagents and chemicals used in this present study were purchased from El Gomhouria Company for Chemicals and Pharmaceutical Trade, Al-Sawah, Al-Zaytoun Al-Qibliya, Qism Al-Zaytoun, Cairo Governorate, Arab Republic of Egypt.

Technological Methods:

Seed preparation:

The seeds were dried using the oven (Titanox Italy 120 L) (for 48 hours at 50°C until the constant weight, cleaned divided and after that were weighed, kept at 5±1°C until used.

Detoxification treatments of Moringa species' kernels: -

Detoxification treatments of *M. oleifera* and *M. peregrina* kernels were carried out by soaking under two conditions:

a- Room temperature at different intervals for 1-6 hours in either tap water and aqueous alkali solution NaOH 0.5% according to the methods of Ghaderi-Ghahfarrokhi *et.al.* (2017) with some modifications.

b- After that, the previously soaked kernels were dried in oven (Titanox Italy 120 L) for 48 hours at 50 ± 5 °C until a constant weight.

Chemical methods:

Moringa oil samples and defatted oil:

Total lipids of Moringa seeds were extracted using chloroform : methanol (2:1 v/v). according to (Folch et al. 1957).

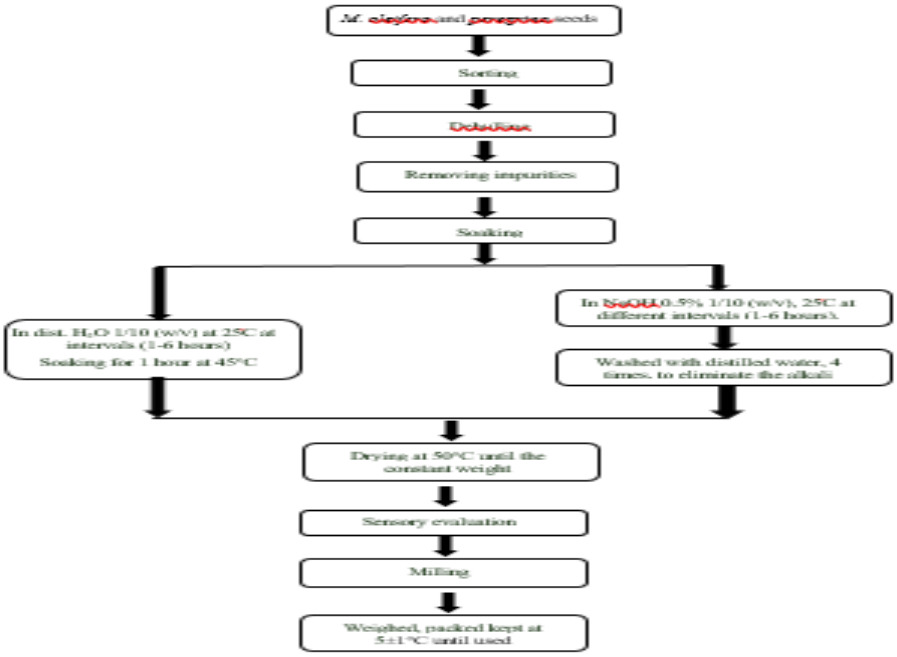

Figure 1. Detoxification treatments of Moringa species kernels by soaking in sodium hydroxide and water

Gross chemical composition of Moringa kernels varieties:

The contents of Moringa kernels from Moisture, total nitrogen, ether extracts, crude fiber and ash were determined according to A.O.A.C (2012). Carbohydrate content was calculated by difference.

Determination of minerals of Moringa seed varieties:

P, Ca, Mg, Fe, and Zn were determined using Perkin-Elmer Atomic Absorption Spectrophotometer 2380, whereas Na and K were determined by Flame Photometer 410, as described in A.O.A.C. (2012) at Faculty of Science, Damietta University.

Determination of bioactive and anti-nutritional composition of Moringa kernels varieties:

1- Phytate determination:

The phytate were determined by using titration procedure described by Lucas and Markaka (1975). The percentage phytic acid was calculated, according to Russel (1980).

Phytic acid=X1.19 x 100 Where X= Titer value x 0.00195g.

2- Oxalate determination:

The oxalate content was determined by using titration according to Munro and Bassir (2010). The oxalate contents of each sample were calculated.

1ml 0.05 M KMnO4 = 2.2mg oxalate.

3- Tannin's determination:

Total tannin content was by using titration by the method according to **Pharmacopoeia (1996).** Total tannin content was calculated using the following formula.

% Total tannins = (A-B) X Normality of KMnO4 solution X 0.004157 X 1000 Weight of sample taken X 0.1

Where,

A = Blank reading, B = Test reading

4- saponin determination:

was determined using the spectrophotometric method as described by Hiai *et al.* (1976).

Gas chromatography - mass spectrometry (GC-MS) of fatty acids of Moringa kernels varieties oils:

Methylation of fatty acids in oil was performed according to Rossell *et al.* (1983). Gas chromatography -

mass spectrometry (GC - MS) analysis of samples was performed using Trace GC - TSQ mass spectrometer (Thermo Scientific, Austin, TX, USA) with a direct capillary column TG - 5MS 30 m x 0.25 mm x 0.25 um film thickness). Spectra were collected, the components were identified by comparison of their retention times and mass spectra with those of WILEY 09 and NIST 14 mass spectral database. Abd El-Kareem, *et al.* (2016). at City of Scientific Research in Burj Al Arab, Alexandria, Egypt.

sensory evaluation:

The sensory evaluation of the bitter taste that consumers accept after the prepared detoxification treatments of *Moringa oleifera* and *peregrina* kernels were carried out by soaking treatments under tow conditions (at room temperature) in either tap water or aqueous alkali solutions (NaOH 0.5%). acceptability was carried out using ten judgments according to Osman *et al.* (1991).

Statistical analysis:

The analysis of variance (ANOVA) was implemented according to Clarke and Green (1988) using the statistical analysis system (Costa) version 6.303, from www.cohort.com. Differences among the means were compared using Duncan's Multiple Range test at the significance level of 0.05.

RESULTS AND DISCUSSION

Detoxification treatments of tested Moringa kernels varieties: -

Detoxification treatments of *M. oleifera* and *M. peregrina* kernels were carried out by soaking treatments under tow conditions (at room temperature) in either tap water or aqueous alkali solutions (NaOH 0.5%). Then the sensory evaluation of the bitter taste that consumers accept after the prepared detoxification treatments by acceptability was carried out using ten judgments. From preliminary experiments of this investigation, could be concluded that the most effective soaking treatments for detoxification and for eliminating the toxic and antinutritional components from tested Moringa kernels, which recorded in Table (1) and Table (2), were found to be that soaking with aqueous alkali solution (NaOH 0.5%) in 3 and 4 hours.

Table 1.Time required to remove bitterness for Moringa kernels varieties by NaOH 0.5%

Treatment	Control	Time / Hours						
Varieties	zero time	1	2	3	4	5	6	LSD
M. oleifera	0.00^{d}	5.20^{c}	7.80^{b}	10.00^{a}	10.00^{a}	10.00^{a}	10.00^{a}	0.70
M. peregrina	0.00^{e}	4.40^{d}	6.20^{c}	8.20^{b}	10.00^{a}	10.00^{a}	10.00^{a}	0.90

a,b,c,d Values with different subscripts on the same row are significant (p<0.05)

Table 2. Time required to remove bitterness for Moringa kernels varieties by water

Treatment	Control	Time / Hours					
Varieties	zero time	2	3	4	5	6	LSD
M. oleifera	0.00^{e}	2.20^{d}	4.00^{c}	7.20^{b}	10.00^{a}	10.00^{a}	0.80
M. peregrina	0.00^{d}	2.40^{e}	4.40^{c}	7.00^{b}	10.00^{a}	10.00^{a}	1.10

a,b,c,d Values with different subscripts on the same row are significant (p<0.05).

M. oleifera and *M. peregrina* respectively Table (1). Whereas bitterness was removed from all tested Moringa kernels varieties treated by water in 5 hours Table (2).

Gross chemical composition of Moringa kernels varieties:

The chemical analysis of the raw and soaked *M. oleifera* and *M. peregrina* kernels are shown in Table (3). There were significant differences among *M. oleifera* and *M. peregrine* ($p < 0.05$). In general, soaking process has not significant ($p < 0.05$) effect on moisture, protein and lipid of *M. oleifera* seeds variety compared to *M. peregrina* seeds variety which has significant differences with soaking in all components of gross chemical composition.

The moisture contents of Moringa seeds were in the range of 3.54 to 5.13%, the lowest protein content was exhibited in *M. peregrina* seeds soaked with water (20.10%) whereas the highest protein content was *M. oleifera* raw seeds (34.62%). Moringa seeds consider a good source of lipids it ranged from (41.44%) in *M. oleifera* seeds soaked with NaOH 0.5% to (56.78%) in *M. peregrina* seeds soaked with water. The kernels, previously treated with detoxification soaking treatment before oil extraction, are considered a good source of protein supplement and should be utilized in the human nutrition field Sharaf (2005).

Table 3. Gross chemical composition of Moringa kernels varieties

Treatment / Components (g/100g on dryweight)	Raw kernels		Soaking process M O W M P Na M P W				LSD
			Alkali solution NaOH 0.5%		Water		
	Moringa Oleifera	*Moringa Peregrina*	*Moringa Oleifera*	*Moringa Peregrina*	*Moringa Oleifera*	*Moringa Peregrina*	
Moisture	4.40^{b}	3.54^{c}	4.69^{a}	4.89^{a}	4.94^{a}	5.13^{a}	0.70
Protein	34.62^{a}	27.35^{b}	34.56^{a}	23.68^{c}	33.89^{a}	20.10^{d}	0.90
Lipid	41.55d	52.52c	41.44d	54.21b	41.79d	56.78a	1.41
Fiber	12.44a	10.97 b	10.83b	9.57c	7.49e	8.44d	0.93
Ash	3.09^{b}	2.59^{cd}	3.56^{a}	2.97^{b}	2.95^{bc}	2.24^{d}	0.37
Carbohydrate***	8.30	6.57	9.61	9.57	13.88	12.44	

a,b,c,d Values with different subscripts on the same row are significant (p<0.05).
***Calculated by differences.**

Data in Table (3) revealed that *M. oleifera* raw seeds exhibited the highest value of crude fiber (12.44%), followed by *M. peregrina* raw seeds (10.97%), while the lowest value of crude fiber was *M. oleifera* seeds soaked with water (7.49%).

The carbohydrates were ranged from 6.57 to 13.88% in raw kernel *M. peregrina* in water soaking *M. oleifera* seeds, respectively. Ash content was ranged from 2.24 to 3.56% as indicated in Table (3). Similar results for crude fiber, carbohydrates, and ash content of various cultivars of Moringa seeds were reported by Sodamade *et al.* (2017); Auriema *et al.* (2019); and Ashour *et al.* (2020).

Mineral content of Moringa kernels varieties:

Moringa seeds are rich in minerals, while it shows low bioavailability due to the presence of some antinutritional factors such as polyphenols, phytate, and trypsin inhibitor Nadeem *et al.* (2010).

Table 4. Mineral's content of Moringa kernels varieties (mg/100g on dry weight)

Treatment	Raw kernels		Soaking process M P W				FDA 2018*
			Aqueous alkali solution NaOH 0.5%		Water		
Minerals Mg/100gm	*Moringa Oleifera*	*Moringa Peregrina*	*Moringa Oleifera*	*Moringa Peregrina*	*Moringa Oleifera*	*Moringa Peregrina*	
K	916.41	813.77	839.43	403.22	865.09	557.18	3500
P	422.37	332.63	364.01	343.29	445.59	337.65	1000
Na	134.87	214.36	664.76	903.21	108.38	187.86	2400
Mg	105.00	42.00	36.00	33.00	117.00	27.00	400
Ca	55.00	35.00	85.00	60.00	105.00	35.00	1000
Fe	15.80	7.75	7.60	5.95	12.75	6.55	18
Zn	9.35	10.90	10.32	11.92	11.52	9.65	15

***FDA (2018), the daily values for Americans 4 years and older age.**
http://www.FDA.gov/nutrioneducation

From the previous table, we notice a decrease in potassium and iron content in the soaked samples compared to the fresh samples. Where the potassium content ranged between 403.22 - 865.09 mg/100g for the soaked samples, while it was 916.41 and 813.77 mg/100g respectively for the fresh *Moringa oleifera* and *Moringa Peregrina*. Also, the iron content ranged between 5.95 – 12.75 mg/100g for the soaked samples, while it was 15.80 and 7.75 mg/100g respectively for the fresh *Moringa oleifera* and *Moringa Peregrina*.

Regarding the sodium concentration, the soaking in the alkaline solution led to an increase in the sodium content in the samples (664.76 - 903.21 mg/100g), while there was a decrease in the sodium concentration when soaking in the water (108.38 - 187.86 mg/100g) compared to the fresh samples (134.87 - 214.36 mg/100g).

In the case of magnesium, the soaking led to a decrease in the magnesium content of the seeds (27.0 – 36.0 mg/100g), except for the soaking in water for *Moringa oleifera*, an increase in the magnesium concentration (117.0 mg/100g) was observed compared to the fresh seeds that contained 105.0 and 42.0 mg/100g respectively for the fresh *Moringa oleifera* and *Moringa Peregrina*.

Considering the phosphorous content of the seeds, an increase in the phosphorous concentration was observed in the soaked samples (337.65 - 445.59 mg/100g) compared to the fresh samples (332.63 -422.37 mg/100g), except for soaking in the alkaline solution of *Moringa oleifera*, a decrease in the phosphorous concentration was observed (364.01 mg/100g).

Regarding the concentration of calcium and zinc elements from the table, we note that the soaking process led to an increase in the content of the seeds of these minerals, with the exception of soaking in water for *Moringa Peregrina* seeds, we did not notice any change in the calcium content (35 mg/100g) while a decrease in zinc content (9.65 mg/100g) was observed when compared to the fresh seeds. The increases in zinc suggest that micro-flora enzymes hydrolyzed the zinc-protein enzymes bonds to release much more free zinc for utilization Mbah *et al.* (2012). Finally, there is a large variation in the value of minerals in research, these results agree with those reported by Rayan and Embaby (2016). and also agree with recommended dietary allowance FDA (2018).

Anti-Nutritional factors of Moringa kernels varieties:

The obtained data of Table (5) illustrated that, treatments by soaking process caused high elimination of antinutritional components from Moringa kernels at different rates depending on Moringa soaking medium under the best similar chosen conditions, since the low residue concentration has no adverse effect Makkar *et al.* (1993).

The elimination rate of all the determined antinutritional factors was higher for kernels soaked in tap water than those for treated with soaking by aqueous alkali solution exception the saponin an which was more leached with soaking with dilute alkali solutions than the former soaking media under the same preferable. These results agree with those reported by Sharaf (2005).

Table 5. Anti-nutritional factors of Moringa kernels varieties Mg/100g

Treatment Components Mg/100g	Raw kernels		Soaking process				LSD
			Alkali solution NaOH 0.5%		Water		
	Moringa Oleifera	*Moringa Peregrina*	*Moringa Oleifera*	*Moringa Peregrina*	*Moringa Oleifera*	*Moringa Peregrina*	
Phytate	145.70^{a}	139.30^{b}	114.00^{c}	101.26^{d}	84.30^{e}	71.40^{f}	3.54
Oxalate	101.00^{b}	113.00^{a}	77.00^{d}	87.64^{c}	61.70^{e}	62.35^{e}	3.09
Tannins	123.00^{a}	117.00^{b}	87.00^{c}	88.16^{c}	53.40^{d}	51.17^{d}	5.12
Saponin	35.00^{b}	47.00^{a}	16.25^{e}	17.28^{de}	19.27^{d}	25.61^{c}	2.11

a,b,c,d Values with different subscripts on the same row are significant ($p<0.05$).

Phytate was the most abundant antinutritional factor found in Moringa seeds. The highest decreasing of Phytate was with the aqueous extract than in the alkali aqueous extract it was 145.70 and 139.30 mg/100g for raw *Moringa oleifera* and *Moringa peregrina*, decreased to 84.30 and 71.40 mg/100g soaked with water, respectively.

Since these components are water soluble Kumar *et al.* (1979). It is possible that soaking reduces phytate levels in seeds since phytic acid occurs entirely as a water-soluble salt. The drop in phytate after the soaking could have been due to the leaching of phytate ions into the soaking water Mehanni *et al.* (2021).

Oxalate the most decreasing was with soaked water in both Moringa seed varieties 61.70 and 62.35 mg/100gm for *M. oleifera* and *M. peregrina* seeds, respectively. Similar results were reported by Olagbemide and Philip (2014). As well tannins were in the same trend in decrease. The highest decreasing of tannins was with the aqueous extract than in the alkali aqueous extract it was 123.00 and 117.00 mg/100g for raw *Moringa oleifera* and *Moringa peregrina*, decreased to 53.40 and 51.17 mg/100g soaked with water respectively.

And so, leach into the liquid media, the loss in tannin content after soaking was significantly greater. The presence of water-soluble tannins in the soaking medium, or their

breakdown by enzymes during the soaking period, could possibly account for losses (Deshpande and Cheryan, 1983; Afifi *et al.*, 2012).

On the other hand, in saponin the most decreasing was with alkali aqueous solution in both Moringa seed varieties 16.25 and 17.28 mg/100gm for *Moringa oleifera* and *Moringa peregrina* seeds, respectively. Similar results were reported by Olagbemide and Philip (2014).

Fatty acids composition% of Moringa kernels varieties oils:

Results of gas chromatographic analysis of raw, soaked with alkali solution and soaked with water solution for *M. oleifera* and *M. peregrina* kernels are presented in Table (6). The data showed that the unsaturated fatty acids were 90.43, 90.73, 86.98, 87.5, 80.07 and 83.16%, for Palmetolic, Oleic, Linoleic and Arachidonic while the levels of saturated fatty acids were 9.57, 9.27, 13.02, 12.5, 19.93 and 16.84%, for Capric, Lauric, Myristic, Palmetic, Arachidic and Behenic of total fatty acids in raw, soaked with alkali solution (NaOH 0.5%) and soaked with water for *M. oleifera* and *M. peregrina* kernels, respectively. Moringa oil exhibited relatively low contents of saturated fatty acids and high contents of unsaturated fatty acids, compared to other common seed vegetable oils, such as corn, olive, sesame, and soybean Manzoor *et al.* (2007). Furthermore, fatty acid oleic (C18:1) represented the highest level of the fatty acids (from 55.66 to 68.59 %) of the total fatty acid content. Meanwhile, Capric (C10) represented the least percentage among the fatty acids of the raw Moringa kernels.

High oleic acid in Moringa oil makes it desirable in terms of nutrition and cooking stability and frying oil Abdulkarim *et al.* (2005). These results are in agreement with reported data by Barakat and Ghazal (2016), Basuny and Al-Marzouq (2016) and Hammam *et al.* (2016).

Likewise, the results in Table (6) showed that there was a high decrease in the total unsaturated fatty acids content after soaking, processes of *M. oleifera* and *M. Peregrina* seeds accompanied by an apparent increase in the total saturated fatty acids. Differences in the fatty acid levels might be due to the lipolytic activity of soaking processes, which agrees with Zimmerman and Klosterman (1965). The nutritional quality index (linoleic /saturated fatty acids) of Moringa seeds were low ranged from 0.36 to 0.77, compared with that of groundnut oil which ranged from 1.8 to 2.4 Nagaraj (1995). The ratio of oleic to linoleic acid being a measure of oil keeping quality (oil stability index) was very high and ranged from 7.40 to 10.31 as presented in Table (6).

Table 6. Fatty acids composition% of Moringa kernels varieties oils

Treatment / Fatty acids	Raw kernels		Soaking process			
			Alkali solution NaOH 0.5%		Water	
a- saturated fatty acids	***Moringa Oleifera***	***Moringa Peregrina***	***Moringa Oleifera***	***Moringa Peregrina***	***Moringa Oleifera***	***Moringa Peregrina***
Capric C:10	0.23	0.60	ND	ND	8.00	6.92
Lauric C12	ND	ND	ND	ND	0.32	ND
Myristic C14	ND	ND	ND	ND	0.69	0.59
Palmetic C16:0	3.76	4.20	4.42	4.39	3.95	5.52
Arachidic C20:0	2.02	1.74	2.54	2.09	2.25	1.56
Behenic C22:0	3.56	2.73	6.06	6.02	4.72	2.25
b- unsaturated fatty acids						
Palmetolic C16:1	14.80	12.08	15.42	15.67	13.64	16.58
Oleic C18:1	65.51	68.59	60.01	59.91	55.66	58.06
Linoleic C18:2	7.36	6.65	8.02	7.79	7.52	6.04
Arachidonic C20:4	2.76	3.41	3.53	4.13	3.25	2.48
Total saturated fatty acid	9.57	9.27	13.02	12.5	19.93	16.84
Total unsaturated fatty acid	90.43	90.73	86.98	87.5	80.07	83.16
Nutritional quality index (linoleic/ saturated fatty acid)	0.77	0.72	0.61	0.62	0.38	0.36
Oil stability index (oleic/linoleic)	8.90	10.31	7.48	7.69	7.40	9.61
Polyunsaturated	10.12	10.06	11.55	11.92	10.77	8.52

ND = Not Detected

The unsaturated fatty acids have high importance in the oil stability because of the chemical reactions occurring at the double bonds. The rate of oxidation reactions depends on the number of double bonds in the carbon chain Westbrook *et al.* (2013). Therefore, Moringa oils with high proportion of oleic acid are more stable than the others. Also, oleic acid is less susceptible to oxidation than polyunsaturated fatty acid from the (18:2, n−6) series (linoleic acid). A considerable content of linoleic acid (C18:2) as an essential fatty acid in the Moringa oil may provide high nutritional remuneration and reduce beneficial healthy effect on blood lipid, blood pressure and cholesterol content, and it is preferred by industries when oil hydrogenation is required Cheikh-Rouhou (2008).

CONCLUSION

There were significant differences among M. *oleifera* and *peregrina*. In general, soaking process has significant ($p < 0.05$) effect on the gross chemical composition of M. *oleifera* seeds variety compared to *Moringa peregrina* seeds. As well, there is a large variation in the value of minerals of the raw and soaked *Moringa oleifera* and *Moringa peregrina* kernels. Detoxification treatments by soaking process caused high elimination of antinutritional components from Moringa kernels at different rates depending on Moringa soaking medium under the best similar chosen conditions, since the low residue concentration has no any adverse effect. Besides, the elimination rate of the determined antinutritional factors was higher from kernels soaked in tap water than those from treated with soaking with aqueous alkali solution. In addition, the results showed that there was a high decrease in the total unsaturated fatty acids content after soaking, processes of *M. oleifera* and *M. Peregrina* seeds accompanied by an apparent increase in the total saturated fatty acids. Therefore, it is recommended to pay attention to expanding the cultivation of Moringa, especially in the Egyptian desert lands, in order to benefit from it as a promise source of edible oil and protein.

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تأثير عملية النقع على الخصائص الكيميائية والعوامل المضادة للتغذية لبعض أصناف بذور المورينجا

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تتميز بذور المورينجا بقيمة غذائية وطبية عالية، ويرجع هذا إلى المخزون الكبير من المكونات النشطة بيولوجيًا في البذور. ومع النقص العالمي في الحبوب الغذائية، والإصابة بأمراض نقص التغذية والتزايد المستمر في عدد السكان، ستكون المورينجا على وجه الخصوص بديلاً جيدًا للتعويض عن نقص الغذاء. الهدف من هذا البحث هو معرفة تأثير المعاملة بالنقع في الماء ومحلول هيدروكسيد الصوديوم 0.5% على التركيب الكيمائى لبذور المورينجا. تم تقدير التركيب الكيميائى والمعادن ومضادات التغذية والأحماض الدهنية لبذور المورينجا أوليفيرا والمورينجا بيريجرينا. أظهرت النتائج أن عمليات النقع ليس لها تأثير معنوى ($p < 0.05$) على التركيب الكيميائى لصنف بذور المورينجا أوليفيرا مقارنة بصنف بذور المورينجا بيريجرينا الذى يختلف معنوياً قبل النقع عن بعده. بالإضافة إلى ذلك، هناك تباين كبير فى محتوى المعادن لبذور المورينجا أوليفيرا والبيريجرينا الخام والمنقوعة. أظهرت النتائج اختلافًا معنويًا في محتوى مضادات التغذية لبذور المورينجا (أوليفيرا وبيريجرينا) قبل النقع وبعده. أظهرت نتائج عمليات النقع في الماء أكثر فعالية من النقع بمحلول هيدروكسيد الصوديوم 0.5% لإزالة العوامل المضادة للتغذية. علاوة على ذلك، فإن الحمض الدهني الأوليك يمثل أعلى نسبة من الأحماض الدهنية، وأشارت النتائج إلى وجود انخفاض ملحوظ في إجمالي محتوى الأحماض الدهنية غير المشبعة بعد النقع، في بذور المورينجا أوليفيرا والمورينجا بيريجرينا مصحوباً بزيادة واضحة في إجمالي الأحماض الدهنية المشبعة.