Middle East Journal of Applied Sciences
ISSN 2077-4613

Volume : 08 | Issue :01 |Jan.-Mar.| 2018
Pages: 01-06

Physico chemical characteristics of mango kernel oil and meal

Sahar A. Abdelaziz

Food and Nutrition Department, College of Home Economics, King Abdulaziz University, Kingdom Saudi Arabia and Nutrition & Food Science Dept., National Research Center, Giza, Egypt.

Received: 30 Oct. 2017 / Accepted: 20 Dec. 2017 / Publication date: 04 Jan. 2018

ABSTRACT

The chemical composition of mango kernel oil and its meal were characterized for their physicochemical properties. Also the function properties of mango kernel meal were also studied. The proximate compositions of whole kernel on dry bases were 6.05%, 7.53%, 11.00%, 2.77%, 2.45% and 69.20% moisture, Crude protein, Crude fats, Total ash, Crude fiber and Total carbohydrates respectively. While, Potassium, magnesium, Sodium, Calcium, iron, zinc and Copper were 310, 230, 2.65, 185, 9.30, 6.10 and 4.20 mg/100g on dry weight basis respectively. The characteristics of mango kernel meal oil The Specific gravity at 24° C, Reflective Index and Iodine value (g/100g oil) were 0.89, 1.58 and 46.0, respectively. Whereas, the value of free fatty acid, Saponification value and Peroxide value were 3.97, 192 and 1.73 respectively. The major fatty acids of the triacylglycrol was oleic acid (44.89%) followed by Stearic acid (36.57%). On the other hand, the minor amounts of fatty acids composition were found to be 10.06%, 6.00% and 2.48 for Palmitic acid, Linoleic acid and Linolenic acid respectively. The defatted apricot kernels cake were free from HCN and contained 16 amino acids, the presence 16 amino acid in mango kernel protein. Whereas, the major amino acids were Glutamic acid 10.58 , Alanine6.31, Leucine 6.09, Aspartic acid 5.56, Arginine5.03, Phenylamine4.16, Lysine3.88 Tyrosine3.20, and Isoleucine3.32 g/100g protein. On the other hand, Methionine, Proline, Valine, Threonine , Histidine , Glycine and Serine were 1.10, 2.34, 2.91, 2.27, 2.21, 2.71 and 2.56g/100g protein respectively.. On the other hand, the mango kernel meal was contained 625.50 mg/ 100g total phenolics. Whereas, 200, 300 ppm phenolic compounds of mango kernel meal as antioxidant was more effective for lowering the development of peroxide value for corn oil than using butylated hydroxyl toluene BHT. Therefore it can recommend with adding natural mango kernel meal phenolic compounds with oil as antioxidant because it was healthier useful and considered as alteration of synthetic antioxidants.

Key words: Mango kernel oil, mango kernel meal, physical and chemical properties, amino acid, fatty acid, phenolic compounds.

Introduction

Mango *(Mangifera indica* L.*)* is one of the most important tropical fruits in the world. During processing of mango, by-products such as peel and kernel are generated. Kernels take up about 17-22% of the fruit. The major components of mango seed are starch, fat and protein. The oil of mango seed kernel consist of about 44-48% saturated fatty acids (majority stearic) and 52–56% unsaturated. Mango seed kernels have a low content of protein but they contain the most of the essential amino acids, with highest values of leucine, valine and lysine. Mango seed kernels were shown to be a good source of polyphenols, phytosterols as campesterol, sitosterol and tocopherols. In addition, mango seed kernel could be used as a potential source for functional food ingredients, antimicrobial compounds and cosmetic due to its high quality of fat and protein as well as high levels of natural antioxidants. The mango stone obtained after decortication of mango seed can be utilized as adsorbent Mango seed consists of a tenacious coat enclosing the kernel. The seed content of different varieties of mangoes ranges from 9% to 23% of the fruit weight and the kernel content of the seed ranges from 45.7% to 72.8% (Kittiphoom, 2012). A preliminary study showed that the seed represents from 20% to 60% of the whole fruit weight, depending on the mango variety and

Corresponding Author: Sahar A. Abdelaziz, Food and Nutrition Department, College of Home Economics, King Abdulaziz University, Kingdom Saudi Arabia and Nutrition& Food Science Dept. National Research Center-Giza-Egypt. E. mail:saharabdelaziz15@yahoo.com

the kernel inside the seed which represents from 45% to 75% of the whole seed (Maisuthisakul, and Gordon, 2009). Soong *et al.* (2004) indicated that mango seed kernel has potent antioxidan activity with relatively high phenolic contents. They referred that mango seed kernel was also shown to be a good source of phytosterols as campesterol, bsitosterol stigmasterol and also contain tocopherols (Abdalla *et al.,* 2007).

Therefore, the present study attempted to estimate the physical and chemical properties, of meal and oil composition in mango kernel seeds.

Material and Methods

Materials:

Ripe mango seeds as by-products (waste) was collected after mango pulp processing from zebdia variety during the summer season of 2017 from Al Rabie Saudi food CO. LTD.

Preparation of Mango Kernel flour

Mango stones were cleaned and washed twice with tap water, then left to dry in the air. After the stones were individually hammered to obtain the kernels of which the outer cover was removed by hand after kernels were soaked in tap water at 50 °C for 48 h followed by autoclaving for 30 min at 121 °C (for reduce tannins) and dried by tray drier at 23 °C According (Legesse and Admassu, 2012). The dried material was ground in a hammer mill into a powdery form and kept in a closed dark glass bottle and stored at 4 °C until further analysis.

Analytical Methods

Moisture, total protein, ether extract, total ash, crude fiber and minerals were determined according to methods in the (A.O.A.C., 2010). Total carbohydrates were calculated by difference.

Determination of the fatty acid methyl esters

Gas-liquid chromatography was used for fractionation and determination of fatty acid methyl esters according to the method described by Zygadlo *et al.* (1994).

Determinations for peroxide, iodine, and saponification values, unsaponifiable matter and free fatty acid contents were carried out using (Pena *et al.,* 1992) standard analytical methods.

Physical properties included specific gravity, refractive index, melting point and color were determined according to AOCS., (1998).

Identification of amino acid for mango kernel meal

Amino acid compositions of mango kernel meal were analyzed using amino acid analyzer, Beckman7300, according to the method of lopaz *et al.* (1991).

Determination of Total Phenolic Content: Total phenolic content of the extracts was determined spectrophotometrically using the Folin-Ciocalteu method, as described by Singleton *et al.* (1999).

Antioxidant activity testing:

Extracted phenolic compounds from mango kernel meal was tested as Antioxidant by the determination of peroxide value (POV) during incubation of sunflower oil at 60ºC for 7 days as described by Matthous, (2002).

A25 g of corn oil were mixed with 100, 200 and 300ppm phenolic compounds of the mango kernel meal in a flask against Butylated hydroxyl Toluene (BHT) as control Ten grams of dried red cabbage were exhaustively extracted with ethanol (100ml).and the mixtures were placed in an oven at 60ºC for 3h daily, the experiment was continued for 7 days. The peroxide value was determined for each according to the method described in A.O.A.C., (2010).

Statistical analysis

Statistical analysis was applied to sensory and biological evaluation of adding different percentages from treated kernels flour. Data were treated to be for complete randomization design. Least significant difference (L.S.D.) was calculated at 1% level as significance. This analysis was carried out as mentioned by Snedecor and Cochran (1980).

Results and Discussion

Chemical constituents and minerals content of mango kernel are presented in Table (1and 2). It could be notice that the mango kernel contained 6.05%, 7.53%, 11.00%, 2.77%, 2.45% and 69.20% moisture, Crude protein, Crude fats, Total ash, Crude fiber and Total carbohydrates respectively. While, Potassium, magnesium, Sodium, Calcium, iron, zinc and Copper were 310, 230, 2.65, 185, 9.30, 6.10 and 4.20 mg/100g on dry weight basis respectively. These results are agreement with Nzikou *et al.* (2010) ; Abdalla *et al.* (2007).

Table 1. Chemical composition of mango kernel meal

Constituents	G /100g
Moisture	6.05d
Crude protein	7.53c
Crude fats	11.00b
Total ash	2. 77e
Crude fiber	2. 45e
Total carbohydrates	69.20a

Values with different letters in the same column are significant different at P<.0.05.

Table 2: Mineral content (mg/100g dry basis) of the mango kernel meal

Elements	mg/100g dry basis
Potassium	310.00a
Magnesium	230.00b
Sodium	2.65f
Calcium	185.00c
Iron	9.30d
Zinc	6.10e
Copper	4.20f

Values with different letters in the same column are significant different at P<.0.05.

Physico chemical characteristics of mango kernel oil

Physical and chemical characteristics (Specific gravity, Reflective Index, Iodine value, Saponification value, free fatty acids and Peroxide value) of mango kernel oil are given in Table (3). The Specific gravity at 24° C, Reflective Index and Iodine value (g/100g oil) were 0.89, 1.58 and 46.0, respectively. Whereas, the value of free fatty acid, Saponification value and Peroxide value were 3.97, 192 and 1.73 respectively. On the other hand, Melting point (°C) and color (30Y+10R) of mango kernel meal were 30.0 °C and 25.0 respectively. these results are in agreement with those reported by other scholars **(**El-Soukkary, 2000 ; Mohamed *et al.,* 2005).

Fatty acid composition (%) of the mango kernel oil:

The mango kernel lipid for their fatty acids composition, and the results recorded in Table 4. The major fatty acids of the triacylglycrol was oleic acid (44.89%) followed by Stearic acid (36.57%). On the other hand, the minor amounts of fatty acids composition were found to be 10.06%, 6.00% and 2.48 for Palmitic acid, Linoleic acid and Linolenic acid respectively. These results confirmed those of Abdalla *et al.* (2007); Nzikou *et al.* (2010).

Amino acid profile of mango kernel meal:

Amino acid contents and types are very important parameters to evaluate the protein. The amino acids composition of mango kernel meal was quantitavely determined by Amino acid analyzer and results to calculate as g amino acid/100g protein. Also the meal was free from HCN.

Amino acid composition of mango kernel meal is illustrated in Table (5). Results revealed that, the presence 16 amino acid in mango kernel protein. Whereas, the major amino acids were glutamic acid 10.58 , alanine6.31, leucine 6.09, aspartic acid 5.56, Arginine5.03, Phenylamine 4.16, Lysine3.88 Tyrosine3.20, and Isoleucine3.32 g/100g protein. On the other hand, methionine, proline, valine, threonine , histidine , glycine and serine were 1.10, 2.34, 2.91, 2.27, 2.21, 2.71 and 2.56g/100g protein respectively.

Table 3: Physico chemical characteristics of mango kernel oil

Properties	Mango kernel oil
Specific gravity at 24° C	0.89
Reflective Index	1.58
Iodine value (g/100g oil)	46.0
Saponification value (mg KOH/g)	192
Free fatty acids (%)	3.97
Peroxide value (meq/kg of oil)	1.73
Melting point (°C)	30.0
Total Lovibond color (30Y+10R)	25.0

Values with different letters in the same column are significant different at P<.0.05.

Table 4: Fatty acid composition (%) of the mango kernel oil

Fatty acid composition	Mango kernel oil
Stearic acid (18:0)	36.57a
Palmitic acid (16:0)	10.06c
Oleic acid (18:1)	44.89b
Linoleic acid (18:2)	6.00d
Linolenic acid (18:3)	2.48e

Values with different letters in the same column are significant different at P<.0.05.

Table 5: Amino acid profile of mango kernel meal

Amino acids	g/100g
Phenylanine	4.16c
Isoleucine	3.32d
Leucine	6.09b
Tyrosine	3.20d
Methionine	1.10f
Proline	2.34e
Valine	2.91e
Threionine	2.27e
Histidine	2.21e
Alanine	6.31b
Glutamic acid	10.58a
Glycine	2.71e
Serine	2.56e
Arginine	5.03bc
Aspartic acid	5.56b
Lysine	3.88d

Values with different letters in the same column are significant different at P<.0.05.

Effect of antioxidant activity for phenolic compounds extracted from mango kernel meal:

Total phenolics content:

The concentration of total extracted phenolics in mango kernel meal was 625.50 mg/ 100g mango kernel meal.

Antioxidant activity for phenolic compounds:

Effect of antioxidant activity for phenolic compounds extracted from mango kernel meal on corn oil is shown in Table (6). The effect of various concentrations of phenolic compounds extracted from mango kernel meal and BHT as antioxidant on the development of peroxide value of corn oil during 7 days of storage at 60 C. it is evident from these results that, as the concentration of antioxidant increased the inhibitory effect on peroxide value POV increased. However after 7 days of storage at 60C, peroxide value were 10.32, 8.63 and 8.00 meq/kg^{-1} for corn oil treated with 100, 200 and 300 ppm of phenolic compound from mango kernel meal. Whereas, the corresponding value were 10.23, 9.10 and 8.92 meq/kg^{-1} at the same concentration of BHT. On the other hand, concentration of 200 and 300 ppm phenolic compounds from mango kernel meal was more effective for retarding development of peroxide value than using BHT. Also, it could be observed that, using 300 ppm BHT was almost the same effect of 200 ppm phenolic extracted from mango kernel meal decreasing the development of peroxide value. Moreover, either using 200 or 300 ppm mango kernel phenolic compounds caused to great decline for peroxide value developing of corn oil after 7 days of storage at 60C on comparing each that 300ppm BHT. Therefore, adding natural phenolic compounds extracted from mango kernel meal as antioxidant with corn oil was more effective for decreasing the development of corn oil oxidation than using synthetic BHT as antioxidant. Our results may be due to the antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in adsorbing and neutralizing free radicals, quenching singlet triplet oxygen, or decomposing peroxides (Zheng and Wang 2001).

Table 6: Effect of phenolic compounds extracted from mango kernel meal and BHT as antioxidant on peroxide value of corn oil during storage at 60C for 7days.

Storage Time (days)	Developing of peroxide value (meq/kg $^{-1}$) for corn oil with various concentration of						
	Corn oil control free antioxidant	BHT			Phenolic compound from mango kernel meal		
		Corn oil with 100ppm	Corn oil with 200ppm	Corn oil with 300ppm	Corn oil with 100ppm	Corn oil with 200ppm	Corn oil with 300ppm
0	1.20e	1.20e	1.20e	1.20e	1.20e	1.20e	1.20e
1	3.65d	2.80d	2.50d	2.36d	3.13d	2.32de	2.21d
2	5.62c	3.67c	3.21cd	3.11cd	4.34d	3.10d	2.90d
3	7.52c	4.28c	4.42c	4.20c	5.86c	4.18c	3.98c
4	8.83bc	5.92bc	5.92b	5.32b	6.92b	5.11b	4.88bc
5	12.36b	7.23b	7.23ab	6.46b	8.38ab	6.28b	5.93b
6	15.90ab	9.16a	8.12a	7.52a	9.47a	7.20a	7.00a
7	19.32a	10.23a	9.10a	8.92a	10.32a	8.63a	8.00a

Values with different letters in the same column are significant different at P<.0.05.

References

Abdalla, A.E.M., S.M. Darwish, E.H.E. Ayad and R.M. El-Hamahmy, 2007. Egyptian mango by-product 1. Compositional quality of mango seed kernel. Food Chemistry, 103: 1134-1140.

AOAC. 2010. Association of Official Analytical Chemists. Official Methods of Analysis, 19th ed. Washington, D. C.,U.S.A

AOCS. 1989. Official methods and recommended Practices (15th ed.). Champaign, New York: American Oil Chemist's Society.

El-Soukkary, H. F. A., M. A.EL-Sahn, H. M. A.Mohamed, 2000. Physico-chemical and nutritional evaluation of mango seed kernel and its utilization for pan bread supplementation. Zagazig Journal of Agriculture and Research., 27,pp. 1319–1342.

Kittiphoom, S., 2012. Utilization of Mango seed. International Food Research Journal 19(4): 1325-1335.

Legesse, M.B and S. Admassu, 2012: Functional and physicochemical properties of mango seed kernels and wheat flour and their blends for biscuit production, African Journal of Food Science and Technology, 3(9) : 193-203.

Lopaz, P.O., A. C. Falomir and O. O. Pezguaz, 1991.Chickpea protein isolate, physiochemical, functional and nutritional characterization. J. Food Sci., 56: 725-729.

Maisuthisakul, P. and M.H. Gordon, 2009. Antioxidant and tyrosinase inhibitory activity of mango seed kernel by product. Food Chemistry, 117: 332–341

Matthaus, B., 2002. Antioxidant activity of extracts obtained from residues of different oil seeds. J. Agric. Food Chem., 47:2350-2354

Mohamed, E.M., A.Y. Girgis, 2005. Utilization of mango seed kernels for improving stability of some oils and biscuit production. J.Agric & Sci. 30(8): 4625-4636

Nzikou, J.M., A.Kimbonguila , L. Matos, B. Loum-ouamou , N.P.G. Pambou–Tobi , C.B.Ndangui, A.A.Abena, T. Silou, J.Scher and S.Desobry, 2010. Extraction and characteristics of seed kernel oil from mango (*Mangifera indica*). Research Journal of Environmental Earth Science. 2: 31–35.

Pena, D.G., R.G.L. Anguiano, J.J.M Arredondo, 1992. Modification of the method 1 AOAC (CB-method) for the detection of aflatoxins, Bull. Environ. Contam. Toxicol., 49 ,pp. 485-489

Singleton, V.L., R. Orthofer and R.M. Lamuela Ravento´s, 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means ofFolin-Ciocalteu reagent. Methods in Enzymology299: 152-178.

Snedecor, W.G. and W.G. Cochran, 1980. Statistical methods, 17th ED Iowa State Univ. press Ames., Iowa, USA.

Soong, Y.Y., P.J. Barlow and C.O. Perera, 2004. A cocktail of phytonutrients: identification of polyphenols, phytosterols and tocopherols from mango (*Mangifera indica* L.) seed kernel. In IFT annual meeting, July 12-16, Las Vegas

Zheng, W. and S. Y. Wang 2001. Antioxidant activity and phenolic compounds in selected herbs. J. Agric. Food Chem., 49: 5165-5170.

Zygadlo, J. A., R. E.Morero, R. E. Abburra and C. A. Guzman, 1994. Fatty acid composition in seed oils of some Onagraceae. J. Am. Oil Chem. Soc. 71: 915-916