



Biochemical estimation of nutritive parameters in waste seed kernel of Mango (*Mangifera indica* L.)

Ankita Sagar* and R.P. Singh

Department of Biochemistry, Narendra Deva University of Agriculture And Technology Narendra Nagar, Faizabad-224 229, India

*e-mail: ankitasagar84@gmail.com

(Received: January 09, 2016; Revised received: August 25, 2016; Accepted: August 31, 2016)

Abstract: The scientific management and disposal agro-wastes are a serious problem causing environmental pollution. Reutilization of these biological wastes for unconventional source of food, oil and medicinal uses could be performed after determining their nutritive and biochemical properties. Mango seed despite of its beneficial characters is treated as waste creating environmental menaces. In the light of the present facts the present investigation was carried out during year 2012-2013. Mangoes were collected from local market. Seeds were separated from fruit, washed thoroughly with tap water, shade and sun dried. The kernels were removed from their tenacious leathery coat. Then they are finely ground into kernel flour. De-fatted mango kernel powder was analyzed for parameters like carbohydrate, protein, crude fiber and ash. Carbohydrate content obtained in mango kernel was reported as 46.85% which was comparable to other traditional animal meal. The fat content obtained from mango kernel was 12.39% is quite good to utilize mango kernel powder as non-conventional source of fat extraction. Therefore, it could be utilized as feed stuff for animals and non-conventional source of oil.

Key words: *Mangifera indica*, Seed kernel, Proximate composition, Feed stuff, Protein, Carbohydrate, Protein, Crude fiber, Ash

Introduction

Mango (*Mangifera indica*) is accredited as the king of fruits, usually found in Southern Asia (Eastern India, China, Thailand, Pakistan, Burma, Andaman Islands) and Central America area. The increasing trend in the production of mango fruit in India could be observed and supported by the statistics provided by APEDA according to which the production during 2011-12 and 2012-13 was 161.96 lakh tonnes and 180.02 lakh tonnes, respectively (APEDA Annual report, 2013). Mangoes are popularly consumed directly as fruits (Jagadeesan and Shankar, 2014) also its processed products like chutney, pickle, juice, flavor, fragrance and coloring purposes etc. are of worldwide popularity (Kittiphoom, 2012). The mango flesh is only 60% of the total weight of the fruit. The seed represents between 10% and 25% of the whole fruit weight of different mango varieties (Maisuthisakul *et al.*, 2007). The kernel inside the seed represents between 45% and 75% of the seed and about 20% of the whole fruit (Arogba, 1997). Mango seed kernel analysis showed that it contains carbohydrate (73.1%), protein (7.2%), fat (9.8%), fibre (0.5%), ash (2.1%), metabolizable energy (3,275 Kcal/Kg), total phenolics (27.9 mg GAE/g), 0.21% calcium and 0.22% phosphorus, depending on the variety Bandyopadhyay *et al.* (2014), Fowomola (2010), Arogba (1997), Dakare *et al.* (2012). Various other minerals (mg/100g) in mango kernel was also found like Sodium (18.52); Potassium (82.01); Magnesium

(30.00); Iron (77.34); Copper (1.81); Zinc (10.61); Manganese (2.99) (Dakare *et al.* (2014). The fat content of the mango kernels was 6.40-7.74% (dry basis) depending upon the variety and having yellowish color (Sonwai and Ponprachanuvut 2014). Mango seeds kernels fat, have linoleic acid (C 18:2) as a predominant fatty acid (56.33%) followed by oleic acid (23.47%). The chemical properties of this oil are in the normal range of edible oils Amalet *et al.* (2008).

Mango kernel extracts from two native Indian varieties (Bagnapalli and Senthura kernel extracts) showed antibacterial activity against *Pseudomonas* and *Streptococcus* strain of human pathogenic bacteria. This property of kernel extracts can be used in various industrial applications in food additives and pharmaceutical compositions for the drugs being used against various human bacterial pathogens (Aloket *et al.*, 2013). Despite of the fact that these wasted mango kernel are a key sources of bioactive compounds of biological significance, possess antimicrobial and antioxidant potential they are allowed to decay naturally causing water pollution, unpleasant odours, explosions and combustion, asphyxiation and greenhouse gas emissions Rodriguez (2008). Mango seed kernels have long been used as food in certain parts of India particularly in scarcity. Flour has been made from kernels of ripe mango seed kernel were dried and made chapattis in North West provinces or boiled/roasted and eaten. Therefore, it is a nutritional promising seed and estimation of its proximate composition would help to

identify the potential benefit of the kernel, to fill the scarcity and competition problem of feed both for livestock and industry use. Also, this study explores information useful to future research on the use of mango kernel for food and unconventional source of oil and other bioactive compounds.

Materials and Methods

Mature mango fruits were collected during year 2012-13 from local market of Kumarganj (Narendra Nagar), Faizabad (U.P.), India. Peel, pulp and seeds were separated. Seed were washed thoroughly with tap water, shade and sun dried. Tenacious leathery seed coat was removed from stone manually using stainless steel knife and mango kernel was obtained. These kernels were chopped into pieces and dried in hot air oven at 60 °C temperature, after complete removal of moisture mango kernel powder was prepared and stored in freezer for further estimation. De-fatting of kernel powder was done by soxhlet apparatus by using petroleum ether boiling point 40-60°C. Defatted cakes were used to analysis of various parameters.

Moisture content and was estimated in fresh mango kernel sample before defatting. It was analysed by the method of (Ranganna, 1986). In which known amount of sample in an oven, it was maintained at 55±2°C till it attained a constant weight. It was calculated by subtracting the dried weight from the fresh weight and expressed as percentage of fresh weight. The total carbohydrate content in mango kernel was estimated by the method of McCreddy *et al.* (1950). In which anthrone reagent was added and after colour development reading was measured by spectronic-20 at 620 nm against blank reagent. Protein content in mango kernel was determined by the Lowry's method (1951). In which alkaline copper reagent was added and it was mixed properly in sample and folin's reagent was added for color development and intensity was recorded at 660 nm on spectronic-20 against blank solution. Total fat content was analyzed by A.O.A.C. (1965). Ten g mango kernel powder was transferred in thimble and placed in Soxhlet apparatus. Fat was extracted with the solvent (petroleum ether, b.p. 40-60°) and collected in flask excess ether was evaporated on water bath. Flask was cooled the in a dessicator and fat was weighed. The crude fiber and total mineral in dried mango kernel was analysed by the method as described by Hart and Fisher (1971). Energy value was calculated by the method given by Mudambi *et al.* (2007). Carbohydrate, protein and fat was multiplied with appropriate factors and then obtained values were added to obtained value of energy value. The statistical analysis of data obtained was carried out by Gomez and Gomez (1984) method.

Results and Discussion

Results obtained from the present investigation have been revealed in table number 1. The moisture content in the present investigation was found as 43.22%. Dhingra and Kapoor (1985) reported moisture content as 38.55% (Chausa) and 50.98% (Dashehri) in two native Indian varieties. Nzikou *et al.* (2010) reported 45.20% moisture content in Kibangou (French variety mango kernel). Kareem (2001) also reported 44% moisture in mango seed kernel from Nigeria. The carbohydrate content in the existing study was found as 46.85%. Similar observations has been

Table-1: Nutritive parameters in waste seed kernel of Mango (*Mangifera indica* L.)

Characteristics	Obtained value	Reported Value		
		1 (M±SD)	2 Chausa	3 Dusherri
Moisture (%)	43.22	45.2±0.17	38.55	50.98
Carbohydrate (%)	46.85	32.24	nd	nd
Protein (%)	4.99	6.36±1.07 ^d	5.34	5.24
Crude fiber (%)	1.60	2.02±0.80	1.75	1.65
Ash (%)	2	3.2±0.30	2.75	2.45
Total fat (%)	12.39	13.0±1.28	7.82	6.98
Energy content (KJ/100g)	318.87	nd	nd	nd

nd: not determined; M±SD, Mean ± Standard Deviation; (1) Nzikou *et al.* (2010), variety Kibangou; (2) Dhingra and Kapoor (1985), variety Chausa; (3) Dhingra and Kapoor (1985), variety Dusherri

recorded by Nzikou *et al.* (2010) and Shobana and Rajalakshmi (2010), they reported carbohydrate content as 32.24 % and 31.68% respectively. Higher value of carbohydrate content was obtained Yatnattiet *et al.* (2014), Bandyopadhyay *et al.* (2014) and Joyce *et al.* (2014). According to them carbohydrate content in mango kernel was 69.77% (Totapuri), 73.10% (chausa) and 76.14% (Nigerian variety mango kernel). Protein content in the existent research was attained as 4.99%. Presented data is strongly supported by Nzikou *et al.* (2010) and Kareem (2001), they reported protein as 6.36% and 6.00%, respectively in mango kernel. Dhingra and Kapoor (1985) obtained similar results in the mango kernel of Chausa (5.34%) and Dashehri (5.24%). Fowomola (2010) obtained higher values for crude protein in mango kernel (10.06%), while Hassan *et al.* (2013) reported extremely low range of protein present in mango kernel (0.0669±0.0027%).

Crude fiber obtained in present investigation was found as 1.60%. The finding was strongly supported by the experimental data of Kumar and Ravi (2015) Kareem (2001) and Kayode (2013). Kumar and Ravi (2015) and Kareem (2001) obtained 2.27% and 2.00% of crude fiber in mango kernel respectively. Kayode (2013) suggested that crude fibre lies in the range of 2.22-3.95% for kernel obtained from different varieties of mango. Total ash content obtained in present investigation was 2.00%. Legesse and Emire (2012) and Kareem (2001) obtained similar results. Legesse and Emire (2012) reported ash content as 2.1% and Kareem (2001) reported exactly same result as obtained in present investigation. Shobana and Rajalakshmi (2010) concluded that more percent of ash in mango kernel suggested that it contain more carbonless substance. Kayode (2013) reported a slight higher and lower content of ash from the obtained value of total ash (0.52-3.54%). Total fat content revealed in the present investigation for mango kernel was quite promising *i.e.* 12.39%. Abdalla *et al.* (2007) and Nzikou *et al.* (2010) reported that fat in mango kernels as 12.30% and 13.00% respectively. Sani (2014) and Dhingra and Kapoor (1985) reported lower value of fat as 8.27% and 6.98-7.82% in mango kernel. Sani (2014) suggested that the mango kernel could not be utilized as source of industrial fat production. Afolabi (2008) and Kholy *et al.* (2008) it could be concluded

that amount of fat obtained from kernel depends upon genetic potential, variety of kernel used, method implemented for fat extraction.

Energy content obtained in mango kernel was 318.87 (KJ/100g). Dakareet *et al.* (2012), Ashifat *et al.* (2012) and Okpala (2015) reported the similar observation for mango kernel of different regions. Ashifat and Dakareereported it as (234 KJ/g) and 3,275 (Kcal/Kg) respectively. Whereas, Okpalastudied two India and Indochinese varieties and reported energy (kcal/100g) as 420.64 and 411.72 respectively. The results of this experiment revealed the fact that variation in the nutritive parameter of mango kernel has obtained by other researcher, also. These variations may be due to environment, genetic makeup, variety of mango and type of soil. In the present study the physiological fuel value (PFV) of *Mangiferaindica* kernel due to carbohydrate content and protein content was found to be 187.40 Kcal and 19.96 Kcal respectively. Obtained value of carbohydrate composition reported in mango kernel was good and comparable to copra meal 45.7 5%, water fern 34.10%, cassia fistula seed meal 50.53%. Protein content reported is quite low. The protein energy value in mango kernel is less than 20% hence, could be used as possible source of energy in livestock feed formulation. The fat content i.e. 12.39 percent is not comparable to oil seeds like ground nut (46%) but could be utilized as alternate source of fat extraction. Food processing procedure like fermentation could help in enhancing the protein quality and hence the nutritive value of mango kernel. Therefore it could be utilized as potential substitute feed stuff production for marine and poultry animals.

References

- A.O.A.C.: 10th edition, Washington, D.C. (1965).
- Abdalla, A.E.M.; Darwish S.M.; Ayad, E.H.E.; and Hamahmy, R.M. El.: Egyptian mango by-product 2: Antioxidant and antimicrobial activities of extract and oil from mango seed kernel. *Food Chemistry*, **103**: 1141-1152 (2007).
- Alok, P., Keerthana, V., Jha, C.K., Ratan, K. and Agrawal D.C.: Antibacterial property of two different varieties of indian mango (*mangiferaindica*) kernel extracts at various concentrations against some human pathogenic bacterial strains. *Int. Res. J. Biol. Sci.*, **2**: 28-32 (2013).
- Amal M., EL-Bastawesy, El-Refai, A.A. and Zakaria: Grape and Mango Seeds as Untraditional Sources of Edible Oils, Antioxidants and Antibacterial Compounds. *Mansoura J. Chem.*, **34**: 17-36 (2008).
- Arogba, S.S.: Physical, Chemical and Functional Properties of Nigerian Mango (*Mangiferaindica*) Kernel and Its Processed Flour. *Electonic J. Sci. Food Agric.*, **73**: 321-328 (1997).
- Ashifat A.A., Omotubga S.K., Kehinde A.S., Olayinka O.O. and Edugbola G.O.: Proximate evaluation of nutritional value of mango (*Mangiferaindica*). *Int. J. Res. Chem. Environ.*, **2**: 244-245 (2012).
- Bandyopadhyay, K.; Chakraborty, C.; and Bhattacharyya, S.: Fortification of Mango Peel and Kernel Powder in Cookies Formulation. *J. Aca. Ind. Res.*, **2**: 661-664 (2014).
- Dakare, M.A., Ameh, A.D., Agbaji, A.S., Atawodi, S.E.: Effects of Processing Techniques on Contents of Mango (*Mangiferaindica*) seed kernel. *World J. Young Researchers*, **2**: 78-82 (2012).
- Dakare, M.A., Ameh, A.D., Agbaji, A.S., Atawodi, S.E.: Effects of Processing Techniques on Contents of Mango (*Mangiferaindica*) seed kernel. *World J. Young Researchers*, **2**: 78 -82 (2012).
- Dhingra, S. and Kapoor, A.C.: Nutritive value of mango seed kernel. *J. Sci. Food Agric.*, **6**: 752-756 (1985).
- Fowomola M.A.: Some nutrients and antinutrients contents of mango (*Mangiferaindica*) seeds. *Afri. J. Food Sci.*, **4**: 472-476 (2010).
- Gomez, K.A. and Gomez, A.A: Statistical procedure for agricultural research edn. 2nd Sjohn Wiley and Sons. New York p. 680 (1984).
- Hart, F.L and Fisher, H.S: Modern food Analysis. Springer Verlog, New York (1971).
- Hassan, L.G., Muhammad, A.B., Aliyu, R.U., Idris, Z.M., Izuagie, T., Umar, K.J. and Sani, N.A. Extraction and Characterisation of Starches from Four Varieties of *Mangiferaindica* seeds. *IOSR J. Appl. Chem. (IOSR-JAC)*, **3**: 16-23 (2013).
- Jagadeesan, L. and Shankar, H.: Operational performance of mango pulp industry in Tamilnadu - An analysis. *Ind. J. Appl. Res.*, **4**: 90-94 (2014).
- Joyce, O.O., Latyo, B.M. and Onyinye, A.C.: Chemical composition and phytochemical properties of mango (*Mangiferaindica*) seed kernel. *Int. J. Adv. Chem.*, **2**: 185-187 (2014).
- Kareem. S.A.: Response of albino rat to dietary levels of mango seed cake. *J. Agric. Res. Dev.*, **1**: 31-38 (2001).
- Kayode, R.M.O., Sani, A., C.O. Oladoye, A.A. Annongu, M.O. Arekemase, M.A. Obalowu and K.O.: Abdulsalam Physico-chemical and anti-nutritional characterization of the kernels of some mango (*Mangiferaindica*) cultivars grown in Western parts of Nigeria. *Food Science and Quality Management*, **22**: 1-8 (2013).
- Kumar, P.V. and Ravi, R.: Chemical composition and nutritive value of raw and processed mango (*Mangiferaindica*) seed kernel. *Int. J. Fam. Home Sci.*, **8**: 145-150 (2015).
- Legesse, M.B. and Emire, S.A.: Functional and physicochemical properties of mango seed kernels and wheat flour and their blends for biscuit production. *Afr. J. Food Sci. Technol.*, **3**: 193-203 (2012).
- Lowery, O.H.; Rosebrough, N.J.; Farr, A.L. and Randal, R.J.: Protein measurement with the folin phenol reagent. *J. Biol. Chem.*, **193**: 265-275 (1951).
- Maisuthisakul, P. and Pasuk, S.A.: Survey of Mango Seed Waste Management in the Thai Food Industry. p. 155-166
- Maisuthisakul, P. and Pasuk, S. and Ritthiruangdej, P.: Antioxidant Properties and Phenolic Phytochemicals from Various Cultivars of Thai Mango Seed Kernels. In Proceeding of Food Innovation Asia. Bangkok: Food Science and Technology Association of Thailand, p. 26-34 (2007).
- McCready, R.M.; Guggoli, J.; Silviera, V.; and Oivens, H.S.: Determination of starch and amylose rice. *Anal. Chem.*, **22**: 1156-1158 (1950).
- Mudambi, S.R.M. and Rajagopalchari: Energy Metabolism. Fundamentals of Food and Nutrition (3rd Edition), p. 72-73 (2007).
- Nzikou, J.M.; Kimbonguila, A.; Matos, L.; Loumouamou, B.; Pambou-Tobi, N.P.G.; Ndangui, C.B.; Abena, A. A.; Silou, Th. Scher J. and Desobry, S.: Extraction and characteristics of seed kernel oil from mango (*mangiferaindica*). *Res. J. Environ. Earth Sci.*, **2**: 31-35 (2010).
- Okpala L.C.: Physicochemical properties of mango seed flour. *Nigerian Food Journal*, **31**: 23-27 (2015).
- Rangana, S.: Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Second Edition, New Delhi (1994).
- Rodríguez-Couto, S.: Exploitation of biological wastes for the production of value-added products under solid-state fermentation conditions. *Biotechnol. J.*, **3**: 859-870 (2008).
- Sani, I.: Soxhlet extraction and physicochemical characterization of *MangiferaIndica* L. seed kernel oil. *Research and Review. Journal of Food and Dairy Technology*, **2**: 20-24 (2014).
- Shobana, V., and Rajalakshmi, K.: Quantitative analysis of primary metabolites in mangiferaindica(unripe mango). *Rasayan. J. Chem.*, **3**: 597-599 (2010).
- Sonwai, S.; Ponprachanuvut, P.: Studies of fatty acid composition, physicochemical and thermal properties, and crystallization behavior of mango kernel fats from various Thai varieties. *J. Oleo Sci.*, **63**: 6619 (2014).
- Vega, V.V., Espinoza, B.A.S, Reynaldo, M., Valenzuela, C., Mercado, A.C.B., Aguilar, G.A.G., Arispuro, I.V., Maldonado, C.G.C., Zavala, J.F.A.: Antioxidant enrichment and antimicrobial protection of fresh cut mango applying bioactive extracts from their seeds by products. *Scientific Reasearch*, **4**: 1-8 (2013).
- Yatnatti, S., Vijayalakshmi, D., Chandru and R.: Processing and Nutritive Value of Mango Seed Kernel Flour. *Curr. Res. Nut. Food Sci.*, **2**: 170-175 (2014).