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Research Article

Evaluation of Nutritional Value and Bioactive Ingredients of Oil from *Magnifera Indica* L. Seeds Kernel

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Abstract

This study was conducted to evaluate the nutritional value and bioactive ingredients of kernel for three mango varieties locally known as Abu-Jebiha (A), Ad-Damazin (B) and Shandi (C). Moisture content of kernel for mango A, B and C was 7.55, 7.65 and 7.45%, respectively. Ash content was 3.4, 2.0 and 1.95%, respectively. Protein content of A, B and C was 0.15, 0.10 and 0.3%, respectively. Fibre content for A, B and C was 22.5, 23.1 and 22.9%, respectively. Minerals for A, B and C were (K) 27.17, 0.86 and 0.94%, (Na) 0.103, 0.06 and 0.13%, (Ca) 14.98, 1.10 and 0.73%, (Fe) 0.24, 0.02 and 0.89% and (Mg) 9.99, 0.35 and 8.38% respectively. Oil content, of sample A was the highest 13.6 followed by B 8.45% and C 7.81%. Oil colour was white, had acceptably taste, a pleasant odour and was solid at room temperature. Oil density was 0.005 (g/cm^3) for the three samples. Viscosity for A, B and C was 0.4, 0.35 and 0.05, respectively. Acid value for sample B was 0.05 (mg KOH/g oil) while samples A and C have the same acid value 0.1 mg KOH/g oil. Peroxide values for A, B and C were 0.1, 0.1 and 0.05 (mg. peroxid/Kg oil), respectively. Saponification values were 0.25, 0.1 and 0.2, respectively. Fatty acids composition for samples A, B and C was 18, 21 and 19 fatty acids, respectively. Saturated fatty acids for A, B and C were 56.79, 58.24 and 59.47%, respectively. While the unsaturated fatty acids for A, B and C were 42.20, 41.83 and 40.53%, respectively. The main fatty acids samples A, B and C were stearic, oleic, Palmitic, Arachidic, linoleic and Lignoceric. Mango seed kernel was rich in alkaloids, flavonoids, steroids, tannin, glycoside, and reducing sugars.

Keywords: Mango Seeds Kernel; Fatty Acid Composition; GC-MS Technique; Atomic Absorption Spectrometry (AAS)

Introduction

Mango *Mangifera indica* L. is one of the most economically important fruit which has been used as raw material for many packed fruit products. Mango belongs to the genus *Mangifera* of the cashew family *Anacardiaceae* [1]. Moreover, it is one of the most important fruits worldwide and is cultivated in more than 100 countries at both tropical and subtropical latitudes especially in Asia [2]. Mango seed is a single flat oblong seed that can be fibrous or hairy on the surface, depending on the cultivar. Inside the seed coat 1 - 2 mm thick is a thin lining covering a single embryo, 4 - 7 cm long, 3 – 4 cm wide, and 1 cm thick. Mango seed consists of a tenacious coat enclosing the kernel. Mango kernel oil has been used in the cosmetics industry as an ingredient in soaps, shampoos and lotions because it is a good source of phenolic compounds [3]. 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%. Mango kernel contains almost 15% wt. of oils [4]. Mango seed kernels contained a considerable amount of total phenolic compounds, total lipid, un-saponifiable matter and a low amount of crude protein. Un-saponifiable matter showed the occurrence of high amounts of squaline followed by sterols and tocopherols. Stearic acid was the main saturated fatty acid, while oleic acid was the major unsaturated fatty acid in all lipid classes. The fatty acid composition of total lipid and neutral lipid was similar, while phospholipid had a high amount of palmitic, linoleic and linolonic acids. Depending on their variety, mango seed kernels contain on a dry weight average protein 6.0%, fat 11%, carbohydrate 77%, crude fibre 2.0% and ash 2.0% [2]. Mango seed kernels were shown to be a good source of polyphenols, phytosterols as campesterol, β-sitosterol and tocopherols [5]. Mango is one such fruit and its seed is reported to contain several potent phytochemicals which are responsible for amazing health benefits. It holds tremendous potential in food, medicine, pharmaceutical and cosmetic industries [6]. Mango seed kernel fat is promising and a safe source of edible oil and was found to be nutritious and non-toxic so that it could be substituted for any solid fat without adverse effects. The lipids extracted from different mango varieties were free from toxic material such as hydrocyanic acid [2].

Methods

Materials

Seeds collection

The seeds of *Mangier inducer* (Shandi, Abu-Jebiha and Ad-Damazin) were obtained from central market of cities Khartoum and Shandi.

Sample preparation

The collected seeds were separated from fruits manually, washed, dried at room temperature and then ground into powder.

Methods

Determination of moisture content

Two g of the sample was weighed into empty and dry crucible, the crucible placed into muffle furnace (105°C) for 2h, the crucible remove and placed in desiccator for 1h, sample and crucible was weighed to the nearest 0.0001g and the moisture content was determined

Determination of ash content

Two g of sample was weighed into empty and dry crucible, the crucible placed in a muffle furnace and the temperature increased slowly to (500°C) over 2h, the crucible allowed, to cool to room temperature in muffle furnace, the door slowly opened and the ashes samples was removed and placed in desiccator for 1h, sample and crucible was weighed to the nearest 0.0001g and the ash content was determined.

Determination of minerals content

The acid digestion method used in this work was the one reported in literature with some modification.

Ten ml of plant sample was dissolved in 4ml HCl in porcelain crucible and heated on hot plate to near dryness. An aliquot of 10ml HCl (1.00M) were added to the digested sample, and filtered through a Whatman No 40 filter paper. The digested sample was transferred quantitatively into a 100ml volumetric flask and diluted with de-ionized water, then transferred into a polyethylene bottle. The digested sample was evaporated at 70°C to give 1ml volume, diluted with de-ionized water to 15ml using volumetric flask. This step was carried out to reduce the pH value. Planks are treated in the same procedure. Standard solution of Na, K, Ca, Mg and Fe were used for analysis [7].

Determination of fibre content

Omission of the initial extraction with petroleum spirit, the initial "creaming" of 3-5g of flour by adding it slowly to 20ml of cold sulphuric acid (1.25%) before the rest (180 ml) of the (boiling) acid is added, the prescribed use of a reflux condenser for the maintenance of constant volume during the digestion, transference of the fibre After the washing with ether, from the filter paper to a dish (previously ignited and weighed) with boiling water. Then the water is evaporated off on the water bath and the dish dried at 100°C, weighed and ignited.

Determination of protein content

The total nitrogen is determined on 1.4g. By the kjeldahl method. The crude protein is calculated using the factor N*5.

Successive extraction

Forty g of the dried powder were extracted with hexane, chloroform, and methanol. The solvents were carefully, evaporated from each extract and the oil yield of each solvent were determined. Figure 1 depicts hexane extraction and seeds *Mangifera indica*.

Refractive index

A concave mirror was placed on the base a retort stand and a pin was clamped approximately to enable adjustment of its position until it coincided with the image at C_o. The distance C_o was measured and sufficient oil sample was poured in the mirror. The position of the pin was adjusted again until it coincided with its image at position C_1. The distance C_1 was measured.

Density

Oil sample was filled into a density bottle and weighed at 60°C, heated for 20 min and allowed to cool. On cooling, the bottle was reweighed and the difference in weighed was recorded as the specific gravity of the oil sample.

Acid value (AV)

Two g of (*Mangifera indica*) seeds oil (hexane extract) in a dried conical flask, 25 ml of diethyl ether and 25ml of absolute ethyl alcohol, and 2 - 3 drops of phenolphthalein indicator were added and the flask content were titrated against KOH 0.1N, then the volume was recorded and the acid value (AV), free fatty acid (%FFA) were calculated.

Saponification value (SV)

Two g of seeds oil (*Mangifera indica*) and 25ml of alcoholic potassium hydroxide solution KOH 0.5N were heated on a boiling water bath for 1h. The contents were cooled and titrated with HCl 0.5N using phenolphthalein indicator, the volume was recorded, and then the saponification number was calculated using the formula: Saponification number is equal to mg of KOH consumed by 1 g of fat.

Peroxide value

Two g of (*Mangifera indica*) seeds oil were weighted into a 250 ml conical flask and 15ml of glacial acetic acid, 10 ml of chloroform, 1 ml of potassium iodide solution, 1 ml of starch indicator were added and the flask content placed in dark room about 30 minutes it was titrated against 0.1N Sodium thiosulfate, The volume was recorded, the same process was repeated without sample. The peroxide value was calculated by liberating iodine from potassium iodide. The amount of peroxides is calculated back by the amount of sodium thiosulfate consumed.

GC-MS methods

Two ml of (*Mangifera indica*) seeds oil was taken into test tube, add alcoholic Na OH (prepared by dissolve 2g sodium hydroxide in 100ml methanol), 7ml of alcoholic H_2SO_4 (prepared by mix 1ml

conk H_2SO_4 and 99 ml methanol) were added, the mixture shacked by vortex for 3min and left overnight, 2ml of super saturated Na Cl was added and 2ml of normal hexane was added, shake for 3min and the hexane layer was collected, from hexane collected 2µl was taken and diluted with 5ml diethyl ether, 1g from sodium sulphate as drying agent was added and filtered through syringe 0.45µm, the filtrate was transferred directly to the GC/MS vial, 1µL was injected directly to the GC/MS. The sample components was identified and recorded.

Results and Discussion

oil yield, moisure, ash, proteins and fibre content

The oil yield, moisture, ash, proteins fibre content of Abu-Jebiha, Ad-Damazin and Shandi mango seeds kernel were detected. Table 1 reflects that.

Table 1: Oil, moisture, ash, protein and fibre content of Abu-Jebiha, Ad-Damazin and Shandi.

Parameters	Oil %	Moisture %	Ash %	Protein %	Fibre %
Abu-Jebiha	13.60	07.55	03.40	00.15	22.50
AL-Damazin	08.45	07.65	02.00	00.10	23.10
Shandi	07.81	07.45	01.95	00.30	22.90

Among the three verity, Abu-Jebiha distinguished by the highest oil content followed by Ad-Damazin and Shandi. The oil extracted from Abu-Jebiha mango seed kernel was 13.6%, this result agreement with [4] and disagreement with result obtained by [1]. Shandi and Ad-Damazin have convergent oil content were 7.81% and 8.45%, which agreement with result reported by [8] and [1]. The differences of oil yield from Shandi and AD-damazin mango seed kernel may be due to the difference in genus, climate and conditions of cultivation.

Moisture content influences the taste, texture, weight, appearance, and shelf life of foodstuffs. Ad-Damazin mango seed kernel has a highest moisture content followed by Abu-Jebiha and finally Shandi mango seed kernel. Three mango seed kernel varieties Shandi, Abu-Jebiha and Ad-Damazin have the convergent moisture content which were 7.45%, 7.55% and 7.65%. The moisture content was similar on three verities this is may be due to the similarity in climate, soil content and conditions of growth.

The ash content represents the minerals and inorganic materials found in the plant. The ash content of three mango seed kernel varieties Abu-Jebiha, Ad-Damazin and Shandi, was conducted. Table (3.0) shows the ash percentage. The difference in ash content may be due to the difference in soil content and conditions of cultivation. Abu-Jebiha mango seed kernel characterised by high ash content 3.3% this result agreement with result reported by [9] and [4]. Al-Damazin 2% and Shandi mango seed kernel 1.95%have approximate ash content, this disagreement with reported by [9] and [10]. The difference in ash content in three varieties may be due to the difference in genus, soil content and conditions of cultivation.

Shandi mango seed kernel has a highest protein content 0.3% followed by Abu-Jebiha 0.15% and finally Ad-Damazin 0.1%. Three mango seed kernel varieties have the convergent protein content, the convergent in protein content may be due to the difference in genus, soil content and conditions of cultivation, these results disagreement with result obtained by [11].

Three mango seed kernel varieties Abu-Jebiha, Ad-Damazin and Shandi, have the convergent fibre content which were 22.5%, 23.1% and 22.9%, the convergent in ash content in three varieties may be due to the convergent in genus, soil content and conditions of cultivation. These results disagreement with result obtained by [9] these results agreement with results obtained by [1] and disagreement with result obtained by [10].

Minerals Contents

Minerals possess some health benefits they are important as constituents of blood Fe, teeth and bones Ca, soft tissues K and muscles and nerve Mg. The results for mineral content of A, B and C are shown in Table 2.

Table 2: Mineral content of Abu-Jebiha, Ad-Damazin and Shandi.

Mango seeds kernel	Minerals content				
	K	Na	Ca	Fe	Mg
Abu-Jebiha	27.17	00.10	14.98	00.24	09.99
Ad-Damazin	00.86	00.06	01.10	00.20	00.35
Shandi	00.94	00.13	00.73	00.89	08.38

Among three varieties Abu-Jebiha has considerable amount of potassium, calcium and magnesium, while Shandi has a considerable amount of magnesium. Ad-Damazin among three variety have a less minerals concentrations. The Diverse in concentration may be resultant due to the different in soil content and condition of Cultivation. Three varieties Shandi, Abu-Jebiha and Ad-Damazin mango seed kernel Characterised by lowest sodium content. Sodium content of Shandi mango seed kernel was 0.13% and Abu-Jebiha 0.103% this result agreement with result obtained by [12]. The sodium content of AD-dmazin mango seed kernel was 0.06%, this result agreement with [12] and disagreement by [13]. Among three varieties Abu-Jebaih mango seed kernel have a highest Potassium content 27.172% followed by Shandi 0.936% and finally Ad-Damazin Variety 0.864%. The potassium content of Abu-Jebiha mango seed kernel was 27.172%, this result disagreement with result obtained by [12]. Shandi mango seed kernel and Ad-Damazin mango seed kernel have a convergent potassium content. The potassium content of shandi mango seed 0.936% and Ad-Damazin mango seed kernel was 0.864%, this result disagreement with result obtained by [3]. The calcium content of shandi mango seed kernel was 0.73%, this result agreement with result obtained by [12]. The calcium content of Ad-Dmazin mango seed kernel was 1.10%, this result agreement with result obtained by [12]. The calcium content of Abu-Jebiha mango seed kernel was 14.979%, this result dissagreement with result obtained by [12] and [3].

The magnesium content of three variety detected which were shandi 8.38%, Ad-Damazin mango seed kernel was 0.35% and Abu-Jebiha mango seed kernel 9.992%, this result disagreement with result obtained by [3] and [6]. Ad-Damazin mango seed kernel have a lowest magnesium content. Among three varieties Shandi mango seed kernel have a highest iron content 0.89% followed by Abu-Jebiha 0.244% and Ad-Damazin mango seed kernel was 0.19%, this result disagreement with result obtained by [13] and [6]. Shandi and Ad-Damazin have convergence in minerals content this is may be due to the similarity in genus.

Physiochemical Properties

Table 3 shows the results for Physiochemical properties of Abu-Jebiha, Ad-Dmazin and Shandi. Shandi variety have The highest peroxide value which was 0.25 followed by Abu-Jebiha 0.2 and finally Ad-Damazin variety 0.1, this disagreement with [14-18]. Shandi and Abu-Jebiha variety have the acid value 0.1 this result agreement with result reported by [3] and disagreement with [8]. The acid value of Ad-Damazin variety 0.05 which disagreement with [3,8]. Shandi and Abu-Jebiha variety have the free fatty acid 0.05%, Ad-Damazin have the free fatty acid 0.025% which disagreement with the result reported by [19].

Table 3: Physiochemical properties of Abu-Jebiha, Ad-Dmazin and Shandi.

Parameters	Ab-Jebiha	Ad-Damazin	Shandi
Color	White	White	White
Odor	Pleasant	Pleasant	Pleasant
State at room temperature	Solid	Solid	Solid
Density (g/cm^3)	0.00055	0.00005	0.0005
Saponification value (mg/g)	186.9	185.7	186.1
Peroxide Value (mg. Peroxide /kg oil)	28.7	25.2	25.8
Acid Value (mg KOH/g oil)	0.1	0.05	0.1
Free Fatty Acid (%)	0.05	0.025	0.05

Physiochemical properties

Table 3 shows the physiochemical properties of Abu-Jebiha, Ad-Dmazin and Shandi mango seed kernel Physiochemical characteristics including colour, odour, state at room temperature, densit, saponification value, peroxide value, acid value and free fatty acid of Abu-Jebiha, Ad-Dmazin and Shandi mango seed kernel oil were shown in Table 3. The acidity, peroxide and saponification values are the major characterization parameters for oil quality. The mango kernel oils were very light yellow in color. The saponification value is high and this suggests the use of the oil in production of liquid soap, shampoos. The saponification value is the milligrams of KOH necessary to saponify 1 g of oil sample and shows the capacity of forming soaps of oil and was in agreement with other authors [2].

Peroxide value is one of the most widely used testing for oxidative rancidity in oils. It is a measure of the concentration of peroxides and hydroperoxides formed in the initial stages of lipid oxidation. Generally, the peroxide value should be less than 10 mg/g oil in the fresh oils. [3] reported that oils with high peroxide values are unstable and easily become rancid. Peroxide values were good indices for the stability of the oil. The acid value was a measure of total acidity of the lipid, involving contributions from all the constituent fatty acids that make up the glyceride molecule, this resuit agreement with [3].

Free fatty acid and peroxide values are valuable measures of oil quality. The low acidity of this oil indicated that the mango seed was almost free from hydrolytic rancidity brought almost by lipases and enables the direct use of such an oilin industries without further neutralization [2].

GC-MS analysis of Abu-Jebiha, Ad-Dmazin and Shandi mango seed kernel oil

Abu-Jebiha mango seed kernel oil

The results of GC-MS analysis for fatty acid profile of Abu-Jebiha mango seed kernel are represented in Table 4 and Figure 1.

Table 4: The major fatty acid present in Abu-Jebiha.

Peak	R'time	Area%	IUPAC Name	Common Name
10	18.474	37.92	Methyl stearate	Stearic acid
9	18.241	33.90	9-octadecadienoic acid (Z)-,methl ester	Oleic acid
5	17.205	11.10	Hexadecenoic acid,methylester	Palmitic acid
8	18.160	6.25	9,12-octadecadienoic acid (Z,Z)-,methl ester	Linoleic acid
13	20.276	5.34	Eicosanoic acid, methyl ester	Arachidic acid
17	23.544	1.65	Tetricosanoic acid,methyl ester	Lignoceric acid

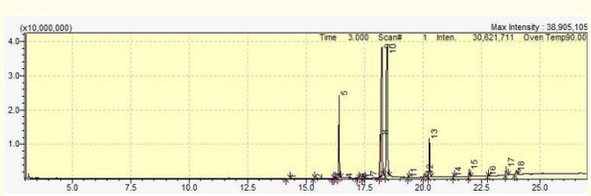

Figure 1: GC-MS chromatogram of Abu-Jebiha mango seed kernel oil.

The analysis of Abu-Jebiha mango seed kernel oil show that a bout eighteen fatty acids were detected. Table 4 reflects the fatty

acids with high concentraction. Furthermore about fourteen fatty acids with low concentration were present in the oil. 56.79% of the total fatty acid represent as saturated fatty acids, while unsaturated fatty acids represent 42.20% which disagreement with [6].

GC-MS analysis of Abu-Jebiha mango seed kernel oil show that oil rich in Stearic, Oleic, Palmitic, Arachidic, Linoleic and Lignoceric, this result disagreement with result obtained by [9].

Stearic and oleic acid considered as the main fatty acid presence in Abu-Jebiha mango kernel seeds other than that, Palmitic, Arachidic, Linoleic and Lignoceric were presences in considerable concentrations this agreement with [9].

Ad-Dmazin mango seed kernel oil

The results of GC-MS analysis for fatty acid profile of Ad-Dmazin mango seed kernel are represented in Table 5 and Figure 2.

Table 5: The major fatty acid present in Ad-Dmazin mango seed kernel oil

Peak	R time	Area%	IUPAC name	Common name
11	18.187	37.37	9-Octadecenoicn acid (Z)-,methyl ester	Oleic acid
12	18.428	34.76	Methyl ester	Stearic acid
7	16.287	12.25	Hexadecenoic acid, methyl ester	Palmitic acid
16	20.142	5.90	Eicosanoic acid, methyl ester	Arachidic acid
10	18.030	3.22	9,12-Octadecenoicn acid (Z,Z)-,methyl ester	Linoleic acid
19	23.418	1.73	Tetracosacoic acid ,methyl ester	Lignoceric acid

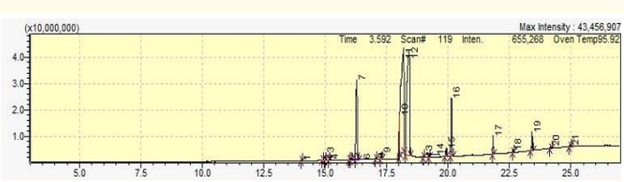

Figure 2: GC-MS chromatogram of Ad-Damazin mango seed kernel oil.

The analysis of Ad-Damazin mango seed kernel oil show that a bout twenty one fatty acids were detected, 58.24% of the total fatty acid represent as saturated fatty acids which considered more saturation than Abu-Jebiha. Unsaturated fatty acids represent 41.83% this disagreement with [6]. Table 3.0 show the main fatty acids presences in Ad- Damazin mango seed kernel oil.

GC-MS analysis of Ad-Damazin mango seed kernel oil show that the oil rich in Stearic 35.78%, Oleic 34.83%, Palmitic 13.27%, Arachidic 6.01%, Linoleic 4.48%, Lignoceric 1.48% and Behenic 1.44% this result disagreement with result obtained by [9].

Stearic and oleic acid considered as the main fatty acid presence in Ad- Damazin mango kernel seeds other than that, Palmitic, Arachidic, Linoleic and Lignoceric were presences in considerable concentrations this results agreed with those reported by [9].

Shandi mango seed kernel oil

The results of GC-MS analysis for fatty acid profile of Shandi mango seed kernel are represented in Table 6 and Figure 3.

Table 6: The major fatty acid present in Shandi mango seed kernel oil.

Peak	R, Time	Area%	IUPAC Name	Common Name
11	18.366	35.78	methyl ester	Stearic acid
10	18.129	34.83	9-Octadecenoic acid (z)-, methyl ester	Oleic acid
6	16.272	13.27	Hexadecenoic acid,methyl ester(z)	Palmitic acid
14	20.136	6.01	Eicosanoic acid, methyl ester	Arachidic acid
9	18.030	4.48	9,12-Octadecadienoic acid (z,z)-, methyl ester	Linoleic acid
1	23.422	1.48	Tetracosanoic acid, methyl ester	Lignoceric acid

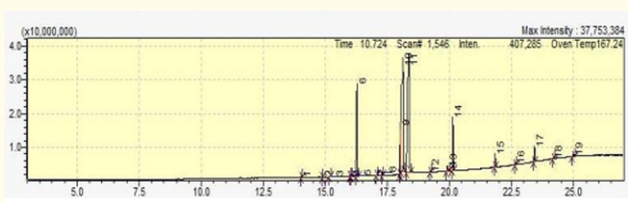

Figure 3: GC-MS chromatogram of Shandi mango seed kernel oil.

The results of GC-MS of the the oil extracted from Abu-Jebiha, Ad-Dmazin and Shandi mango seeds kernel were treated by statistical analysis table 7 shows that.

The statistical analysis of were done which gave significant differences between Abu-Jebiha, Ad-Dmazin and Shandi, this difference may be due to the differences in soil content, climate and other conditions of growth.

The analysis of Shandi mango seed kernel oil show that about nineteen fatty acids were detected, 59.47% of the total fatty acid represent as saturated fatty acids which considered more saturation than Abu-Jebiha and Ad-Dmazin. Unsaturated fatty acids represent 40.35%, this disagreed with [6] Table 7show the main fatty acids presences in Shandi mango seed kernel oil.

Table 7: Fatty acids composition for Abu-Jebiha, Ad-Dmazin and Shandi mango seeds kernel oil.

MSk	Stearic acid	Oleic acid	Palmitic acid	Arachidic acid	Linoleic acid	Lignoceric acid
Abu-Jebiha	37.90 ± ^{a}.01528	33.88 ± ^{a}.02645	11.03 ± ^{a}.06083	5.32 ± ^{a}.01528	6.15 ± ^{a}.13650	1.36 ± ^{a}.02000
Ad-Damazin	34.72 ± ^{b}.02887	37.47 ± ^{b}.19655	12.55 ± ^{b}.03512	5.87 ± ^{b}.03215	3.14 ± ^{b}.12166	1.71 ± ^{b}.01528
Shandi	35.73 ± ^{c}.04359	34.82 ± ^{c}.01528	13.24 ± ^{c}.02517	6.01 ± ^{c}.01000	4.45 ± ^{c}.02082	1.44 ± ^{c}.03512

MSK: Mango seed kernel

Values are means ± STD for triplicate independent experiments. Different superscript letters in the same column indicate significant ($p < 0.05$) differences between means

GC-MS analysis of Shandi mango seed kernel oil show that the oil rich in Stearic 35.78%, Oleic 34.83%, Palmitic 13.27%, Arachidic 6.01%, Linoleic 4.48%, Lignoceric 1.48% and Behenic 1.44% this result disagreed with result obtained by [9]. Stearic and oleic acid considered as the main fatty acid presence in Shandi mango kernel seeds. Palmitic acid was present in seed kernel in good concentration this disagreed with [6], other than that, Palmitic, Arachidic, Linoleic and Lignoceric were presences in considerable concentrations this agreement with [9].

Among three varieties stearic acid content were highest in Shandi and Abu-Jebiha, while the oleic acid highest in Ad-Damazin. Palmitic, Arachidic and Lignoceric acid were found in three varieties in convergent concentrations. Abu-Jebiha higher than Shandi and Ad-Damazin about the concentration of Linoleic acid. The difference in oil content in the three varieties may be is due to the difference in environmental conditions, soil content and conditions of cultivation.

Conclusion

- Mango seeds kernel oil is a good source of oil due to its high percentage oil yield obtained in the present study.
- Mango seeds kernel oil contains high levels of stearic and plamitic acids, so it could be classified as saturated oil.
- Mango seeds kernel is a good source of fibre.

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