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Fatty Acid Compositional Analysis of Different Edible Oils and Fats in the kairwara, Alwar (Rajasthan)

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Abstract- The fatty acid may be either saturated or unsaturated. The main objective of this work was to identify the fatty acid composition of several edible oils and fats. Taking most four different types of edible oils and fats, coconut fat, peanut oil, olive oil, rice bran oil samples were taken, tested with widely accepted and internationally used methodology of Association of ISO 548 Part 3 for used for fatty acids analysis. Fatty acid analysis of the four type of edible oil was carried out using a gas chromatograph equipped with a flame ionization detector, stainless steel packed column. Among the evaluated oils the higher contents of different fatty acids were found in coconut fat (lauric 46.110), peanut oil (oleic 40.750, linoleic 40.477), olive oil (oleic 77.665), rice bran oil (oleic 44.322). The result showed that the coconut oil contained the highest percentage of saturated fatty acids (92.178 %) compared to peanut oil (18.36%), rice bran (19.948%) and olive oil (13.067%) and the olive oil highest percentage of long chain mono and polyunsaturated fatty acids (86.934%) compared to peanut oil (81.641 %), rice bran oil (80.053 %), and coconut oil (7.822 %).

Keywords- Fatty acid, Gas chomatograph, Coconut Fat, Peanut oil, Olive oil, Ricebran oil

I. INTRODUCTION

Fats and oils are recognized as essential nutrients in both human and animal diets [1]. Edible oils and fats are important parts of our diet and more than 90 % of the world production from vegetable oil, animal. Edible oil is most often plant based oil, edible oil is fat of plant or edible oil may be liquid at room temperature. It is suitable for food and cooking use. Some of the many different kinds of edible oils are include- mustard oil, rice bran oil, soybean oil, sesame oil, ground nut oil, sunflower oil, peanut oil, canola oil, palm oil, olive oil and non edible oil such as petroleum chemical based products (biodiesel, fuel oil and related products). These include mahua, jatropha, rubber seed, cotton seed, karanja, neem oils.

Coconut is one of the most important sources of vegetable oil in the world [2]. It is produced by crushing copra and about 60-65% of the oil [3]. Peanut and groundnut is one of the important edible oilseed crop cultivated in world. The peanut plays an important role in the economy of several countries [4]. Groundnut oil content about 40-65% depending upon variety, season and maturity [5]. Olive oil fatty acids are the important components in olive oil with the majority of fatty acid chains containing 16 to 18 carbon atoms as shown in C16 or C18 respectively [6]. Rice bran oil extracted from bran of rice has been used extensively in Asian countries such as Korea, Japan, Taiwan, China, and Thailand and rice bran oil utilization in foods, pharmaceuticals and cosmetics applications is increasing now days[7].

II. MATERIAL AND METHODS

Samples of four vegetable oils and fat as: coconut fat, peanut seed oil , olive oil, rice bran oil were collected from the local kairwara, alwar market during the period between May 2017 to june 2018.

Preparation of plant extracts:

The seeds were removed from their pods and ground to powder from using grinder- machine and the seed power to extraction by soxhlet extractor using n-hexane at 60 ^{0}C for 60 hours.

Reagents

All the reagents and solvents used were of HPLC grade.

- n- Heptane
- Alcoholic potassium hydroxide
- HPLC grade water

Preparation of fatty acid methyl esters (FAMEs): Take 2 ml oil sample in a graduated cylinder with stopper. to which 10 ml n-Heptane have been added .Mix the content well ,add 3 ml of alcoholic potassium hydroxide and remaining HPLC grade water for making a 25 ml approx. Mixture and keep the mixture for 2 hrs approx with closing it with stopper for making a volatile mixture. 1 µl fatty acids methyl ester was injected, peaks were recorded for their respective RT (Retention time), areas by data processor unit of the gas chromatography [8].

Chromatography

Nuckon – 5700 gas chromatograph equipped with a flame-ionization detector (FID) and glass column, digital controls, separate independent proportional temperature controllers for oven, detector, Injector, Detector temperature 390 ^{0} C in 10 C steps set by thumbwheel switches, oven temperature 399 ^{0} C in 1 C step set by thumbwheel switches. Temperature programming: - microprocessor based programmer with rate 0.1 ^{0} C – 29.9 ^{0} C per minute with initial time hold up to 99 minute. Dual channel data station, 2 detectors can be operated simultaneously. Use Nitrogen gas cylinder *-60 psi. Hydrogen gas cylinder -20 psi. Zero air gas cylinder -20 psi.*

III. RESULT AND DISCUSSION

A total of four samples of vegetable oils and fats samples collected from the local kairwara, alwar markets were analyzed on the composition of fatty acids using gas chromatographic method. Types of collected samples were: coconut fat, peanut seed oil, olive oil, rice bran oil. The content of following saturated and unsaturated fatty acids was tested in the samples: caproic acid, caprylic acid, capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, arachidic acid, behenic acid, lignoceric acid, oleic acid, linoleic and linolenic acid. The fatty acid percent composition of tested oils and fats are shown in Table 1 to 4 respectively.

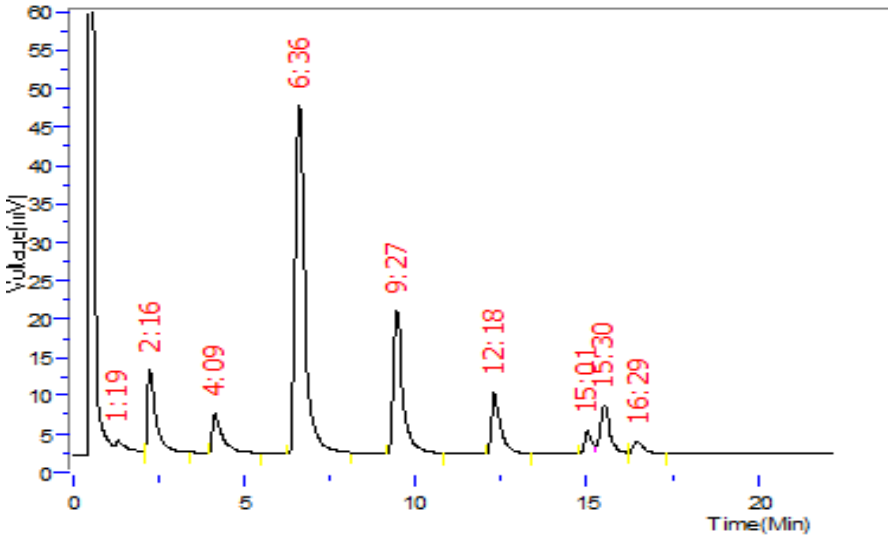

Figure: 1 Gas chromatogram of coconut fat.

Table: 1 presenting the different parameters of the fatty acid of the coconut fat.

Peak No.	RT (Min)	Area (mV-Sec)	Height (mVolt)	RF	Amount (ML)	Amount%	Component Name
1	1:20	31.675	1.795	1.000	31.675	1.639	Caproic
2	2:16	168.301	10.734	1.000	168.301	8.709	Caprylic
3	4:9	111.801	5.155	1.000	111.801	5.785	Capric
4	6:36	891.097	45.226	1.000	891.097	46.110	Lauric
5	9:27	372.871	18.456	1.000	372.871	19.294	Myristic
6	12:18	158.897	8.116	1.000	158.897	8.222	Palmitic
7	15:2	46.741	2.988	1.000	46.741	2.419	Stearic
8	15:30	123.286	6.326	1.000	123.286	6.379	Oleic
9	16:30	27.892	1.465	1.000	27.892	1.443	Linoleic

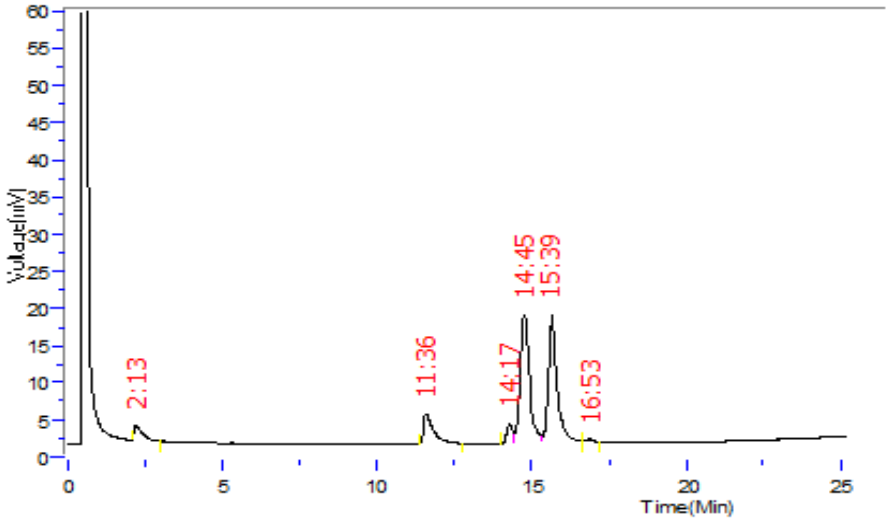

Figure: 2 Gas chromatogram of peanut seed oil.

Table: 2 presenting the different parameters of the fatty oils of the seeds of peanut.

Peak No.	RT (Min)	Area (mV-Sec)	Height (mVolt)	RF	Amount (ML)	Amount%	Component Name
1	2:14	34.106	2.090	1.000	34.106	3.926	Myristic
2	11:36	86.009	3.845	1.000	86.009	9.901	Palmitic
3	14:18	39.381	2.673	1.000	39.381	4.533	Steric
4	14:45	354.002	17.251	1.000	354.002	40.750	Oleic
5	15:39	351.630	17.157	1.000	351.630	40.477	Linoleic
6	16:54	3.597	0.230	1.000	3.597	0.414	Linolenic

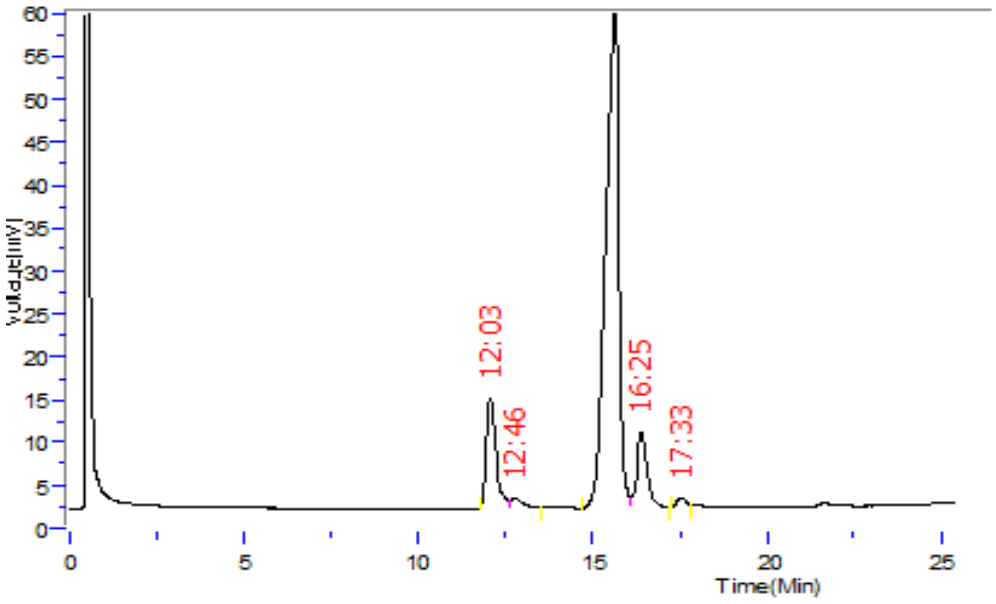

Figure: 3 Gas chromatogram of olive oil.

Table: 3 presenting the different parameters of the fatty oils of the olive oil.

Peak No.	RT (Min)	Area (mV-Sec)	Height (mVolt)	RF	Amount (ML)	Amount%	Component Name
1	12:3	249.275	12.762	1.000	249.275	11.854	Palmitic
2	12:47	25.499	1.081	1.000	25.499	1.213	Stearic
3	15:40	1,633.260	64.107	1.000	1,633.260	77.665	Oleic
4	16:25	180.798	8.651	1.000	180.798	8.597	Linoleic
5	17:33	14.132	0.925	1.000	14.132	0.672	Linolenic

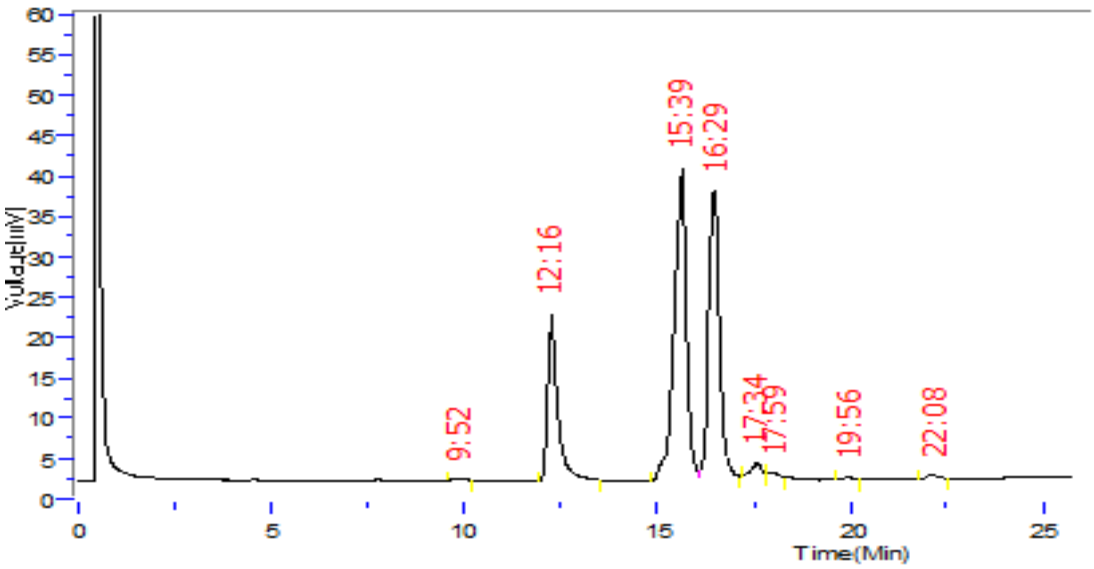

Figure: 4 Gas chromatogram of rice bran oil.

Table: 4 presenting the different parameters of the fatty oils of the rice bran oil.

Peak No.	RT (Min)	Area (mV-Sec)	Height (mVolt)	RF	Amount (ML)	Amount%	Component Name
1	9:52	3.441	0.166	1.000	3.441	0.169	Myristic
2	12:16	399.375	20.621	1.000	399.375	19.590	Palmitic
3	15:39	903.577	38.692	1.000	903.577	44.322	Oleic
4	16:30	690.652	35.492	1.000	690.652	33.878	Linoleic
5	17:35	24.648	1.495	1.000	24.648	1.209	Linolenic
6	17:0	3.847	0.301	1.000	3.847	0.189	Archidic
7	19:57	4.069	0.267	1.000	4.069	0.200	Eicosenoic
8	22:9	9.059	0.470	1.000	9.059	0.444	Eicosedenoic

Table 5. The content of SFA, MUFA, PUFA (% w/w). (SFA- Saturated fatty acid, MUFA- Monounsaturated fatty acid, PUFA- Polyunsaturated fatty acids

Name of Edible oils/fats	SFA	MUFA	PUFA
Coconut fat	92.178	6.379	1.443
Peanut oil	18.36	40.750	40.891
Olive oil	13.067	77.665	9.269
Rice bran oil	19.948	44.522	35.531

Their respective fatty acid compositions in different edible oil are shown in table 5. The result showed that the coconut oil contained the highest percentage of SFA (92.178 %) compared to peanut oil (18.36%), rice bran (19.948%) and olive oil

(13.067%) and the olive oil highest percentage of long chain MUFA and PUFA (86.934%) compared to peanut oil (81.641 %), rice bran oil (80.053 %), and coconut oil (7.822 %).

Edible oils are sources of important fatty acids, embracing all groups of SFAs, MUFAs, and PUFAs. However, their fatty acid composition varies according to the source plant or it depends on the technology process during their production. The study was focused on the oils obtained mostly by mechanical ways under the conditions that do not cause any changes in their chemical composition [9].

IV. CONCLUSION

Overall this is the short research work the fatty acid composition of the fatty acids; we worked on the amount of the saturated as well as the unsaturated fatty acids. Oils and fats are recognized as essential nutrients in both human and animal diets. They provide the most concentrated source of energy of any foodstuff, supply essential fatty acids (which are precursors for important hormones, the prostaglandins), contribute greatly to the feeling of satiety after eating, are carriers for fat soluble vitamins, and serve to make foods more palatable. Oils and fats are present in varying amounts in many foods. From the fatty acid compositional analysis of coconut oil shows higher content in SFA up to 92.178 % and very low in MUFA and PUFA content about 7 % thus should be consumed in low levels, so should be consumed minimally.

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