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Comparative Physicochemical Properties of Sesame Oil from Various Methods of Processing

[1]Dr. K.S. Maanickha Chelvi, Siddha Regional Research Institute, Poojappura, Thiruvananthapuram, Kerala, India.

[2]Dr. Vasuki Devi A, Principal, Santhigiri Siddha Medical College, Thiruvananthapuram, Kerala, India.

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Corresponding Author: Dr. M. Manicaka Selvi, Research Officer (Siddha), Siddha Regional Research Institute, Poojappura, Thiruvananthapuram, Kerala.

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Abstract

Every different culture of people in India following their food habits according to their environmental conditions and availability in that area. Sesame oil predominantly used for cooking long time ago. Preparation and processing of sesame oil changed according to machinery revolution. Three types of processing methods commonly used such as Ghani, Solvent and Expeller pressing methods. The Ghani method is traditional method by using grinder made up of wood or stone. In this study, we have reported that whether the processing method alters its physicochemical properties or Nutritional value of the oils. For this study, sample taken from above said three methods. The physicochemical analysis carried out on the three samples respectively sample T, M and A oils. samples have the following properties: Iodine values are 88.83, 99.17 and 106.25, Saponification values are 222.66, 230.14 and 189.02, free fatty acid contents are 1.32, 1.76 and 1.88, loss on drying is 0.09, 0.39 and 0.07 and weight of the oils are 0.898, 0.912 and 0.918 gm/ml respectively. Hence, it concluded that the sample from Ghani method is more stable and less prone for oxidation than other samples. Traditional method is preferred one.

Keywords

Sesame oil, Traditional methods, Ghani, Expeller pressing, Iodine value, free fatty acids.

Introduction

Sesame (*Sesamum indicum L.*) believed to be one of the most ancient crops cultivated by humans (Abou-Gharbia et al., 2000). Varieties of oils used for garnishing in worldwide. Using of sesame oil started from Harappa period. Sesame seed, a rich source of protein, is one of the first crops processed for oil production(Anilakumar et al., 2010), also known as benniseed, benne, sesamum, gingelly, sim–sim and tila (Hassan, 2012).Sesame contains significant amounts of the lignans, sesamin and sesamolin. Sesame oil is rich source of polyunsaturated fatty acids. These substances have to possess cholesterol-lowering effect in humans (Ogawa et al., 1995; Hirata et al., 1996) and to prevent high blood pressure and increase

vitamin E supplies in animals(Yamashita et al., 1992; Kamal-Eldin et al., 1995). Cooking with sesame oil reduces the diastolic and systolic blood pressure markedly and decreases in weight, waist and hip girth. Sesame oil cooking is benefit to maintain blood sugar, triglycerides and LDL cholesterol within normal limits. [8,9]The medicinal properties and health benefits of sesame oil is by its mild laxative, emollient and demulcent properties. (Anila kumar et al., 2010). Sesame seed oil found to inhibit the growth of malignant melanoma in vitro and the proliferation of human colon cancer cells(Smith and Salerno, 1992). Sesame oil belongs to oleic-linoleic acid. The amount of oleic and linoleic acid are 41.68 ± 0.61 & (C18:2) 38.29 ± 0.24 (Abou – Gharbia, 2011)

Ancient Indians used sesame oil as lighting oil, and sesame seeds commonly used in the religious rites of Hindus. Indian history was devised a crushing device used for oil seeds using human or animal power described in Sanskrit literature. [13]. The Arthasastra of kautilya believed that written about 300 B.C. carries information on oil seed crushing. The oil extracted from the tila seeds to be one fourth of its initial quantity[14]Domestic mortar and pestle device used to crush exhilarating oil from oil seeds by bulls and horses. It also mentioned in Rigveda. [15]A sculptured frieze showing an oil mill in operation found in the Airateswara temple (1150-1173 AD) at Darasuram, near Kumbakonam in Tamilnadu. It tells the story of a devotee who regularly crushed oilseeds to offer the oil for use in the temple. On one occasion, he could not find raw material, and decided to cut off his head and offer his own blood instead, when Lord Shiva intervened to save his devoted disciple [16]. In Karnataka, three types of oil mills categorized in same period. i. e driven by oxen, by hand and by foot.[17]Modern names of oilseed processing device are Chekku, Ghani, Kolhu. Chekku, Chekku mentioned in Tamil literature. Ghani is most common in North India. Kolhu is common in Uttar Pradesh, Bihar, Bengal, Orissa and Madhya Pradesh.

In traditional system of medicines like Siddha and Ayurveda, various medicated oils used for internal and external purpose. Most of oils are prepared as base of using gingelly oil. Apart from that, gingelly oil also used in the one of the diagnostic tools i.e. *neikuri* in Siddha system of medicine. The spreading pattern of oil is indicator of particular disease.(Krishnamurthy and Chandramouli,1984; Saroja and Veluchamy, 1983) Various process of extraction for more amount of gingelly oil from seeds is the poly press method is preferredone [20].(Krishnamurthy and Chandramouli, 1984; Saroja and Veluchamy, 1983)

In this present study deals with whether the processing method alters its physicochemical properties or Nutritional value of the oils.

Materials and Methods

Chemicals of analytical grade purity and distilled water used in the preparation of reagents. All glassware used washed with detergent solution and rinsed with water before drying in the oven.

Three types of oil samples were collected from commercially available market, Coimbatore, Tamil Nadu, India.

i. Sample T from tradition method (Ghani Method) obtained from Coimbatore district.
ii. Sample M from market sample (Fast Moving Brand – solvent method)
iii. Sample A from company (Expeller Pressing method)

Obtain samples of oil according to various processing methods and analyse in GLP & GMP certified company laboratory and to know the differences.

Procedure

The methods for proximate analyses were the standard procedure of AOAC, 1990. Crude oil extracted by the use of a soxhlet extractor with n-hexane at 40°C for 24 hours. Chemical analysis of saponification value, Iodine value, oil content, and specify gravity carried out using the methods of AOAA, 1990. The free fatty acid (FFA) calculated from the relation: 1unit of acid value = 0.053% FFA (Ajiwe et al., 1997).

Loss on drying

Take 2-6 grams of sample in a tarred weighing bottle. Put the sample bottle in a Hot air Oven for three hours at 105°C ± 10°C then cool it and weigh the sample. Calculate the percentage of moisture content as follows.

Calculation

Calculation:

Weight of empty weighing bottle	=	A gems
Sample + Weighing bottle weight	=	B gems
Sample weight	=	(B – A) = C gems
Drying sample + Weighing bottle weight	=	D gems
Dried sample	=	(B – D) = E gems

$$\text{The \% of Moisture content} = \frac{E}{C} \times 100$$

Weight /Ml Method

Choose a thoroughly clean and dry pycnometer. Calibrate the pycnometer by filling it with recently boiled and cooled Water at 25º and weighing the contents. Assuming that the weight of 1 ml of water at 25º weighed in air of density 0.0012 g per ml is 0.99602 g. Calculate the capacity of the pycnometer. (Ordinary deviations in the density of air from the value given do not affect the result of a determination significantly). Adjust the temperature of the substance examined, to about 20º and fill the pycnometer with it. Adjust the temperature of the filled pycnometer to 25º, remove any excess of the substance and weigh. Subtract the tare weight of the pycnometer from the filled weight of the pycnometer. Determine the weight per milliliter dividing the weight in air, expressed in g, of the quantity of liquid, which fills the pycnometer at the specified temperature, by the capacity expressed in ml, of the pycnometer at the same temperature.

Saponification Value

Dissolve 35 to 40 g of potassium hydroxide in 20 ml water, and add sufficient Alcohol to make 1,000 ml. Allow it to stand overnight, and pour off the clear liquor. Weigh accurately about 2 g of the substance in a tarred 250 ml flask. Add 25 ml of the alcoholic solution of potassium hydroxide attach a reflux condenser and boil on a water-bath for one hour, frequently rotating the contents of the flask. Cool and add 1 ml of solution of phenolphthalein and titrate the excess of alkali with 0.5 N hydrochloric acid. Note the number of ml required (a). Repeat the experiment with the same quantities of the same reagents in the manner omitting the substance. Note the number of ml required (b)

Calculate The Saponification Value From The Following Formula

$$\text{Saponification Value} = \frac{(b-a) \times 0.02805 \times 1.000}{W}$$

Where 'W' is the weight in g of the substance taken.

Iodine value

Apparatus: Iodine Flasks—the Iodine flasks have a nominal capacity of 250 ml.

Place the substance accurately weighed, in dry iodine flask, add 10 ml of carbon tetrachloride, and dissolve. Add 20 ml of iodine monochloride solution, insert the stopper, previously moistened with solution of potassium iodine and allow standing in a dark place at a temperature of about 17º or thirty minutes. Add 15 ml of solution of potassium iodine and 100 ml water; shake, and titrate with 0.1 N sodium thiosulphate, using solution of starch as

indicator. Note the number of ml required (a). At the same time carry out the operation in exactly the same manner, but without the substance tested, and note the number of ml of 0.1 N sodium thiosulphate required (b).

Calculate the iodine value from the formula:—

$$\text{Iodine value} = \frac{(b-a) \times 0.01269 \times 100}{W}$$

Where 'W' is the weight in g of the substance taken.

Free Fatty Acid

Weigh accurately about 10 g of the substance (1 to 5) in the case of a resin into a 250 ml flask. Add 50 ml of alcohol, which has neutralized after the addition of 1 ml of solution of phenolphthalein indicator. Heat gently on a water-bath, if necessary until the substance has completely melted. Titrate above mixture with 0.1 N Sodium hydroxide, shaking constantly until a pink colour, which persists for fifteen seconds. Note the number of ml required. Calculate the acid value from the following formula:

$$\text{FFA} = \frac{a \times 28.2 \times 0.1}{W}$$

Where 'a' is the number of ml. of 0.1 N potassium hydroxide required

'W' is the weight in g of the substance taken.

Adulterants

Take 22ml of the Alcoholic KOH solution in a conical flask and add 1ml of the sample of oil to be tested. Boil in a water bath using an air or water-cooled condenser until the solution becomes clear and no oily drops found on the sides of the flask. Take out the flask from the water bath, transfer the contents to a wide mouthed warm test tube and carefully add 25ml of boiling distilled water along the side of the test tube. Continue shaking the tube lightly from side to side during the addition. The turbidity indicates presence of mineral oil (adulterant), the depth of turbidity depends on the percentage of mineral oil present.

Table 1: Results of various characteristics of Sesame oils

S. No	Parameters	In-house standard	Sample T	Sample M	Sample A
1	ORGANOLEPTIC CHARACTER				
	1.COLOUR	Golden yellow	Turbidity	Passes	Passes
	2.ODOUR	Characteristic	Passes	Passes	Passes
	3.TASTE	Bland	Passes	Passes	Passes
2	PHYSIO CHEMICAL CHARACTER				
	a).LOSS ON DRYING in %	Not more than 1.0 %	0.09	0.39	0.07
	b).WEIGHT/ML in gm	0.915 to 0.921 gm/ml	0.898	0.912	0.918
3.	SAPONIFICATION VALUE	188-193	222.66	230.14	189.02
4.	IODINE VALUE	105-115	88.83	99.17	106.25
5.	ADULTERANTS	Other oils	Nil	Nil	Nil
6.	FFA	2.0	1.32	1.76	1.88

Results and Discussion

Table.1.of results shows the values of physicochemical analysis carried out on the crude extract of sesame oil. The results indicate that the three samples passed the organoleptic character and having standard golden yellow, odour and having bland taste.

The physicochemical character shows loss on drying is low in sample-T (0.09%). In sample A (0.07%) is low when compared to traditional sample and in sample M is high (0.39%). The Weight of the sample A is within standard (0.918 gm/ml), sample M is low than standard(**0.912**gm/ml) and traditional sample value is low than other two samples.

Saponification is an indicator of average molecular weight and chain length. It has an inverse relationship with molecular weight of lipids. The saponification values of sample-A (189.02) within standard. Whereas sample-T is higher **222.66** and sample-M is higher **230.14**. The lower value of saponification values suggests that the mean molecular weight of fatty acids is lower or that the number of ester bonds is less. This might be that the fat molecules did not interact with each other. The higher the iodine

value, the more unsaturated fatty acid bonds are present in a fat. These unsaturated fatty acids important in most of the Essential fatty acids. The sample M is the high value i.e containing the more essential oils, T is next one.

Iodine value determines the stability of oils for oxidation and allows the overall un-saturation of the fat to be determined qualitatively [21,23]. Among the Iodine value, sample T is low (**88.83),** sample M is mildly high (**99.17)** and sample A is within limit(106.25), this oil value could be used to quantify the amount of double bonds present in the oil, which signifies the susceptibility of oil to oxidation. The higher the iodine value, the less stable the oil and the more vulnerable for oxidation and free radical production. High iodine value oils are prone to oxidation and polymerization. During heating, such as when used in cooking, oils with high iodine value readily oxidize and polymerize. Hence, Sample T is more stable and preferable one.

The oxidative and chemical changes in oils during storage characterized by an increase in free fatty acid contents and a decrease in the total un-saturation of oils. In free fatty acids, it is low in sample T(1.32), little bit high in sample M(1.76) and in sample A is more high(1.88). The low value of sample T indicated that this oil sample could be more stable when compared with samples A and M.

Conclusion

Based on the analysis of the organoleptic and physicochemical properties are important studies to determine the physical, chemical state and quality of the oil. The analysis report reveals that traditional method (Ghani) of preparation of sesame oil is more stable, less interact with other molecules, less prone for free radical production. Sample T is having more nutritional value when compared with other methods (solvent and Expeller pressing methods). The sesame oil (sample-T) which is prepared by Ghani might be recommended for human consumption to promote their health and longevity. Recommended for document the difference in the spreading pattern in diagnostic method i.e, *Neikkuri* in Siddha system of medicine in future.

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References

1. Abou-Gharbia, H.A., Shehata, A.A.Y., Shahidi, F., 2000. Effect ofprocessing on oxidative stability and lipid classes of sesame oil. Food Res. Int. 33, 331–340.
2. Anila kumar, K.R., Pal, A., Khanum, F., Bawa, A.S., 2010.Nutritional, medicinal and industrial uses of sesame (Sesamumindicum L.) seeds – an overview. Agric. Conspec. Sci. 75 (4).
3. Hassan, Manal A.M., 2012. Studies on Egyptian sesame seeds (Sesamum indicum L.) and its products 1 – physicochemicalanalysis and phenolic acids of roasted Egyptian sesame seeds(Sesamum indicum L.). World J. Dairy Food Sci. 7 (2), 195–201.
4. Ogawa, H., Sasagawa, S., Murakami, T., Yoshizumi, H., 1995. Sesamelignans modulate cholesterol metabolism in the stroke-pronespontaneously hypertensive rat. Clin. Exp. Pharmacol. Physiol.Suppl. 1, 10–12.
5. Hirata, F., Fujita, K., Ishikura, Y., 1996. Hypocholesterolemic effectof sesame lignan in humans. Atheroscler 122 (1), 135–136.
6. Yamashita, K., Nohara, Y., Katayama, K., Namiki, M., 1992. Sesameseed lignans and gamma-tocopherol act synergistically to producevitamin E activity in rats. J. Nutr. 122 (12), 2440–2446.

7. Kamal-Eldin, A., Pettersson, D., Appelqvist, L.A., 1995. Sesamin (acompound from sesame oil) increases tocopherol levels in rats fedad libitum. Lipids 30, 499–505.
8. http://www.livestrong.com/article/514307-the-benefits-of-sesame-oil-for-high-blood-pressure/
9. http://www.naturalnews.com/039891_sesame_oil_type2_diabetes_healthy_fats.html#ixzz3zl7whBVQ
10. Smith, D.E., Salerno, J.W., 1992. Selective growth inhibition of ahuman malignant melanoma cell line by sesame oil in vitro. Prostaglandins Leukot Essent Fatty Acids 46 (2), 145–150.
11. Abou-Gharbia; H.A.. Shahidi F and et. al. (1997);Effect of processing on oxidative Stability of sesame oil extracted from intact and dehaulledseeds; JAOCS, 74, 215-221.
12. Borchani , S. Besbes, Ch. Blecker , and H. Attia ;Chemical Characteristics and Oxidative Stability of Sesame Seed, Sesame Paste, and Olive Oils J. Agr. Sci. Tech. (2010) Vol. 12: 585-596
13. Monier monier-william, Asankrit-english dictionary (1899), motilal banarsidass, Delhi, repr.1963, 448.
14. Sharma sastry R., Kautilya's arthasatra, nesleyan mission press,mysore, 2 nd edition, 1923, 112-113.
15. Rigveda I, 28 1-4&6
16. sivaramamurthy.C., Chola temples,Director-general of archaeology, New Delhi 1960, 73.
17. K.T.Achaya, Indian oilpress(ghani), Indian journal of history of science 27(1),1992.
18. Krishnamoorthy KH, Chandramouli G. Siddha system of medicine: a historical appraisal. Indian J History Sci. 1984;19: 43-53.
19. Saroja PR, Veluchamy G. Simple medicine in Siddha system. Subramanian S.V. and Madhaven V.R. (Eds), Heritage of Tamil Siddha medicine. (Madras, India: International Institute of Tamil Studies), p.185, 1983bb
20. M. Kaviani, Z. Darjani, J. Tomovska, Z.Mazandarani, MA Shariati. "Comparing Different Extraction Methods of Sesame Oil" Int. J. Of Pharm. Res. & All. Sci. 2015; 4(2):22-25.
21. Erum Zahir et al: Study of physicochemical properties of edible oil and evaluation of frying oil quality by Fourier Transform-Infrared (FT-IR) Spectroscopy: Arabian journal of chemistry: June 2004.
22. W. D. Pocklington, Determination of the iodine value of oils and fats-Results of a Collaborative Study ; Pure & Appl. Chem., Vol. 62, No. 12, pp. 2339-2343,1990
23. http://www.sciencedirect.com/science/article/pii/S1878535214001014