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Study of Fatty acid in Coconut Oil

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INTRODUCTION

kernels, fruits and seeds of plants are used for extracting oil which is edible and serves as vegetable oil. Vegetable oils are liquid vegetable fats that remain liquid form at room temperature. Fatty acids are the building blocks of fats. An important feature common to most plant derived oils and fats are the presence of high percentage of triglycerols. They yield nutritional value to both human and animal diet. According to Tannenbaum (1979) the oil must be well digested and absorbed into the body in order to supply energy .

Fats with a high percentage of saturated or trans fatty acids are solid at room temperature and are called as solid fats, while those with more unsaturated fatty acids are liquid at room temperature and are referred to as oils. "Lipids" refer to both liquid and solid fat (Anthea ,1993). Fat is particularly regarded as energy-yielding nutrient. In recent years, attention has been focused on the dietics and health effects of fats and oils in food which is

consumed by living beings.. Dietics effects of fat and oil depend primarily on the levels of individual fatty acids and on the mutual ratios of fatty acids.

According to a published result by Senanyake & Shahidi ,(2002); St-Angelo,(1996) the physical and chemical characteristics of oils and fats are influenced by the kind and proportion of fatty acids on triacylglycerol, while Christie, (1992) reported that in a triacylglycerol two or more fatty acid moieties are present in molecule .Vegetable oil contains triglycerides with long chain fatty acids, which are insoluble in water. Triglycerides are composed of three fatty acids that are attached to the compound glycerol, so glycerol is known as the "backbone" of triglycerides.

National institute of Nutrition & The Indian council of Medical Research recommended edible oil that have an equal proportion of saturated fatty acids, monounsaturated & polyunsaturated fatty acids.

In the ratio of 80:6:14 the oil and fat consumption was shared between food, feed and industrial use. At present, about 55-60 % of global fatty acid production and capacity is located in Southeast Asia owing to its proximity to the raw material sources. South East Asia is the major source of palm, palm kernel and coconut oil, Ofwona Edith (1994).

In recent years coconut oil and groundnut oil products are thronging the market. It is impossible to step into a grocery store without seeing a coconut, groundnut- containing product on display. Now-a-days

advertisements potray the worthiness of health benefits of coconut products, including weightloss, cancer prevention and improved brain function. Certainly this imply that coconuts are the upcoming superfood.

COCONUT OIL

Coconut (*Cocos nucifera L*.) is a tropical palm tree which yields edible oil extracted from the "meat" of matured coconut . It can thrive as long as 100 years and its internationally traded major products are tender nuts, fresh coconuts, desiccated coconut, cup copra, coconut oil, oil cake (poonac), and copra meal (Prasad *et al.*, 1991). It is colourless to pale brownish yellow oil with the melting point ranging from 23ºC to 26ºC. The glycerides of coconut oil are invariably a mixture of one, two or three fatty acids. Though coconut oil is known as triglyceride or lipid, it also contains minor proportions of mono and diglycerides and has highest content of glycerol (13.5 to 15.0 %) . Glycerol is a carbohydrate with chemical composition similar to that of simple sugar. This implies that with coconut oil as dietary fat, the actual intake of fatty substance is less than that with same quantity of any other oil. It has several applications in the food industry. It is used in processing foods because it is relatively inexpensive and can provide crisp texture to foods. Coconut oil has a high smoke point, the temperature where it starts to break down, which makes it shelf stable and ideal for foods that need a longer shelf,-life. coconut oil is the latest miracle food, claiming it can cure everything from heart disease to obesity and cancer (Craig-Schmidt 1993).

However, the effects of coconut oil on health have not been well studied. These health claims tend to be based more on personal testimonials than on scientific evidence. In fact, there are very few studies in people showing benefits of coconut oil, most of these studies are epidemiology studies (e.g., population studies) that show a link between high coconut-consuming countries and longevity. Coconut oil is considered a saturated fat and contains 9 calories per gram, Nevin, K. G., & Rajamohan, T. (2009), Arunimaa, S., & Rajamohan, T. (2013)..

As stated in Organic facts (2014), primarily there are 6 varieties of coconut oil found on the world market. The varieties are pure coconut oil, refined coconut oil, virgin coconut oil, organic coconut oil, organic virgin coconut oil and extra virgin coconut oil. According to Fife (2004), coconut oil can be divided into two categories; "refined, bleached and deodorized" (RBD) coconut oil and "virgin" coconut oils. There are a lot of methods for processing coconut into oil that can affect the quality, appearance, flavour and aroma. The quality of coconut oil depends a lot on the method of extraction that is practised. Basically, there are two main categories of coconut oil extraction; the first is Cold Pressing of copra (dried coconut kernels) and the second is Boiling/heating of fresh coconut milk . Cold pressing is the preferred method for the extraction of coconut oil since it retains much of oil's goodness

(Organic facts, 2014). Coconut contain about 33 % of oil in the nut (Agarwal, R. K., & Bosco, S. J. D. (2017).

The world price for coconut oil had increased within the past few years and now cost more than soya oil and palm oil. Averagely the world market price was US$1,500 / tonne while the average price paid by ACP countries for coconut oil was estimated at US$1,327/ tone based on the value of imports in 2008 **.**A study on 'Marketing strategies for coconut' points out that India accounts for 25.57% of world production of coconut (Maheshwari *et al*; 2003).

Material and Method

Sampling and Sample Preparation

Samples of 2 different varieties of vegetable oils are used for the study. Three samples of coconut oil were taken for study . The samples were numbered as C_1, C_2 and C_3 for coconut oil

C1- Coconut prepared in laboratory by using coconut milk

C2 – Coconut oil purchase directly from refinery

C3- Coconut oil purchase from supermarket

Method for Extraction of Coconut oil

The coconut seed was bought from market and it was taken to the Laboratory and the fresh kernel was used for the study. Two medium size coconuts were used for the extraction of oil. The coconut was grated and the coconut milk was extracted using sterile distilled water and the fresh coconut milk was transferred to a clean and dry beaker and was boiled in slow flame till the coconut oil separated from the milk . This fresh coconut oil is known as virgin coconut oil and for the study it was numbered as C_1.

PHYTOCHEMICAL ANALYSIS:

The samples were tested for the presence of bioactive compounds by using following standard methods (Harborne J .B 1998).

Physiochemical properties

The extracted oil was transferred to clean dry bottles and stored for 60 days. The physicochemical properties of the oil were observed periodically for every 30 days. The Colour, odour, viscosity and moisture was observed.C_1 appears transparent with a mild odour and has a low viscous which solidifies at low temperature and the melting point is 22.After an interval of 30 days it becomes rancid.C_2 appears pale yellow and is highly viscous but becomes rancid at an interval of 30 days and is highly viscous.C_3 appears pale yellow but at an interval of 30 days there is no change in the physiochemical properties.At interval of 60 days there is no change in the odour,colour and viscosity. G_1 appears pale yellow but

becomes rancid at an interval of 30 days which has low viscosity.G_2 appears brownish yellow in colour and becomes rancid at interval of 30 days and remains highly viscous.G_3 appears dark yellow and has a strong odour even at the end of 60 days due to the presence of preservatives to extend the shelf life.

RESULT

The present study was performed to analyse the fatty acid content of six oil samples out of this 6 samples three were coconut oil and three groundnut oil .The samples were numbered as C_1, C_2 and C_3 for coconut oil .

The fatty acid content of the coconut oil was performed by gas chromatography The retention time of the various fatty acid in the oil are given in figure -9 .The retention time for the fatty acids are as follows. The retention time of $C1_{is}$ 7.385 minutes at 80 Volts, 12.210 minutes above 190 volts, and 17.348 minutes at 120 volts, 20.902 minutes at 70 volts. The retention time of C_2 is 6.936 minutes at 49 volts, 11.930 minutes at 180 volts whereas the retention time of C_3 is 7.012 minutes at 90 volts. The percentage of various fatty acid in the coconut oil was calculated by the standard formula. (Fig-7)

The percentage of the various fatty acids in the coconut oil is given in table - 10

The percentage of lauric acid in the oil C_1 is 54.3 %, in C_2 it is 49.3%, in C_3 it is 49%. The percentage of lauric acid is more in the C_1 and was little less in the other two samples.

The percentage of Capric acid in the oil C_1 is 12%, in C_2 it is 23%,in C_3 it is 20%. The percentage of capric acid is more in C_2 and was little less in the other two samples.

The percentage of Myristic acid is nil in C_1, in C_2 it is 22.55 %, in C_3 it is nil.The percentage of Myristic acid is more in C_2 while nil in other two samples.

The percentage of Palmitic acid in the oil C_1 is 14%, in C_2 it is 21%, in C_3 it is 17%. The percentage of Palmitic acid is high in C_2 and was less in other two samples.

The physico chemical property of the oil was observed at various time intervals. The property was studied as soon as it was extracted. The colour, odour and the viscosity of the oil was observed . The observations were also made at the end of 30 days and 60 days to find whether the physicochemical properties of the sample get changed during the storage as C_1,C_2 were stored without adding preservatives Whereas the property of the oil which was purchased from market was not altered .This shows that the oil purchased contain added preservatives .The result of the study is given Table

Figure: 1

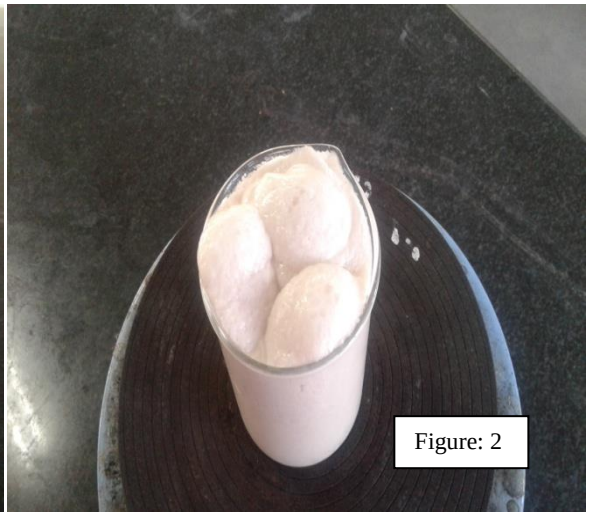
Figure: 2

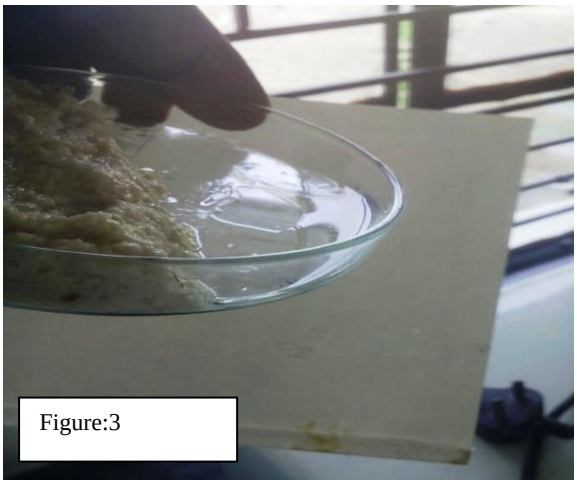
Figure:3


Separated Coconut oil

Figure 1,2 and figure 3 shows the separation of oil and the oil separated. The oil extracted from two medium size coconut was nearly 50 ml and is shown in figure 4 .

Sl.No	**Fatty acids**	**Fatty acid [%]**		
		C_1	**C_2**	**C_3**
1	Lauric acid ($CH_3(CH_2)_{10}COOH$)	54.3	49.3	49
2	Capric acid ($CH_3(CH_2)_8COOH$)	12	23	20
3	Myristic **acid** ($CH_3(CH_2)_{12}COOH$)	-	22.55	-
4	Palmitic **acid** ($CH_3(CH_2)_{14}COOH$)	14	21	17

TABLE 1 - Fatty acid compositions of coconut oil obtained by GS method

Sl.No	Phytochemical	Fresh coconut extract	Copra extract	Coconut oil
1	Carbohydrates	+	+	+
2	Proteins	-	-	-
3	Phytosterol	+	+	+
4	Alkaloid	+	+	+
5	Flavonoid	-	-	-
6	Phenolic compound	-	-	-
7	Tannin	-	+	-
8	Saponin	+	+	+
9	Fats and oils	+	+	+
10	Glycosides	+	+	-
11	Terpenoid	+	+	+

TABLE 2- Phytochemical Composition of Coconut Oil.

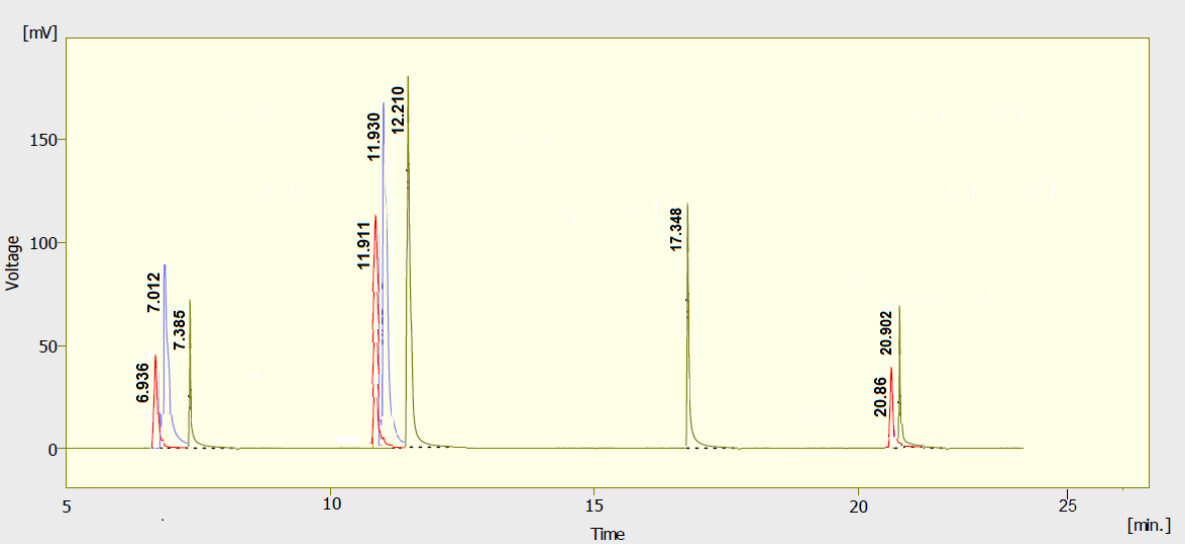

Figure 5. Coconut oil gas chromatography

C_1 C_2 C_3

Table 3–physicochemical properties of coconut oil

S.NO	PROPERTY	C1	C2	C3
1.	Colour	Transparent	Pale yellow	Pale yellow
2.	Odour	Rancid	Rancid	Strong
3.	Viscosity	Low viscous	High viscous	High viscous

S.NO	PROPERTY	C1	C2	C3
1.	Colour	Transparent	Pale yellow	Pale yellow
2	Odour	Mild	Medium	Strong
3.	Viscosity	Low viscous	High viscous	High viscous
4	Solidification at low temperature	Not solidified	Solidified	Solidified
5	Moisture percentage	< 0.1	< 0.1	< 0.1
6	Melting Point	22	23	25

Table 4- Physiochemical property of the coconut oil after 30 days

S.NO	PROPERTY	G1	G2	G3
1.	Colour	Transparent	Pale yellow	Pale yellow
2.	Odour	Rancid	Rancid	Strong
3.	Viscosity	Low viscous	High viscous	High viscous

Table 5 Physiochemical property of the coconut oil after 60 days

DISCUSSION

Oils and fats are very much essential for living system. There are many oils available in market. The oils are manufactured by various company and they market by saying that they have added mineral, Vitamin and other nutrients for the health. The actual fact is that during the processing of the oil they add Flavours and preservatives and during the processing the nutrients actually present in the oil get destroyed. The present research was done to bring out the difference between the freshly prepared oil which is called as virgin oil, oil extracted by the oil extractors directly i.e. before processing for packing and the packed oil – oil available in super market.The research was an attempt to bring out the fact – which oil can be used by human in their food. This means that which one of the oils contains all the original nutrient of the

COCONUT OIL

The coconut oil was selected for the study and the virgin oil was prepared in the laboratory. The study started with the hypothesis that this virgin oil will be best for food. The lauric acid and the capric acids are the major fatty acids which is available at a percentage of 46.36 to 48.42% and 8 to 11% in RCO and little lesser in other coconut oil samples were found to be similar to the result of the present study (Mansor *et al.*,2012,). This result is in line with the work (Gregorio 2005 and Gopala et al.,2010), they reported that coconut oil is a major source of lauric acid. Lauric acid is found at a ratio of 59.83 % during the transesterification process of VCO and less in other forms of coconut oils (Loosli, J. K., J. et al., 1955.).

The percentage of Lauric acid was more in (C_1) virgin oil when compared to the oil purchased from the extractors directly (C_2) Which shows the lauric acid content gets reduced during the drying of the coconut or any other process. The oil C_2 is extracted from the coconut copra by the extractors for which the coconut is sliced into small pieces and then the pieces of coconut are dried under sun and

then in shade and then the coconut copra are put into the extractor for oil extraction . Then the oil is filtered by a filteration unit and in the present study we confirm that the content of lauric acid may be reduced during the above-mentioned processing of the coconut copra. The percentage of Lauric acid less in C3 than C1 and C2. The Processing of oil by the companies might be the reason for this decrease in the concentration. So as for the Lauric acid content C1 which is a type of virgin coconut oil is the best as per the study

Davis and Melina 2010 reported the presence of 25 % of Capric acid, in coconut and its derived products. The present study reported 12 %, 23 % and 20 % of Capric acid in C_1, C_2 and C_3 respectively. The study revealed that content of capric acid is less in C_1 when compared to C_2 and C_3. The reason for the reduction may be due to the heating procedures used in extraction of the oil in the laboratory. There are previous reports in which 15 % of Capric acid is reported by Gervagio (2005). They also have reported 55 % of Capric acid in coconut oil which was obtained by low molecular weight fraction and 40 % in original oil (without fractionation)

22.55 % of Myristic acid is reported in the present study in C_2 and only trace of myristic acid in seen in C_1 and C_3. This may be due to destruction of the fatty acid during heating process in case of C1 and other processing by the companies in case of C3 and this is a near value which is reported by the previous researchers Davis and Melina (2010).They have reported 18 % of Myristic acid in their research. Leyva and Salvador 1943 reported 38.89 % of Myristic acid which is in acceptance with our study.Myristic acid increases LDL

In the research done by Davis and Melina (2010) they reported 8 % of Palmitic acid in coconut oil and its product whereas in our study 14 % of Palmitic acid is seen in C_1, 21 % in C_2 and17 % in C_3. Leyva and Salvador 1943 reported 22.51 % of palmitic acid in coconut oil which is in acceptance with the present study. There are other studies which reported that there is only trace of palmitic acid. The presence of Palmitic acid increases LDL.

SUMMARY A comparative study of fatty acid composition in different edible oils such as coconut (*Cocos nucifera*. Of which three coconut oil samples (C_1, C_2, C_3) were experimentally subjected to profiling of fatty acids, photochemical studies, physicochemical studies and their shelf life were experimented by storing each sample in each bottle in our biotechnology lab. The bottle labelled with virgin coconut oil was transparent but became rancid at the interval of 30 days whereas the bottle labeled with C_2 containing copra extracted oil also became rancid at the interval of 30 days but C_3 containing commercial coconut oil remained unchanged till the end of sixteeth day due the presence of additional preservatives. Fatty

acids such as lauric acid,palmitic acid,myristic acid is obtained . Lauric acid is the predominant fatty acid with antimicrobial properties.

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