

Effect of storage time on nutritional quality of edible oils

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Abstract—The present study reports the changes in major nutrient quality parameters of edible oils with respect to storage time. The measurement performed at room temperature with a difference of three months. Four edible oils namely Spanish olive, yellow mustard, coconut, and red peanut oils tested for changes in calories, total fat, saturated fat, monounsaturated fat, poly-unsaturated fat, omega-3, omega-6, and vitamin E (% RDA). The Gas Chromatography technique is utilized for the constituent’s measurement. It is observed from the analysis that, in the case of Spanish Olive oil, only Vitamin E is significantly affected. The yellow mustard oil, loses the calories due to the long storage time. Considering the most important component i.e. calories, the yellow mustard oil is not suitable for long storage time after extraction. In coconut oil, the saturated fat is reduced with a small amount, which is favorable.

Index Terms: Edible oils, Nutrient quality, fatty acid, storage time, human health

I. INTRODUCTION

Edible oils are an integral part of the human diet. Therefore, the nutrient quality analysis of oils from time to time is essential to ensure good health. The oils are extracted from the seeds of oilseed crops. First, the oil is extracted from the seeds. In India, usually, the Ghani method is used for oil extraction. The extracted oil can then be purified and, if required, refined or chemically altered. The main steps in producing edible oils are represented in Figure 1.



Figure 1 Production line of edible oils

A. Edible oils and quality

The major consumed oils in India are mustard, soybean, sunflower, sesame, coconut, olive, linseed, red peanut and groundnut oils. The edible vegetable oils are the main source of nutritionally essential fatty acids in the human diet.

Spanish Olive

The olive (*OleaEuropea* L.) crop farms in the subtropical climate. It is one of the oldest main traditional crops of Mediterranean countries. The consumption of this edible oil also rises in non-Mediterranean places. The quality of edible also attracts to consumers. The quality of edible oils such as olive is influenced by various factors like harvesting, storage, etc. [1].

The scientific position of olive oil is shown in Figure 2. The main nutrient components of olive oil are saturated and unsaturated fatty acids. That are simple in structure and constructed by a long chain of carbon atoms [2]. Quality is generally the combination of different characteristics or factors of a product. Quality determines the edibility, acceptability and suitability for health.



Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Asterids
Order:	Lamiales
Family:	Oleaceae
Genus:	<i>Olea</i>
Species:	<i>O. europaea</i>
Binomial name	<i>Olea europaea</i> L.

Figure 2 Position of olive oil

Flaxseed (Linseed Oil)

Flax (*Linum usitatissimum* L.) is one of the ancient and multipurpose crop. Basically, two varieties of

flax are grown. One for oil i.e., seed flax and another for fiber, i.e., fiber flax. The central regions of this crop are Canada, Argentina, America, China and India [3]. The seeds provide approx. 38% of oil is useful for human diet [4].

Yellow Mustard oil

Yellow mustard oil is used as edible oil in India since long. It is also known for its medicinal values ([5][6]. The mustard belongs to Brassicaceae Family. The Scientific Names of white or yellow mustard is Sinapisalba L. The mustard oil is one of the most widely used and important part of the diet for Indians. It is also known as Indian mustard, black mustard, white mustard leaf mustard, yellow mustard, etc. Figure 3 shows the systematic position of mustard plant for oil production.



Kingdom-	Plantae
Division-	Magnoliophyta
Class-	Magnoliopsida
Order-	Brassicales
Family-	Brassicaceae
Genus-	Brassica

Figure 3 Systematic position of mustard plant

Coconut oil

Coconut oil obtained as functional food oil. It has some unique capabilities to provide the healthy contents to human. Compound such as tocopherols and phenolics is retained in this oil, making it the functional food oil [7]. Its extraction is performed through different techniques, such as coconut milk [7][8]. This oil is considered as saturated fat due to the presence of fatty acid an amount of more than 90%. The scientific details of coconut plant is shown in Figure 4.



Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Monocots
Clade:	Commelinids
Order:	Arecales
Family:	Arecaceae
Subfamily:	Arecoideae
Tribe:	Cocoseae
Genus:	<i>Cocos</i> L.
Species:	<i>C. nucifera</i>
Binomial name	<i>Cocos nucifera</i> L.

Figure 4 Scientific details of coconut plant

Red Peanut oil

Red Peanut is ideal for stir frying and as drizzle to infuse your dishes with a delicious nutty fragrance. It reduces cholesterol, enhances cognitive health, improves insulin sensitivity, relieves joint pain and improves hair and skin health. It is suitable for medium to high heat applications, as salad dressing and drizzle oil. It should store in a cool and dark place and use within six months of opening. The details about peanut plant are shown in Figure 5.



Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Fabales
Family:	Fabaceae
Subfamily:	Faboideae
Tribe:	Aeschynomeneae
Genus:	<i>Arachis</i>
Species:	<i>A. hypogaea</i>
Binomial name	<i>Arachis hypogaea</i> L.

Figure 5 Details of peanut plant

The research on edible oil quality is not new but it performed by many people since long. Different fatty acid profiles of different edible oils have investigated through different advanced techniques such as gas chromatography method Knothe and Kenar[9], Sánchez et al [10] studied the effect of acidity-salt level, pasteurization, light, and storage time on pH, titratable acidity, brine color, and firmness and color. The pH increases significantly during storage of oil found which shows its microbiological instability. The color index also found to be altered. The colours of olives also ruined with time.

López-Aguilar et al[11] evaluated the efficacy of two different techniques to study the rancidity of soybean oils. The physico-chemical quality and the sensory attributes of soybean oil also investigated. Fatty acid profiles such as Free fatty acid (FFA), Anisidine Value (AV), Peroxide Value (PV), Conjugated Dienes (CD), Colour, Rancimat and TOTOX analyzed.

Knothe and Steidley[12]analysed the quality of oils collected from sixteen different restaurants. They investigated the difference between the fatty acid profiles before and after use of oils at restaurants. The gas chromatography technique was used for the quality parameters analysis. Results show that oils and fats saturated during cooking. Different independent samples collected from same user shows a little similarity.

II. PROCEDURE AND TECHNIQUES FOR QUALITY TEST

The gas chromatography is one of the most widely used and powerful techniques to study edible oils' composition and quality parameters. The principle of GC first, converted the sample to vapor a flowing stream of carrier gas sweeps the specimen into a thermally-controlled column. The retention time is also important in this process. The retention time is the duration between the injections of sample to the detection of component. The volatility of components affects the retention time. After exiting the column detected response is recorded as the separated component.

This study utilized the GC system for the analysis of fatty acid compositions in different edible oils at different time intervals. The variation in compositions are recorded and compared to study the impact of storage time on quality of edible oils. A sequential theme of overall work methodology is shown in Figure 6.

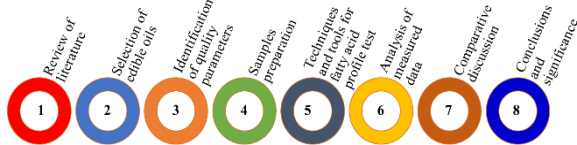


Figure 6 Major steps of methodology

Figure 7 shows the equipment available in the laboratory for analysis of selected oils with respect to the considered quality parameters.



Figure 7 Test equipment for sample analysis

III. RESULTS

Figure 4.20 shows the comparative analysis of nutrients quality parameters of Spanish Olive oil. The graph shows the measurements of parameters with

three months of difference after the extraction of oil. It can be observed from the analysis that, in the case of Spanish Olive oil, only Vitamin E is affected greatly.

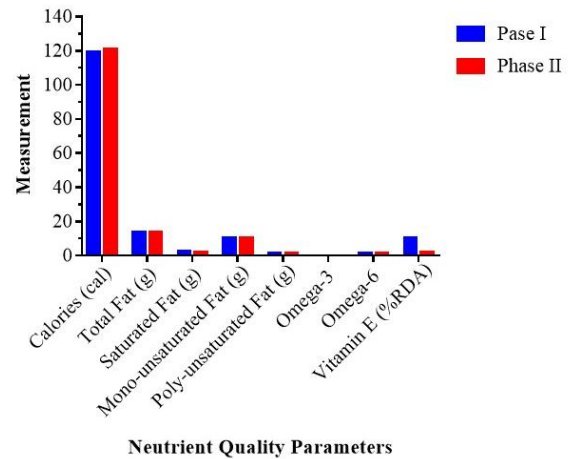


Figure 8 Effect of storage time on Spanish Olive oil

Figure 9 shows the comparative analysis of nutrients quality parameters of yellow Mustard oil. It can be observed from the analysis that, in the case of yellow mustard oil, the calories degraded due to the long storage time. The effects of storage duration on coconut oil quality parameters after six months is graphically represented in Figure 10. The graph shows that none of the constituent degraded significantly. Even the calories value is found to be enhanced after the second phase analysis. All other nutrient quality parameters such as total fat, saturated fat, monounsaturated fat, poly-unsaturated fat, omega-3, omega-6 and vitamin E are not affected considerably.

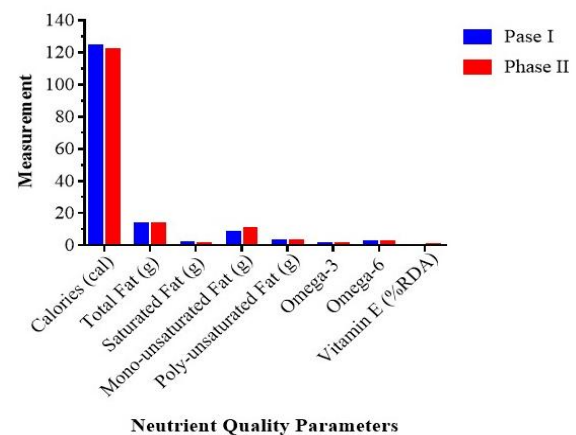


Figure 9 Effect of storage time on Yellow Mustard oil

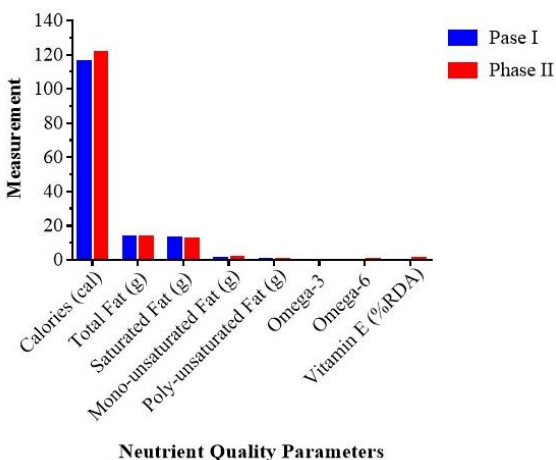


Figure 10 Effect of storage time on quality of coconut oil

The effects of storage time on red peanut oil quality parameters after six months is graphically represented in Figure 11. The graph shows that the unsaturated fatty acid was reduced which is not positive results for human health. Overall, the increasing storage time degrading the nutrients quality of red peanut oil.

IV. CONCLUSIONS

The main focus of the present study is to investigate the impact of storage time on nutrients quality factors such as calories, total fat, saturated fat, monounsaturated fat, poly-unsaturated fat, omega-3, omega-6, and vitamin E (% RDA) of four different edible oils namely Spanish olive, yellow mustard, coconut, and red peanut oils. The quality parameters of edible oils have been tested after every three months and compared for suitability for human health after storage. Based on the data analysis, the findings of the study following conclusions have been made.

It is observed from the analysis that, in the case of Spanish Olive oil, only Vitamin E is significantly affected. In case of yellow mustard oil, the calories are degraded due to the long storage time. Considering the most important component i.e. calories, the yellow mustard oil is not suitable for long storage time after extraction.

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