

Extraction and comparison of properties of jackfruit seed oil and sunflower seed oil

Nandhitha Ganesh Babu, Srikala Kumar, Swetha Sundar

School of Food Science and Management, MOP Vaishnav College for Women, Chennai

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ABSTRACT The objective of the study is to extract oil from jackfruit seeds and compare its properties with that of sunflower oil. The oil was extracted by milling the jackfruit seeds. The jackfruit seed oil was used as a medium for frying potato chips. The frying properties were compared to that of milled sunflower oil. The potato chips were analysed for their sensory properties. The chips were evaluated by a team of 20 semi-trained panellists who graded the samples on a 5-point Hedonic scale. The sensory attributes included texture, aroma, flavour, colour, taste and overall acceptability. The results revealed that the texture and colour of the potato chips fried in jackfruit seed oil were similar to those which were fried in sunflower oil. The jackfruit seed oil was also tested for its physicochemical properties such as Acid value, Iodine value, Peroxide value and Saponification value. The results were 3.51, 14.15, 0.954 and 251 respectively. The free fatty acid was estimated to be 1.35g/100g. The peroxide value of the oil was found to be lower than that of sunflower oil.

Keywords: Extraction, Milling, Physicochemical Properties, Fatty acids, Anti-oxidants, Saturated fat, Gluten-free, Frying, Drying.

1 INTRODUCTION

The research focusses on using jackfruit seed oil as a frying medium and comparing its properties with that of sunflower oil. Jackfruit oil is obtained by milling the jackfruit seeds. This processing method is safer when compared to commercial oil processing methods. The benefits of processing the seeds into oil are unknown to many. So, the research aims to educate people about this alternative plant oil.

1.1 JACKFRUIT

Jackfruit (*Artocarpus heterophyllus*) is a tropical fruit which is grown in India, China, Malaya, Africa and East Indies. These fruits are ready for harvest in 90-110 days after appearance of spike. Watery latex at harvest indicates that the fruit is mature. Jackfruit is rich in many vitamins and minerals such as thiamine, niacin, riboflavin, calcium, potassium, iron, zinc, sodium and folic acid. Jackfruit possesses various medicinal properties. It can heal asthma, cancer, malaria, diarrhoea, inflammation, arthritis, tuberculosis and atherosclerosis. It contains less calories and is rich in dietary fibre. Studies also reveal that it promotes blood circulation and is beneficial for hair and skin. [1]

1.2 JACKFRUIT SEED

The seeds of the ripe jackfruit are encased in 'bulbs' of yellow, banana- flavoured flesh. The shape of the seeds varies from oval to oblong ellipsoidal to round. The seeds are light brown in colour and generally 2-3 cm in length and 1-1.5 cm in diameter. (Morton, 1987, p. 58-64)

The seeds can be consumed after boiling, steaming and roasting. Boiled seeds are also canned in brine and in tomato sauce. The seeds have an appreciable amount of

phenolic content and anti-oxidant activity. The seed contains about 2.78 % moisture. The seeds are a rich source of protein. The protein content of jackfruit seed is 20.19%. The protein contents are higher than those from high protein animal sources such as beef and marine fishes. The predominant nutrient in jackfruit seed is carbohydrate. The carbohydrate content of these seeds is 51.82%. The starch composition of these seeds is relatively high. Hence, these seeds can be processed into flours. The flour obtained from these seeds is gluten-free and diabetic friendly. The flour has potential in food formulation because of its high starch, dietary fiber and protein and mineral content. The seeds are also a rich source of fibre. The fibre content of these seeds is 7.10%. Fibre aids in weight loss and also helps in maintaining cholesterol levels in the blood. It promotes digestion and reduces the risk of cardiovascular diseases. The crude fat content in jackfruit seed is 11.39 %. Jackfruit seeds can be processed into oils. Studies show that jackfruit oil can serve as a good alternative to the regular plant oils. Spreads prepared out of jackfruit seeds are found to be healthier when compared to other nut spreads. [2]

1.3 JACKFRUIT SEED OIL

The jackfruit seed oil is rich in Essential Fatty Acids (EFA). EFA like linoleic acid and alpha-linolenic acid cannot be synthesized by the body and must be obtained from food. These fatty acids aid in the formation of healthy cell membranes, proper development and functioning of the brain and nervous system, proper thyroid and adrenal activity, production of hormones, regulation of blood circulation and promotes healthy hair and skin. The oil exhibits remarkable antioxidant properties. Several reactions occur continually inside the body giving rise to formation of free radicals. Free radicals can cause oxidative stress leading to deterioration of normal cell functions and even cell death. The antioxidant properties of jackfruit seed oil prevents the occurrence of free radicals. It is supportive in the maintenance of health and in the prevention of chronic diseases. [5]

1.4 SUNFLOWER OIL

Sunflower oil is a non-volatile oil extracted from seeds. It is the most commonly used oil for cooking and frying. Sunflower oil is rich in Vitamin-E and low in saturated fat. It can help in the prevention of heart- related diseases. [5]

1.5 PROCESSING METHOD

The processing method which was followed for extracting oil from jackfruit seeds is 'milling.' This is a traditional method in which the seeds are first dried under the sun and then placed in between two rotating stone and ground. The oil obtained is then filtered to remove impurities. The benefit of this method is that at each stage of the milling process, no harmful chemical is added or no modification is done.[6]

2 PROCEDURE

2.1 PROCUREMENT OF RAW MATERIALS

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The main raw material used in this research is jackfruit seed for the extraction of the oil. These seeds were procured from Koyembedu wholesale market at Chennai. About 6kg of the seed was obtained to extract 2L of oil. The oil was extracted using the traditional method which involves grinding the dried seeds in between two stones at a village near Vellore, India.

2.2 EXTRACTION OF OIL

The first product to be prepared is the jackfruit seed oil. About 6kg of the seed was obtained to extract 2L of oil. The oil was extracted using the traditional method which involves grinding the dried seeds in between two stones. This oil does not undergo any processing but is just filtered to remove impurities.

2.3 PREPARATION OF POTATO CHIPS

The second product to be prepared is potato chips. The samples are named as 'A' and 'B' as they are different from each other. 'A' is prepared by frying the potatoes in sunflower seed oil while 'B' is prepared by frying the potatoes in jackfruit seed oil that has been extracted.

3 PRODUCT ANALYSIS

3.1 Chemical Analysis

3.1.1 Saponification Value

It is the amount of potassium hydroxide required in mg to saponify one gram of fat. It is done by dissolving 1mL of fat in 3mL of ethanol. To this add 25mL of KOH. Set up another beaker with blank and boil both mixtures for 30 min and allow them to cool. Add phenolphthalein indicator and titrate against 0.5N HCl. Calculate saponification value by using the formula.

Saponification value or number of fat = mg of KOH consumed by 1g of fat.

(1)

Weight of KOH = Normality of KOH * Equivalent weight* volume of KOH in litres

(2)

Volume of KOH consumed by 1g fat = [Blank – test]ml

(3)

3.1.2 Peroxide Value

Defined as the amount of peroxide oxygen per one kilogram of fat or oil. The oil sample is treated in a solution with a mixture of acetic acid and an organic solvent and then with a solution of potassium iodide. The liberated iodine is titrated against a standard solution of sodium thiosulphate.

$$\text{Peroxide value} = \frac{S \times N \times 1000}{\text{Weight of sample (g)}}$$

(4)

Where,

S = mL Na₂S₂O₃ (Test-Blank) and

N = normality of Na₂S₂O₃

3.1.3 Free Fatty Acid

10g of the oil is dissolved in 50mL of the solvent mixture. This is titrated against KOH to the end point of a pink colour that persists for 10 seconds. The acid value is calculated using the formula.

3.1.4 Iodine Value

This is done by preparing two solutions of which one has 10mL of the oil with chloroform while the other has 10 mL of chloroform (blank). 20mL of iodine monochloride is added to both samples and is incubated for 30 mins. The samples are taken out and 10 mL of potassium iodide is added. It is titrated against standard sodium thiosulphate solution until a pale straw colour appears. 1mL of starch indicator is added and the solution turns purple. It is further titrated and the end point is when the solution turns colourless. The iodine value is calculated using the formula.

3.2 Physical Analysis

3.2.1 Smoke Point

Smoke point is the temperature at which fumes start coming from the surface of the oil when heated. This can be measured by inserting a thermometer into the oil at the time when fumes start appearing.

3.3 Sensory Analysis

The sensory analysis was performed for the chips that is fried in sunflower seed oil and jackfruit seed oil. A 5 point hedonic scale was used for the analysis of colour, flavour, texture, aroma and overall acceptability.

4 RESULTS AND DISCUSSION

The research on '**extraction and comparison of properties of jackfruit seed oil and sunflower seed oil**' was done to analyse the physicochemical properties of the oil and estimate the acceptance of chips fried in jackfruit seed oil.

In this study, jackfruit seed oil was extracted by milling and its properties were analysed thereof. The sensory evaluation was carried out by using the chips fried in sunflower oil as the control and chips fried in jackfruit seed oil as the experimental sample. The physicochemical parameters included acid value, iodine value, peroxide value, saponification value and free fatty acid content. The results of all the tests and evaluations have been analysed and tabulated. The **free fatty acid** in jackfruit seed oil was estimated to be 1.35g/100g. The **smoke point** and **frying time** were observed to be 120°C and 50 seconds respectively.

4.1 PHYSICOCHEMICAL ANALYSIS

PARAMETER	JACKFRUIT SEED OIL	SUNFLOWER OIL
Acid Value	3.51	0.055
Iodine Value	14.15	126
Peroxide Value	0.954	2.54
Saponification Value	251	189

Table 4.1 Comparison of physicochemical properties

4.2 SENSORY EVALUATION

Sensory evaluation was done for potato chips fried in jackfruit seed oil and sunflower seed oil. The parameters included texture, aroma, flavour, colour and overall acceptability. 20 semi-trained panellists performed the sensory

evaluation and graded the samples on a 5 point hedonic scale. The data then analysed and tabulated is presented below.

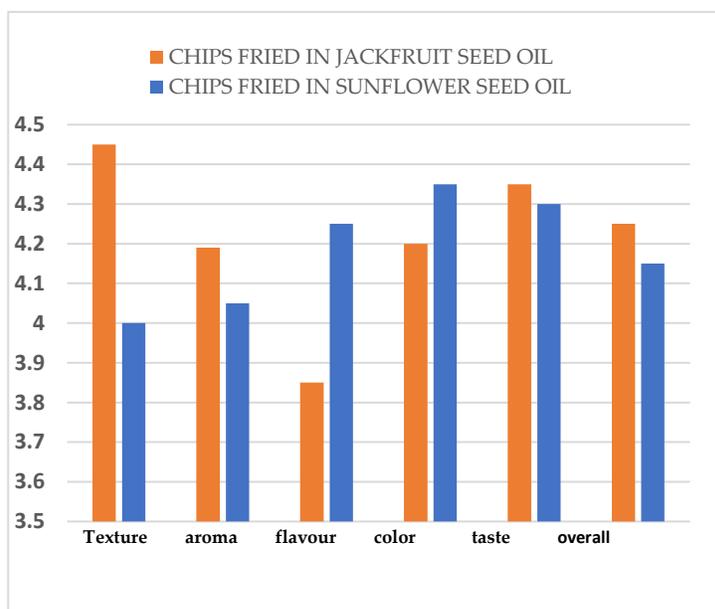


Figure 4.1 Graph of comparison of sensory attributes

5 SUMMARY AND CONCLUSION

Since time immemorial, jackfruit seeds have been thrown away once the fruit has been consumed. Little did we know about the benefits that this seed had? This thought paved way for the research to be carried out on the oil extraction from jackfruit seeds and its comparison with another vegetable oil. Researches done in the past convey the possibility of oil extraction from jackfruit seeds. The functional properties of the starch indicate that the seeds have the potential for use in foods. The seed contains around 55% moisture and is a good source of starch and protein. A 100-gram serving, or about 3.5 ounces of jackfruit seeds, provides about 184 calories, 7 grams of protein and 38 grams of carbohydrates, including 1.5 grams of fibre. The main raw material used in this research is jackfruit seed for the extraction of the oil. These seeds were procured and the oil was extracted using the traditional method which involves grinding the dried seeds in between two stones. About 6kg of the seed was obtained to extract 2L of oil. This oil does not undergo any processing but is just filtered to remove impurities. The second product to be prepared is potato chips. The samples are named as 'A' and 'B' as they are different from each other. 'A' is prepared by frying the potatoes in sunflower seed oil while 'B' is prepared by frying the potatoes in jackfruit seed oil that has been extracted. The oil was then analysed based on the physicochemical properties and sensory evaluation was done for both samples on a 5 point Hedonic scale. Since the iodine value of the oil is 14.15, we can infer that the degree of saturation in the oil is higher. Lower value of peroxide indicates that the oil is less prone to oxidation and rancidity and is more stable. Oils with saponification value greater than 250 contain short chain fatty acids. Hence jackfruit seed oil contains short chain fatty acids. Extraction of oil from jackfruit seed is done and analysis of the physicochemical properties of the same is carried out. Sensory analysis revealed that chips fried in jackfruit seed oil had higher acceptance levels than ones fried in sunflower seed oil.

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