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Methodology

The methodology of the study **"Formulation of Blended Vegetable Oils and Investigation of their Fatty Acid Profile in Cooked Products**", is discussed under the following phases.

Phase I : A Survey on Consumption of Fats and Oils and Market Availability of Blended Vegetable Oils

A) Survey on Household Consumption of Fats and Oils

B) Market Survey on Availability of Blended Vegetable Oils

Phase II : Formulation of Blended Vegetable Oils and its Quality Analysis

Phase III: Fatty acid Profile of Formulated Blended Vegetable oils

PhaseIV: Fatty Acid Profile of Selected Recipes Cooked using Formulated Blended Vegetable oil

Phase I: A Survey on Consumption of Fats and Oils and Market Availability of Blended Vegetable Oils

A) Survey on Household Consumption of Fats and Oils

Fats and oils are necessary components of a well-balanced diet and plays an important role in the maintenance of health and well-being of any individual irrespective of age, sex, region, and cultural difference. Hence as a primitive step to understand, the consumption pattern of dietary fat, a survey was conducted by the investigator.

The research study was approved by the Institutional Human Ethics Committee of Avinashilingam Institute for Home Science and Higher Education for Women **IHEC/19-20/FSMD/28** (Annexure I).

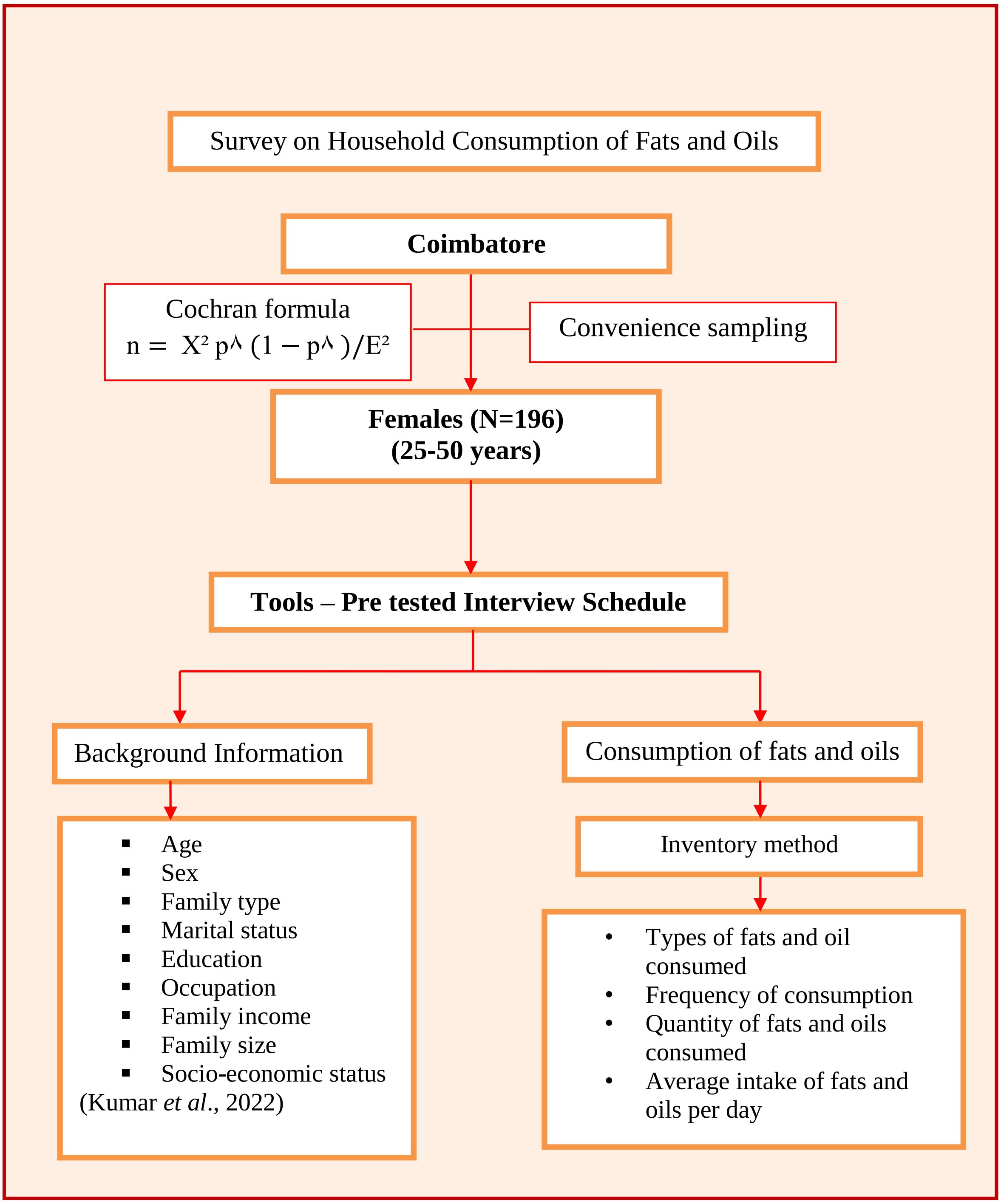

Figure 1a: Survey on Household Consumption of Fats and Oils

Selection of Area

Coimbatore, a tier II city is a known industrial and education hub of the state of Tamil Nadu. The city is also known for its rich agricultural farming practices. Agricultural production of edible oil accounts for the overall production of 10,507 tonnes which includes 10,370 tonnes of groundnut and 137 tonnes of gingelly seeds per year (Statistical Handbook of Tamil Nadu – 2020-2021). With a population of 13,08,675(census of India 2011), the morbidity and mortality rate of Coimbatore was observed to be 1.928 million (Jebakumar *et al*., 2020) and 29,959 for the year (Vital Statistics- Statistical Handbook of Tamilnadu 2020-2021). Also, literature survey on the incidence of diet-related non-communicable diseases such as cardiovascular, obesity, hypertension, and diabetes was found to be1.92 million (Jebakumar *et al*., 2020).Thus the city of Coimbatore was selected for the conduct of the study using purposive sampling.

Selection of Sample

Out of 2,82,839 (census 2011) households from the urban part of Coimbatore, 272 households were selected using Cochran formula $n = X^2 p^{\wedge} (1 - p^{\wedge})/E^2$.The households were selected using convenient sampling. Since the study was initiated during COVID-19 pandemic period,the investigator was not able to survey all the selected houses and hence had to restrict the survey to 196 houses. Thus,a total of 196 female members from selected households were selected for the conduct of the study.

Development of Tool

The investigator developed an interview schedule to collect information on fat consumption patterns in the selected household. Information such as background details, dietary patterns, food frequency, purchase of different types of fats and oils, the quantum of consumption of different types of oil, and the type of cooking with oil as a medium were elicited. The developed interview schedule was tested and validated using SPSS software (version - 26) and validity was found to be 0.70 - Cronbach's alpha (Yusoff.,2019).

Background Information

The background information for name, age, sex, family type, family size, marital status, educational qualification, occupation, and family income of all the selected households was obtained using an interview schedule (Annexure II).

Dietary Pattern

Dietary pattern is defined as the amount, portion size, diversity or combination of several foods and beverages. It also comprises the frequency of food consumption. Food intake is a multi-dimensional process that is complex in nature. There are various distinguished combinations of foods to potentially enquire. The changes in dietary habits are generally characterized by substitution effects, were an increased consumption of some foods is associated with decreased intake of other foods. This defines the challenge in consumption of particular foods. Hence, the investigator also studied the dietary pattern, to account for interrelationships in food choices, reflecting the cumulative exposure to different dietary components.

The dietary pattern of the selected household namely, the types of diet consumed, meal pattern, preference for particular food, and the different methods of cooking were collected from the female subjects, with the help of the interview schedule.

Food Frequency

The modified food frequency schedule was developed, tested and validated (Annexure-III). The schedule was administered to all the selected subjects and they were asked to specify the quantum of consumption in terms of grams and milliliters and the frequency of consumption for daily, weekly, fortnightly and occasionally was obtained. To avoid missing data, proper prompting in between was made by the investigator whenever necessary.

Assessment of Average Consumption of Dietary Fats and Oils

Intake of dietary fats and oils, greatly influences the health and well-being of the individual, hence using an Inventory list (Annexure IV) the consumption of oil by the selected household was obtained. The investigator collected information on the type of fat and oil consumed (saturated and unsaturated fats and oils). The frequency and purpose of oil usage and the types of frying done were also elicited. To have precise data on the amount of oil consumed by the household, the investigator measured the intake of oil used for the preparation of each meal. For this, the investigator provided 100 ml of oil every day and instructed the female to measure the oil used for every single preparation made. The total amount of oil used for the preparation of all the meals was calculated. Flexibility to use excess oil in case of deep fat frying was allowed, however the investigator requested the subjects to maintain data on the excess use of oil. The consumption pattern was observed for five consecutive days and the average consumption of oil per person was calculated using the formula

$$\text{Average oil consumption per person} = \frac{\text{Quantum of oil used per month}}{\text{Number of family members}}$$

B) Market Survey on Availability of Blended Vegetable Oils

The city of Coimbatore was geographically divided into four regions namely north, east, south, and west. A total of eight retail shops comprising two shops (one commercial supermarket and one wholesale) were selected from each zone. The investigator developed a checklist (Annexure V) to collect information on the availability of different types of oil, brands of oil, their price, the available quantity, manufacturing details, food, and nutritional labeling, if any. The investigator also surveyed on market availability of blended vegetable oil, types, and number of oils used for blending.

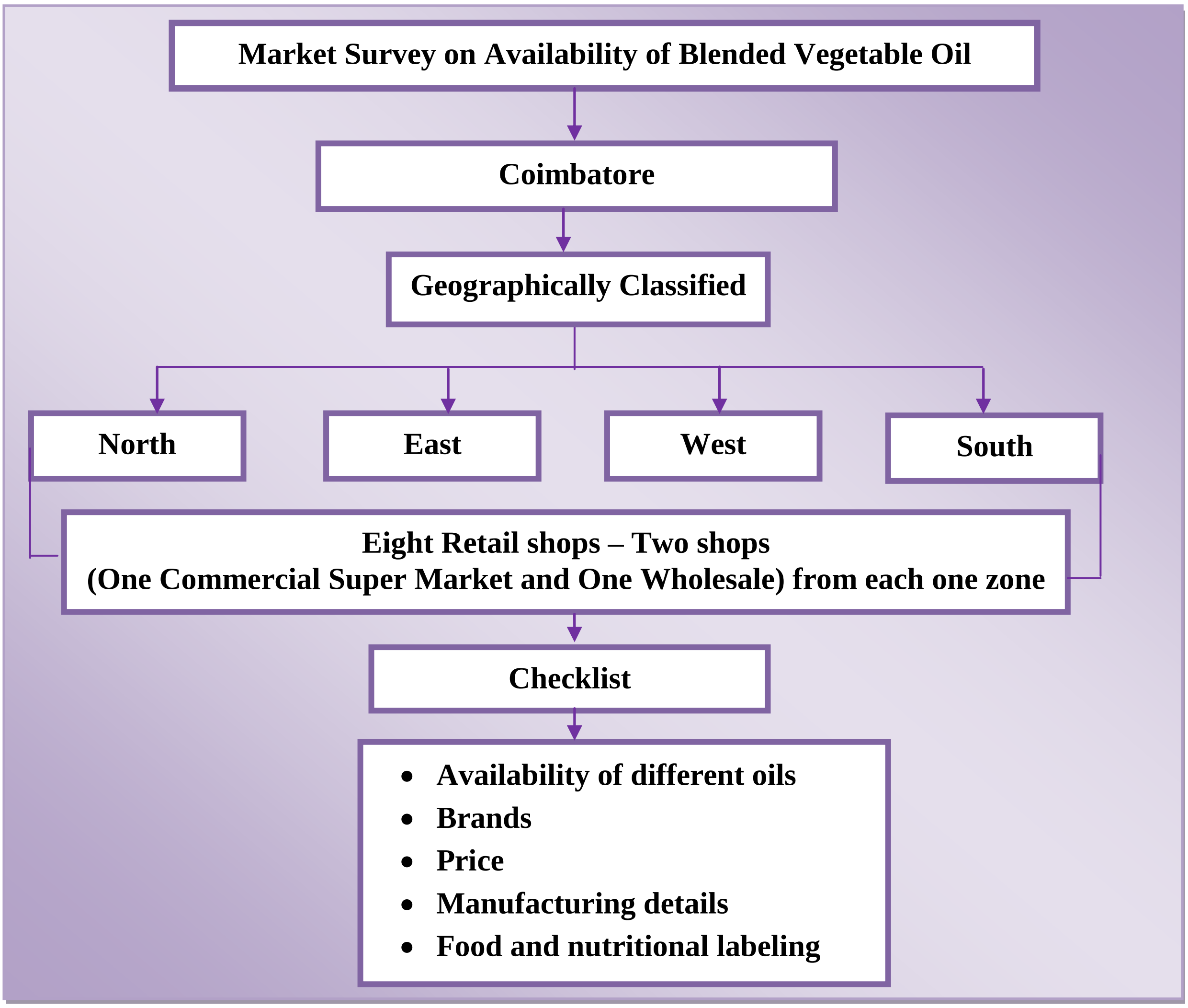

Figure 1b : Market Survey on Availability of Blended Vegetable Oil

Plate 1: Market Survey on Availability of Blended Vegetable Oil

Phase II: Formulation of Blended Vegetable Oil and its Quality Analysis

Selection of oil

According to recent studies (Lopes *et al*., 2023: Memon *et al*., 2024) oil may not always provide the proper ratio of fatty acids in the triacylglycerol (TG) of oils and fats. As rightly suggested by FSSAI (Act 2006, Rule 2011) creating a Structural Lipids (SLs) from various oils/ formulation of a physical mixture of various oils in the appropriate ratio is the need of the hour. Hence to make cooking oil a medium of healthier food choice, the investigator felt the need to blend oil.

Based on the intense literature survey, functional properties and observations of the investigator on the consumption of a standalone oil by the majority of the household in the first phase of the study, the following oils namely groundnut, gingelly, sunflower, safflower and flaxseed oil were chosen for blending.

Groundnut oil otherwise called as peanut oil is widely used in cooking in many parts of India (Ojiewo *et al*., 2020) and is also rich in monounsaturated (53.89%), polyunsaturated (27.17 %), and saturated fatty acids (18.94 %) (Herrera *et al*. 2013).

Gingelly oil (or) sesame oil is the most popular among the South Indian population. As per Indian Food Composition Table (IFCT 2017), Gingelly oil contains an equal proportion of polyunsaturated fatty acid (42.34%) and monounsaturated fatty acid (41.41%). It is well-balanced in ω3, ω6, and ω9 fatty acids. Studies suggest that diets rich in these healthy fats can reduce the risk of heart disease. Consumption of gingelly oil has been associated to lower levels of LDL cholesterol and triglycerides, contributing to heart health. Additionally, the lecithin in gingelly oil acts as an emulsifier, preventing the buildup of cholesterol and saturated fats in the arteries. Furthermore, sesamin in gingelly oil is known to inhibit Δ5-desaturase activity and cholesterol absorption. Along with the antioxidant properties of sesaminol, sesamin plays a role in cancer prevention (Wu *et al*., 2019).

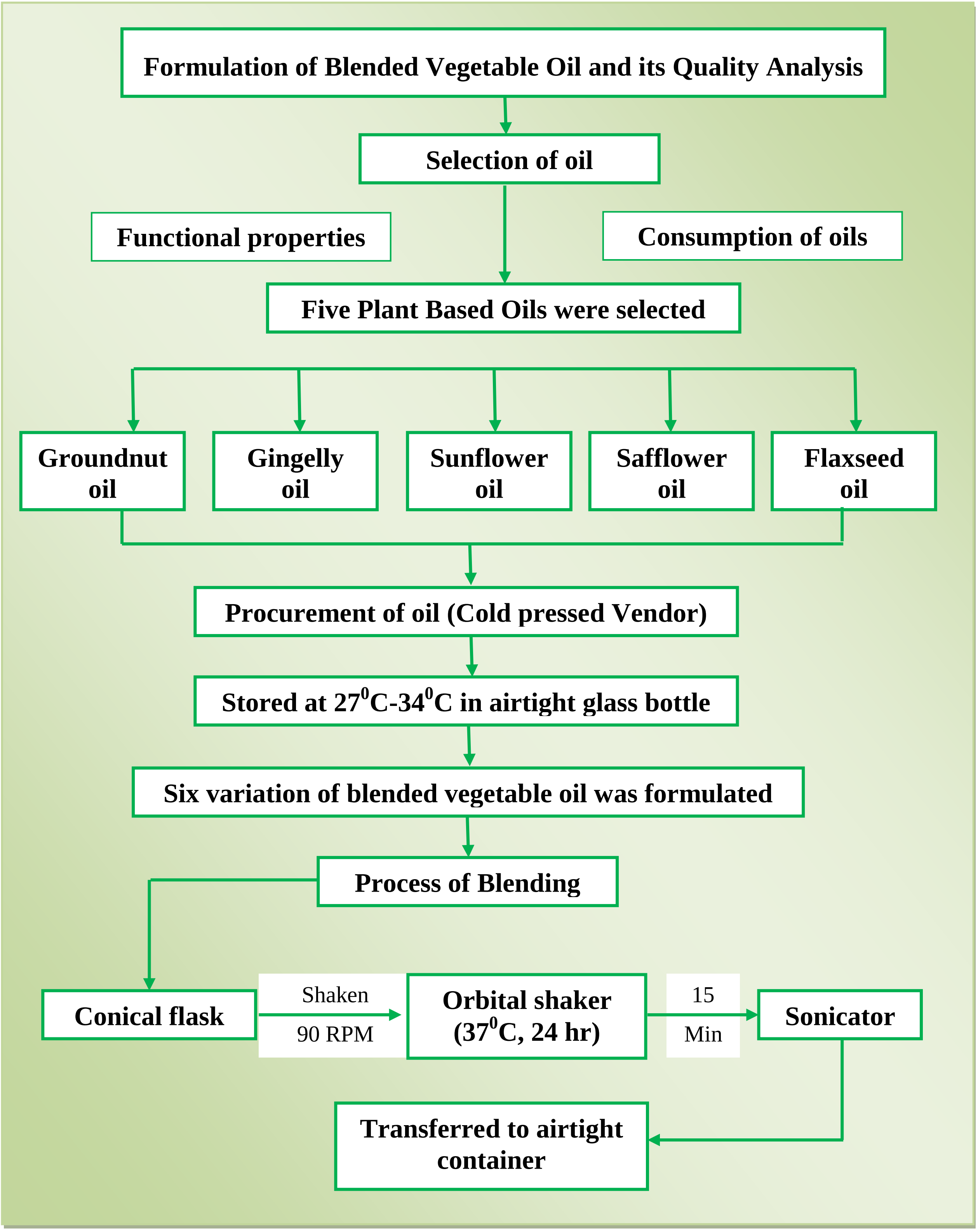

Figure 2a: Formulation of Blended Vegetable Oil

Sunflower oil is India's most popular cooking oil and it contains desirable polyunsaturated (62.65g), monounsaturated (25.96g), and saturated fatty acids (11.39g). Monounsaturated and polyunsaturated fats found in sunflower oil are good for heart when consumed in moderation. They also include plenty of antioxidants, like vitamin E, which may help reduce inflammation and risk for heart diseases.

Safflower oil is rich in polyunsaturated (76.78g), monounsaturated fatty acids (14.04g), and saturated fatty acids (9.19g). Regular safflower oil contains approximately 2-13% stearic acid, 6-20% palmitic acid, 71-75% linoleic acid, and 6-20% oleic acid (Liu *et al.*, 2016). By lowering the area of myocardial infarction, relieving myocardial ischemia, raising heart rate, and boosting oxygen delivery to the myocardium, the safflower oil rich inflavonoids, protects the heart (Ji *et al.*, 2018). Nutritional factors found in safflower can be applied to a variety of medical and pharmaceutical applications as anti-inflammatory, antioxidant, antibacterial, and anticoagulant agents (Mani *et al.*,2020).

Flaxseed (*Linumusitatissimum L.*), is well-studied for its numerous health benefits but has not yet become popular in the cooking oil market. To counteract the instability caused by its high omega-3 fatty acid content, blending flaxseed oil is a viable solution (Grover *et al*, 2021). Flaxseed oil is one of the richest plant-based sources of Alpha-Linolenic Acid (ALA), a primary omega-3 fatty acid known for its strong anti-inflammatory properties.

Procurement of oil

Traditionally cold-pressed groundnut, gingelly, sunflower, safflower, and flaxseed oils were procured from a cold-pressed oil vendor. To retain the homogeneity of the oil sample for quality attributes, the investigator made all effort to procure the oils on the same date of cold pressed for all the oils on request. The procured cold-pressed oils were further transferred to a one-liter airtight glass bottle and were stored at room temperature (27º C- 34ºC). Care was taken to prevent rancidity and spoilage.

Blending of oil

Formulation of blended vegetable oil

According to Grover *et al.*, (2021) one of the simplest, most affordable, and effective ways to enhance the nutritional, physical, and sensory properties of any oil is to combine edible vegetable oil. The compositional variation of the oils may allow for the production of a superior blend with higher quality.

Blending of oil was attempted only with two oils. Since Indian cuisine uses a variety of vegetable oils by different populations in different states, an attempt to blend five standalone vegetable oils namely groundnut, gingelly, sunflower, safflower and flaxseed oils with high polyunsaturated fatty acid and functional properties was made by the investigator. Using the above standalone oils, six variations of blends as projected in the Plate 2 was done.

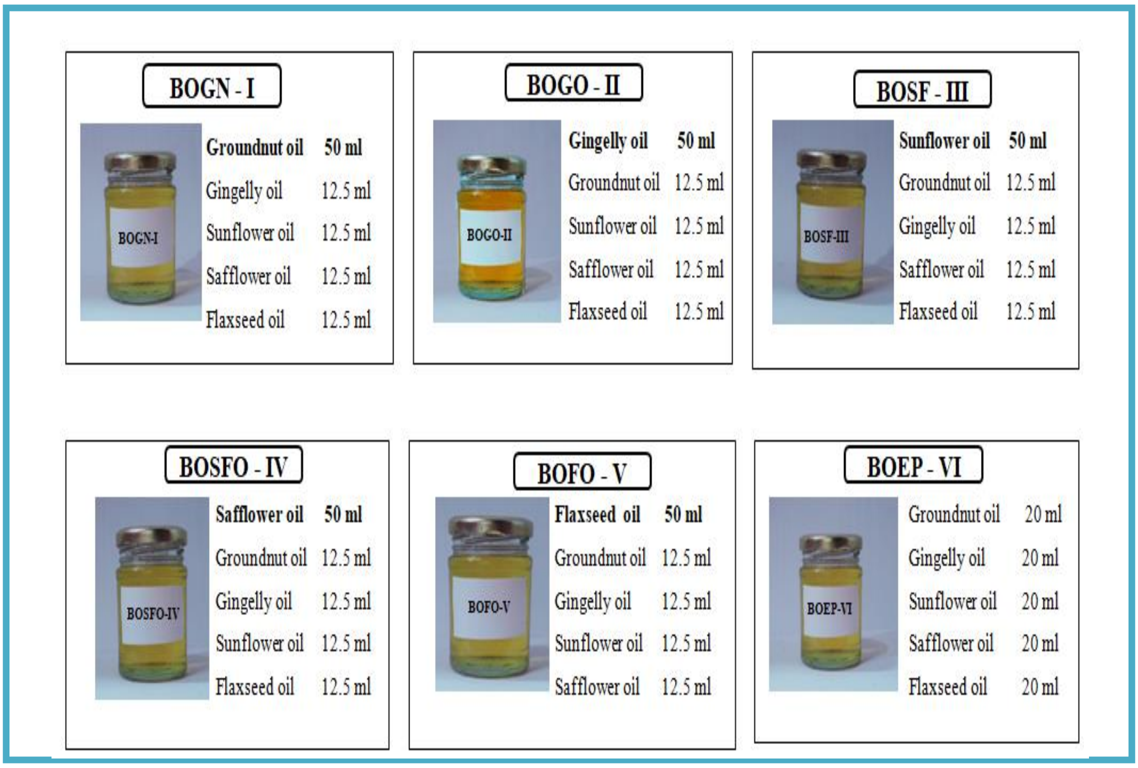

Plate 2: Formulation of Blended Vegetable Oils

Out of six variations of blended vegetable oil, five variations with hundred milliliters of blended vegetable oils comprising 50 ml of stand-alone oil and the remaining 50 ml with equal distribution of (12.5 ml) each of gingelly, sunflower, safflower and flaxseed oil was formulated. The sixth variationwas blended with an equal quantum (20 ml) of selected stand-alone oil.

Process of Blending

The formulated oils for blending were taken in a conical flask and shaken for 90 rpm using an orbital shaker at 37ºC for 24 hours and were kept in the sonicator for 15 minutes. The blended vegetable oil was then transferred into an airtight container. Care was taken by the investigator to prevent any oxidative changes.

Quantitative Analysis of Blended Vegetable Oil

The blended vegetable oil was then tested for their quality attributes namely physical and chemical properties, sensory attributes, antioxidant and shelf life using standard qualitative and quantitative techniques (Figure 2b).

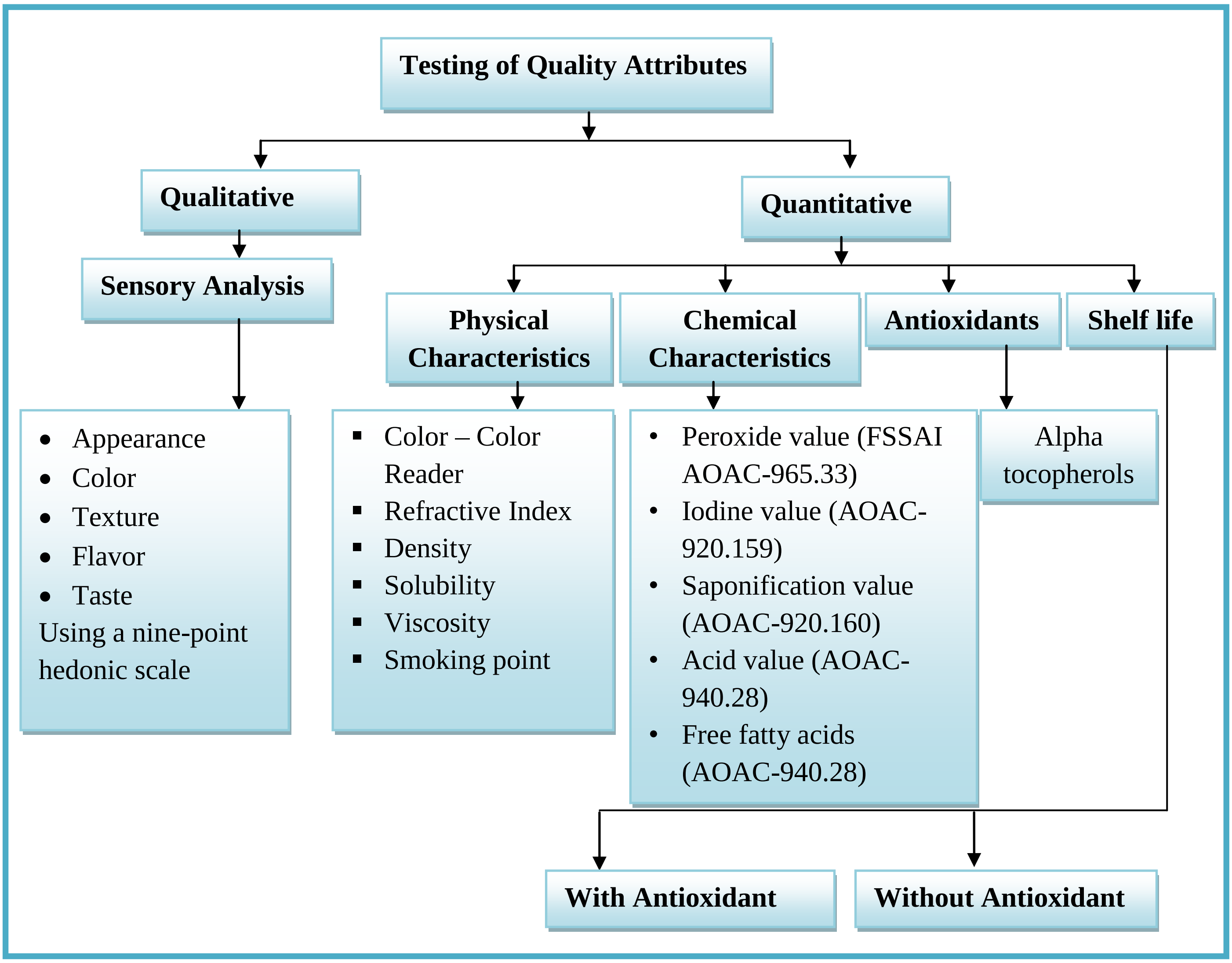

Figure 2b: Qualitative Analysis of Blended Vegetable Oil

Sensory Analysis and Acceptability Analysis

The acceptability of all six blended vegetable oils was tested for its organoleptic quality in terms of colour, flavour, texture, taste, and appearance using a nine-point hedonic scale. Three types of cooking were chosen by the investigator for this purpose namely deep frying, pan frying, and shallow fat frying. For the above cooking methods, the preparation of vada for deep fat frying, chapati for pan frying, and potato poriyal for shallow fat frying was done. The selected recipes were cooked using the formulated blended vegetable oils and were evaluated for acceptability by 20 semi-trained panel members (postgraduate students with basic knowlegde and training on sensory attributes of food) against the recipes cooked in stand-alone oils, namely groundnut oil, gingelly oil, sunflower oil, safflower oil, and flaxseed oil based on the consent . The members were asked to rate each sensory character of the cooked recipes on a nine-point hedonic scale ranging from, like extremely to dislike extremely, with a maximum score of 45 and a minimum score of 5 (Peryan and Girrdot., 1952). Recipes that obtained a score between 35-45 were rated as highly acceptable, 25-35 as acceptable and a score less than 25 as not acceptable (Annexure VI).

Plate 3: Sensory Evaluation of Deep fat Frying, Pan Frying and Sauteing of food products using Blended Vegetable Oils

Physical properties

The physical property of all the six formulated blended vegetable oil for colour, refractive index, density, viscosity, smoking temperature, and solubility were analyzed using standard procedure and are detailed below.

Colour

The colour change is a sign of oil deterioration due to oxidation. The colour of oils is determined by the presence of colouring materials such as chlorophyll and carotene. The colour of the six blended vegetable oil was tested using Gowegroup Multitesters digital food colour card reader. The black and white cavity of the instrument was calibrated. The oil sample was taken in a watch glass and was placed under the instrument's test aperture, the hue value of the oil sample was detected and was displayed as L*, a*, b*. The colour of the tested oil was calculated using the formula $\Delta Ea^*b = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$ and compared with the corresponding hue chart interpretation (Annexure VII)

Plate 4: Colour of the Formulated Blended Vegetable Oil

Refractive Index

To understand the dispersion characteristic, unsaturation, and chain length of fatty acid present in the six blended vegetable oils, the refractive index was measured using Abbes Refractometer. The refractive index of the blended vegetable oil was measured in a thermo stable controlled environment (temperature of the refractometer maintained within ± 0.1ºC) at the wavelength of 89.3 nm using the standard procedure (AOAC 17^{th} ED, 2000). To know the level of deviation of the refractive index of blended vegetable oil with that of the stand-alone oils, the refractive index of the gingelly, groundnut, sunflower, safflower, and flaxseed oils was also measured. (Pandurangan *et al.*, 2014) (Annexure VIII).

The refractive index was calculated using the formula

$R= R^1 + K (T^1-T)$

Where,

R=Reading of the refractometer reduced to the specified temperature T°C

R^1 = Reading atT^1C

K=constant 0.000365 for fats and 0.000385 for oils (Abbe Refractometer is used)

T^1 = temperature at which the reading R^1 is taken and

T = specified temperature (generally 40°C).

Density

Density is an important factor that influences oil absorption and it affects the drainage rate after frying and the mass transfer rate during the cooling stage of frying. It is also related to the smoking temperature of oil and hence the investigator tested the density of all six blended vegetable oils against the stand-alone oils namely gingelly, groundnut, sunflower, safflower, and flaxseed oil by following standard procedure (AOAC 185.19).

The density of the blended vegetable oil was calculated using the formula,

$$d=M/ V$$

Where d is density, M is mass and V is volume (Annexure IX).

Viscosity

The thermal behavior of the cooking oil can be well predicted based on the viscosity of the blended vegetable oil using a viscometer. The viscometer was calibrated. The device was set at 27^{o}C as viscosity may vary with temperature. The spindle was inserted into the viscometer and was submerged in the oil without touching the sides of the container. The reading on the resistance of oil flow as displayed was recorded in Centipose (cP) (Annexure X).

Smoking Temperature

The smoking point of the formulated blended vegetable oil was measured by heating 100 ml of blended vegetable oil over a medium flame in a frying pan of eight inch in diameter. The investigator recorded the temperature of the oil using a thermometer (thermopro) when the oil began to emit a continuous stream of smoke. Care was taken to avoid overheating. The smoking temperature of groundnut, gingelly, sunflower, safflower and flaxseed oils were also measured and compared with a smoking chart (Agarwal and Porwal, 2021).

Solubility

Fat solubility is defined as the mass fraction of a substance that forms a homogeneous phase with a liquid fat (oil) without causing chemical reactions. As fats are soluble in organic solvents like, chloroform and alcohol, the solubility of blended vegetable oil was tested in ethanol, petroleum ether, chloroform and water. For this equal amounts of water, ethanol, petroleum ether and chloroform were taken in separate test tubes and 4 drops of oil sample was added to each test tubes. The test tubes were then shaken well and were kept for 15 minutes. The level of solubility was observed visually and was recorded.

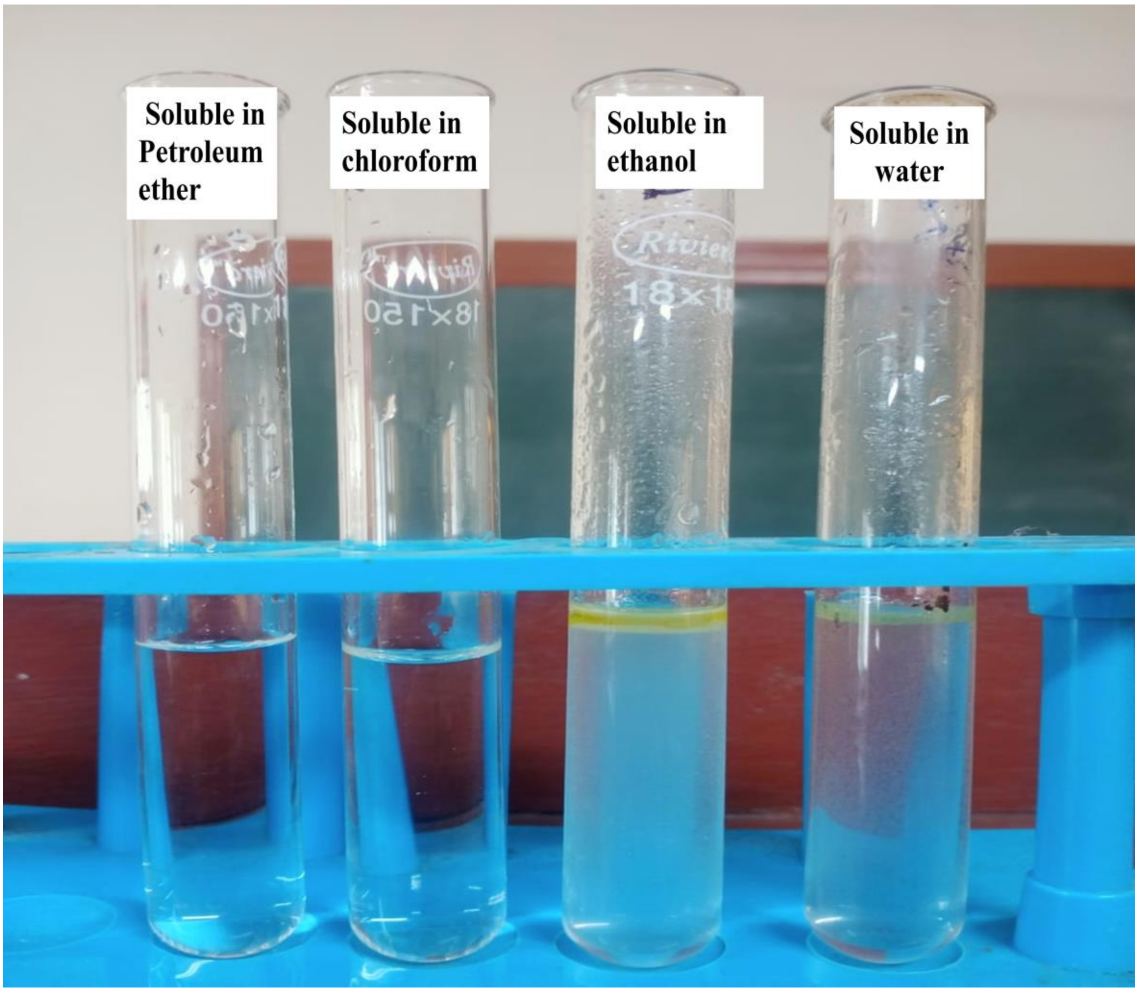

Plate 5: Solubility of the Formulated Blended Vegetable Oil

Chemical Properties of Blended Vegetable Oil

The chemical properties of all six blended vegetable oils for peroxide value, iodine value, saponification value, and acid value were analyzed using standard procedure and are detailed below.

Peroxide Value

To test the oxidative stability of the blended vegetable oil, the peroxide value was analyzed by adding five milliliters of oil sample to 12 ml of chloroform in a 25 ml beaker. Potassium iodide KI solution (0.5-1.0 ml) was added to the beaker. The beaker was shaken for at least one minute and 30 ml distilled water was added. The mixture was titrated with sodium thiosulphate (0.01M) until the disappearance of yellow color and the peroxide value was calculated using the formula,

$Peroxidevalue = \frac{Titre \text{ x } N \text{ x } 1000}{wt\ of\ the\ sample}$(Annexure X).

Where,

Tire = ml of Sodium Thiosulphate used (blank corrected)

N = Normality of sodium thiosulphate solution (0.01N).

Iodine Value

The iodine value of fat and oils indicates the degree of unsaturation. In fatty acids, unsaturation occur mainly in double bonds which are very reactive towards halogens like iodine. Thus estimation of iodine value will give an idea about the degree of unsaturation present in the blended vegetable oil. The iodine value of blended vegetable oil was analyzed using the Wijs method (AOAC-920.159) as given in (Annexure XI).

The iodine value was calculated using the formula

$$Iodine\ value = \frac{12.69\ (B - S)\ N}{W}$$

B = volume in ml of standard sodium thiosulphate solution required for the blank
S = volume in ml of standard sodium thiosulphate solution required for the sample
N = normality of the standard sodium thiosulphate solution (0.1N)
W = weight in gm of the sample
Units: gm of iodine per 100g of oil

Saponification Value

The saponification value is an important parameter used for the characterization and assessment of the quality of edible fats and oils. To understand the average molecular weight of the fatty acids present in the formulated blended vegetable oils, the saponification value was estimated. For this two to five grams of oil sample was accurately weighed and transferred to the conical flask. Twenty-five milliliters of 0.5N alcoholic potassium hydroxide (KOH) and a few anti-bumping granules were added to the conical flask. The conical flask was placed in a water bath and refluxed gently for one hour. Care was taken to prevent the loss of alcohol. After refluxing, the mixture was cooled and titrated against 0.5N hydrochloric acid (HCl) solution using phenolphthalein as an indicator. The quantum of hydrochloric acid used was noted. The saponification value of blended vegetable oil was calculated using the formula: (Annexure XII).

$$Saponification\ value = \frac{56.1\ (B - S)\ N}{W}$$

Where,

B = Volume in ml of standard hydrochloric acid required for the blank.

S = Volume in ml of standard hydrochloric acid required for the sample

N = Normality of the standard hydrochloric acid (0.5N) and

W = Weight in gm of the oil taken for the test.

Units: mg of KOH/1 g oil

Acid Value

Acid value (AV), which measures free fatty acid content, is a crucial component in determining refined fats and oils and how their quality varies over time. The hydrolysis of triglycerides leads to the generation of free fatty acids, which gets aggravated when moisture reacts with the oil. To measure the acid value, two to five grams of the oil sample was weighed and transferred into a conical flask. A few drops of phenolphthalein indicator were added along with 50 ml of neutralized isopropyl alcohol.

Potassium hydroxide (KOH) solution (0.1N) was added to the mixture until a steady pink hue develops (Annexure XIII). The acid value was calculated using the formula,

$$Acidvalue = \frac{56.1\ V \text{ x } N}{W}$$

Where V = Volume in ml of standard sodium hydroxide used
N = Normality of the Sodium hydroxide solution (0.1N) and
W = Weight in gm of the sample

Free Fatty Acids

Fifty milliliters of alcohol was taken in a clean, dry 150 ml flask. A few drops of the oil were added along with 2 ml of phenolphthalein. The flask was placed in water at 60-65℃ until it turned warm and enough of 0.1N NaOH was added to produce a slight permanent pink colour. Then, 56.4g oil was weighed into the neutralized alcohol and titrated against 0.1N NaOH, with occasional warming and vigorous shaking of the mixture until the appearance of faint permanent pink. The volume of 0.1N NaOH used was multiplied by 0.05 and reported as a percent of free fatty acids and was expressed in terms of oleic acid (Annexure XIV). Free fatty acids may also be expressed in terms of acid value (mgKOH necessary to neutralize 1g oil) (AOAC-940.28).

$$\text{Free fatty acids (as oleic acid\%)} = \frac{\text{Titre Volume X Strength of NaOH X 28.2}}{\text{Sample weight}}$$

Here, the strength of NaOH =0.1N.

Antioxidant properties of Blended Vegetable Oil

Tocopherols

Tocopherol is the main antioxidant that helps in the retardation of rancidity and also serves as a source of the essential nutrient vitamin E. Thus, the investigator analyzed the tocopherol content of the formulated blended vegetable oil using HPLC-UV (High-Performance Liquid chromatography with UV detector) as per standard procedure (AOAC-2012.09) [Annexure XV].

Shelf Life

The shelflife of the formulated blended vegetable oil was studied using the peroxide value, which indicates the oxidative stability of the belnded vegetable oils. The peroxide value was analyzed by adding antioxident and without antioxident using the standard protocol (AOAC-965.33). The formulated blended oils were examined weekly once for a period of 56 days, to determine its storage stability (Annexure X).

Phase III: Fatty Acid Profile of Formulated Blended Vegetable Oils

Quantitative analysis for the fatty acids profile of all six blended vegetable oils was carried out using the Gas Chromatography – Flame Ionization detection method (AOAC 996.06) – AOAC, 2019. Using soxhlet extraction the fat samples were collected. The collected fat samples (100 µl) were taken in a test tube. The mouth of the test tube was closed and shaken well for 10 seconds using a vortex mixture. The tube was made to rest for two minutes and 2 ml of hexane was added and shaken well for four minutes. To the sample, 50 ml of sodium sulfate was added and centrifuged at 1500 rpm for three minutes. The hexane layer was collected through a 0.22 µm filter and injected in Gas Chromatography- Flame Ionization for detection. The fatty acids were then identified in a chromatogram by comparing their retention time to that of the corresponding peak. Similarly, the fatty acid profile of the stand-alone oils namely, groundnut, gingelly, sunflower, safflower, and flaxseed oil was done (Annexure XVII).

Phase IV: Fatty Acids Profile of Selected Recipes Cooked Using Formulated Blended Vegetable Oils

Preparation of recipes with blended vegetable oil

The investigator was curious to study the fatty acid profile of foods cooked using the formulated blended vegetable oil to understand its dietary contribution. Three commonly consumed recipes namely vadai (deep fat frying), chapatti (pan frying), and potato poriyal (sauteing) were selected for this purpose.

Vadai a common deep-fried snack was prepared by soaking 100gms of Bengal gram dhal for 20 minutes and grinding it to a coarse consistency. Finally chopped onions (20gm), ginger (small piece), green chills (1 no.), curry leaves (3 leaves), asafoetida (pinch) and salt to taste were added and mixed well. The mixture was made into small balls and pressed gently to fit flat. Three hundred milliliter of blended vegetable oil was added to the frying pan and was brought to respective smoking temperature. The vadai was deep fried (6 minutes, 132°C) to a golden brown colour and was removed and strained for excess oil. Likewise for sauteing potato poriyal which is a common recipe prepared by combining potato with spices and condiments was selected. Hundred grams of potato was sliced and sautéed in 15 ml of blended vegetable oil seasoned with mustard seeds, onion, chili powder, and salt.

Chapatti, a north Indian flat bread was prepared with wheat flour dough, was chosen for the pan frying method. For preparing chapatti, wheat flour, was mixed well with measured quantity of water and salt. The dough was kneaded and made into a soft and pliable consistency. Twenty-five grams of dough was made into a small ball and rolled out into round flatbread using a rolling pin. The pan was heated and the flattened chapatti dough was cooked on both sides by adding one teaspoon of oil.

a) Procedure for Oil Extraction from the Cooked Products

The necessary glassware used for oil extraction was initially rinsed with petroleum ether dried in an oven at 102°C and kept in desiccators. Five to 10gm of food sample was weighed and placed in the thimble. The thimble was then placed in a soxhlet extractor. In 150 ml of round bottom flask, 90 ml of petroleum ether was taken and the soxhlet extraction unit was set up. The petroleum ether was allowed to boil and the extraction process was continued for six hours (AOAC 948.22). The condensing unit was removed and allowed to cool. The extract was collected and weighed (Annexure XVIII). The percentage of fat absorption was calculated using the formula,

$$\text{Fat percentage} = \frac{(\text{Weight of the flask with extracted fat} - \text{Weight of empty flask}) \times 100}{\text{Sample weight}}$$

Plate 6: Soxhlet Extractor

b) Fatty acid profile of Blended vegetable oils (GC-FID)

The fatty acid profile of the oil extracted from the cooked food sample was again analyzed using a gas chromatography- Flame Ionization Detector.

The findings of the study was statistically analyzed.