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Assessment of Physicochemical Parameters and Bioactive compounds of Cold-pressed Sesame Oils Released from PJTSAU Sesame Seed varieties (JCS 1020. HIMA & SWETHA)

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ABSTRACT: Cooking oils are mostly derived from seeds, fruits and nuts. Oil from the seed is obtained by heating, crushing and refining. Of all the oil extraction methods, cold pressing is known to be the best natural way to obtain fresh and healthy oils. In cold pressed extraction, seeds are pounded by an external force. It does not include any heating process. Because the oil is not expected to be heated, and it retains the essential nutrients, proteins and various bioactive compounds present in oils, making it a better oil for cooking than oils made by the heating process. Due to this reason present study aims to extract the cold pressed sesame oil from selected varieties released by PJTSAU to assess the quality of oil with physicochemical parameters and bioactive compounds investigated. Results concluded that density, saponification and total carotenoids had significant differences at $p<0.05$ whereas total tocopherol content and specific gravity had significant difference at $p<0.01$ level of significance between by the cold pressed sesame oil varieties (JCS 1020, HIMA & SWETHA). The highest content of bioactive compounds such as total tocopherol was found in JCS 1020 (490.5±0.05 mg/kg) whereas the total carotenoid content was reported for SWETHA (19.44±0.61mg/kg) variety.

Keywords: Cold pressed sesame oil, Total tocopherol content, Total carotenoid content, Iodine value and Physicochemical parameters.

INTRODUCTION

Edible vegetable oil forms a vital part of the human diet. It is one of the basic and essential ingredients used in daily cooking. There are many varieties of oils available for cooking in the refined and unrefined oil categories in the market. However, from a health view point, only cold-pressed oils would provide health benefits in addition to taste, provide the energy and fatty acids needed by the body and promote the digestion and absorption of fat-soluble vitamins (Maochong, 2014).

The market for cold-pressed oil was estimated at USD 27.05 billion in 2021, and from 2022 to 2028, it was anticipated to rise at a compound annual growth rate (CAGR) of 5.7%. The market is expanding primarily due to the high demand for cold pressed oils for numerous uses, including animal feeds, food and beverages, and personal care. Also, the industry is expanding significantly because of its excellent nutritional value and enhanced flavour. When compared to other oil extraction techniques, cold pressed extraction is one of the mechanical extraction processes that use the least amount of energy. Cold pressed extraction process is the conventional method, crushing the seeds or nuts and applying pressure to extract the oil without the use of any additional ingredients, preservatives, or external heat (Market analysis report, 2022-2028).

The global cold pressed sesame oil market is expected to grow at a CAGR of 6.2% during the period 2023-2028. The market is likely to be driven by uses of the oil in alternative medicine, flavouring, cooking, and body massage. Myanmar, China, India and Japan are key producers of sesame oil (Historical Market and Forecast 2018-2028).

Sesame is one of the most commonly eaten foods either in fresh or processed. It is also an important component of many processed food products with its excellent flavor, aroma, taste and attractive color. These qualities enable also use in salads, forcemeat, and appetizers as well as in the production of margarine and cooking oils. It has higher unsaponifiable content (2%) compared to other vegetable oils, including phytosterols, triterpene alcohols, tocopherols, and lignans (primarily sesamin and sesamolin), which results in greater oxidative stability. Sesame oil is extensively used in food processing and nutraceutical industries in many different countries due to its high content of oil and protein (Capellini *et al*., 2019).

Sesame oil is rich in bioactive compounds such as lignans includes sesam in and sesamolin, tocopherols and phenolic compounds. These lignans like sesamin and sesamolin are vital for pharmacological properties such as antioxidant activity, antiproliferative activity, enhancing the antioxidant activity of vitamin–E in lipid peroxidation systems, lowering cholesterol, neuroprotective effects, reducing the incidences of breast and prostate cancer. The tocopherols, play a crucial role in free radical scavengers that work as lipid soluble antioxidants (Gysin *et al*., 2002).

The stability and purity of vegetable oils are the important factors that indicate their acceptability, desirable use and market value. A number of factors influence the effect of oil quality (Justyna and Waldermar 2011).

The quality of vegetable oil mainly depends on its antioxidant capacity. Chemical stability, which can ultimately be thought of as an antioxidant capacity, depends on the chemical composition of the oil, especially the antioxidants and oxidizable compounds, as well as on the chemical interactions. The physical interface and the microenvironment in which the reactants interact (Rajko *et al*., 2010).

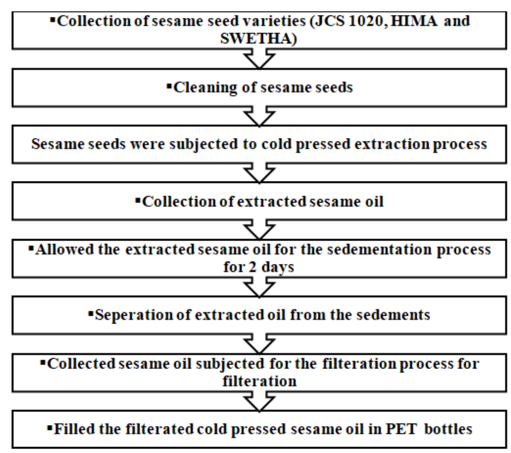
In general, refined oils show higher losses of phenolic compounds, tocopherols, phytosterols and carotenoids, which become more susceptible to oxidation. In contrast, cold pressing does not involve thermal or chemical processes, resulting in oils that maintain high levels of these antioxidant compounds. However, cold pressed oil stend to contain more oxidizing compounds than refined oils. Therefore, oil quality should be consider edholistically by considering industrial process, chemical composition and oxidation stability simultaneously (Rui *et al*., 2007; Elham, 2008).

The quality of edible oils was assessed by several physical and chemical parameters that depend on the oil source and storage conditions. Several physical parameters (refractive index, viscosity, specific gravity, etc.) and chemical parameters (smoke point, saponification number, acid number, iodine number, peroxide number) can be used to assess oil purity and quality (Mohammed and Ali 2015). The present study was aims to extract the cold pressed sesame oil from selected varieties JCS 1020, HIMA and SWETHA released from PJTSAU. The physicochemical parameters and bioactive compound concentration were analysed for the extracted cold pressed sesame oil varieties.

MATERIAL AND METHODS

The cold pressed sesame oil was extracted from selected sesame seed varieties JCS 1020, HIMA and SWETHA were used in the present study conducted at RARS (Regional Agricultural Research Station), Polasa, Jagtial. The analysis for cold pressed oil varieties was done at the Post Graduate & Research Center, Hyderabad. All the chemicals used in the investigation were of Food and Analytical reagent (AR) grade. The glassware and equipment were from Post Graduate & Research Center and Central Instrumentation Cell, PJTSAU, Rajendranagar, Hyderabad.

Extraction process of cold pressed sesame oil: The selected sesame seeds (JCS1020, HIMA and SWETHA) were cleaned to remove dirt and husk. Cold pressed sesame seed oil extraction was carried out by the cold pressed oil expeller machine (model- BHARAT AGRITECH 10 HP) by crushing the seeds and forcing out the oil through pressure with 45 rpm per minute. The temperature of extracted oil was 37°. After the extraction of oil, the filtration process was done through a cold-pressed filtration unit. The extraction process was carried out by step by step process mentioned below.



Assessment of Physical characteristics of the cold pressed sesame oil varieties. Refractive index: The refractive index (RI) of the sesame oils was measured using a refractometer. The refractive index (n) of a substance is the ratio of the velocity of light in a vacuum to its velocity in the substance. It varied with the wave length of light used in its measurement. The refractometer was cleaned with alcohol or ether. A drop of oil was placed on the prism. The prism is closed by the ground glass half of the instrument (Olaleye *et al.*, 2018).

Viscosity: The kinematic viscosity of the oil samples was measured according to the Brookfield Viscometer Model DV-E AOAC. (1999). Viscosity is a crucial factor in determining friction loss, due to the shear energy in a fluid process system. A Brookfield Viscometer Model DV-E was used to measure the viscosity of extracted oil. Viscosity was determined at a constant speed of 100 rpm and at a constant temperature with a spindle number S-62 and it was expressed in terms of centipoise (cP).

Density: Density is an important factor that influences oil absorption as it affects the drainage rate after frying and also the mass transfer rate during the cooling stage of frying. The density of cold pressed sesame oil samples were determined by using a relative density bottle ($50cm^3$) according to the standard method of AOAC. (1993). Density was calculated as:

$$\text{Density} = \frac{\text{Weight of the oil sample (W)}}{\text{Volume of the R.D bottle (V)}} /cm^3$$

Smoke point: The smoke point is a vital analytical measurement for any oil used for frying. The temperature is measured while observing a steady evolution of smoke from the oil in the vessel, the test is being carried out under standard conditions (AOCS, 1998). Smoke point of cold pressed sesame oils were determined in the open lab with lots of fresh air flow. About 150ml of oil was taken in a beaker and heated until it starts giving out smoke at this point smoke point was noted using a digital thermometer.

Flashpoint The flash point is defined as the minimum temperature at which the oil gives off sufficient vapour that ignite for a moment, when a flame is brought near it AOCS (1998).

Procedure: The oil cup was filled with the cold pressed sesame oil to be tested upto the mark. The cover was fixed with the top of cup comprised the stirring device, the thermometer and the flame exposure device. The test flame is lighted and adjusted to about 4 mm in diameter. Heated the apparatus by Bunsen burner slowly at the rate of 5 to 6° per minute while the stirrer is rotated approximately 60rpm. At every 1° rise in temperature, introduce the test flame for about 2 seconds into the oil vapour. This is done by operating the shutter. By twisting the knob, the test flame is lowered and the shutter opens. The moment knob is released, the test flame springs back to its original position and the shutter is closed. The flash point is noted down when the test flame causes a flash in the interior of the cup. Repeated it three times to get a constant value or take a mean value.

Specific gravity: Specific gravity of cold pressed sesame oil was determined using the AOAC (1920) method. The specific gravity of the cold pressed sesame oil samples were determined using a 25 ml pycnometer or specific gravity bottle. The specific gravity bottle was weighed empty and then filled with the oil sample up to the mark on the bottle. The bottle with the sesame oil sample was weighed again. The weight of the empty bottle was subtracted from the total weight of the bottle and oil sample. The weight of the empty bottle was divided by the total weight of the bottle and oil to obtain the weight of the oil sample. The weight of the oil sample was then divided by the weight of an equal volume of water to get the specific gravity of the oil sample.

Specific gravity = A-B/C-B

Where,

A = Weight in grams of specific gravity bottle with sample

B = weight in grams of specific gravity bottle

C = Weight in grams of specific gravity bottle with water

Foaming capacity: Foaming capacity was determined by the method of Lawhon *et al.* (1972). 5.0 g of cold pressed sesame oil was dispersed in 20.0 ml of distilled water, homogenized for 10 min and centrifuged at 3000 rpm for 15 min. The supernatant obtained was stirred for 5 min using a magnetic stirrer at 1200 rpm, poured into a 100 ml measuring cylinder and its volume was immediately noted. FC was calculated using the following equation and represented in percentage.

$$FC = \frac{\text{Volume after whipping} - \text{volume before whipping}}{\text{Volume before whipping}} \times 100$$

Iodine value: The iodine value (IV) of the cold pressed sesame oil varieties was determined using the Wijs method (AOCS, 1990). The iodine value is used to measure unsaturation or the average number of double bonds in fats and oils. Decrease in iodine value shows decrease in the number of double bonds and it indicates oxidation of the oil.

Procedure: Take 3.0 g of cold pressed sesame oil mixed with 20 ml cyclohexane to dissolve the oil followed by adding 25 ml of Wijs solution (8g of iodine trichloride, 9g iodine mixed with 600ml of glacial acetic acid). The conical flask was sealed and the solution was continuously shaken for 30 min. Also, 20 ml of aqueous KI solution (15% v/v) and 100 ml of water were then added to the mixture. A few drops of the starch solution was then added, which changes the solution to blue, and the titration was continued until the blue color disappeared. The volume of spent $Na_2S_2O_3$ was recorded and represented as S. The titration step was repeated with a blank sample untill the blue colour disappear and the volume of spent $Na_2S_2O_3$ is represented as B. The IV was calculated using

$$IV = (B - S) \times \frac{\text{Normality of } Na_2S_2O_3}{\text{Weight of sample}} \times 12.69$$

Where B = Blank titrate value

S = Sample titrate value

Saponification value: The saponification value (SV) of the cold pressed sesame oil samples were determined using the method of (AOAC, 1998). The saponification number is the amount of potassium hydroxide required to saponify one gram of fat. This data can be used to compute the number of acids (esters and free acids) in a fat or oil.

Procedure: About 2.0 g of cold pressed sesame oil was mixed with 25 ml of 0.5 N ethanolic KOH, and the mixture was boiled for 60 min in a reflux condenser. The mixture was then cooled down to room temperature and subsequently titrated with 0.5 N HCl using 1% phenolphthalein solution as an indicator until the color of the mixture changed from pink to colorless. The volume of spent HCl was recorded and represented as S. A similar experiment was repeated with a blank, and the volume of spent HCl was noted as B. The SV was calculated using formula

$$SV = \frac{(B - S) \times \text{ml of HCl}}{\text{Weight of the sample (g)}} \times 28.05$$

Where,

B = Blank titrate value

S = Sample titrate value

Determination of Insoluble Impurities: The insoluble impurities were determined according to the method by Odoom and Edusei (2015). It is determined by dissolving oil in petroleum ether and filtering out the impurities and is expressed as a percentage (%) of the total oil.

Procedure: Take 2.0 g of cold pressed sesame oil was weighed into a 250mL conical flask and 20mL of 1:1 solvent mixture (petroleum ether + diethyl ether) was added. The flask was then shaken vigorously and allowed to stand for 30 minutes at 30°. The liquid was then filtered through a dried and weighed Whatman number 1 filter paper. The filter paper was carefully washed with 10mL of the solvent mixture. The filter paper was then dried to a constant weight in an oven at 103°.The increase in weight represented the weight of impurities and was expressed as a percentage of the initial sample as follows:

$$\%\ \text{Impurity} = \frac{a}{w} \times 100$$

Where,

a = Increase in the weight of filter paper

w = Weight of sample

Assessment of bioactive compounds in cold pressed sesame oil varieties

Total Tocopherols: Total tocopherol content in cold pressed sesame oil was estimated by using the method of Rani *et al.* (2017).

Preparation of reagent: Dissolve the 0.07% of 2-2 dipyridyl reagent in 95% ethanol. As well as dissolve 0.2% of $FeCl_3$ in 95% ethanol in another conical flask.

Preparation of standard: Aliquots (10, 15, 20 and 25 mg/ml) of a solution of alpha tocopherol in the 95% ethanol was transferred to a volumetric flask and the volume was adjusted to 8ml with ethanol.

Working procedure: Take the cold pressed sesame oil samples in different concentrations 10, 15, 20 and 15 mg/ml and make up each oil sample adjusted to 8ml with 95% ethanol. Add 1ml of 2,2-dipyridyl reagent and 1ml ferric chloride to the above prepared diluted solutions. The mixture was shaken for 10 seconds by vertex mixture. The absorbance of the mixture was read at 520 nm. The 95% ethanol was used as blank. Then the standards curve was drawn based on the absorbance plotted on the graph.

Total Carotenoids: Total carotenoids were found by the method of Rani *et al.* (2017). Take 0.5 g of cold pressed sesame oil in a 100 ml conical flask. The oil sample was dissolved in cyclohexane (2.5% w/v) and the absorbance was read at 417 nm and the following equation was used to estimate total carotenoids.

$$\text{mg carotene/kg oil} = \frac{(\text{Absorbance at 417 nm}) \times \text{sample in volume in ml}}{0.204 \times (\text{Sample weight in g})}$$

Statistical analysis: Statistical analysis was conducted by using SPSS (16.0 version) software and the mean scores were compared at P≤0.05 and P≤0.01 at the level of significance (IBM SPSS).

RESULTS AND DISCUSSION

Assessment of physicochemical parameters in cold pressed sesame oil varieties: Physicochemical parameters of cold pressed sesame oil varieties were done and presented in Table 1.

Table 1: Physicochemical characteristics of cold pressed sesame oil varieties.

Sample	RI	Density (cm^3)	Smoke point (°)	Saponification value (mg KOH/g oil)	Insoluble impurity (%)	Foaming capacity (%)	Viscosity (cP)	Flash point (°)	Iodine value (g/100g)	Specific gravity g/cm^3
JCS 1020	$1.46^{a}\pm0.00$	$0.33^{a}\pm0.003$	$111^{a}\pm2.10$	$188.2^{c}\pm0.50$	$0.14^{a}\pm0.006$	$0.81^{a}\pm0.46$	$0.05^{a}\pm0.002$	$276.3^{a}\pm0.90$	$109.28^{a}\pm0.02$	$0.918^{a}\pm0.00$
HIMA	$1.46^{a}\pm0.00$	$0.33^{a}\pm0.00$	$108^{a}\pm1.20$	$185.7^{b}\pm1.80$	$0.11^{a}\pm0.004$	$0.41^{a}\pm0.23$	$0.051^{a}\pm0.001$	$275.7^{a}\pm1.20$	$105.76^{a}\pm0.17$	$0.916^{b}\pm0.00$
SWETHA	$1.46^{a}\pm0.00$	$0.34^{b}\pm0.00$	$111.7^{a}\pm1.70$	$182.2^{a}\pm0.40$	$0.12^{a}\pm0.10$	$0.27^{a}\pm0.27$	$0.052^{a}\pm0.0001$	$277^{a}\pm1.00$	$106.52^{a}\pm0.03$	$0.918^{a}\pm0.00$
Mean	1.46	0.33	110.22	185.33	0.12	0.50	0.052	276.3	107.186	0.917
F – Value	6.00	7.00	1.355	7.669	3.589	0.663	1.404	0.414	0.977	25.00
P Value	0.579	0.027*	0.327	0.022*	0.094	0.549	0.316	0.679	0.429	0.001**

Note: Values were expressed as mean standard deviation for all the three determinants.
Means within the same column followed by common letter do not significantly differ at *p≤0.05, **p≤0.01 level of significance.

Refractive index: Refractive index indicates the possible chances of rancidity development in oil. The higher the refractive index, higher is the chances of spoilage due to oxidation. The refractive index is an important optical parameter to analyze the light rays traversing through materials medium (Sarkar *et al.*, 2015). Refractive index mean scores of the selected cold pressed sesame seed oil was found to be same (1.46±0.00) for the all three cold pressed sesame seed oil varieties (JCS 1020, HIMA and SWETHA). Hence Table 1 indicated that there was no significant differences (p≤0.05) between the refractive index for cold pressed sesame oil varieties.

Similar results reported by Zerihun and Berhe (2020) investigated physicochemical properties in sesame oil varieties The refractive index for the sesame oil varieties were identical to the refractive index of the present investigation. The refractive index of sesame oil varieties were KALAFO-74 (1.46), E (1.46), S (1.46), MEHALO (1.46), ABASENA (1.46) and TATE (1.46) respectively. Similar results reported by Khier *et al.* (2008) analysed physicochemical parameters in solvent extracted sesame oil. The refractive index was analysed in sesame oil varieties such as HURIA 49 (1.472±0.001), HURIA 11 (1.472±0.001), ZIRRA 7 (1.473±0.001) and ZIRRA 2 (1.473±0.002) respectively.

Gulla and Waghray (2011) reported the refractive index in sesame oil was 1.465±0.0002 respectively.

Borchani *et al.* (2010) reported the refractive index in solvent extracted sesame oil was 1.471 ± 0.001 at 20°C respectively.

Clara *et al*. (2020) evaluated the refractive index in cold pressed sesame oil was 1.468 ± 0.029 respectively.

Density: The mean scores for the density of cold pressed sesame oils were found to be similar for JCS 1020 (0.33±0.003) and HIMA (0.33±0.00). Hence results concluded that there was no significant difference between the density for JCS 1020 and HIMA whereas SWETHA (0.34) had significant differences ($p \leq 0.05$).

Smoke point: The smoke point is a vital analytical measurement for any oil used for frying. The smoke point indicates the breakdown of fats to glycerol and FFAs (Guillaume *et al*., 2018). The smoke point mean scores were found highest for SWETHA (111.7±1.70°) followed by JCS 1020 (111±2.10°). The lowest smoke point was observed for HIMA (108±1.20°) variety cold pressed sesame oil. However, results concluded that there was no significant difference between the smoke point for three cold pressed sesame oil varieties. The smoke point limit is often specified for frying oils since it indicates a long life in its use. A higher smoke point is a desirable characteristic. Smaller, more volatile material, particularly fatty acids, lowers the smoke point and the reduction is maintained during the time of frying until the oil is no longer usable. The smoke point at this stage is <170°C (Eyres, 2015).

Ramroudi *et al.* (2022) estimated the physicochemical parameters in sesame oil purchased from a local company of Yazd, Iran. Finding reported the smoke point was 242.50±3.53° which contained high temperature compared to the present investigation.

Aslam *et al*. (2021) reported the smoke point in solvent extracted sesame oil variety (PB TILL -90) was 184 ± 3°C.

Olasunkanmi *et al*. (2017) reported the smoke point in solvent extracted sesame oil was 227.0±0.68°.

Saponification value: The mean scores for the saponification value for cold pressed sesame oils observed maximum for JCS 1020 (188.2±0.50mg KOH/g) followed by HIMA (185.7±1.80 mg KOH/g) and the lowest mean score was found for SWETHA (182.2±0.40 mg KOH/g). Results showed that there was significant difference between the saponification value for cold pressed sesame oil varieties (JCS 1020, HIMA and SWETHA).

Similar results was reported by Clara *et al.* (2020) reported the saponification value in cold pressed sesame oil was 192.03 ± 0.01 mg/g respectively.

Khier *et al*. (2008) analysed physicochemical parameters in solvent extracted sesame oil. The saponification value was analysed in sesame oil varities ranged from KENANA 1 (187.04±0.05 mg KOH/g), HURIA 49 (186.10±0.23 mg KOH/g) and HURIA 11 (185.02±0.26 mg KOH/g) respectively.

Zerihun and Berhe (2020) investigated physicochemical properties in sesame oil varieties. The saponification value of sesame varieties were ARGENE (189.18±0.500 mg KOH/g) and ABASENA (184.47±0.320 mg KOH/g).

Borchani *et al*. (2010) reported the saponification value in solbvent extracted sesame oil was 186.60 ± 0.59 mg KOH g^{-1} oil. Hassan and Wawata (2018) were reported 176.15 ± 0.21 mg KOH/g.

Aslam *et al*. (2021) was assessed and reported the saponification value was 189.7 ± 3.97 mg KoH/g. The saponification value was (192.24±0.92 mg KOH/g oil) reported by Olasunkanmi *et al*. (2017)

Insoluble impurity percentage: The insoluble impurity index was observed lowest mean score for HIMA (0.11±0.004%) followed by SWETHA (0.12 ±0.10%). The highest mean score was noted for JCS 1020 (0.14±0.006%) cold pressed sesame oil. Results concluded that there was no significant difference between the insoluble index for three cold pressed sesame oil varieties.

Borchani *et al*. (2010) reported the unsaponifiable matter or impurities in solvent extracted sesame oil was 1.35 ± 0.40 µg/g.

Aslam *et al*. (2021) reported the unsaponifiable matter in solvent extracted sesame oil a variety (PB TILL -90) was 1.44 ± 0.03%.

Foaming capacity: The mean scores for the foaming capacity for cold pressed sesame oils were noted lowest mean score for SWETHA (0.27±0.27%) followed by HIMA (0.41 ±0.23%) and JCS 1020 (0.81±0.46%). However, results showed that there was no significant difference between the foaming capacity for three cold pressed sesame oil varieties.

Viscosity: The viscosity for cold pressed sesame oil varieties were observed same mean scores with minute differences ranging from 0.052±0.0001 (SWETHA) to 0.05±0.002 (JCS 1020). However, results indicated that there was no significant difference between the viscosity of three cold pressed sesame oil varieties.

Diamante and Lan (2014) investigated the viscosity of different cold pressed oils purchased from local supermarkets. The viscosity of cold pressed oils were avocado (0.0576 ± 0.0002), canola (0.0462 ± 0.0005), grape seed (0.0466 ± 0.0003), Macadamia nut (0.0583 ± 0.0003), olive (0.0562 ± 0.0003), peanut (0.0574 ± 0.0007), rice bran (0.0593 ± 0.0006), sesame (0.0525 ± 0.0007), walnut (0.0429 ± 0.0003), soybean (0.0405 ± 0.0003) and safflower (0.0445 ± 0.0003). The present investigation had similar viscosity of cold pressed sesame oil varieties to this study.

Flash point: The mean score for the flash point for cold pressed sesame oil was given the highest score for SWETHA (277±1.00°) whereas HIMA (275.7±1.20°) had lowest mean score for flash point. Results stated that there was no significant difference between the viscosity for JCS 1020, HIMA and SWETHA cold pressed sesame oil varieties.

Olasunkanmi *et al*. (2017) reported the flash point in solvent extracted sesame oil was 248.0±0.49°.

Serve *et al*. (2015) reported the flash point in sesame seed oil was 240° it was lower than the present investigation.

Iodine value: Iodine value is a quality parameter that is regularly used to measure the physicochemical properties of edible oils. Moreover, iodine value is an index of the total number of the double bonds in oils. The higher number of double bonds is associated with the increased iodine value and lower oxidative stability. The iodine value for the cold pressed sesame oil varieties HIMA (105.76± 0.17g/100 g) scored lowest iodine value compared to JCS 1020 (109.28±0.02g/100 g) and SWETHA (106.52±0.03g/100 g) cold pressed sesame oils. Results concluded that there was no significant differences between the iodine value for HIMA, SWETHA and JCS 1020 verities cold pressed sesame oil.

Similar results was reported by Zanjani *et al*. (2019) investigated the iodine value in cold pressed sesame oil was 106.9 ± 0.1-113.1 ± 0.1 g/100 g. Clara *et al*. (2020) reported that 112.27 ± 0.05 g/100 g of iodine value.

Khier *et al*. (2008) analysed physicochemical parameters in solvent extracted sesame oil. The iodine value was reported in sesame oil varieties such as ZIRRA 9 (106.46±0.22g/100 g), HURIA 11 (104.05±0.02g/100 g), ZIRRA 2 (111.30±0.08g/100 g) KENANA 1 (101.11±0.32g/100 g) and local white (106.43±0.2g/100 g) respectively.

Gulla and Waghray (2011) analysed the iodine value in sesame oil was 106.9±0.264g/100 g.

Borchani *et al*. (2010) reported iodine value in solvent extracted sesame oil was 113.35 ± 0.59 g of I 2 100 g^{-1} of oil. Hassan and Wawata (2018) reported 98.6 ± 0.16 g I2/100g of iodine value. Olasunkanmi *et al*. (2017) reported the iodine value was 112.21±0.38g I2 /100 g oil. Aslam *et al*. (2021) analysed the iodine value in solvent extracted sesame oil variety (PB TILL -90) was 113.4 ± 1.46g/100 gm.

Specific gravity: The mean scores for the specific gravity for cold pressed sesame oils were observed same mean scores for SWETHA (0.918±0.00g/cm^3) and JCS 1020 (0.918±0.00 g/cm^3). The lowest specific gravity was noted for HIMA (0.916±0.00 g/cm^3). However results stated that there was no significant differences between the specific gravity for SWETHA and JCS 1020 cold pressed sesame oils whereas HIMA had significant difference at p≤0.01 level of significance.

Zerihun and Berhe. (2020) analysed the physicochemical properties in sesame oil varieties. The specific gravity of sesame oil varieties was T-85 (0.90±0.012 g/cm^3) and ARGENE (0.90±0.010 g/cm^3).

Khier *et al*. (2008) analysed physicochemical parameters in solvent extracted sesame oil. The specific gravity was analysed in sesame oil varieties and reported that ASWAD (0.890± 0.001 g/cm^3), HAURIA 11 (0.892 ±0.002 g/cm^3) and KENANA 1 (0.889± 0.001 g/cm^3) respectively.

Gullaand Waghray (2011) analysed specific gravity in sesame oil was reported that 0.922±0.0015 respectively. Hassan and Wawata. (2018) investigated the specific gravity in solvent exracted sesame oil and the finding showed that 0.89 ± 0.01 g/cm^3 respectively.

Aslam *et al*. (2021) reported the specific gravity in solvent extracted sesame oil variety (PB TILL -90) was 0.921 ± 0.0 g/cm^3. Olasunkanmi *et al*. (2017) reported 0.910±0.02 g/cm^3.

Similar finding for the current investigation was reported by Salaheldeen *et al*. (2019) analysed the physicochemical characteristics in sesame oil purchased from sudhan local market. The relative density (0.8964 ± 0.0007), Visocity (0.03440 ± 0.8485 Pa.s), saponification value (198.65 ± 11.55 mg KOH/g) and refractive index (1.4711±0.0011) respectively.

Assessment of bioactive compounds in cold pressed sesame oil varieties. The bioactive compounds such as total tocopherol and total carotenoid content were done in cold pressed sesame oil varieties and presented in Table 2.

Table 2: Bioactive compounds in cold pressed sesame oil varieties.

Sample	Bioactive compounds	
	Carotenoids (mg/kg)	Tocopherols (mg/kg)
JCS 1020	13.67^a±0.72	490.5^c±0.05
HIMA	15.86^b±1.21	397.1^a±0.01
SWETHA	19.44^c±0.61	460.7^b±0.01
Mean	16.32±0.95	451.1±1.44
F – Value	10.858	31.23
P Value	0.000**	0.0001**

Note: Values were expressed as mean standard deviation for all the three determinants.
Means within the same column followed by common letter do not significantly differ at *p≤0.05, **p≤0.01 level of significance.

Total carotenoid content: The mean scores for the total carotenoid content in cold pressed sesame oils was noted highest carotenoid content for SWETHA (19.44±0.61mg/kg) followed by HIMA (15.86±1.21) whereas lowest carotenoid content was showed for JCS 1020 (13.67±0.72mg/kg). Results indicated that there was a significant difference (p≤0.01) between the total carotenoid content for all the three cold pressed sesame oil varieties (JCS 1020, HIMA and SWETHA).

Total tocopherol content: The total tocopherol content for the cold pressed sesame oils mean score was observed highest for JCS 1020 (490.5±0.05mg/kg) followed by SWETHA (460.7±0.01 mg/kg). The lowest tocopherol content was observed for HIMA (397.1±0.01 mg/kg) cold pressed sesame oil. Findings indicated that there was a significant difference (p≤0.01) between the total tocopherol content for three cold pressed sesame oil varieties.

Melo *et al*. (2021) investigated the total tocopherol content in cold pressed sesame oil was 456.13 ± 6.05 mg/kg oil.

Gharby *et al*. (2015) reported the total tocopherol content in moracco sesame seed oil was 446 mg/kg.

CONCLUSIONS

From the present investigation results concluded that the highest mean value of physical parameters such as for SWETHA variety cold pressed sesame oil was given for density (0.34 ±0.00), Smoke point (111.7±1.70), Viscosity (0.052±0.0001), flash point (277±1.00) and specific gravity (0.918±0.00) whereas for JCS 1020 variety cold pressed sesame oil was given highest for saponification value (188.2±0.50), insoluble impurity percentage (0.14±0.006), foaming capacity (0.81±0.46) and iodine value (109.28±0.02). Among the physical parameters of cold pressed sesame oil varieties (JCS 1020. HIMA and SWETHA) density and saponification had significantly differed at p≤0.05 level of significance whereas specific gravity significantly differed at p≤0.01 level of significance.

FUTURE SCOPE

Cold pressed sesame oil varieties had similar physicochemical properties which can be used in the preparation of backed products as well as in the confectionery industry to make products quality. From the present investigation cold pressed sesame oil varieties had detected bioactive compounds such as carotenoids and tocopherols due to these compounds cold pressed sesame oil varieties can be used in the preparation of innovative products to make products nutrient dense.

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Conflict of Interest. None.

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