

Proximate Analysis of *Sesamum indicum* (Sesame) Seeds and Physicochemical Parameters of Extracted Oil

Mansur Lawal and Humulkhair Bello

Department of Biochemistry and Molecular Biology, Usmanu Danfodiyo University, Sokoto, Nigeria

Corresponding author; Humulkhair Bello / Email: bello.humulkhair.k@gmail.com

doi: <https://doi.org/10.37745/ijbbbs.15/vol10n14147>

Published May 10, 2026

Citation: Lawal M. and Bello H. (2026) Proximate Analysis of *Sesamum indicum* (Sesame) Seeds and Physicochemical Parameters of Extracted Oil, *International Journal of Biochemistry, Bioinformatics and Biotechnology Studies*, 10(1) 41-47

Abstract: *This study investigated the proximate composition of *Sesamum indicum* L. seeds and the physicochemical properties of the extracted oil. Standard analytical methods were employed for all determinations. Proximate analysis revealed that the seeds contained 45.38% crude lipid, 22.70% crude protein, 19.35% carbohydrate, 5.87% ash, 3.72% moisture, and 2.98% crude fiber, indicating that sesame seeds are a rich source of oil and plant-based protein. The extracted oil was light yellow with a nutty odor and taste, a specific gravity of 0.910, acid value of 11.22 mg KOH/g, iodine value of 25.72 g/100 g, saponification value of 110.80 mg KOH/g, and peroxide value of 15mEq/kg, reflecting its nutritional and industrial quality and stability. These findings are consistent with previous studies, confirming the potential of sesame seeds as a valuable source of edible oil and essential nutrients. The results provide information relevant to nutritional, industrial, and commercial applications of sesame seeds in human and animal diets.*

Keywords: *Sesamum indicum*, proximate composition, physicochemical properties, sesame oil, oil quality

INTRODUCTION

Sesamum indicum L., commonly known as sesame or beniseed, is an herbaceous plant widely cultivated in tropical regions, including Nigeria, India, China, Sudan, Burma, Bangladesh, Indonesia, Egypt, and Tunisia. Belonging to the family Pedaliaceae, sesame is one of the oldest known oilseed crops cultivated by humans and is notable for its annual growth cycle and drought tolerance (Dutta, 2004).

The seeds contain approximately 50% oil of high nutritional quality, composed of about 47% oleic acid, 39% linoleic acid, and roughly 25% protein, with considerable amounts of methionine and tryptophan. Sesame oil is widely used in culinary applications and margarine production and contains bioactive compounds such as antioxidants, beta-carotene, and steroids (Yoshida et al., 2001). Among oilseeds, sesame ranks high in oil content and possesses a rich nutty flavor, making it a staple ingredient in cuisines worldwide (Oplinger et al., 1990; Hansen, 2011).

In Nigeria, beniseed is an important soup condiment, particularly in the Northern States,

Middle Belt, and parts of Cross River State, and also serves as a source of vegetable oil for cooking (Bedigan, 2006). Beyond oil production, sesame is used in various food formulations such as Halaweh (sweetened tahini), java beans, and bennimix in Sierra Leone, contributing significantly to human nutrition (Namiki, 1995; Abou-Gharbia et al., 2000).

Sesame seeds are naturally rich in phytosterols, cardio-protective fiber, essential minerals, and healthy fats, containing one of the highest total phytosterol contents among common foods (400–413 mg/100 g) compared to walnuts (113 mg/100 g in English walnuts; 95 mg/100 g in Brazilian walnuts). Phytosterols help lower blood cholesterol, enhance immune function, and reduce the risk of certain cancers (Anilakumar et al., 2010). The bioactive lignan sesamin protects the liver from oxidative damage, promotes fat oxidation, and reduces lipogenesis by suppressing lipogenic enzymes (Ide et al., 2003). Additionally, zinc-rich sesame seeds may improve bone mineral density in older men, thereby reducing the risk of osteoporosis (Hyun et al., 2004).

The roots and leaves of *S. indicum* also have traditional medicinal applications, including the treatment of migraine, hypertension, ulcers, constipation, chickenpox, and piles (Odugbemi, 2006). Economically, sesame remains a major crop in Asia and Africa due to its high edible oil and protein content (Makinde & Akinoso, 2019). The plant thrives in well-drained soils, tolerates drought and extreme heat, and requires careful water management as it cannot withstand waterlogging or high salinity. Its deep root system enables efficient nutrient absorption, supporting growth under low-input and sustainable farming systems (Dutta, 2004). Globally, sesame ranks among the leading oilseeds, with Nigeria being one of the major producers where it serves as an important commercial crop (National Agricultural Extension and Research Liaison Services [NAERLS], 2010).

Despite the increasing cultivation and utilization of sesame in Nigeria, limited scientific information exists on the proximate composition and physicochemical properties of locally produced sesame oil. This lack of data restricts its effective application in food, health, and industrial sectors. Therefore, this study evaluates the proximate composition and physicochemical properties of oil extracted from sesame seeds to provide useful data for nutritional assessment, industrial application, and quality improvement.

MATERIALS AND METHODS

Materials

Laboratory Equipment and Wares

Kjeldahl apparatus, Soxhlet extractor, weighing balance (PC440, Kori-Korlb, Germany), muffle furnace (Lento furnace, Gallenkamp, USA), burette, conical flask, beaker, crucible, spectrophotometer (AE-350, Japan), water bath, pipette, filter paper (Whatman No. 1), measuring cylinder, and muslin cloth.

Chemicals and Reagents

N-hexane, hydrochloric acid, phenolphthalein, ethanol, potassium iodide, chloroform, sodium thiosulphate, glacial acetic acid, iodine (Wij's solution), sodium hydroxide, starch indicator, carbon tetrachloride, and alcoholic KOH. All chemicals were of analytical grade with purities ranging from 97–99.4%.

Sample Collection and Preparation

Sesame seeds were purchased from the central market in Minna, Niger State, Nigeria. The seeds were cleaned manually to remove stones and other extraneous materials, then ground into a fine powder using a pestle and mortar. The powdered samples were stored in airtight containers at room temperature until analysis.

Methods

Proximate Analysis

Proximate composition was determined according to AOAC (2006) methods. Moisture content was determined using the oven-drying method at 105 °C for 2 hours. Crude protein was determined by the micro-Kjeldahl method, and the nitrogen content was multiplied by a factor of 6.25 to obtain protein content. Lipid content was determined using Soxhlet extraction with n-hexane. Ash content was determined by incineration in a muffle furnace at 600 °C for 2 hours. Crude fibre was determined by acid–base digestion after defatting. Carbohydrate content was calculated by difference.

Determination of Physicochemical Properties

The physicochemical properties of the extracted oil were determined using standard methods. Acid value was determined by titration with 0.1 N KOH using phenolphthalein as an indicator. Iodine value was determined using the Hanus method to assess the degree of unsaturation. Saponification value was determined by refluxing the oil with alcoholic KOH followed by titration with hydrochloric acid. Peroxide value was determined by titration with sodium thiosulphate after reaction with potassium iodide. Specific gravity was measured using a specific gravity bottle. Melting and boiling points were determined by controlled heating of the solidified oil.

Organoleptic Properties

The color, odor, and taste of the oil were evaluated by direct observation.

RESULTS**Table 1: Proximate Composition of *Sesamum indicum* Seeds**

Parameter	Concentration (%)
Moisture	3.72± 0.020
5.87± 0.008	Crude protein
22.70± 0.719	Crude lipid
45.38± 0.013	Crude fibre
2.98± 0.050	Carbohydrate
19.35± 0.020	

**Table 2: Physicochemical Properties of
Extracted Oil Parameters**

Values	
Physical state	liquid
Oil content	45.38%
Color	light yellow
Odor	nutty
Taste	midly nutty
Melting point	0–5 °C
Boiling point	*85–90°C
Acid value	11.22± 0.56 mg KOH/g
Iodine value	25.72± 0.38 g I ₂ /100 g
Saponification value	110.80± 1.41 mg KOH/g
Peroxide value	15 ± 5.0 mEq/kg
Specific gravity	0.91

*Apparent boiling point under experimental conditions.

DISCUSSION

The proximate composition of *Sesamum indicum* seeds (Table 1) showed high crude lipid ($45.38 \pm 0.013\%$), followed by crude protein ($22.70 \pm 0.719\%$) and carbohydrate (19.35%), while ash ($5.87 \pm 0.008\%$), moisture ($3.72 \pm 0.020\%$), and crude fibre ($2.98 \pm 0.050\%$) were lower. These values indicate good nutritional quality and are consistent with previous studies. The low moisture content is slightly lower than values reported by (Karaye et al., 2022; Nzikou et al., 2009), suggesting improved shelf stability due to reduced microbial activity (Karaye et al., 2022). The ash content agrees with (Karaye et al., 2022; Samuel & Genevieve, 2017), indicating the presence of essential minerals important for physiological functions (Anilakumar et al., 2010)

The crude protein content is comparable to values reported by (Anilakumar, Pal, Khanum, & Bawa, 2010; Nzikou et al., 2009; Shah, 2013; Dashak & Fali, 1993; Karaye et al., 2022), confirming sesame as a good source of plant protein. Similarly, the crude lipid content aligns with reports by (Anilakumar et al., 2010; Nzikou et al., 2009; Shah, 2013; Karaye et al., 2022), confirming its oil-rich nature and nutritional importance. The crude fibre content falls within the range reported by (Samuel & Genevieve, 2017; Karaye et al., 2022), contributing to digestive health, while the carbohydrate content is comparable to (Nzikou et al., 2009; Shah, 2013) but lower than recommended intake, indicating that sesame complements other carbohydrate sources (Karaye et al., 2022).

The physicochemical properties of the oil (Table 2) showed that it was liquid at room temperature, light-yellow, with a nutty odor and taste, consistent with previous reports (Tunde-Akintunde, 2012; Olasunkanmi, Omolayo, & Olusegun, 2017), which are attributed to unsaturated fatty acids and natural antioxidants. The melting point ($0-5\text{ }^{\circ}\text{C}$) reflects high unsaturation and ensures fluidity (Elleuch et al., 2007; Borchani et al., 2010), while the observed boiling point ($85-90\text{ }^{\circ}\text{C}$) represents initial vapor formation before decomposition (Gulla & Waghray, 2011). The specific gravity (0.91) falls within reported ranges (Betiku et al., 2012; Gulla & Waghray, 2011), indicating purity (Tunde-Akintunde, 2012). The acid value ($11.22 \pm 0.56\text{ mg KOH/g oil}$) is higher than previous reports (Tunde-Akintunde et al., 2012; Olasunkanmi et al., 2017), possibly due to hydrolysis, but remains within acceptable limits (Nzikou et al., 2009). The iodine value ($25.72 \pm 0.38\text{ g I}_2/\text{g oil}$) indicates moderate unsaturation but is lower than earlier reports (Tunde-Akintunde et al., 2012; Gulla & Waghray, 2011), likely due to variation in seed or processing conditions (Elleuch et al., 2007). The saponification value ($110.80 \pm 1.41\text{ mg KOH/g oil}$) is lower than reported values (Betiku et al., 2012; Borchani et al., 2010), suggesting longer-chain fatty acids but still indicating suitability for industrial use (Nzikou et al., 2009). The peroxide value ($15 \pm 5.0\text{ meq O}_2/\text{kg}$) falls within acceptable limits (Gulla & Waghray, 2011), indicating good oxidative stability despite slight variation from other reports (Betiku et al., 2012; Olasunkanmi et al., 2017).

CONCLUSION

Sesamum indicum seeds cultivated in Nigeria are rich in crude lipid, protein, and carbohydrate, confirming their nutritional value. The extracted oil exhibited desirable physicochemical and organoleptic properties, indicating suitability for both edible and industrial applications. These findings support the potential use of sesame seeds in human nutrition, animal feed, and commercial oil production.

REFERENCES

- Abou-Gharbia, H. A., Shehata, A. A. Y., & Shahidi, F. (2000). Effect of processing on oxidative stability and lipid classes of sesame oil. *Food Research International*, 33(5), 331–340.
- Anilakumar, K. R., Pal, A., Khanum, F., & Bawa, A. S. (2010). Nutritional, medicinal and industrial uses of sesame (*Sesamum indicum* L.) seeds – An overview. *Agriculturae Conspectus Scientificus*, 75(4), 159–168.
- AOAC. (2006). *Official Methods of Analysis*. 18th Edition. Association of Official Analytical Chemists.
- Bedigan, D. (2006). Assessment of sesame and its wild relatives in Africa. In S. A. Ghazanfar & H. J. Beentje (Eds.), *Taxonomy and ecology of African plants: Their conservation and sustainable use* (pp. 481–491). Royal Botanic Gardens.
- Betiku, E., Adepoju, T. F., Omole, A. K., & Aluko, S. E. (2012). Statistical approach to the optimization of oil from Beniseed (*Sesamum indicum*) oilseeds. *Journal of Food Science and Engineering*, 2, 351–357.
- Borchani, C., Besbes, S., Blecker, C. H., & Attia, H. (2010). Chemical characteristics and oxidative stability of sesame seed, sesame paste, and olive oils. *Journal of Agricultural Science and Technology*, 12, 585–596.
- Dashak, D. A., & Fali, C. N. (1993). Chemical composition of four varieties of Nigerian benniseed (*Sesamum indicum*). *Food Chemistry*, 47, 253–255.
- Dutta, A. C. (2004). *Botany for degree students* (5th ed.). Macmillan Publishers. <https://doi.org/10.4314/bajopas.v3i1.58706>
- Elleuch, M., Besbes, S., Roiseux, O., Blecker, C., & Attia, H. (2007). Quality characteristics of sesame seeds and by-products. *Food Chemistry*, 103(2), 641–650.
- Gulla, S., & Waghray, K. (2011). Effect of storage on physico-chemical characteristics and fatty acid composition of selected oil blends. *Journal of Lipid Science*, 3(1), 35–46.
- Hansen, R. (2011). Sesame profile. Agricultural Marketing Resource Centre.
- Hyun, T., Barrett-Connor, E., & Milne, D. (2004). Zinc intakes and plasma concentrations in men with osteoporosis: The Rancho Bernardo study. *American Journal of Clinical Nutrition*, 80(3), 715–721.
- Ide, T., Kushiro, M., Takahashi, Y., Shinohara, K., Fukuda, N., & Yasumoto, S. (2003). Sesamin, a sesame lignan, as potent lipid-lowering food component. *Japan Agricultural Research Quarterly*, 37(3), 151–158.
- Karaye, I. U., Maishanu, S. I. M., Anka, S. A., Shehu, A., Adili, S. U. I. I., Muhammad, L. H., & Musa, A. (2022). Nutritional and extractable oil profile in seeds of *Sesamum indicum* L. and *Moringa oleifera* Lam. grown in Sokoto, Nigeria. *Journal of Plant Development*, 29.
- Makinde, F. M., & Akinoso, R. (2019). Nutrient composition and effect of processing treatments on antinutritional factors of Nigerian sesame (*Sesamum indicum* Linn.) cultivars. *International Food Research Journal*, 20(5), 2293–2300.
- Namiki, M. (1995). The chemistry and physiological functions of sesame. *Reviews International*, 11(2), 281–329. <https://doi.org/10.1080/87559129509541043>

Publication of the European Centre for Research Training and Development -UK

- National Agricultural Extension and Research Liaison Services (NAERLS). (2010). *Beniseed production and utilization in Nigeria* (Extension Bulletin No. 154, Horticultural Series No. 5). Ahmadu Bello University.
- Nzikou, J. M., Matos, L., Bouanga-Kalou, G., Ndangui, C. B., Pambou-Tobi, N. P. G., Kimbonguila, A. K., Silou, T., Linder, M., & Desobry, S. (2009). Chemical composition on the seeds and oil of sesame (*Sesamum indicum L.*) grown in Congo Brazzaville. *Advance Journal of Food Science and Technology*, 1(1), 6–11.
- Odugbemi, T. (2006). *Outlines and pictures of medicinal plants from Nigeria*. University of Lagos Press.
- Olasunkanmi, G. S., Omolayo, F. T., & Olusegun, O. T. (2017). Fatty acid profile, physico-chemical and functional properties of oil and protein isolate simultaneously extracted from sesame (*Sesamum indicum*) seed. *Annals: Food Science & Technology*, 18(1).
- Oplinger, S., & Putnam, D. H. (1990). *Sesame*. Purdue University Press.
- Samuel, N. C., & Genevieve, A. C. (2017). Proximate analysis and phytochemical properties of sesame (*Sesamum indicum L.*) seeds grown and consumed in Abakaliki, Ebonyi State, Nigeria. *International Journal of Health and Medicine*, 2(4), 1–4.
- Shah, H. C. (2013). *Sesamum indicum* (Sesame or Til) – An historical and scientific evaluation from Indian perspective. *Indian Journal of History of Science*, 48(2), 151–174.
- Tunde-Akintunde, T. Y. (2012). Physicochemical properties of sesame oil from local and improved cultivars. *International Journal of Food Science and Nutrition*, 63(6), 745–752.
- Yoshida, H., Abe, S., Hirakawa, Y., & Tagagi, S. (2001). Roasting effects on fatty acid distributions of triacylglycerols and phospholipids in sesame (*Sesamum indicum*) seeds. *Journal of the Science of Food and Agriculture*, 81(7), 620–626. <https://doi.org/10.1002/jsfa.857>

International Journal of Biochemistry, Bioinformatics and Biotechnology Studies, 10(1) 41-47, 2026

Print ISSN: 2397-7728(Print)

Online ISSN: 2397-7736(Online)

Website: <https://www.eajournals.org/>

Publication of the European Centre for Research Training and Development -UK
