

**TOTAL PHENOL CONTENT OF SESAME SEED OIL (*Sesamum indicum L.*)  
(MANUALLY EXTRACTED AND COMMERCIALY MADE) AND COTTONSEED  
OIL (*Gossypium hirsutum L.*)**

**BY**

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BENIN CITY**

**NOVEMBER 2025**

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**A PROJECT SUBMITTED TO THE  
DEPARTMENT OF MEDICAL BIOCHEMISTRY, SCHOOL OF BASIC MEDICAL  
SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILMENT OF  
THE REQUIREMENT FOR THE AWARD OF BACHELOR OF SCIENCE (B.SC) IN  
MEDICAL BIOCHEMISTRY**

**NOVEMBER 2025**

**CERTIFICATION OF PROJECT ON PLAGIARISM**

We the undersigned attest and declare that the project undertaken by:

**EGHIANRUWA ISOKEN JOY**

Titled:

**TOTAL PHENOL CONTENT OF SESAME SEED OIL (*Sesamum indicum L.*)  
(MANUALLY EXTRACTED AND COMMERCIALY MADE) AND COTTONSEED  
OIL (*Gossypium hirsutum L.*)**

Has successfully passed the anti-plagiarism test and does not violate any copyright regulations.

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## CERTIFICATION

This is to certify that this project work was carried out by Isoken Joy EGHIANRUWA with matriculation number BMS2006651 in the Department of Medical Biochemistry, School of Basic Medical Sciences, University of Benin, Benin-City, in partial fulfillment of the requirements for the award of Bachelor of Science (B.Sc.) degree in Medical Biochemistry.

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(HEAD OF DEPARTMENT)

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DATE

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EXTERNAL EXAMINER

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DATE

## **DEDICATION**

I dedicate this work to GOD and my lovely family members whose prayers and support have been unwavering over the years.

## ACKNOWLEDGEMENTS

My deepest gratitude goes to GOD Almighty who in the words of Psalm 139 made all the delicate inner parts of my body and has unnumbered precious thoughts towards me. I have done nothing to deserve all the mercy he showed me during the course of my academic journey, I am beyond grateful for God's sustenance and mercies.

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## ABSTRACT

This study aimed at evaluating and comparing the total phenolic content (TPC) of manually extracted and commercially made sesame seed oil, alongside manually extracted cottonseed oil. Phenolic compounds are recognized for their antioxidant properties, which enhance the nutritional quality, oxidative stability and shelf life of edible oils. Oil samples were analyzed using the Folin-Ciocalteu colorimetric method and statistical evaluation was performed with SPSS to determine mean values and standard errors. Results revealed that manually extracted cottonseed oil contained a greater TPC than sesame seed oil extracted using the same methods, while commercially made sesame seed oil expressed the lowest phenolic levels. These findings indicate that traditional extraction methods better preserve bioactive compounds compared to commercial refining, which tends to reduce antioxidant content. The elevated phenolic content in manually extracted oils suggests improved oxidative stability and potential health benefits, positioning them as favorable options for health-conscious consumers. Overall, this research underscores the importance of minimally processed oils, supports the use of TPC as a quality indicator and highlights the need for improved commercial processing techniques in order to retain beneficial phytochemicals.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Edible oils are an important source of essential fatty acids and energy in human diets. Among these oils, sesame (*Sesamum indicum*) seed oil stands out for its high oxidative stability, unique aroma and rich composition of bioactive compounds, especially phenolic compounds.

According to Shahidi and Ambigaipalan (2015), Phenolic compounds are secondary plant metabolites with antioxidant properties that contribute significantly to the health benefits of edible oils, including anti-inflammatory, cardio protective and anticancer effects.

The method of oil extraction influences its ability to retain phenolic compounds significantly. Local(traditional) methods such as cold pressing and roasting often differ from commercial (industrial) processes in terms of heat exposure and solvent use, potentially leading to variations in total phenolic content and nutritional value (Mohdaly *et al.*, 2010).

Sesame seed oil extracted using traditional methods is commonly consumed in many Nigerian communities while Cotton seed oil, though less preferred, is also extracted locally and used as a cheaper alternative in rural diets (Mohdaly *et al.*, 2010).

Comparative data on the phytochemical quality of sesame seed oil and cotton seed oil, especially phenolic, is limited. Evaluating the phenolic content of edible oils provides insight into their antioxidant potential and offers a basis for comparing oil sources and extraction techniques.

### 1.2 Justification of the Study

Despite the health significance of phenolic compounds in oils, local consumers are largely unaware of the nutritional differences arising from extraction techniques. This study will provide scientific evidence on how local and commercial oil extraction methods affect phenolic

composition. The findings will guide consumers, health professionals, and food processors in making informed decisions on oil consumption and production.

### **1.3 Aim of the Study**

To determine the total phenolic content in manually extracted and commercially made sesame seed oil, as well as in locally extracted cottonseed oil.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Overview of Edible Oils

Edible oils are essential in human nutrition as they supply energy, essential fatty acids, and aid in the absorption of fat-soluble vitamins. Common edible oils include sesame, cottonseed, groundnut as well as sunflower oils. According to Shahidi and Naczk (2004), nutritional value and stability depend on the fatty acid profile and bioactive components, especially phenolic compounds.

##### 2.1.1 Sesame Seed Oil

Sesame seed oil is derived from the seeds of the sesame plant (*Sesamum indicum L.*) which is one of the oldest oilseed crops known to humankind. It is broadly used in Asian, African, and Middle Eastern cuisines and has been cultivated for thousands of years. A distinct nutty flavor, oxidative stability and therapeutic benefits are among the main characteristics that set sesame oil apart from other edible oils (Pathak *et al.*, 2014).

Sesame seeds contain about:

- 50–60% oil by weight of seed
- Unsaturated fatty acids like Oleic acid (monounsaturated) and Linoleic acid (polyunsaturated)
- Saturated fatty acids like Palmitic and Stearic acids in smaller amounts

- Natural antioxidants such as Sesamin, Sesamol, Sesaminol and Sesamolin, which contribute to the high oxidative stability and health benefits of sesame seed oil (Elleuch *et al.*, 2007).

Sesame seed oil can be extracted in two ways:

- Cold-pressed (local/traditional): This method often produces oils that are richer in phenolic content and flavor but possess a shorter shelf life.
- Refined (commercial): Using this method, oils are clearer and more stable, but may lose some beneficial compounds during processing.

Sesame seed oil can be used in cooking, hair care, skin care and dental care. (Memon, 2022).

Studies have shown that sesame oil possesses antioxidant, anti-inflammatory, and anticancer properties (Namiki, 2007).



**Fig.2.1 Sesame seeds (raw and toasted respectively) and sesame seed oil.**

### **2.1.2 Cotton Seed Oil**

Cotton seed (*Gossypium hirsutum L.*) oil is an edible oil obtained from the seeds of *Gossypium* species like *Gossypium hirsutum* and *Gossypium barbadense*.

Cottonseed oil mainly contains:

- Palmitic acid (saturated)
- Oleic acid (monounsaturated)
- Linoleic acid (polyunsaturated)

It is naturally rich in tocopherols (vitamin E compounds), which contribute to its antioxidant properties and shelf life.

Though cottonseed oil is free of trans fats and cholesterol, it also contains gossypol; a naturally occurring polyphenolic compound that is toxic in high concentrations and as such must be removed during refining (Rani *et al.*, 2020). Despite the presence of this toxic compound, locally extracted cotton seed oil is widely used due to its affordability (Cherry, 1983).

It is a by-product of cotton production, often used for culinary (baking, frying), cosmetic and industrial (soap and lubricant making) purposes due to its mild flavor, versatility and stability. (Gunstone, 2011) Its phenolic profile is less studied compared to that of sesame oil.



**Fig.2.2 Cotton, cotton seeds and cotton seed oil.**

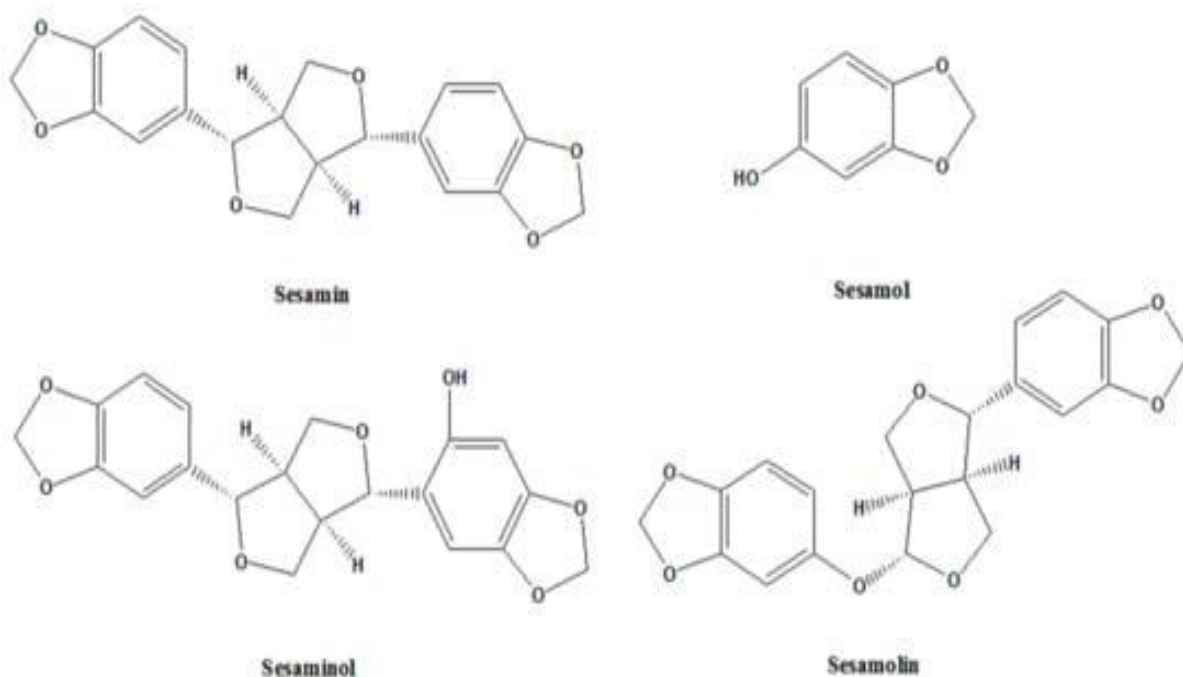
## 2.2 Phenolic Compounds in Edible Oils

According to Shahidi and Ambigaipalan (2015), Phenolic compounds are a broad class of secondary plant metabolites known for their antioxidant, anti-inflammatory, and antimicrobial properties. In edible oils, these compounds contribute greatly to oxidative stability, shelf life and nutritional value. They are especially important in oils like sesame seed and cottonseed oil, where their presence can vary depending on extraction and processing methods.

### 2.2.1 Phenolic Composition

Phenolic compounds in edible oils include flavonoids, phenolic acids, tannins, and lignans.

Sesame oil is rich in Sesamin, Sesamol, Sesaminol and Sesamolol, which are lignans that are unique to sesame seeds and contribute to its strong antioxidant properties (Moazzami and Kamal-Eldin, 2006).



**Fig.2.3 Phenolic compounds found in sesame seed.**

Cottonseed oil on the other hand contains phenolic antioxidants like gossypol and tocopherols, although gossypol levels are usually reduced during refining due to its toxicity at high concentrations (Zabidov *et al.*, 2020).



**Fig.2.4 Phenolic compound found in cotton seed.**

### 2.2.2 Functionality and Benefits

The primary role of phenolic compounds in edible oils is to prevent lipid oxidation, which degrades oil quality and produces harmful compounds. These antioxidants help prevent spoilage by neutralizing harmful free radicals and binding metal ions that could otherwise accelerate degradation, thereby extending the oil's shelf life and maintaining flavor (Frankel, 2005).

From a health perspective, dietary phenols contribute to reducing risks associated with cardiovascular diseases and certain cancers (Pandey and Rizvi, 2009).

## **2.3 Extraction Methods of Sesame and Cotton Seed Oils**

The method of oil extraction used plays a crucial role in determining the nutritional value, quality and total phenolic content (TPC) of edible oils, including sesame and cotton seed oils. Extraction techniques affect how well bioactive compounds such as phenols, tocopherols and sterols are preserved or broken down (Ramadan and Moersel, 2006).

### **2.3.1 Traditional and Local Extraction Methods**

Local or traditional extraction methods are often manual or semi-mechanical and involve steps such as roasting, grinding, pressing, and decanting.

In the local extraction of sesame seed oil, the seeds may be roasted before pressing to enhance the flavor and yield. This process can increase the concentration of certain phenolic compounds due to Maillard reactions (Narasimman and Rajamohan, 2015).

Cotton seed oil extraction at the local level is less common due to the presence of gossypol. Traditional processing may include boiling, sun-drying and simple mechanical pressing. However, local methods can pose a health risk due to the residual gossypol often left behind, these risks can be reduced through proper refining of oils. (Yunus *et al.*, 2019).

Traditional methods tend to retain more natural antioxidants since minimal heat and no chemical solvents are used. For example, cold-pressed sesame oil from local extraction retains higher levels of sesamin and sesamolin, contributing to both oxidative stability and health benefits (Ghosh *et al.*, 2017).

### **2.3.2 Commercial Extraction Methods**

Commercial extraction typically involves solvent extraction (e.g., hexane) and refining, which includes degumming, neutralization, bleaching, and deodorization. While solvent extraction produces a higher oil yield, it greatly reduces phenolic content due to high temperatures and chemical treatments (Siger *et al.*, 2008).

In commercially extracted sesame oil, much of the antioxidant activity may be lost during refining stages, reducing its oxidative and nutritional stability. Similarly, cotton seed oil undergoes extensive refining to remove gossypol, free fatty acids and pigments. While the removal of this toxic compound makes the oil safer for consumption, it also reduces beneficial phenolic and vitamin E content (Rani *et al.*, 2020).

### **2.3.3 Impact of Oil Type and Processing**

The concentration of total phenolic content (TPC) in oils greatly depend on the oil source and the extraction method. Cold-pressed/traditionally extracted oils often retain higher levels of phenolic compounds compared to those that undergo industrial refining, which can strip away bioactive components due to heat and chemical treatments (Siger *et al.*, 2008). This difference is often used as a quality marker when comparing locally and commercially extracted oils.

Research indicates that traditionally extracted sesame seed oils contain a higher total phenolic content (TPC) compared to solvent-extracted or commercially refined versions. This supports the growing preference for minimally processed oils especially among health conscious consumers. (Abou-Gharbia *et al.*, 2000).

## 2.4 Determination of Total Phenolic Content

Total phenolic content (TPC) is usually determined using the Folin-Ciocalteu method, a colorimetric assay that measures the reducing capacity of phenolic compounds. Results are typically expressed in milligrams of Gallic acid equivalents per gram (mg GAE/g) of oil (Luaces *et al.*, 2021)

## 2.5 Factors Affecting Total Phenolic Content

The total phenolic content in edible oils is influenced by several factors that can either enhance or degrade these valuable compounds; understanding these factors is essential for optimizing extraction processes and preserving the nutritional quality of oils. These chapters include:

- **Extraction Method:** Cold-pressed or traditionally extracted oils often contain higher levels of phenolic compounds compared to solvent-extracted or refined oils (Nyam *et al.*, 2009). Commercial extraction due to high temperature and chemicals can lead to reduction or loss of phenolic compounds (Zeb, 2012).
- **Seed Variety and Origin:** Different cultivars of sesame or cotton may differ in phenolic profiles and concentrations due to genetic variation and the geographical origin of seeds. The production of phenolic compounds in seeds is affected by variables like the type of soil, environmental climate and farming methods (Kahkonen *et al.*, 1999).
- **Storage Conditions:** Oils stored in dark, cool environments in airtight containers tend to retain their phenolic content longer. Storage time, temperature and exposure to light and oxygen can significantly reduce TPC. Phenolic compounds are sensitive to oxidative degradation over time, and improper storage accelerates this loss (Ismail *et al.*, 2004).

- **Maturity and Harvesting Time:** Mature seeds often contain more phenolic compounds, but delayed harvesting can result in deterioration due to exposure to environmental conditions (Shahidi and Naczki, 2004).
- **Processing Techniques:** Processes such as bleaching, deodorizing and filtration during oil refining can remove beneficial phenolic compounds (Rombaut *et al.*, 2015). While minimal processing helps retain these antioxidants.

Maximizing extraction and storage techniques while selecting seeds can significantly enhance the total phenolic content of oils, improving both their nutritional value and shelf life.

## 2.6 Health Benefits of Phenolic-Rich Oils

The benefits of consuming oils rich in phenolic compounds on our health include:

- **Antioxidant Activity:** Phenolic compounds help combat free radicals and lower oxidative stress, a key contributor to aging and chronic illnesses such as cancer and heart disease. By neutralizing reactive oxygen species, they shield essential cellular components (like DNA, proteins, and fats) from damage. (Shahidi and Ambigaipalan, 2015).
- **Cardiovascular Protection:** Consistently consuming oils rich in phenolic compounds has been associated with better cardiovascular health. These compounds help decrease the oxidation of low-density lipoprotein (LDL), boost high-density lipoprotein (HDL) levels, and support healthy blood vessel function, ultimately reducing the chances of developing atherosclerosis and high blood pressure. (Martinez-Gonzalez *et al.*, 2014).
- **Anti-inflammatory Effects:** Phenolic compounds help regulate inflammation by blocking the production of pro-inflammatory substances such as cytokines and

prostaglandins. As a result, they are useful in controlling inflammatory conditions like arthritis and metabolic syndrome. (García-Lafuente *et al.*, 2009).

- **Antimicrobial Properties:** Certain phenolic compounds found in oils possess antimicrobial properties that can act against different types of pathogens. This not only helps extend the shelf life of the oils but may also provide health benefits by offering protection against gastrointestinal infections when consumed. (Daglia, 2012).
- **Cancer Prevention:** The cancer-preventive effects of phenolic compounds are largely due to their ability to influence detoxification enzymes, suppress tumor development, and trigger programmed cell death (apoptosis) in cancer cells (Russo *et al.*, 2010). For example, sesame oil contains bioactive compounds like Sesamin and Sesamol, which have demonstrated anticancer potential in laboratory studies.
- **Neuroprotective Benefits:** Due of their antioxidant properties, phenolic compounds shield nerve cells from oxidative stress, a contributing factor in neurodegenerative diseases such as Alzheimer's and Parkinson's (Scalbert *et al.*, 2005).

Summarily, phenolic-rich oils are not only nutritionally valuable but also offer functional benefits that contribute to the prevention and management of chronic illnesses making them increasingly important in the development of health-conscious diets and nutraceutical products.

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1. MATERIALS:

##### 3.1.1 Apparatus and Equipments

The apparatus or equipment used for this study were gotten from the Chemistry laboratory at the University of Benin and were confirmed to be in good working condition before use. They include: Oil extraction machine, Paper tapes, Foil paper, Test tubes, Cotton wool, Methylated spirit, Stopwatches, Bunsen burner, Glass cylinder (10mL or 25Ml), A water distiller, Simple weighing balance, Round bottom flask, Spatula, Measuring cylinders (10 ml, 500ml, 1L), Sample bottles, Microplate reader (to measure absorbance), Micropipettes, Incubator, HH-W Constant Temperature Water Bath, Refrigerator, Stirring rod, Ultrasonic cleaner, Computer with software, UV-Visible Spectrophotometer (Jenway 6100, Dunmow, Essex, U.K), Analytical weighing balance and Microplates.

##### 3.1.2 Chemicals and Reagents

Enzyme kits and other reagents used were of standard quality and were purchased from qualified/accredited suppliers or their authorized representative in Nigeria. The Chemicals used were of analytical quality and obtained from Chemistry Department Laboratories, University of Benin, Benin-city, Nigeria. They include: Hydrochloric Acid (HCl), Anhydrous Sodium Sulfate ( $\text{Na}_2\text{SO}_4$ ), Hexane or Petroleum Ether, Distilled or Deionized Water, Methanol or Ethanol, Tannic Acid, Sodium Carbonate ( $\text{Na}_2\text{CO}_3$ ), Folin-Ciocalteu reagent.

## **3.2 METHODS**

### **3.2.1 Sample Collection and Preparation**

The dried sesame (*Sesamum indicum L.*) and cotton (*Gossypium hirsutum L.*) seeds used for this study were obtained from a local market in Benin metropolis. The seeds were carefully inspected to ensure they were free from foreign particles, dust as well as mold contamination and were allowed to dry thoroughly under ambient conditions. The cotton seeds were decorticated to eliminate the tough shells surrounding them and access the inner seed. The cleaned seeds were then directly subjected to mechanical pressing using an oil extraction machine. This process allowed for efficient recovery of crude oils without the need for prior grinding into fine powder, thereby minimizing handling losses and preserving oil quality. The extracted oils from both seed types were collected, filtered to remove residual solids and stored in clean, dried containers. Each container was properly labeled and kept in a cool, dry environment until required for further analysis.

### **3.2.2 Extraction of Phenolic Compounds**

The sesame and cottonseed oil samples were extracted using standard phytochemical procedures with minor modifications. Each extraction was performed in triplicate to ensure accuracy and reproducibility. Approximately 1.0 g of each oil sample (sesame seed oil and cottonseed oil) was accurately weighed into a clean centrifuge tube. To each tube, 5 mL of n-hexane was added to dissolve the oil completely. Subsequently, 5 mL of 80% methanol (methanol:water, 80:20 v/v) was introduced to extract the phenolic compounds into the polar phase. The mixture was vortexed for about one minute and centrifuged at 3,000 rpm for 10 minutes to facilitate phase separation. The lower methanol layer containing the phenolic compounds was carefully

collected, while the upper hexane layer was discarded. This extraction process was repeated twice more to ensure complete recovery of the phenolic constituents. The combined methanolic extracts were then concentrated to dryness under reduced pressure using a rotary evaporator, and the residue was dissolved again in 5 mL of methanol. The resulting solution represented the oil phenolic extract used for analysis.

### **3.2.3 Preparation of Standard Solutions**

A stock solution of Tannic acid was prepared by dissolving 100 mg of Tannic acid in 100 mL of methanol, yielding a concentration of 1 mg/mL. From this stock, a series of standard solutions ranging from 10 to 200  $\mu\text{g/mL}$  were prepared by serial dilution with methanol. These standards were used to generate a calibration curve by plotting absorbance against concentration.

### **3.2.4 Determination of Total Phenolic Content (TPC)**

The total phenolic content (TPC) of the extract was measured using the Folin-Ciocalteu method as outlined by Singleton and Rossi (1965), with slight modifications. Tannic acid served as the calibration standard. In summary, 1.0 mL of extract solution (250  $\mu\text{g/mL}$ ) was transferred into a test tube and mixed with 1.0 mL of Folin-Ciocalteu reagent. After a 5-minute reaction period, 15.0 mL of 20% sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) solution was added. The mixture was then left to stand for 2 hours at room temperature, after which the absorbance was recorded at 760 nm using a UV-Visible spectrophotometer (Jenway 6100, Dunmow, Essex, UK). The total phenolic concentration was calculated from a standard curve generated using tannic acid and expressed as micrograms of tannic acid equivalent ( $\mu\text{g TAE}$ ) per gram of extract.

### **3.2.5 Calibration Curve and Quantification**

A calibration curve was constructed by plotting absorbance against Tannic acid concentration ( $\mu\text{g/mL}$ ). The phenolic content of each oil sample was calculated from the linear regression equation of the standard curve. The results were expressed as milligrams of Tannic acid equivalents per gram of oil ( $\text{mg TAE/g oil}$ ) using the following formula:

$$\text{TPC} = \{C \times V\} / \{M\}$$

Where C is the concentration of phenolic compounds obtained from the calibration curve ( $\mu\text{g/mL}$ ), V is the final volume of the extract (mL), and M is the mass of the oil sample (g).

### **3.2.5 Data Analysis**

Data obtained from the spectrophotometric and gravimetric analyses were processed using IBM SPSS statistics 27 (2019). Each test was performed in triplicate ( $n = 3$ ), and the outcomes were reported as mean  $\pm$  standard deviation (SD) to enhance precision and reliability. Descriptive statistical methods were applied to interpret the data, and the results were clearly presented in tables for easy understanding.

## CHAPTER FOUR

### RESULTS

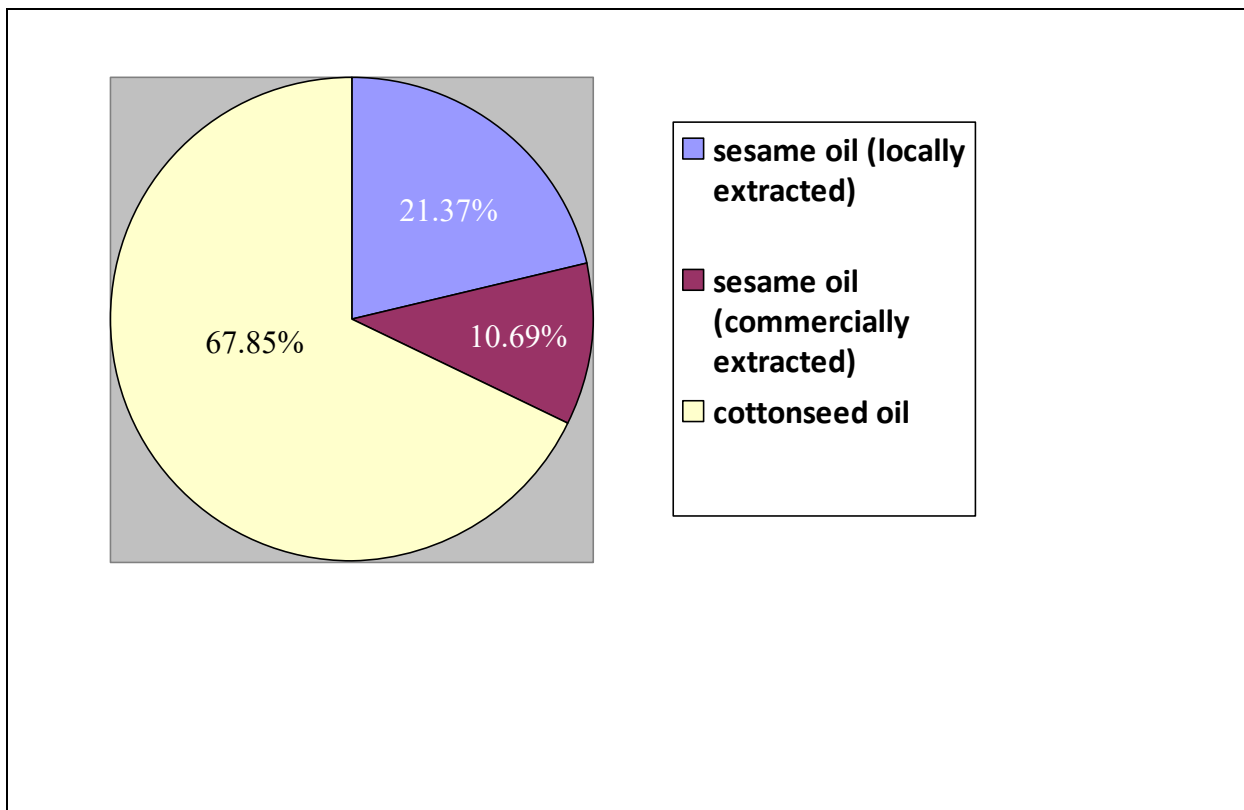
**Table 4.1 Showing the Qualitative Phytochemical Analysis of Sesame Seed Oil (*Sesamum indicum L.*) (Manually Extracted and Commercially Made) and Cottonseed Oil (*Gossypium hirsutum L.*)**

Sample	Phytochemicals	Indications
Cotton Seed Oil	Total Phenol	(+)
Sesame Seed Oil	Total Phenol	(+)

**Key + = Present. – = not present**

**Table 4.2 Showing the Total Phenolic Content of Sesame Seed Oil (*Sesamum indicum L.*) (Manually Extracted and Commercially Made) and Cottonseed Oil (*Gossypium hirsutum L.*)**

SAMPLE	PHYTOCHEMICAL	MEAN± S.E.M
<b>Sesame Seed Oil (Manually Extracted)</b>	Total Phenolic Content (g TAE/kg)	1.5620±0.0480
<b>Sesame Seed Oil (Commercially Made)</b>	Total Phenolic Content (g TAE/kg)	0.7816±0.0243
<b>Cotton Seed Oil</b>	Total Phenolic Content (g TAE/kg)	4.9593±0.2115



**Fig.4.1 A Pie Chart Showing Comparison of Mean Total Phenolic Content in Sesame and Cotton seed oils.**

From the tables and chart above, Manually Extracted Sesame seed oil recorded a mean value of 1.5620 mg GAE/g while Commercially Made Sesame Seed oil recorded a mean value of 0.7816 mg GAE/g however, Cottonseed oil showed a higher mean value of 4.9593 mg GAE/g. The observed increase in total phenol concentration in Cottonseed Oil suggests a higher presence of phenolic compounds, which are associated with stronger antioxidant potential.

Variation between samples may be attributed to differences in extraction techniques, plant material composition, processing conditions as well as storage conditions.

## CHAPTER FIVE

### DISCUSSION AND CONCLUSION

#### 5.1 Discussion

The findings from this study reveal that cottonseed oil possesses the highest total phenolic content compared to both manually extracted and commercially made sesame seed oils. This elevated phenolic concentration is particularly significant because phenolic compounds are well-recognized contributors to antioxidant activity, which plays a central role in protecting oils against oxidative degradation and enhancing their nutritional value (Riaz et al., 2021).

Cottonseed oil's rich phenolic profile translates into superior antioxidant properties, reinforcing earlier reports that highlight its ability to maintain oxidative stability during storage and processing. These antioxidant effects not only extend the shelf life of the oil but also provide potential health benefits by mitigating oxidative stress in biological systems. In contrast, sesame seed oils, especially those refined through commercial processes, exhibited comparatively lower phenolic concentrations, which corresponded with reduced antioxidant capacity (Springer, 2024). Previous studies have consistently demonstrated that oils with higher phenolic content exhibit stronger radical-scavenging activity and improved resistance to lipid peroxidation (Sam et al., 2024). The present results align with this principle, showing that cottonseed oil's elevated phenolic levels directly enhance its antioxidant potential. This makes cottonseed oil particularly valuable in health-conscious markets where oxidative stability and bioactive compound retention are prioritized.

Overall, the current findings underscore the nutritional and functional importance of antioxidant-rich oils. Cottonseed oil, with its superior phenolic composition and associated antioxidant properties, stands out as a promising candidate for both dietary applications and industrial uses

where oxidative stability is critical. By highlighting the antioxidant advantages of cottonseed oil relative to sesame oils, this study contributes to a deeper understanding of how seed composition influences oil quality and health-promoting potential.

## **5.2 Conclusion**

This study found that cottonseed oil has the highest total phenolic content compared to locally and commercially extracted sesame oils, showing that both seed type and extraction method affect phenolic retention. Oils richer in phenolic compounds, like cottonseed oil, offer greater antioxidant and nutritional benefits, underscoring the value of traditional extraction methods. Future research should focus on optimizing processing and exploring the functional health effects of these oils.

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