



## FLAVONOID CONTENT AND ANTIOXIDANT POTENTIAL OF WHITE AND BROWN SESAME SEED OILS

Ibrahim Sani\*, C. C. Okpalaoka, F. Bello, A. A. Warra, A. Abdulhamid

Department of Biochemistry, Kebbi State University of Science and Technology, Aliero,  
P.M.B. 1144, BirninKebbi, Kebbi State, Nigeria.

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**\*Correspondence for  
Author**

**Ibrahim Sani**

Department of Biochemistry,  
Kebbi State University of  
Science and Technology,  
Aliero, P.M.B. 1144,  
BirninKebbi, Kebbi State,  
Nigeria.

### ABSTRACT

Medicinal plants are the most important sources of life saving drugs for the majority of world's population. People of all continents have used hundreds to thousands of indigenous plants in curing and management of many diseases. Sesame (*Sesamum indicum* L.) is one of the most widely cultivated species for its nutritious and medicinal seeds and oil. This research work was carried out to determine the flavonoid content and antioxidant potential of two varieties of sesame seeds oil. Oil extraction was done using Soxhlet apparatus. The

Percentage oil yield for white and brown seeds were 47.85% and 20.72% respectively. Flavonoid was present in both seeds with concentration of  $480 \pm 0.20$  mg/g and  $360 \pm 0.16$  mg/g in white and brown sesame seeds respectively. The antioxidant potential was determined at different oil volume; 1.00, 0.75, 0.50 and 0.25ml. The results for the white and brown sesame seed oils were  $96.8 \pm 1.71$  and  $70.7 \pm 2.57$ ,  $91.0 \pm 2.57$  and  $65.2 \pm 3.47$ ,  $83.1 \pm 1.03$  and  $55.4 \pm 1.80$ ,  $77.9 \pm 1.76$  and  $50.2 \pm 2.61$  respectively. The white seed oil has higher oil yield than the brown seed oil. Likewise, the white seed oil has more flavonoid content than the brown seed oil and also better reducing power than the brown seed oil.

**KEYWORDS:** Flavonoid Content, Antioxidant Potential, White Sesame Seeds, Brown Sesame Seeds; Sesame Seed Oil, *Sesamum indicum* L.

## INTRODUCTION

Sesame (*Sesamum indicum* L.) also known as simsim, beniseed and till in East Africa, West Africa and India respectively is the one of the oldest cultivated plants<sup>[1]</sup>. Its seed contains about 42-54% quality oil, 22-25% protein, 20-25% carbohydrates and 4-6% ash<sup>[2]</sup>. *Sesamum indicum* is an ancient spice, one of the first recorded plants used for its seeds. It has been used for thousands of years and is still an oil seed of worldwide significance. This plant is a very drought tolerant crop. It has been called a survivor crop, with an ability to grow where most crop fail<sup>[3]</sup>.

*Sesamum indicum* is a flowering plant in the genus *sesamum*. Numerous wild relatives occur in Africa and a smaller number in India. It is widely naturalized in tropical regions around the world and is cultivated for its edible seeds which grow in pods. Sesame seed is considered to be the oldest oilseed crop known, domesticated over 5000 years ago<sup>[3]</sup>. Within Nigeria, sesame is called with different names in different localities. In northern part, it is called 'ridi', while Igalas, Idomas and Tivs call it 'Igogo', 'Ocha' and 'Ishwa' respectively. The Ibos call it 'Isasa' and Yorubas call it 'Ekuku' or 'Eeku'<sup>[4]</sup>.

*Sesamum indicum* is an annual plant which is a member of the family Pedaliaceae. It is an erect and hairy plant, which grows to 50 - 100cm in height, with the opposite leaves 4 to 14cm (1.6 to 5.5inches) long with an entire margin. The seed are oblong or ovate, slightly flattened<sup>[5]</sup>. The seeds are about 3 to 4cm long by 2 mm wide and 0.5 mm thick. They are broad lanceolate, to 5cm (2inches) broad at the base of the plant, narrowing to just 1cm (0.4inches) broad on the flowering stem. The flowers may vary in colour with some being white, blue and purple<sup>[5]</sup>. Sesame seeds are small in size.

The seed oil is a natural salad oil, requiring little or no winterization, and is one of the few vegetable oils that can be used directly without refining<sup>[6]</sup>.

Among the commonly used vegetable oils, sesame oil is known to be most resistant to oxidative rancidity<sup>[1]</sup>. It also exhibits noticeably greater resistance to autoxidation than would be expected from its content of tocopherols (vitamin E). Stability of unrefined sesame oil is attributed to the presence of endogenous phenolic antioxidants<sup>[7, 8]</sup>. Lignans and tocopherols, identified as major antioxidants in *Sesamum indicum* have also been reported to have protective effects against neurodegenerative disease<sup>[9]</sup>. The lignans such as sesamin, episesamin, sesaminol and sesamolin are major constituents of sesame oil and all have

chemically methylenedioxyphenyl group <sup>[10]</sup>. It ranks ninth among the top thirteen oilseed crops which make up 90% of the world production of edible oil <sup>[11]</sup>.

Antioxidants are a group of compounds that facilitate survival in plants and may promote the health of humans that consume the plants as food <sup>[12, 13]</sup>. In plants, the term antioxidant often refers to a wide range of flavonoids and phenolic compounds that vary from simple acids to highly polymerized compounds <sup>[14, 15]</sup>.

## MATERIALS AND METHODS

### Sample Collection and Preparation

The brown *Sesamum indicum* seeds were purchased from Argungu market, Argungu local government area of Kebbi State, Nigeria, while the white *Sesamum indicum* seeds were purchased from Nasko market, Nasko local government area of Niger State, Nigeria. The seeds were cleaned, dried and ground manually using a mortar and pestle. The powdered samples were then used for the oil extraction.

### Oil Extraction

The routine extraction of 50g of the ground sesame seeds was conducted in a Soxhlet extractor (Sontex Kontes, U.S.A) according to the method described by <sup>[15]</sup>.

### Determination of the Percentage Oil Yield

The total amount of oil obtained from the white and brown *Sesamum indicum* seeds by the complete distillation of the solvent on the heating mantle were transferred into a measuring cylinder. The measuring cylinder was then placed over water bath for 2-3 hours in order to evaporate completely the little solvent present in the oil which is in line with an earlier reported method <sup>[16]</sup>.

### Calculation

The percentage oil yield was calculated as follows:

$$\text{Oil content (\%)} = \frac{\text{Weight of oil}}{\text{Weight of sample}} \times 100$$

The extracted oil was kept in a clean container and later used for the analysis.

### Test for Flavonoids

2 mL of 10% sodium hydroxide was added to 2 mL of the oil extract in a test tube. An intense yellow color was formed which turned colorless upon addition of 2 mL of dilute hydrochloric acid indicating a positive result <sup>[17]</sup>.

### Determination of Total Flavonoids Content

The total flavonoids content was determined using a standard method <sup>[18]</sup>. 2.5g of the oil extract was mixed with 25 mL of 80% aqueous methanol. The whole solution was filtered through whatman filter paper. The filtrate was transferred to a crucible and evaporated to dryness over a water bath (HH-S Stainless Steel, Gallenkamp, U.S.A.) and weighed. All samples were analyzed in triplicates.

$$\text{Flavonoid (mg/g)} = \frac{\text{weight of residue}}{\text{weight of sample}}$$

### Determination of Antioxidant Potential by Ferric Reducing Antioxidant Power Assay

The ferric reducing power of oil extract was determined by using the potassium ferricyanide-ferric chloride method <sup>[19]</sup>. 2 mL of extract was added to 2.5 mL of potassium ferricyanide and the mixture was incubated at 50°C for 20minute. Then 2.5 mL of trichloroacetic acid was added to the mixture which was then centrifuged at 650g for 10minutes. To 2.5 mL of the supernatant, 2.5 mL of distilled water and 0.5 mL of ferric chloride were added. The absorbance was read using spectrophotometer (SMS 752s, Spectrum Lab. 23A Guflex, Medical and Scientific, England) at 700 nm. High absorbance indicates greater read using capacity and calculated as follows.

$$\text{Reducing power} = \frac{AM}{AC} \times 100$$

AM = Absorbance of reaction mixture

AC = Absorbance of control mixture (distilled water).

## RESULTS

The percentage yield (%) of the extracted white and brown *Sesamum indicum* seed oils were 47.85% and 20.72% respectively, while the results of the qualitative and quantitative screening of the flavonoid content are presented in Table 1. The results of the antioxidant potential of the white and the brown *Sesamum indicum* seed oils are presented in Table 2.

**Table 1: Qualitative and quantitative screening of flavonoid content of white and brown *Sesamum indicum* Seed oils**

White <i>Sesamum indicum</i>		Brown <i>Sesamum indicum</i>	
Qualitative	Quantitative(mg/g)	Qualitative	Quantitative(mg/g)
++	480±0.20 <sup>a</sup>	+	360±0.16 <sup>b</sup>

Note: +: present in small concentration; ++: present in moderately high concentration. The results for the quantitative screening are expressed as mean ± standard deviation of three replicates. Values with different superscript are significantly different (P<0.05), Student's t-test was used to compare the values.

**Table 2: Antioxidant Potential of White and Brown *Sesamum indicum* Seed oils**

Sample	Volume (mL)			
	1.0	0.75	0.50	0.25
White <i>Sesamum indicum</i>	96.8±1.71 <sup>a</sup>	91.0±2.57 <sup>a</sup>	83.1±1.03 <sup>a</sup>	77.9±1.76 <sup>a</sup>
Brown <i>Sesamum indicum</i>	70.7±2.57 <sup>b</sup>	65.2±3.47 <sup>b</sup>	55.4±1.80 <sup>b</sup>	50.2±2.61 <sup>b</sup>

The values are presented as mean ± standard deviation of three replicates. Values with different superscript along each column are significantly different (P<0.05), Student's t-test was used to compare the values.

## DISCUSSION

From the result, the percentage yield of white and brown *Sesamum indicum* seed oils were found to be 47.85% and 20.72% respectively. The percentage yield of the white seed oil is comparable with that obtained by <sup>[8, 20]</sup> which were 46.4% and 48% respectively. The seed oil content varies from 35-57% among different varieties of *Sesamum indicum* seed <sup>[21]</sup>. The percentage oil yield of the brown seeds is less than the value reported by <sup>[22]</sup> which was 40%, this might be as a result of differences in the climate of the cultivation area, type of soil, stage of ripening, harvesting time or the oil extraction method used.<sup>[8]</sup> The high percentage oil yield of the white seed makes it to be a distinct potential for an oil industry. Also the high percentage oil of the white seeds shows that; the processing of the oil for industrial or edible purposes would be economical. *Sesamum indicum* seeds have higher oil content (around 50%) than most of the known oil seeds <sup>[23]</sup>.

The results of the qualitative and quantitative screening of the flavonoid content of oil extract of the white and brown *Sesamum indicum* seeds shown in Table 1 indicated presence in both seeds; this is comparable with that obtained by<sup>[24]</sup>.

Flavanoids are most commonly known for their antioxidant activity. The presence of flavonoids in *Sesamum indicum* seed oil accounts for its antioxidant property as reported by [25].

The results of the quantitative screening of the total flavonoid content of the white and brown seed oils are  $480 \pm 0.20$  mg/g and  $360 \pm 0.16$  mg/g respectively. The presence of flavonoids indicates that, the oil will be good for the management of oxidative stress because, flavonoids are potent biological antioxidants. Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species, such as singlet oxygen, superoxide, peroxy radicals and peroxy nitrile. An imbalance between antioxidants and reactive oxygen species results in oxidative stress, leading to cellular damage [26]. The presence of flavonoids in *Sesamum indicum* seed oil also accounts for its use in inhibiting the replication of human colon cancer cells as reported by [27]. The natural *Sesamum indicum* seed oil has high stability due to the presence of high levels of these natural antioxidants [28].

Table 2 shows the result of the potential reducing power of the white and brown seed oils. Based on the results of the analysis at different concentration, the reducing power of both seed oils (which may serve as a significant reflection of antioxidant activity) decreases as the volume decrease. Statistically there is significant different when the reducing power of the white seed oil was compared with that of the brown. Thus, the white seed oil that has more flavonoid content than the brown seed oil has better reducing power, i.e. the white seed oil has better antioxidant activity when compared with that of the brown seed.

## CONCLUSION

This analysis with the n-hexane extract of *Sesamum indicum* seed oils reveals that the white seed is a good source of oil because it has high percentage of oil yield compared to the brown seed. This research also reveals the presence of flavonoids which have important therapeutic applications, especially been an active biological antioxidant. Both white and brown seed oils possess good reducing power *in-vitro* which makes them to have antioxidant activity, but the white *Sesamum indicum* seed oil has better antioxidant activity compared to the brown seed oil.

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