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# Physicochemical Properties and Fatty Acid Profile of *Hyptis spicigera* Seed Oil

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**Abstract:** *Hyptis spicigera* seed oil was characterized using GC-MS and UV-VIS spectrometry for its fatty acid composition, tocopherol content and physicochemical properties. The oil content was 21% while unsaturated fatty acids were linoleic acid (71.85%) and Palmitic acid (16.06%) as predominant fatty acids. Tocopherol content was 186.15 mg $mL^{-1}$ while Vitamin A was absent. This study showed potentials of *Hyptis spicigera* seed oil to have high oxidative stability which could be suitable for food and beverage as well as other industrial applications while the tocopherol content could improve human health.

**Key words:** *Hyptis spicigera*, GC-MS, UV-VIS, fatty acid profile, tocopherol, vitamin A

## INTRODUCTION

The plant, *Hyptis spicigera* belongs to the family Lamiaceae. It is an erect aromatic herb, up to 1 m in height with a terminal inflorescence in which the seeds are packed in quadruplets or more in the flowers. The seeds are very small and light and are very tiny brown/black seeds that clustered in groups of fours, fives or even more which are encased in each flower that make up the inflorescence. It is commonly called Black Beniseed or black sesame. The whole plant is used in traditional stores/barns to protect cowpea and maize against damage by *Callosobruchus* species (Lambert *et al*., 1985) by resource poor West-African farmers. It is also locally used as mosquito repellent by burning of the whole plant in enclosures (Dalziel, 1937).

The seeds and the leaves are eaten as vegetables because of its spicy aroma. Several researchers have reported on the volatile oils and the seeds of *Hyptis spicigera* to possess insecticidal, pharmacological and biological activity (Jo *et al*., 2009; Pendleton, 2007; Raja *et al*., 2001; Shaaya and Kostyukovsky, 2006; Sanon *et al*., 2006).

There is little or no available nutritional and physicochemical properties data of the oil seed despite its wide use by local natives in northern Nigeria. The aim of the present study therefore is to provide analytical data on some of the physical and chemical properties of the oil extracted from the *Hyptis spicigera* seeds for medicinal and nutritional utility.

## MATERIALS AND METHODS

**Material collection:** The plant was collected in Basawa Village, Zaria, Kaduna State, Nigeria. It was taxonomically identified and authenticated by Mr. U.S. Gallah of the Herbarium Section, Department of Biological Science, Ahmadu Bello University, Zaria, Nigeria. A sample Voucher No. 528 was deposited at the Herbarium Section.

**Lipid extraction:** The seed was rendered powdered using a pestle and mortar and 50 g weighed into a Soxhlet thimble and extracted with petroleum ether (40-60°C) according to the methods of Horowitz (1984) and Omoti and Okyi (1987). The solvent was concentrated *in vacuo* and allowed to dry in the fume hood to afford the oil.

**Physicochemical analysis:** The physicochemical properties (Refractive index, specific gravity, colour, iodine value, saponification value, acid value, free fatty acid, peroxide value) were determined using standard procedures of AOAC (1997). Tocopherol and vitamin A were determined using IUPAC (1979) and Pearson (1981) methods.

**Preparation of the fatty acids:** The oil was converted to fatty acid methyl esters (FAME) using Potassium hydroxide/Methanol method. The FAME was extracted and dissolve in hexane for the GC-MS analysis.

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**GC/MS analyses of the fatty acids:** The fatty acid methyl esters of the oil were analyzed by GC/MS (Shimadzu QP2010 Series) adopting the following analytical conditions: Column: cross-linked 5% phenyl methyl silicone (DB-WAX 30 m ×0.25×0.25 μm). Carrier gas: helium at flow rate 0.90 mL $min^{-1}$; injector temp program was 100°C for 2 min then increased to 190°C at 4°C $min^{-1}$. Identification of the fatty acids was achieved by retention times when compared with authentic standards analyzed under the same conditions and relative percentages of each fatty acid was determined based on peak area measurements.

## RESULTS AND DISCUSSION

Table 1 showed the physicochemical properties of the oil with the following properties: refractive index (1.4950) which is in close agreement with other drying oils that exhibit values of 1.48 and 1.49 (Duel, 1951), respectively. Iodine value of 81.22 g $I_2$/100 g is an indication that the oil contains unsaturated fatty acids which is close to the iodine value of peanut oil of 86 g $I_2$/100 g.

The peroxide value (1.95 meq. $H_2O_2$) showed the oil to be stable to oxidative degradation cause by over exposure to oxygen, heating and improper storage. Peroxide value depends on a number of factors such as oxidation by oxygen, extraction methods and storage. It is a measure of degree of lipid prone to oxidation in fats/oil. Acid and free fatty acid values (2.25 and 3.5%) of the oil are within tolerable limits required for oil that will be lost during refining steps designed to remove fatty acids. These values are relatively low compared to almond (7.6 mg KOH $g^{-1}$) and similar to that of fluted pumpkin (3.5 mg KOH $g^{-1}$) (Dhellot *et al*., 2006).

The oil has four main fatty acids namely: palmitic acid (16.0%), Stearic acid (3.53%), Linoleic acid (71.85%) and Myristic acid (6.40% with linoleic acid being the most abundant. Its high content of linoleic acid is of particular interest especially in the fight against cardiovascular diseases and also as a good source of edible oil. Linoleic acid contents in sesame oil (35-50%), palm oil (10.5%) and palm kernel oil (2.3%) and other oils used as food additives have health promotive properties (Kapseu and Parmentier, 1997; Rocquelin *et al*., 1998).

*Hyptis spicigera* seed oil with high linoleic levels is also potentially useful as food additive and can be converted to gamma-linolenic acid that could be used as a dietary supplement to increase the production of anti-inflammatory l-series prostaglandins (Wretenjo and Karlberg, 2002). Fatty acid profile of the *Hyptis spicigera* is shown in Table 2.

Table 1: Physicochemical properties of *Hyptis spicigera* seed oil

| Analysis | Results |
|---|---|
| Colour | Golden yellow |
| Texture at 27°C | Liquid |
| Specific Gravity at 20°C | 0.9261 |
| Refractive index | 1.4950 |
| Lipid content | 21% |
| Iodine value | 81.22 g $I_2$/100 g |
| Saponification value | 154.10 mg KOH $g^{-1}$ |
| Acid value | 2.25 mg $g^{-1}$ |
| Free fatty acid | 3.50% |
| Peroxide value | 1.95 meq $H_2O_2$ |
| Tocopherol (Vitamin E) | 186.15 mg $mL^{-1}$ |
| Vitamin A | -0.025 mg $mL^{-1}$ |

Table 2: Fatty acid profile of the *Hyptis spicigera* seed oil

| Name | Retentiontime (mins) | Area (%) |
|---|---|---|
| Palmitic acid | 16.035 | 16.06 |
| Linoleic acid | 17.788 | 71.85 |
| Stearic acid | 17.943 | 3.53 |
| 1-Undecanol | 18.136 | 6.40 |

Industrial Trans Fatty Acid (TFA) consumption is believed to increase cardiovascular risk in multiple ways such as having adverse effects on blood lipoprotein profiles and Coronary Heart Disease (CHD) risk impacting in individuals and population (Uauy *et al*., 2009). Oils rich in linoleic acid are more effective in enhancing contents and yields of vaccenic acid and conjugated fatty acids in milk fat than oils (Bu *et al*., 2007). The oil of *Hyptis spicigera* seed therefore is a potential oil that can be used in the modification of cow's diet for improve intake. Globally, current dietary recommendations are geared towards assisting consumers choose low fat low saturated fat diets that are beneficial for cardiovascular health (FAO, 1994).

The vitamin E content of *Hyptis spicigera* oil is relatively high (186.15 mg $mL^{-1}$) than in sesame oil (1.40 mg $g^{-1}$) and sunflower oil (41.08 mg $g^{-1}$). Vitamin E is an antioxidants which have been correlated with lowering of cholesterol levels. Though the oil is rich in vitamin E, there is an insufficient research finding on the medicinal properties of *Hyptis spicigera* oil. Vitamin A is absent in the oil like cottonseed, sesame, sunflower oils but present in other oils (soybean oil 1 μg) palm oil amongs others.

## CONCLUSION

From the analytical data obtained, it showed that *Hyptis spicigera* seed oil is rich in linoleic fatty acid and vitamin E and therefore is a potential source of vitamin E and linoleic acid which could find use in reducing the risk of Coronary Heart Disease (CHD). Also the physicochemical properties of the oil showed the oil to be similar to other vegetable oils and is a potentially valuable non-conventional source for high quality oil needed by

the oleochemical and pharmaceuticals industries. There is the need for toxicity evaluation of the oil to gurantee its consumption by humans.

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