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Nutritional Composition and Fatty Acids Analysis of *Senna Singueana* Leaves and Seeds

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Abstract
The proximate analysis and fatty acid composition of seeds and leaves were determined by analyzing samples of identified leaves and seeds of *Senna Singueana* using A. O. A. C (1990) methods. The results of analysis showed that the seeds of *Senna Singueana* contain crude protein (14.88%), crude fiber (15.85%), moisture (4.07%), total ash (7.67%), total carbohydrate (55.68%), total sugar (.078%) and total oil percentage (1.85%).The results of proximate analysis of, *Senna Singueana* leaves showed that the crude protein (11.38%), crude fiber (1.36%), moisture (2.92%), total ash (6.93%), total carbohydrate (74.09%), total sugar (.08%) and total oil percentage (3.32%) The fixed oils extracted from seeds and leaves were evaluated for chemical composition. The GC-MS analysis showed the presence of various saturated and unsaturated fatty acids such as Stearic acid (5.330%), Oleic acid methyl ester (1.986%), Behenic acid methyl ester (3.06%) and palmatic acid methyl ester (1.515%) of *Senna Singueana* leaves and the fatty acid found in the Seeds part were Eicosanoic acid, methyl acid (4.17%), Hexadecanoic acid, methyl acid (1.515%), Teteracosanoic acid, methyl acid (3.64%) and 16 - Octadecenoic acid, methyl ester(26.01%). Also leaves and seeds indicate the presence of calcium (Ca), magnesium (Mg), iron (Fe), zinc (Zn), magnesium and copper at different concentrations.

1. Introduction

Senna Singueana is belong to *Fabaceae* family a shrub or small tree 1-15 m high; branchless glabrous to densely pubescent, crown open; bark reddish, becoming grey brown and rough with age. Leaves compound, with 4-10 pairs of oval leaflets, 2.5-5 cm long, rachis with a conspicuous gland between each pair of leaflets, rounded at apex, glabrous or nearly so to densely pubescent. Flowers deep yellow, fragrant, in racemes to 15 cm, often aggregated towards branchlet-ends and often produced when the plant is leafless; flower stalks 2-4 cm, with conspicuous glands. Pods linear, straight or somewhat twisted, torulose, slightly compressed, 5- 26 cm long, indehiscent, with stiff and rather hard valves, glabrous to pubescent, rounded to abruptly acute and often apiculate at apex; yellowish when ripe. Seeds dull brown, almost circular, flattened, 5-6 mm in diameter, with a small areole 2-2.5 x 1-1.5 mm on each face. Website (Africa free database). The root bark is used in Tanzania against convulsions, gonorrhea, bilharzias,

heartburn, stomach-ache, constipation, wounds and snake bites. The ash from the burnt roots mixed with porridge provides a remedy for stomach pains Pods are edible raw or cooked, whereas leaves are eaten as a vegetable and Leaves, pods and seeds are fed to livestock.

The aim of this study was to find out the nutritional value, minerals concentration and fatty acids composition of one of the most popularly known tropical plants, *Senna Singueana* for two part of the plant (leaves and Seeds) has been carried out by analyzing samples of the plant leaves and seeds collected from Angassna city blue Nile province for chemical composition.

2. Materials and Methods

The leaves of *Senna Singueana* were collected from Angassna city Blue Nile province and identified in the science herbarium of the Department of International Research Center Medicinal and Aromatic Plants Institute the leaves and seeds were sun dried for about five days and then grounded into fine powder using a food blender. The grounded samples were stored in an air-tight labeled plastic container from which samples were removed for chemical analysis.

2.1. Proximate Analysis of Plant Samples

The proximate analysis of the powdered plant samples for protein, fat, fiber, ash and dry matter was determined using the methods described in AOAC (1990).

2.2. Preparation of Methyl Ester

The methyl ester was prepared according to method described by Christie, 1990.

GC- MS and GC-FID identification of methyl ester:

Gas Chromatography Mass Spectrometer was performed using Shimadzu instrument (GC- MS- QP- 2010) fitted with electron impact (EI 1.70 eV) mode. The analytical column was RTX 5 (5% phenyl - 95% dimethyl polysiloxane with length of 30 meter x 0.25 µm). Helium gas was used as a carrier gas at a flow rate of 1ml/min. the temperature was programmed at 50 ˚C for 3 min then increased to 280 ˚C at the rate of 5˚C/min. The temperature of injector was 250 ˚C. Then a result was taken after comparison with NIST27 library for GC-MS.using mixture of standard.

2.3. Mineral Analysis

Minerals were analyzed by dry-ashing 1 g of the sample at 550° C in a furnace. The ash obtained was dissolved in 10% HCl, filtered through an acid-washed filter paper and made up to standard volume with dionized water. Sodium, potassium, calcium, magnesium, manganese, zinc, copper and iron contents were determined using atomic absorption spectrophotometer (Perkin Elmer A100) the methods described by AOAC (1990).

3. Results and Discussion

The results of the determination of the proximate and fatty acids of *Senna Singueana* leaves and seeds are represented in Table 1, 2 and 3 respectively.

Table 1. *Proximate composition and nutritional data of Senna Singueana leaves and seeds.*

Parameters	Senna Singueana (Leaves)	Senna Singueana (seeds)
Crude protein	11.38	14.88
Crude fiber	1.36	15.85
Ash	6.93	4.07
Ether extract	3.32	1.85
Moisture	2.92	4.07
Carbohydrate	74.09	55.68
Total Sugar	.0800	.070

3.1. Nutritional Value

Seed of *legumes* family are generally considered to be rich in protein, energy, vitamin and minerals. In the present study, crude protein of *Senna Singueana* seeds (14.88%) was slightly higher than the value (11.38%) of *Senna Singueana* leaves so both seeds- leaves can contribute to the formation of hormones which controls a variety of body functions (Mau *et al.,* 1999) in this study the values of crude protein obtained was higher than values (2.3%) of *Senna-Occidentalis* but low when compared with *Senna Obtusifolia* (18.46%) reported by Ismaila *et al*. (2011).

The crude fiber value (15.85) of *Senna Singueana* seeds was higher than *Senna Singueana* leaves (1.36%).The comparison of crude fiber of this seeds is slightly higher than *Senna Obtusifolia* (2.45%) and lower than *Senna Alata* (25%), *Senna Hirsute* (40%) reported by (U. A. Essiett, *et al*. 2013).

The moisture content of *senna Singueana* seeds (4.07%) was high than the leaves (2.92%) the result of moisture content in two part of the plant was not high indicates less chances of microbial degradation of the drug during storage because excess moisture can result in the breakdown of important constituents by enzymatic activity and as a result may encourage the growth of yeast and fungi during storage (African Pharmacopoeia, 1986), as such the moisture content (%) of 12.5, 13.5, 13 in *S. alata, S. hirsuta and S. obtusifolia* respectively. In general requirement for moisture content in crude drug was that, it should not be more than 14% since it was normal, and implies that the plants can be stored for longer period with lower change of microbial attack.

The total ash value of *senna Singueana* seeds was (7.67%) and leaves was found to be (6.93%) this implies that plants have normal complexes of inorganic and organic compound (British Pharmacopoeia, 1980) as such as ash content of the total ash value was 6, 11, and 9 % in *S. alata*, *S. hirsuta* and *S. obtusifolia* respectively (U. A. Essiett, *et al*. 2013).

Total carbohydrate of *senna Singueana* leaves (74.09%) was higher than that found in seeds (55.68%) the two part of the plant have high carbohydrate when compared them with

senna. Alata (53.7%), *Senna. Hirsuta* (42%) and *Senna. Obtusifolia* 40%). The relatively high carbohydrate content can be used as energy sources and also it is necessary in the digestion and assimilation of other food; however *Senna Singueana* contains essential nutrients for good human and animal health (U. A. Essiett, *et al*. 2013).

3.2. Fatty Acids Composition of *Senna Singueana* Leaves and Seeds

Identification and quantification of fatty acids were identified as their methyl esters by searching the potential structures Fatty acids from NIST MS Search 2.0 database.

Table 2. *Fatty acids Composition of Senna Singueana leaves.*

Fatty acid	Fatty acid percentage (%)
Tetracosanoic acid, methyl ester	3.64
16- octadecenoic acid, methyl ester	26.01
Pentadecenoic M.E	.970
Palmatic acid M.E	1.515
Eicosanoic acid,methyl ester	4.17
Oleic acid M.E	1.986
Octacosanoic acid, methyl ester	.770
Stearic acid M.E	5.330
Tricosanoic acid,methyl ester	.430
Octacosanoic acid, methyl ester	.770
Behenic acid M.E	3.06
Tricosanoic acid M.E	.1790

Table 3. *Fatty acids Composition of Senna Singueana seeds.*

Fatty acid	Fatty acid percentage (%)
Myrisoleic acid M.E	.0950
cis-10-Pentadecenoic M.E	.5060
Pentadecenoic M.E	.0940
palmitoleic acid M.E	.2770
Palmatic acid M.E	1.515
Cis-10-Heptadecenoic acid M.E	.3230
Oleic acid M.E	1.986
Elaidic acid M.E	1.245
Arachidnoic acid M.E	1.798
Heneicosanoic acid M.E	.2230
Behenic acid M.E	.2920
Tricosanoic acid M.E	0.179
Stearic acid M.E	5.330

M.E: Methyl Ester

Fatty acids, both free and as part of complex lipids, play a number of key roles in metabolism – major metabolic fuel (storage and transport of energy), as essential components of all membranes, and as gene regulators. (Mankilik. Mhya.2014). As in table (2) and (3) for leaves and seeds respectively the leaves of *Senna Singueana* which contain high concentration of 16-octadecenoic acids methyl ester (26.01%), stearic acid methyl ester (5.3 %) and behenic acid, methyl ester (3.06%) while the seeds part the fatty acids which showed high concentration were stearic acid methyl ester (5.330 %) and oleic acid methyl ester 1.986 %) compared this result with other species the results showed that The extracted seed oil of *Cassia* species contained significant amount of linoleic acid (45.96% to 60.25 %), which is the one of the most important unsaturated fatty acid. Oleic acid was second major unsaturated fatty acid (34.91% in *Cassia laevigata*, 34.80% in *Cassia javanica* and 30.11% in *Cassia alata* and 26.29 % in *Cassia absus*) except in *Cassia roxburghii* where the percentage of oleic acid and linoleic acid were 46.08% and 45.96 % respectively. Palmitic acid and stearic acid exhibited the third and fourth highest FA content and ranged between 16.41% to 2.61% and 1.62 % to 8.10% respectively. Minor percentage of linolenic acid was observed in *Cassia absus* (1.96%) and in *Cassia roxburghii* (1.28%). (Lalita Ledwani and Shelley Oberoi, 2010).

3.3. Minerals Content of *S. Singueana* Leaves and Seeds

The elemental analysis result (Table 4) shows the presence of calcium (Ca), magnesium (Mg), iron (Fe), zinc (Zn), magnesium and copper at different concentrations in the plant parts all the elements tested for were present in *Cassia Singueana.* The concentrations of the essential elements appear to be within safety limit according to W.H.O (1996) the elements (Mg, Ca, Cu, Mn) are used extensively in chemotherapy and are essential in human and animal health. Magnesium and calcium are known to help in bone and teeth development (Khan, 1996; Ogugbuaja *et al., 1997*). (calcium was the predominant macronutrient element (600 – 8.3620 ppm), for leaves and seeds respectively followed by magnesium (2850 – 55.6 ppm) for leaves and seeds respectively, The concentration of metals were compared with *Cassia Siberiana* reported by (Adeyanju *et al*, 2012).

Table 4. *Mineral concentration of Senna Singueana leaves and seeds.*

Plants part	Element	Cu	Fe	Mn	Mg	Zn	Ca
Leaves	Concentration	5.90	270	38	2850	16	600
Seeds	Ppm	0.1965	2.038	0.2272	55.6	0.1796	8.3620

4. Conclusion

The results of nutritional composition of *Senna Singueana* leaves and seeds suggest that, this plant if consumed sufficiently could contribute greatly towards meeting human nutritional requirement for normal body growth in Sudan. Moreover, results of minerals content study suggest that *Senna Singueana* leaves and seeds might be considered as good sources of natural minerals and fatty acids which are essential in the human diet that could help in the prevention of some diseases like anemia. Thus, this study may provide valuable information on the potential application of *Senna Singueana* leaves and seeds in the nutritional and pharmaceutical industries.

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