

Evaluation of Nutrient and Anti-nutrient Components of Coffee Senna (*Senna occidentalis* (L)) Seed Meal in Mubi

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ABSTRACT

Senna occidentalis is an indigenous wild legume whose seeds have been reported to contain good nutritional profile, however, the leaves, pods and seeds have been observed to be avoided by most species of livestock probably indicating its potential for toxicity and therefore the need to evaluate the chemical properties of the seed meal before recommending it as feed ingredient for livestock feeding. The proximate composition and level of anti-nutritional factors of *Senna occidentalis* seed meal (SOSM) was evaluated using standard method of analysis while the amino acid profile of the seed meal was determined using isocratic high performance liquid chromatography (HPLC) equipment. The seed meal was found to contain dry matter (94.00%), crude protein (20.70%), crude fibre (9.80%), ether extract (2.30%) ash (5.70%) and nitrogen free extract (55.80%). The seed meal indicated good array of amino acid with lysine (4.20g), phenylalanine (4.30g), glycine (4.70g), valine (5.30%) and glutamic acid recording the highest values. Methionine (1.35g), cysteine (0.70g) and proline (1.75%) are the limiting amino-acids observed in the seeds. The seed meal was found to contain anti-nutritional factors with tannins recording the highest value (4.10g/100g) followed by phytates (4.30g/100g) while oxalates was the least (2.50g/100g). It can be concluded that SOSM may serve as a potential cheaper alternative protein source for livestock especially monogastric animals. It is therefore recommended that the seeds of *Senna occidentalis* be adequately detoxified by using suitable processing treatments such as boiling, soaking and fermentation. Further studies on the characterization of the phytochemical components and methods of detoxification are required.

KEYWORDS: Evaluation, nutrients, anti-nutritional factors, coffee senna, seed meal, *Senna occidentalis*

Introduction

The rising feed crises in the Nigerian livestock industry can be addressed by harnessing the nutritional potentials of wild legumes that are predominant in Nigeria. Adegbenro *et al.* (2011) buttressed the need to exploit some under-utilized seeds which are possible replacers for the expensive protein and energy sources that are utilized in nourishing domestic animals. Aletor and Agbede (2005) further pointed out that legumes seeds are found throughout the world but the greater number grow in the tropics and sub-tropics where they contribute substantially to dietary protein consumption.

Senna occidentalis seed may be an alternative protein source for livestock and therefore there is need to focus attention on assessing the chemical composition of the seed meal before recommending it to livestock farmers. *Senna occidentalis* is a pan tropical plant species that belongs to the family of *Fabaceae*, subfamily *Caesalpinioide* and genus *Senna*. The flower is ovate yellow (USDA, 2004; Wikipedia, 2016). Information on the chemical composition of the seed meal seems to be scanty hence the need to bridge such information gap. In view of the above, this study was designed to evaluate the nutrients and anti-nutritional components of *Senna occidentalis* seed meal (SOSM) indigenous to Mubi.

Materials and Methods

Identification and collection of Senna occidentalis seeds

Senna occidentalis plant and the seeds were identified at the Department of Biological Sciences Adamawa State University, Mubi by a Botanist. The dried matured pods containing the seeds of *Senna occidentalis* were harvested from the bushes around Mubi area of Adamawa State. Mubi is located between latitudes 9°30' and 11° North of the equator and longitudes 13° and 13° 45' East of the Greenwich meridian. The temperature regime in Mubi region is warm to hot throughout the year however, there is usually a slight cold period between November and February. There is a gradual increase in temperature from January to April. The minimum and maximum temperatures of the area are 18.1°C and 32.8°C. The mean annual rainfall ranges from 900-1050 mm (Adebayo, 2004).

Sample preparation

The pods were properly threshed and the seeds were removed and cleaned of dirt. The seeds samples were properly dried, milled and sieved using a 1mm sieve. The seed meal was properly stored prior to the commencement of the analysis.

Analytical procedure

The proximate composition of *Senna occidentalis* seed meal was determined using the standard procedure of Official Association of Analytical Chemist [AOAC] (1990). The dry matter content was determined using the oven dry method and the crude protein was determined using the Kjeldahl method. Soxhlet extraction method was used for the determination of ether extract and the fibre content was evaluated using the defatting and reflux method. The ash content was determined using the muffle furnace ignition method, while nitrogen free extract (NFE) was computed indirectly by using the formula:

$$\text{NFE} = 100 - (\text{Moisture} + \text{CP} + \text{CF} + \text{EE} + \text{Ash})$$

Where:

CP= crude protein

CF = crude fibre

EE = ether extract

The level of anti-nutritional factors was determined using the standard methods of AOAC (1990). The amino acid profile was analyzed using isocratic high performance liquid chromatography (HPLC) equipment BLC 10/11 model using the procedure described by Pearson (1991).

Results and Discussion

The result of the proximate composition of *Senna occidentalis* seed meal is presented in Table 1. The seed meal was found to contain high dry matter content 94%. This is an indication that it may have less storage problem. This was supported by Yashim *et al.* (2009) who attested that high dry matter content of a feedstuff increase shelf life of the ingredient. Ingweye *et al.* (2010) further buttressed that high value of dry matter of feedstuff will reduce the cost of handling and ensure long term storage. The dry matter content obtained in this study is slightly higher than 92.5% of *Senna obtusifolia* (a close relative of *Senna occidentalis*) as reported by Ingweye *et al.* (2010).

Table 1: Proximate Composition of *Senna occidentalis* Seed Meal

Proximate content	Composition (%)
Dry matter	94.00
Crude protein	20.70
Crude fibre	9.80
Ether extract	2.00
Ash	5.70
Nitrogen free extract	55.80

Senna occidentalis seed meal had protein content of 20.70% which qualifies it to be an alternative cheaper protein source for livestock. This agreed with earlier report of Aletor and Agbede (2005) that under-utilized seeds are rich in nutrients such as protein with good array of amino-acids. The protein content of the *Senna occidentalis* seed meal is slightly lower than the protein value (29.54%) of its close relative *Senna obtusifolia* (Ingweye *et al.*, 2010). However, the protein content of the seed meal is within the range (20 – 50%) for most legumes (Ustimenko – Bakumonsky, 1983). The crude protein value of *Senna occidentalis* seed meal is however within the range (7.34 – 21.25%) reported by Adegbenro *et al.* (2011) for some under-exploited wild legumes (*Sphenostylis stenocarpa*, *Mucuna pruriens*, *Phaseolus lunatus*, *Cajanus cajan* and *Lecaniodiscus cupanioides*).

The *Senna occidentalis* seed meal was observed to exhibit fairly high crude fiber (9.8%). This is a clear indication that its utilization as a feed ingredient for livestock may be limited by the fibre level. Monogastric animals may find difficulties in digesting the seed meal. However, processing of the seed meal may improve digestibility and utilization of the seed meal. The fibre content of the seed

meal is within the range (5.26 – 15.26%) reported by Adegbenro *et al.* (2011) for most wild legumes.

The *Senna occidentalis* seed meal showed a very low ether extract (2.00%) which is similar to that of *Senna obtusifolia* (2.31%) seed meal reported by Ingweye *et al.* (2010). The ether extract is also lower than the range (3.77 – 7.04%) for some related lesser-known legumes reported by (Aja and Madubuike, 1997; Vadivel and Janardhanan, 2000; Umoren, *et al.*, 2005; Bawa, *et al.*; 2007; Tuleun and Patrick, 2007).

The *Senna occidentalis* seed meal was found to contain high nitrogen free extract (55.8%). This is an indication that the seed meal may also be rich in carbohydrate. This suggests that the inclusions of the seed meal in livestock diets may elevate the energy value of the diet and nourish the animal with the required energy.

Table 2: Amino acid Profile of *Senna occidentalis* Seed Meal

Amino acid	Composition(g/100)
Lysine	4.20
Methionine	1.32
Threonine	2.85
Isoleucine	3.24
Leucine	3.64
Phenylalanine	4.33
Valine	5.34
Histidine	2.85
Arginine	2.80
Serine	2.97
Cysteine	0.70
Tyrosine	3.20
Alanine	3.70
Aspartic acid	3.05
Glutamic acid	9.95
Glycine	4.70
Proline	1.75

The amino acid profile of *Senna occidentalis* seed meal is summarized in Table 2. The seed meal possesses fairly high lysine (4.2%), leucine (4.33%), valine (5.34%) glycine (4.7%) and glutamic acid (9.95%). The *Senna occidentalis* seed meal however showed inferior methionine (1.35%) and proline (1.75%) content. This indicates that, the use of the SOSM as feed ingredient for animal especially monogastric animals requires adequate methionine supplementation. The amino acid profile on general trend revealed that *Senna occidentalis* seed meal had good array of amino acid profile which qualifies it to be an alternative quality animal protein source. The amino-acid profile of *Senna occidentalis* seed meal obtained in this study is comparable to that of *Senna obtusifolia* seeds and *Detarium microcarpum* (Obun and Kehinde, 2011; Ingweye *et al.*, 2010)

The anti-nutritional factors of *Senna occidentalis* seed meal are shown in Figure 1. The result indicated that it contains some toxic components which could be harmful to livestock when consumed beyond certain threshold. The seed meal was found to contain high levels of tannins followed by phytates and flavonoids. Tannins and total free phenolics were reported to decrease digestibility of proteins, carbohydrate and the availability of vitamins and minerals (Liener, 1994). These anti-nutritional factors also decreased the activities of digestive enzymes and may cause damage to the mucosa of digestive tract and reduced the absorption of nutrients (Doss *et al.*, 2011).

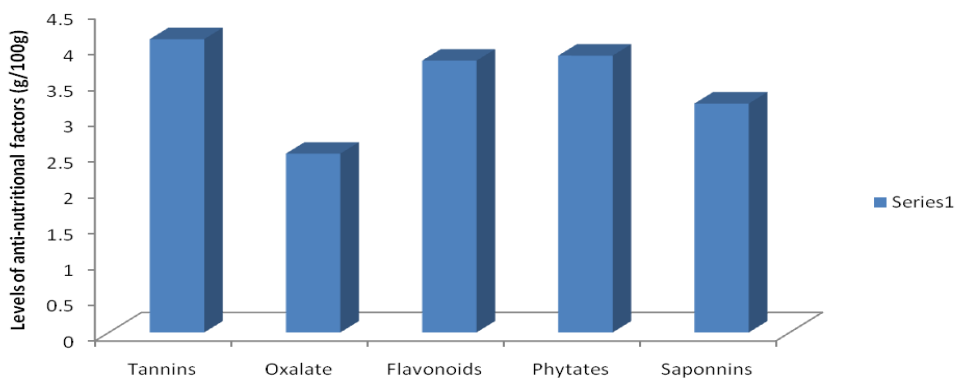


Figure 1 : Anti-nutritional factors of raw *Senna occidentalis* seed meal

Conclusion

Senna occidentalis seed meal was found to exhibit good nutritional properties even though the presence of anti-nutritional factors (tannins, oxalates, flavonoids, phytates and saponins) may limit optimal utilization of the seed meal as feed ingredient for domestic animals. In conclusion *Senna occidentalis* seed meal may serve as a cheaper alternative feed ingredient for livestock if it is processed. Further studies are required especially on the characterization of the anti-nutritional factors of the seed meal and methods of detoxification.

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