Chemical Composition of Sickle Pod (*Senna obtusifolia*) and Coffee Senna (*Senna occidentalis*) Leaves Indigenous to Mubi

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Abstract: A study was conducted to evaluate the chemical composition of *Senna obtusifolia* and *Senna occidentalis* leaves. Freshly harvested *Senna obtusifolia* and *Senna occidentalis* leaves were properly air-dried under shade in triplicates. They were milled into powder, properly sieved and taken into the laboratory for analysis. The samples were analysed in triplicates for their proximate composition, amino acid profile and levels of anti-nutritional factors using standard laboratory procedures. The results revealed that *Senna obtusifolia* and *Senna occidentalis* leaves had dry matter and crude protein content of 90.50 and 91.30% and 19.55 and 17.55%, crude fibre 14.16 and 15.02%, ether extract 3.15 and 3.45% and nitrogen three extract of 38.06 and 39.60%, respectively. The leaves were also observed to have good array of amino acid. The lysine and methionine content of the leaves which are the major limiting amino acid in most plant feeds are quantitatively observed to be 3.59 and 4.13% and 1.55 and 1.37g/100g. The *Senna obtusifolia* and *Senna occidentalis* leaves also contained some anti-nutritional factors such as tannins (1.85 and 3.32g/100g), phytates (3.70 and 3.85g/100g), oxalates (1.38 and 2.87g/100g), saponins (3.40 and 3.81g/100g) and phenols (8.15 and 15.03g/100g), respectively. It can be concluded that *Senna obtusifolia* and *Senna occidentalis* have good nutritional properties but *Senna obtusifolia leaves* appeared to possess superior nutritional values than *Senna occidentalis leaves*. It was also observed that the leaves contain some toxic factors that may adversely affect nutrient utilization and overall animal performance. The leaves should therefore be processed before incorporation into the diets of domestic animals and aquaculture species.

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Introduction

The scarcity and high cost of conventional feed materials have been the major problem confronting livestock production in Nigeria. Nsa *et al.* (2011) further stressed that conventional feedstuffs especially protein ingredients are becoming scarce and expensive. This has placed limitation on the growth of the Nigerian livestock industry. Therefore, the use of under-utilized unconventional feed resources will go a long way in addressing the feed crises in Nigeria.

Senna obtusifolia and *Senna occidentalis* are wild legumes that belong to the family *leguminosae caesalpinioideae*. *Senna obtusifolia* commonly called sickle pod or African foetid cassia, is an annual or perennial herb or shrub that grows to about 20.25 cm tall. *Coffee Senna* (*Senna occidentalis*) is also an erect, hairless shrub growing up to about 100 cm high. The leaves are compound pinnate, alternate and about 10-15 cm long (Akobundu and Agyakwa, 1998; Wikipedia, 2017).

Before the leaves of *Senna obtusifolia* and *Senna occidentalis* can be recommended as feed resource, it is important to thoroughly investigate the chemical properties to forestall any nutritional problems that may arise after consumption. Furthermore, environmental and genetic factors can influence the chemical properties of plants (Santosh and *et al*., n.d) and therefore it is important for animal nutritionists to analyze the chemical composition of feed materials in their localities before recommending them for livestock feeding. At the moment, there appears to be scanty information on the chemical composition of *Senna obtusifolia* and *Senna occidentalis* leaves hence the need to conduct more studies and provide more relevant information on their chemical properties. It was in view of the above that this study was conducted to investigate the chemical properties of *Senna obtusifolia* and *Senna occidentalis* indigenous to Mubi Area of Adamawa State, Nigeria.

Materials and Methods

Study area

The leaves were harvested with the aid of a sickle in bushes around Mubi Area of Adamawa State, Nigeria. The area 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 and the mean annual rainfall ranges from 900 to 1050 mm (Adebayo, 2004).

Collection and preparation of *Senna obtusifolia* and *Senna occidentalis* leaf meals

Senna obtusifolia and *Senna occidentalis* leaves were harvested in bushes around Mubi Area of Adamawa, State Nigeria and were authenticated at the Department of Botany, Adamawa, State University, Mubi, Nigeria. The leaves were properly air-dried under shade, in triplicates, milled into powder and taken into the laboratory for analysis.

Chemical Analysis

Proximate composition of the *Senna obtusifolia* leaves was determine using standard laboratory procedures of AOAC (2004). The Kjeldahl procedure was used to determine the crude protein content. The dry matter was determined first by obtaining the moisture content using the vacuum oven-dried method and the dry matter was determined by difference using the formula:

Dry matter = 100 - % moisture.

The ashing procedure as described by Onwuka (2005) was used to determine the ash content. The defatting boiling and reflux procedure was used to determine the crude fibre. Soxhlet fat extraction method was carried out to determine the ether extract. The nitrogen-free extract (NFE) was obtained by difference using the formula shown below:

NFE=100- (%moisture + CP + CF + EE + Ash)

Where:

CP = crude protein,

CF = crude fibre

EE = ether extract

The energy values of the leaves were calculated using the formula of Pauzenga (1985), ME (kcal/kg) = 37 x %CP + 81 x %EE + 35.5 x %NFE

The levels of the anti-nutritional factors and amino acid profile were determined using the chromatographic methods specifically the high power liquid chromatography (HPLC) Buck Scientific BLC 10/11 model (Pearson 1991).

Experimental Design

Each representative sample was randomly analyzed in triplicates in a completely randomized design (CRD).

Statistical Analysis

Data obtained were analyzed using a software statistical package (Statistix, 9.0) and the values were expressed as means with their standard errors.

Results and Discussion

The proximate composition of *Senna obtusifolia* and *Senna occidentalis* leaves is presented in Table 1. The result indicated that both leaves recorded high dry matter content. The dry matter content of *Senna obtusifolia* leaves obtained in this study are close to the values of 87.18 and 93.51% reported by Kubmarawa *et al*. (2011) and Yakubu *et al.* (2017). The high dry matter content of both leaves is an indication that the leaves might have less storage problems. This is consistent with the report of Augustine *et al.* (2017) for *Senna obtusifolia* seeds. Adjoudji *et al.* (2005) further buttressed that high dry matter content of leaves is an advantage for the conservation of the dry leaves.

Table 1: Proximate composition of *Senna obtusifolia* and *Senna occidentalis* Leaves

Proximate composition (%)	SOL	SOCL
Dry matter	90.50±2.3	91.30±9.51
Crude protein	19.55±3.11	17.25±3.88
Crude fibre	14.76±1.05	15.03±2.21
Ether extract	3.15±0.18	3.45±0.16
Ash	8.20±2.31	7.80±1.11
Nitrogen-free extract	38.06±4.71	39.60±2.99
Energy (kcal/kg)	2329.03±8.33	2323.50±1.51

SOL = *Senna obtusifolia* leaves; SOCL = *Senna occidentalis* leaves.

The outcome of this investigation showed that *Senna obtusifolia* and *Senna occidentalis* leaves are fairly rich in protein and can be used as alternative protein sources for feeding livestock especially monogastric animals. However, *Senna obtusifolia* leaves appeared to contain more protein than *Senna occidentalis* leaves. The protein content of *Senna obtusifolia* leaves obtained in this study is however, lower than the value (21.40%) reported by Adjoudji *et al.* (2005) but higher than the value (11.63%) reported by Kubmarawa *et al.* (2011). The variations in some of the proximate composition might be attributed to differences caused by environmental and genetic factors as earlier reported by Santosh *et al.* (n.d). The crude protein content of *Senna obtusifolia* and *Senna occidentalis* leaves are close to the range

of 21-30% for many leafy vegetables as reported by Lucas (1988) and Falade *et al.* (2004).

The crude fibre content of *Senna obtusifolia* and *Senna occidentalis* leaves reported in this study are however, lower than the value of 27.07% reported by Kubmarawa *et al.* (2011), but close to the value of 13.90% reported by Adjoudji *et al.* (2005). This variation might be attributed to the stage at which the leaves were harvested which is consistent with the findings of Adjoudji *et al*. (2005) for *Senna obtusifolia* leaves. The fairly moderate fibre content of the leaves might be an advantage in monogastric nutrition.

The ether extract content (Lipid content) of *Senna obtusifolia* and *Senna occidentalis* leaves observed in this study is lower than the value of 4.8% reported by Adjoudji *et al.* (2005) but close to the value of 2.02% for *Senna obtusifolia* leaves as reported by Kubmarawa *et al.* (2011). The ether extract content of *Senna occidentalis* leaves is also close to the value of 3.32% reported by MissaMohammed *et al.* (2015) for *Senna singueana* leaves a close relative of the *Senna* family.

The values for the nitrogen free extract observed for *Senna obtusifolia and Senna occidentalis* leaves are however, similar to the value (38.19%) reported by Yakubu *et al.* (2017). The fairly high percentage of nitrogen free extract is an indication that the leaves might contribute to the energy content of diet when incorporated into livestock diet.

The ash content of *Senna obtusifolia* and *Senna occidentalis* leaves recorded in this study is however, close to the values of 9.86 and 10.30% reported by Adjoudji (2005) and Kubmarawa *et al.* (2011), respectively. The fairly high ash content of the leaves was an indication that the leaves might be a fair source of minerals such as calcium, sodium, potassium and magnesium. Michael and David (2002) reported that percentage ash is useful in assessing a plant and gives an idea of the amount of minerals present in a sample. Leafy vegetables have been documented to be rich sources of proteins, minerals and vitamins (Adewusi and Bradbury 1998; Rangaranjan and Kelly 1998; Rangaranjan *et al.*, 1998). The outcome of this investigation revealed that the utilization of *Senna obtusifolia* and *Senna occidentalis* leaves will, to some extent, combat mineral deficiencies in animals fed the leaf meals.

The leaves of *Senna obtusifolia* and *Senna occidentalis* were observed in this study to have good amino acid profile. This is consistent with the report of Aletor and Agbede (2005) that legumes have good nutritional profile with good array of amino acids. This therefore indicates that these leaves might be good alternative protein sources for livestock. The values for the amino acid content recorded fell within the range of values reported by Kubmarawa *et al.* (2011) for *Senna obtusifolia* leaves. However, *Senna obtusifolia* leaves appeared to have better amino acid profile than *Senna occidentalis.*

Table 2: Amino Acid Profile of *Senna obtusifolia* and *Senna occidentalis* Leaves

Amino acid profile (g/100g)	SOL	SOCL
Lysine	4.13±0.22	3.51±0.16
Methionine	1.85±0.11	1.37±0.89
Threonine	3.51±0.91	2.89±0.97
Isoleucine	3.48±1.88	3.45±1.07
Leucine	6.40±1.35	6.01±1.95
Phenylalanine	4.86±1.28	4.45±1.11
Valine	3.95±1.77	3.33±0.93
Histidine	2.45±0.19	1.78±0.67
Arginine	2.97±1.09	2.21±0.13
Serine	2.80±0.33	2.77±0.11
Cysteine	1.71±0.78	0.51±0.01
Alanine	3.97±0.67	3.71±0.16
Aspartic acid	3.60±0.99	2.01±0.11
Glycine	4.81±1.75	4.08±1.66
Proline	3.37±0.95	1.81±0.08

SOL = *Senna obtusifolia* leaves, SOCL = *Senna occidentalis* leaves

Despite the nutritional potentials observed in *Senna obtusifolia* and *Senna occidentalis* leaves, the leaves contained some anti-nutritional factors (Table 3). Both leaves were observed to contain tannins, oxalates, saponins, phytates and phenols. However, the concentration of this toxic factors were higher in *Senna occidentalis*, an indication that the leaves might have deleterious effects when consumed by animals. Sambasivam *et al.* (2016) and Algadi and Yousif (2015) in a similar study revealed that *Senna occidentalis and Senna obtusifolia* contain these anti-nutritional factors. These therefore suggest that the

leaves must be processed before they can be safely utilized as livestock feed.

Table 3: Levels of Anti-nutritional Factors in *Senna obtusifolia* and *Senna occidentalis* Leaves

Anti-nutritional factors (g/100g)	SOL	SOCL
Oxalates	1.38±0.55	2.87±0.31
Tannins	1.85±0.22	3.32±0.24
Phenols	8.15±2.09	15.03±4.11
Phytates	3.70±1.27	3.85±1.30
Saponins	3.40±1.18	3.81±0.59

SOL = *Senna obtusifolia* leaves, SOCL = *Senna occidentalis* leaves

Anti-nutritional factors have been reported to adversely affect digestibility and utilization of nutrients (Shaahu *et al.,* 2015) and this may adversely affect the overall performance of animals when they consume this leaves.

Conclusion

The outcome of this investigation revealed that *Senna obtusifolia and Senna occidentalis* leaves have good nutritional values. However, *Senna obtusifolia* appeared to have better nutritional values than *Senna occidentalis*. The leaves also contain some anti-nutritional factors which might place limitations on their utilization as alternative protein sources. *Senna occidentalis* seems to have more concentration of the anti-nutritional factors when compared with *Senna obtusifolia*. Before these leaves can be used as feed resources, it is recommended that they should be thoroughly processed.

References

1. Adebayo, A. A,. *Mubi Region a Geograhical Sysnthesis* Paraclete Publishers Yola, Nigeria 2004; 133 Pp.
2. Adewusi, S. R. A. and Bradbury, J. H. Carotenoids in cassava, comparison of open column and HPLC, methods of analysis. *Journal of the Science of Food and Agriculture* 1993; 62:375-383.
3. Adjoudji, O., Ngassoum, M. and Kamga, C. Chemical composition of *Cassia obtusifolia* Leaves. *Journal of Food Technology* 2005; 3(3): 453-455.
4. Akobundu, I. O. and Agyakwa, C. W. *A Handbook of West African Weeds*. 2nd Edition Published by INTEC Printers Ibadan, Nigeria 1998; Pp. 307-309.
5. Aletor, V.A. and Agbede, J.O. Studies of the chemical composition and protein quality evaluation of differently processed *Canavalia ensiformis* and *Mucuna pruriens* seed flour. *Journal of Food Composition and Analysis*, 2005; 18:89 – 103.
6. Algadi, M. Z. and Yousif, N. E. Anti-nutritional factors of green leaves of *Cassia obtusifolia* and Kawal. *Journal of Food Process Technology* 2015; 6: 483.doi.10.4172/2157-7110.1000483.
7. AOAC. *Official Methods of Analysis,* 18th edition Washington, D.C USA; 2004.
8. Augustine, C., Kwari, I.D., Igwebuike, J.U. Adamu, S.B., Khobe, D., Maxwell, H. and Midau, A. Response of sickle pod (*Senna obtusifolia*) seeds subjected to varying boiling periods. *Proceedings of the 6th Animal Science Association/Nigerian Institute of Animal Science Joint Annual Meeting*, held September, 10-14th 2017, Abuja, Nigeria 2017; Pp514 – 517.
9. Falade, O. S., Dare, A. F., Bello, M. O., Osuntogun, B. O. and Adewusi, S. R. A. Varietal changes in proximate composition and the effect of processing on the ascorbic acid content of some Nigerian Vegetables. *Journal of Food Technolog* 2004; 2:103-108.
10. Kubmarawa, D., Magoniya, A. M., Yebpella, G. G. and Adebayo, S. A. Nutrient content and amino acid composition of the leaves of *Cassia tora* and *Celtis integrifolia*. *International Research Journal of Biochemistry and Bioinformatics* 2011; 1(9): 222-225.
11. Lucas, E. O. The potential of leaf vegetables in Nigeria. *Outlook on Agriculture* 1988; 17:163-168.
12. Michael, K. L. and David, M. P. The useful plants of west Tropical Africa. *Nigerian Journal of Biochemistry and Molecular Biology* 2002; 12:53-60.
13. MissaMohammed S.A. A., Malik, A.A. and Ahmed, E.M.S. Nutritional composition and fatty acids analysis of *Senna singueana* leaves and seeds. *American Journal of Science and Technology* 2015; 2(6): 270-273.
14. Nsa, E.E., Ukachukwu, S.N., Isika, M.A. and Ozung, P.O.Effects of boiling and soaking duration on the proximate composition, ricin and mineral contents of undecorticated castor oil seeds (*Ricinus communis*). *International Journal of Plant, Animal and Environmental Science* 2011; 1(3): 244-252.
15. Onwuka, G. I. *Food Analysis and Instrumentation Theory and Practice*. Ghthaji Prints Division of HG Support Nigeria Limited. Surulele, Lagos, Nigeria 2005; Pp: 64-161.
16. Pauzenga, U. (1985). Feeding parent stock. *Zootecnia International* Pp22- 25.
17. Pearson, D. *Composition and Analysis of Food*, 9th Edition, Churchill, London, 1991; 480p.

18. Rangaranjan, A. and Kelly, J. F. Iron bioavailability from *Amaranthus species*. *In vitro* dialysate iron from estimating genetic variation. *Journal of the Science of Food and Agriculture*, 1998; 78:267-273.
19. Rangaranjan, A., Chenowesh, W.A., Kelly, J. F. and Agee, K.M. (. Iron bio-availability from *Amaranthus specie*, 2. Evaluation using haemoglobin repletion anaemic rats. *Journal the Science of Food and Agriculture*, 1998, 78:274-280.
20. Sambasivam, M. Vellingiri, V. and Pemaiah, B. Studies on physicohe physiochemical and nutritional properties of aerial parts of *Cassia occidentalis*. *Journal of Food and Drug Analysis* 2016; 24: 508-515.
21. Santosh, K.., Richard, K. and Owusu, A. (n.d.). Anti-nutritional factors in food legumes and effects of Processing. http://www.eolss.net/Eolss-sampleAllchapter.aspx, retrieved 11th June, 2017.
22. Shaahu, D. T., Carew, S. N. and Ikurior, S. A. C.. Effect of processing on proximate composition, energy, anti-nutritional factors, amino acid and mineral composition of lablab seed. *International Journal of Scientific and Technology Research* 2015; 4(4): 1-4.
23. Wikipedia. *Senna occidentalis.* Wikipedia the free encyclopedia. *https://en.wikipedia.org/"w/index.php?title=sennao* occidentalis & oldid=791110237". 2017; retrieved 12th November, 2017.
24. Yakubu, B., Mbahi, T. F., Haniel, G. W. and Wafar, R. J. Effects of feeding *Cassia obtusifolia* leaf meal on growth performance, carcass characteristics and blood profiles of broiler chickens. *Greener Journal of* 2017; *Agricultural Sciences*, 7(1): 001-008.
25. Physiochemical and nutritional properties of Aerial parts of *Cassia occidentalis*. *Journal Of Food and Drug Analaysis*, 2016; 24:508-515.

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