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# IMPACT OF SOAKING PERIODS ON THE CHEMICAL COMPOSITION OF COFFEE SENNA (*SENNA OCCIDENTALIS LINN*) LEAVES

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**Abstract:** A study was conducted to evaluate the effects of soaking period on the proximate composition, amino acid profile and levels of anti-nutritional factors of *Senna occidentalis* leaves. Fresh leaves of *Senna occidentalis* were divided into five representative batches. The first batch was air-dried under shade designated as T1, while the second, third, fourth and fifth samples were soaked in water for 10, 15, 20 and 25 hours, respectively. At the end of each soaking period, the sample was removed, drained, properly sun-dried and milled into powder. All the processed samples were analyzed for their proximate composition, amino acid profile and levels of anti-nutritional factors using standard laboratory procedures. The results indicated significant ($P<0.05$) variation for the proximate composition, amino acid profile and levels of the anti-nutritional factors. The dry matter, crude protein, crude fibre, nitrogen-free extract and ash were observed to decrease from 92.40 to 86.45%, 17.45 to 15.55%, 13.71 to 12.18%, 3.35 to 1.18%, 37.18 to 35.01 and 6.65 to 4.70% in treatments T1 to T5, respectively. The amino acid profile and levels of anti-nutritional factors showed similar trend as that of the proximate composition. Lysine and methionine decreased from 3.20 to 1.44g/100 g and 1.20 to 0.95g/100 g in treatments T1 to T5, respectively. Percent reduction for Oxalates, tannin and phenols increased from 5.74 to 46.36%, 6.01 to 38.61% and 8.38 to 25.51% in T1 to T5, respectively. In conclusion, *Senna occidentalis* leaves can be soaked for up to 15 hours with minimal level of nutrient depreciation and appreciable reduction in the levels of anti-nutritional factors.

**Keywords**: Chemical composition, soaking periods, *Senna occidentalis* leaves.

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## Introduction

The high cost of conventional feed resources such as soya bean, groundnut cake and fishmeal has challenged Animal Scientists in Nigeria to intensify research on the utilization of cheaper alternative feed resources. Augustine *et al*., (2017a) suggested the use of lesser-known legumes in the feeding of livestock. *Senna occidentalis* is a wild legume that belongs to the family of *leguminosae caesalpinioideae.* It is an erect, hairless shrub growing up to 100 cm high. The leaves are compound pinnate alternate and about 10-15 cm long (Akobundu and Agyakwa, 1998; Wikipedia, 2011). The chemical composition of the leaves as revealed by Sambasivam *et al.,* (2016) indicated that the leaves have good nutritional values (0.49 mg/g crude protein and 34.44 kcal/100g energy) but contains some anti-nutritional factors such as flavonoids (2.45 mg/g), alkaloids (1.56 mg/g) and phenols (0.16 mg/g). The presence of these anti-nutritional factors in the leaves therefore necessitates some forms of processing (Akobundu and Agyakwa, 1998), before *Senna occidentalis* leaves can be safely utilized, methods such as soaking, cooking and fermentation have been used to eliminate or reduce anti-nutritional factors in the seeds (Parul, 2014). Soaking period was reported to cause nutrients and dry matter losses (Tracie, 2014). Therefore, it is important to investigate the best soaking period that will effectively reduce the levels of anti-nutritional factors without appreciable depreciation in the nutritive value of *Senna ocidentalis* leaves (SOLs). At the moment, base-line information on the effects of soaking period on the chemical composition of SOLs is very scanty hence the need to conduct more studies and bridge such information gap. In view of the above, the present study was conducted to evaluate the influence of varying soaking period on the chemical composition of SOLs.

## Materials and methods

### Collection and preparation of *Senna occidentalis* leaves

*Senna occidentalis* leaves were manually harvested using sickle in bushes around Mubi Local Government Area of Adamawa State, Nigeria. The leaves were divided into five representative samples. The first batch was air-dried under shade designated as T1 while the second, third, fourth and fifth batches were soaked in water (1kg of leaves in 2 liters of water) for 10, 15, 20, and 25 hours designated as T2, T3, T4 and T5, respectively. At the end of each particularly soaking period, the sample was removed, drained and properly sun-dried, milled and taken to the laboratory for analysis.

### Chemical analysis

Proximate composition of the *Senna occidentalis* 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 used to determine the ether extract. The nitrogen-free extract 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) expressed as:

ME (kcal/kg) = 37 x %CP + 81 x %EE + 35.5 x %NFE

The levels of 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 as described by Pearson (1991).

## Experimental design

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

## Statistical analysis

Data obtained were subjected to a statistical package (Statistix, 9.0). Least significant different (LSD) was used to separate the means where significant differences occurred. The results were considered significant at 5% level of probability.

## Results and Discussion

The proximate composition of *Senna occidentalis* leaves (Table 1) was significantly (P<0.05) affected by the different soaking periods. This variation was attributed to the differences in the length of the soaking periods.

**Table 1. Proximate Composition of *Senna occidentalis* Leaves Subjected to Different Soaking Periods**

| Proximate composition (%) | | Soaking periods (hours) | | | | |
|---|---|---|---|---|---|---|
| | T1(0) | T2(10) | T3(15) | T4(20) | T5(25) | SEM |
| Dry matter (DM) | 92.40$^{a}$ | 91.35$^{a}$ | 89.75$^{b}$ | 88.65$^{b}$ | 86.45$^{c}$ | 0.15 |
| Crude protein (CP) | 17.45$^{a}$ | 17.20$^{a}$ | 16.01$^{b}$ | 15.75$^{b}$ | 15.55$^{c}$ | 0.18 |
| Crude fibre (CF) | 13.71$^{a}$ | 13.65$^{a}$ | 13.35$^{a}$ | 13.07$^{b}$ | 12.18$^{c}$ | 1.90 |
| Ether extract (EE) | 3.35$^{a}$ | 2.16$^{b}$ | 2.03$^{b}$ | 2.14$^{b}$ | 1.18$^{c}$ | 0.013 |
| Ash | 6.65$^{a}$ | 6.55$^{a}$ | 6.25$^{a}$ | 5.50$^{b}$ | 4.70$^{c}$ | 2.07 |
| Nitrogen free extract (NFE) | 37.18$^{a}$ | 37.06$^{a}$ | 36.19$^{b}$ | 36.33$^{b}$ | 35.01$^{c}$ | 3.06 |
| Energy (kcal/kg) | 2236.89$^{a}$ | 2122.13$^{a}$ | 2041.55$^{b}$ | 2045.81$^{b}$ | 1988.94$^{c}$ | 1.17 |

a, b, c = Means in the same row with different superscripts are significantly different at 5% level of probability; SEM = Standard error of the mean

Dry matter was observed to reduce as the soaking period increased with soaking at 20 and 25 hours indicating the highest level of dry matter loss which is consistent with the report of Tracie (2014) who observed that prolong soaking or cooking may lead to appreciable dry matter loss. Dry matter loss is associated with loss of essential nutrients. The crude protein also indicated similar reduction trend as the soaking period increased with soaking periods of 20 and 25 hours indicating the highest level of reduction. This reduction might be connected to the leaching out of soluble nitrogenous components which are the key building blocks of protein and amino acid compounds. This result is consistent with the results of Augustine (2017a) who similarly observed same for soaked *Senna obtusifolia* seed meal. Similar reduction trend for the proximate composition was also reported by Udensi *et al*., (2010) for *Mucuna flagellipes* subjected to different soaking and boiling periods. This trend is also similar to the observation made by Obasi and Wogu (2008). The ash content similarly showed a reducing trend with increase in the soaking time which is also consistent with the findings of Udensi *et al*., (2010) who similarly observed reduction of the ash content of *Mucuna flagellipes*. Such decrease might be linked to the leaching out of soluble minerals into the soaking water.

The amino acid profile (Table 2) significantly (P<0.05) decreased with progressive increase in the soaking time. This findings is in agreement with the result of Augusitne (2017b) who similarly observed a decreasing trend in the amino acid content of *Senna obtusifolia* seeds soaked at different periods. He attributed such losses to leaching out of some soluble nitrogenous compound which are components of amino acid.

**Table 2. Amino Acid Profile of *Senna occidentalis* Leaves Subjected to Different Soaking Periods**

| Proximate | | Soaking periods (hours) | | | | |
|---|---|---|---|---|---|---|
| (g/100g) | T1(0) | T2(10) | T3(15) | T4(20) | T5(25) | SEM |
| Lysine | $3.20^{a}$ | $3.19^{a}$ | $3.17^{a}$ | $3.09^{b}$ | $1.44^{c}$ | 0.17 |
| Methionine | $1.20^{a}$ | $1.14^{a}$ | $1.02^{b}$ | $1.03^{b}$ | $0.95^{c}$ | 0.03 |
| Threonine | $2.50^{a}$ | $2.46^{a}$ | $2.42^{a}$ | $2.43^{a}$ | $1.31^{c}$ | 0.03 |
| Isoleucine | $2.65^{a}$ | $2.63^{a}$ | $2.35^{b}$ | $2.25^{bc}$ | $2.07^{c}$ | 0.12 |
| Leucine | $4.68^{a}$ | $4.12^{b}$ | $4.23^{b}$ | $3.87^{bc}$ | $2.65^{c}$ | 1.01 |
| Phenylalanine | $3.35^{a}$ | $3.21^{a}$ | $3.06^{b}$ | $3.04^{b}$ | $2.86^{c}$ | 0.37 |
| Valine | $1.85^{a}$ | $1.83^{a}$ | $1.78^{a}$ | $1.30^{b}$ | $1.09^{c}$ | 0.18 |
| Histidine | $1.26^{a}$ | $1.23^{a}$ | $1.20^{a}$ | $1.17^{b}$ | $0.92^{c}$ | 0.01 |
| Serine | $2.34^{a}$ | $2.05^{a}$ | $2.02^{a}$ | $1.99^{b}$ | $0.85^{c}$ | 0.04 |
| Cysteine | $0.52^{a}$ | $0.34^{b}$ | $0.32^{b}$ | $0.21^{c}$ | $0.17^{d}$ | 0.07 |
| Tyrosine | $2.62^{a}$ | $2.54^{b}$ | $2.23^{c}$ | $1.85^{c}$ | $1.25^{d}$ | 0.16 |
| Alanine | $3.33^{a}$ | $3.23^{a}$ | $3.05^{a}$ | $2.01^{b}$ | $1.17^{c}$ | 0.11 |
| Aspartic acid | $1.79^{a}$ | $1.62^{a}$ | $1.53^{b}$ | $1.32^{c}$ | $1.01^{d}$ | 0.13 |
| Glutamic acid | $4.55^{a}$ | $4.33^{a}$ | $3.41^{b}$ | $3.53^{c}$ | $3.00^{d}$ | 1.09 |
| Glycine | $2.55^{a}$ | $2.46^{a}$ | $2.33^{b}$ | $2.00^{c}$ | $1.99^{d}$ | 0.08 |
| Proline | $1.25^{a}$ | $1.05^{b}$ | $1.12^{b}$ | $0.87^{c}$ | $0.79^{c}$ | 0.11 |

a, b, c, d = Means in the same row with different superscripts are significantly different at 5% level of probability; SEM = Standard error of the mean.

The levels of the anti-nutritional factors of soaked SOL (Table 3) were observed to significantly (P<0.05) decrease with increase in the soaking time. However, soaking for 20 and 25 hours gave the highest level of reduction of the anti-nutritional factors which has some nutritional benefits. Augustine (2017b) in a similar study subjected *Senna obtusifolia* seeds to different soaking periods and reported reduction in the anti-nutritional factors as the soaking period increases. Vidal *et al.*, (1994) and Taiwo (1998) further reported that soaking process can remove soluble anti-nutritional factors which can be eliminated with the discarded water.

**Table 3. Levels of Anti-nutritional Factors of *Senna occidentalis* Leaves Subjected to Varying Soaking Periods**

| Anti-nutritional factors (mg/100g) | | Soaking periods (hours) | | | | |
|---|---|---|---|---|---|---|
| | T1(0) | T2(10) | T3(15) | T4(20) | T5(25) | SEM |
| Oxalates | $2.96^{a}$ | $2.79^{b}$ | $2.03^{b}$ | $1.65^{c}$ | $1.46^{d}$ | 0.11 |
| % reduction oxalate | 0.00 | 5.74 | 31.41 | 44.25 | 46.36 | |
| Tannins | $3.16^{a}$ | $2.97^{b}$ | $2.65^{b}$ | $2.25^{c}$ | $1.94^{d}$ | 0.16 |
| % reduction tannins | 0.00 | 6.01 | 16.13 | 28.79 | 38.61 | |
| Phenols | $8.35^{a}$ | $7.65^{b}$ | $7.20^{b}$ | $6.55^{c}$ | $6.22^{c}$ | 1.13 |
| % reduction phenols | 0.00 | 8.38 | 13.77 | 21.55 | 25.51 | |
| Phytates | $4.16^{a}$ | $3.88^{b}$ | $3.76^{b}$ | $2.87^{c}$ | $2.48^{d}$ | 1.04 |
| % reduction phytates | 0.00 | 6.73 | 9.61 | 31.01 | 40.86 | |
| Saponins | $3.50^{a}$ | $3.25^{ab}$ | $3.18^{c}$ | $3.05^{d}$ | $2.99^{d}$ | 0.31 |
| % reduction saponins | 0.00 | 7.14 | 9.14 | 12.86 | 14.57 | |

a, b, c, d = Means in the same row with different superscripts are significantly different at 5% level of probability; SEM = Standard error of mean.

## Conclusion

The outcome of this study revealed that the proximate composition, amino acid profile and levels of anti-nutritional factors of SOL decreased as the soaking period increases. However, *Senna occidentalis* leaves can be soaked in water for up to 15 hours with only little and acceptable depreciation in their nutritional values and appreciable level of reduction of the anti-nutritional factors.

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