

Effects of Varying Soaking Periods followed by Boiling on the Chemical Composition of Tropical Sickle Pod (*Senna obtusifolia*) Seeds

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Abstract: A laboratory analysis was conducted to determine the effects of Varying soaking periods followed by boiling for one hour on the proximate composition, amino acid profile and levels of anti-nutritional factors of *Senna obtusifolia* seeds. The representative seed samples were subjected to different soaking periods of 0, 6, 12 and 24 hours followed by boiling each for one hour. Each representative sample was analysed in triplicates for the proximate composition, amino acid profile and levels of anti-nutritional factors using standard laboratory procedure. The results indicated a decreasing trend for the proximate composition, amino acid profile and level of anti-nutritional factors as the soaking period progresses. Crude protein for instance was observed to decrease from 25.33 to 21.86% crude fibre 11.77 to 6.18% and ash 4.11 to 2.17%. The amino acid contents and level of anti-nutritional factors indicated a similar reduction trend. Methionine and lysine decreased from 2.58 to 0.78g/100g and 1.18 to 0.41g/100g, respectively. While tannins and oxalates for instance decreased from 5.44 to 2.31g/100g and 1.95 to 0.39g/100g, respectively. It can be concluded that soaking for up to 24 hours followed by boiling for one hour is more effective in reducing the level of anti-nutritional factors with little depreciation on the nutritional qualities of *Senna obtusifolia* seed meal. It is also important to use the processed seeds in a feeding trial with a view to evaluate its feeding values in livestock.

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Introduction

The Nigerian livestock industry has long been faced with the problem of high cost of feeds and feed ingredients therefore; there is urgent need to intensify research on the utilization of lesser-known legumes such as *Senna obtusifolia*. Adegbenro *et al.* (2011) buttressed the need to exploit some under-utilized seeds which could possibly replace the costly protein and energy feedstuffs. Augustine (2016) in a recent study documented the use of *Senna obtusifolia* seeds as protein feed ingredient for poultry. *Senna obtusifolia* is a pantropical weed that belongs to the family *leguminosae caesapinioideae*. It is an erect bushy annual shrub that grows up to 90 cm tall and propagates through seed. The leaves are obovate and the flowers are yellow in colour, 2-3cm across and borne on pedicels that are 1.5-3.5 cm long (Akobundun and Agyakwa, 1998). The nutritive value and utilization of *Senna obtusifolia* seed is limited by the presence of anti-nutritional factors such as tannins, saponins and oxalates. Adequate utilization can be achieved when the seeds are subjected to processing treatments such as soaking and boiling. Soaking in water allows the seeds to decrease and eliminate anti-nutritional factors in legumes. However, soaking for a long period of time has been found to reduce nutritional quality of legumes through leaching of nutrients into the soaked water (Taiwo, 1998). In view

of the above, there is need to conduct study on the best soaking and boiling period that will enhance optimal utilization of *Senna obtusifolia* seed meal. At the moment, base-line information on the effect of soaking and boiling on the chemical composition of *Senna obtusifolia* seems to be scanty hence the need to bridge such information gap. This study was designed to evaluate the effect of soaking and boiling on the chemical composition of *Senna obtusifolia* seed meal.

Materials and Methods

Sample identification, collection and preparation

The *Senna obtusifolia* plants and seeds were authenticated at the Department of Biological Sciences, Adamawa State University, Mubi. The seeds were collected in bushes around mubi area. The seeds were soaked for 0, 6, 12, and 24 hours, respectively followed by boiling each of the representative sample for one hour.

Chemical analysis

The proximate composition and levels of the anti-nutritional factors (tannins, oxalates, flavonoids, phytates and saponins) were determined using the standard procedure described by AOAC (2004). 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

Metabolizable energy (ME) was calculated using the formula of Ponzenga, (1985) express as $ME = 37 \times \%CP + 81 \times \%EE + 35.5 \times \%NFE$.

Amino acid profile was determined using the High power liquid chromatography (HPLC) Buck Scientific BLC 10/11 model equipment.

Statistical analysis

Data obtained were subjected to analysis of variance (ANOVA) using a computer statistical package (Statistix 9.0). Least significant difference (LSD) was used to separate means and significant difference was accepted at $P < 0.05$. Results were expressed as mean values with standard error of means of triplicate determinations.

Results and Discussion

The result of the proximate composition of *Senna obtusifolia* seed meal subjected to varying soaking periods followed by boiling each of the representative sample for one hour is presented in Table 1. Soaking for 6 and 12 hours, followed by boiling for one hour did not indicate significant ($P < 0.05$) difference. However, soaking for 24 hours followed by boiling for one hour showed a significant ($P < 0.05$) variation for the crude protein, crude fibre, ether extract, ash, and nitrogen free extract which were observed to be lower than the other treatments. The decrease in the protein content is in agreement with the findings of Effiong

and Umoren (2011) who subjected *Mucuna urens* seeds to different soaking and boiling periods. This decrease was attributed to solubilization and leaching out of nitrogenous compound in the soaking and boiling water as reported by Nsa *et al.* (2011).

The decrease in crude fibre content at soaking period of 24 hours followed by boiling for one hour (1 hour) is in agreement with the findings of Nsa *et al.* (2011) who observed same for castor (*Ricinus communis*) seeds. They attributed such a decrease to softening and subsequent loss of seed coat of the seed in the process of soaking and boiling. Furthermore, soaking prior to cooking may open up more surface area for heat penetration (Emenalom and Udedibie, 2005), this may facilitate weakening of the structural fibre components of the seed coat. The significant ($P < 0.05$) reduction of the ether extract when the seed was soaked for 24 hours and boiled for one hour, is in agreement with the findings of Nsa *et al.* (2011).

The decrease for the nitrogen free extract at soaking period of 24 hours, followed by boiling for one hour might be due to the reduction in other components (Crude protein, crude fibre, ether extract and ash) which are the indices used in computing the NFE. Similarly, the decrease in NFE consequently led to the reduction of the computed energy content.

The reduction observed for the ash content may be attributed to the leaching out of minerals in the soaking and boiling water as earlier pointed out by Samantray *et al.* (1989) and Rani and Hira *et al.* (1998).

Table 1: Effects of Soaking/Boiling Periods on the Proximate Composition of *Senna obtusifolia* Seed

Varying soaking periods followed by boiling for 1 hour					
	T1(0hrs)	T2(6hrs)	T3(12hrs)	T4(24hrs)	SEM
Dry matter	90.55	90.74	90.91	90.82	0.04 ^{NS}
Crude protein	25.33 ^a	24.68 ^b	24.17 ^b	21.86 ^c	0.72*
Crude fibre	11.77 ^a	9.94 ^b	8.87 ^b	6.18 ^c	0.27*
Ether extract	3.00	2.72	2.83	1.85	0.05 ^{NS}
Ash	4.11 ^a	3.97 ^a	3.05 ^b	2.17 ^c	0.44*
NFE	40.34 ^a	37.91 ^b	36.69 ^b	32.18 ^c	5.15*
Energy (MJ/Kg)	9.93 ^a	9.46 ^a	9.20 ^a	8.17 ^b	1.07*

a, b, c, d, e = means in the same row with different superscripts are significantly different ($P < 0.05$) * = Significant at 5% level of probability, SEM = standard error of mean.

The amino acid content (Table 2) of *Senna obtusifolia* seeds soaked for 24 hours and boiled for one hour indicated a similar reduction trend as that of the proximate composition.

For instance, *Senna obtusifolia* seeds soaked for up to 24 hours and boiled for one hour recorded the least lysine and methionine content of 0.41 and 0.78g/100g.

The level of anti-nutritional factors was observed to significantly ($P < 0.05$) decrease as the soaking

period progresses from 0 to 24 hours. Vidal *et al.* (1994) reported that soaking process can remove soluble anti-nutritional factors which can be eliminated with the discarded soaking solution. Taiwo *et al.* (1998) further reported that soaking in water decrease and eliminate anti-nutritional factors in legumes. However, soaking of the seeds for 24 hours followed by boiling for one hour was found to be most effective in reducing level of the anti-nutrients. This is an indication that longer period of soaking followed

by boiling is more effective in reducing level of the anti-nutritional factors.

Table 2: Effects of Soaking/Boiling on the Amino Acid Profile of *Senna obtusifolia* Seed

Varying soaking periods followed by boiling for 1 hour					
Amino acid (g/100g)	T1(0hrs)	T2(6hrs)	T3(12hrs)	T4(24hrs)	SEM
Lysine	1.18 ^a	0.66 ^b	0.68 ^b	0.41 ^c	0.11*
Methionine	2.58 ^a	1.39 ^b	1.47 ^b	0.78 ^b	0.94*
Threonine	2.75 ^a	2.64 ^a	1.73 ^b	1.27 ^b	0.06*
Isoleucine	1.72 ^a	1.43 ^a	1.37 ^b	1.04 ^b	0.05*
Leucine	2.63 ^a	1.85 ^b	0.87 ^c	0.34 ^d	0.03*
Phenylalanine	1.75 ^a	0.91 ^b	0.82 ^b	0.51 ^c	0.03*
Valine	1.64 ^a	0.77 ^b	0.71 ^b	0.48 ^c	0.06*
Arginine	1.66 ^a	1.46 ^a	1.45 ^a	0.38 ^b	0.13*
Alanine	0.95 ^a	0.42 ^b	0.40 ^b	0.21 ^c	0.03*
Glutamic acid	0.95 ^a	0.66 ^b	0.65 ^b	0.56 ^b	0.02*
Glycine	1.04 ^a	0.41 ^b	0.40 ^b	0.30 ^c	0.06*
Proline	1.84 ^a	1.28 ^a	1.14 ^a	0.56 ^b	0.07*

a, b, c, d e = means in the same row with different superscripts are significantly different (P<0.05) * = Significant at 5% level of probability, SEM = standard error of mean

Table 3: Effects of Soaking/Boiling on the Levels of Anti-nutritional Factors of *Senna obtusifolia* Seed

Varying soaking periods followed by boiling for 1 hour					
	T1(0hrs)	T2(6hrs)	T3(12hrs)	T4(24hrs)	SEM
Tannins	5.44 ^a	3.05 ^b	2.18 ^c	2.31 ^c	0.03*
Oxalates	1.95 ^a	0.75 ^b	0.77 ^b	0.39 ^c	0.17*
Flavonoids	3.88 ^a	2.28 ^b	2.41 ^b	1.83 ^c	0.09*
Phytates	4.61 ^a	2.64 ^b	2.75 ^b	1.97 ^c	0.17*
Saponins	2.44 ^a	1.17 ^b	1.18 ^b	1.31 ^c	0.04*

a, b, c, de = means in the same row with different superscripts are significantly different (P<0.05) * = Significant at 5% level of probability, SEM = standard error of mean.

Conclusion

The proximate composition, amino acid profile and levels of anti-nutritional factors of *Senna obtusifolia* seeds subjected to the varying soaking period followed by boiling each of the representative sample, indicated a decreasing trend. However, it can be concluded that

soaking for 24 hours followed by boiling treatment was more effective in reducing the level of the anti-nutritional factors without much depreciation in the nutritional value of *Senna obtusifolia* seed meal and it is therefore recommended for processing the seeds of *Senna obtusifolia*.

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