Response of Tropical Sickle Pod (*Senna obtusifolia*) Seed Meal to Varying Soaking Periods

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Abstract: A laboratory analysis was conducted to determine the effects of varying soaking period on the proximate composition, amino acid profile and levels of anti-nutritional factors of *Senna obtusifolia* seeds soaked in water. The seed were subjected to different soaking periods of 0, 6, 12 and 24 hours. 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 some of 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 20.08% and ash 4.11 to 3.01%. The amino acid contents and level of anti-nutritional factors indicated a similar reduction trend. Methionine and lysine decreased from 2.55 to 1.78 g/100g and 1.19 to 0.64g/100g, respectively. While tannins and oxalates decreased from 5.42 to 2.59g/100 g and 1.95 to 0.18g/100g/, respectively. It can be concluded that soaking treatments for up to 24 hours slightly reduced the proximate composition, amino acid profile and levels of the anti-nutritional factors of *Senna obtusifolia* seeds. However, soaking for up to 24 hours was more effective in reducing levels of the anti-nutritional factors with less depreciation in the nutritional properties of *Senna obtusifolia* seeds and is therefore recommended for processing of *Senna obtusifolia* seeds. Further studies should be conducted to investigate the chemical composition of *Senna obtusifolia* seeds soaked beyond 24 hours.
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Introduction

One of the major problems facing the Nigerian livestock industry is the increasing unavailability and high cost of conventional feed stuff (Bawa *et al*., 2007). This has been attributed to the high level of competition between livestock and man for the same ingredient (Iorgyer *et al*., 2009). Many other potentially useful legumes are marginally known (Emanalom and Udedibie, 2005). These potential legumes might be of great importance in many zones of developing countries where there is a pressing need for food sources of high energy and good protein quality (Effiong and Umoren, 2011). 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 a protein feed ingredient for poultry. *Senna obtusifolia* is a pantropical weed that belongs to the family *leguminosae caesapinioideae*. *Senna obtusifolia* 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 (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 is believed to eliminates 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 soaking water (Taiwo, 1998). In view of the above, there is need to conduct study on the best soaking period that will enhance optimal utilization of *Senna obtusifolia* seed meal. At the moment, information on the effect of soaking period 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 chemical composition of *Senna obtusifolia* seeds subjected to different soaking periods.

Materials and Methods

Sample identification, collection and processing

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 properly sundried, soaked in water for 0, 6, 12,

and 24 hours, respectively. The representative samples were milled and used for the chemical analysis.

Chemical analysis

The proximate composition and levels of the anti-nutritional factors (tannins, oxalates, flavonoids, phytates and saponins) of *Senna obtusifolia* seeds were determined using the standard procedure described by AOAC (2004). Nitrogen free extract (NFE) was computed using the formula:

NFE = 100 – (% Moisture + CP + CF +EE +ASH)

Where:

CP = crude protein, CF = crude fibre and EE = ether extract

Metabolizable energy (ME) was calculated using to the formula of Pauzenga (1985) express as

ME (kcal/kg) = 37 × % CP + 81 × % EE + 35.5 × % NFE. Energy values obtained were converted to mega joules per kilogram

Amino acid profile was determined using the High Power Liquid Chromatography (HPLC) Buck Scientific BLC 10/11 model.

Statistical analysis

Data collected were subjected to analysis of variance (ANOVA) using a computer statistical package (Statistix 9.0) and means were separated using Least significant difference (LSD). Results were expressed as mean values with their standard error of means of triplicate determinations.

Results and Discussion

The proximate composition of *Senna obtusifolia* seeds subjected to different soaking periods is presented in Table 1. The high dry matter content of the soaked seeds was attributed to thorough drying of the seeds after soaking which is in line with the findings of Gadzama *et al*. (2017), who found same for soaked and dried soya bean. The fairly high dry matter content is an indication that the seeds may have less storage problem when it is soaked and properly dried. Some of the proximate components were however observed to significantly ($P < 0.05$) decrease as the soaking period increases from 0 to 24 hours. *Senna obtusifolia* seeds soaked for 24 hours recorded the least crude protein and ash. This finding is in line with the results of Effiong and Umoren (2011) who made similar observation for horse eye bean (*Mucuna urens*). They attributed such decrease to leaching out of some nitrogenous compounds and soluble minerals in the soaking water. However, this finding is contrary to the result of Gadzama *et al*. (2017) who reported an increase in the crude protein and crude fat of soaked soya bean. A slight decrease was observed for the energy content of the soaked *Senna obtusifolia* seeds as the soaking period progresses. This observed trend was attributed to the reduction in the proximate components (crude protein, ether extract and nitrogen free extract) used in computing the energy values. Nsa *et al*. (2011) also reported similar reduction of crude protein, ether extract and nitrogen free extract for castor (*Ricinus communis*) seeds soaked and boiled in water.

Similarly, the amino acid content of *Senna obtusifolia* seeds (Table 2) soaked for 24 hours indicated a reduction trend as that of the proximate composition. For instance, *Senna obtusifolia* seeds soaked for up to 24 hours recorded the least lysine and methionine content of 0.64g/100g and 1.78g/100g. This might be due to the leaching out of soluble nitrogenous compounds which are components of amino acid. This agreed with the findings of Augustine (2016) who reported reduction on the amino acid content of soaked *Senna obtusifolia* seeds

Table 1: Effects of Soaking Periods on the Proximate Composition of *Senna obtusifolia* Seeds

Varying soaking periods (hours)					
Nutrients (%)	**T1(0hrs)**	**T2(6hrs)**	**T3(12hrs)**	**T4(24hrs)**	**SEM**
Dry matter	90.55	90.33	90.30	90.27	0.03^{NS}
Crude protein	25.33^{a}	24.99^{ab}	23.97^{b}	20.08^{c}	0.50*
Crude fibre	11.77^{a}	10.87	10.79	10.63	0.81^{NS}
Ether extract	3.00	2.91	2.98	2.88	0.03^{NS}
Ash	4.11^{a}	4.01^{a}	3.99^{a}	3.01^{b}	0.31*
NFE	40.34^{a}	40.03	39.61	39.21	0.32^{NS}
Energy (MJ/Kg)	10.93	10.83	10.54	9.91	-

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 2: Effects of Soaking Periods on the Amino acid of *Senna obtusifolia* Seed

Varying soaking periods (hours)					
Amino acid (g/100g)	**T1(0hrs)**	**T2(6hrs)**	**T3(12hrs)**	**T4(24hrs)**	**SEM**
Lysine	1.19[a]	0.86[b]	0.85[b]	0.64[c]	0.08*
Methionine	2.55[a]	1.75[b]	1.77[b]	1.78[b]	0.67*
Threonine	2.77[a]	1.85[b]	1.96[b]	0.92[c]	0. 07*
Isoleucine	2.21[a]	2.08[a]	2.07[b]	1.38[c]	0.04*
Leucine	3.59[a]	1.25[b]	1.12[b]	0.94[c]	0.02*
Phenylalanine	1.82[a]	0.96[b]	0.88[b]	0.63[c]	0.02*
Valine	1.63[a]	1.18[a]	1.33[a]	0.67[b]	0.05*
Arginine	1.69[a]	1.68[a]	1.57[ab]	1.02[c]	0.09*
Alanine	0.97[a]	0.72[ab]	0.71[ab]	0.54[c]	0.02*
Glutamic acid	0.94[a]	0.78[b]	0.64[c]	0.66[c]	0.01*
Glycine	1.09[a]	0.69[b]	0.65[b]	0.53[b]	0.04*
Proline	2.55[a]	1.65[b]	1.51[c]	1.45[c]	0.11*

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 level of anti-nutritional factors (Table 3) were also observed to significantly (P < 0.05%) decrease with increasing duration of soaking with those seeds soaked for 24 hours indicating the highest level of reduction of most of the anti-nutritional factors. Vidal *et al*. (1994) earlier 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 soluble anti-nutritional factors in legumes. This will enhance safety in feeding of *Senna obtusifolia* seeds to livestock.

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

Varying soaking periods (hours)					
Ani-nutrients (g/100g)	**T1(0hrs)**	**T2(6hrs)**	**T3(12hrs)**	**T4(24hrs)**	**SEM**
Tannins	5.42[a]	2.59[b]	2.76[b]	2.59[b]	0.01*
Oxalates	1.95[a]	0.98[b]	0.86[b]	0.18[c]	0.03*
Flavonoids	3.86[a]	2.59[b]	2.78[b]	1.92[c]	0.07*
Phytates	4.61[a]	3.12[b]	3.32[b]	2.73[c]	0.12*
Saponins	2.37[a]	1.45[b]	1.37[b]	0.97[c]	0.025*

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 varying soaking periods indicated a slight decreasing trend as the soaking period progresses. It can be concluded that *Senna obtusifolia* seeds soaked for 24 hours was more effective in reducing level of the anti-nutritional factors without much depreciation in the nutritional value of the seeds. This soaking period can be recommended for processing *Senna obtusifolia* seeds for livestock feeding. Further studies should be conducted to ascertain the chemical composition of *Senna obtusifolia* seeds soaked beyond 24 hours.

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