Research Article

Response of Coffee Senna (*SennaOccidentalis*) Seeds to Different Fermentation Periods

Augustine C[1],Ismaila Yada Sudi[2], Igwebuike JU[3]

[1]Department of Animal Production, Faculty of Agriculture, Adamawa State University (ADSU),Mubi, Adamawa State, Nigeria

[2]Department ofBiochemistry, Adamawa State University (ADSU), Mubi, Adamawa State, Nigeria

[3]Department of Animal Science, University of Maiduguri, Borno State, Nigeria

***Corresponding author:** Ismaila Yada Sudi, Department of Biochemistry, Adamawa State University (ADSU), Mubi, Adamawa State, Nigeria, Tel: 234816078713; E mail: yada280@ymail.com

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Abstract

A laboratory analysis was conducted to investigate the effect of varying fermentation period on the proximate composition, amino acid profile and levels of anti-nutritional factors of *Sennaoccidentalis* seeds.The seeds were fermented for 0,3,5,7 and 9 days, respectively in replicate of three in a completely randomized design. The proximate composition, amino acid profile and level of anti-nutritional factors of the *Sennaoccidentalis* seeds subjected to different fermentation periods were determined using standard laboratory procedure. Data obtained were subjected to analysis of variance of the completely randomized design (CRD) using Statistics 9.0. The results indicated that the proximate composition of *Sennaoccidentalis* seeds significantly (P<0.05) increases as the fermentation period progresses except for the ether extract and nitrogen-free extract which reduced as the fermentation period increased. The amino acid content similarly showed significant (P<0.05) increase as the fermentation period advanced. The level of the anti-nutritional factors were observed to significantly (P<0.05) decline as the fermentation period progresses. It can be concluded that *Sennaoccidentalis* seeds can be fermented up to 9 days without adverse effect on the nutritive value of the seeds. However, fermentation for 5 is recommended due to its minimal reduction of ether extract and nitrogen-free extract when compared to 7 and 9 days fermentation. The fermented seed meals

Keywords:

Response; Fermentation Periods; *Sennaoccidetalis*; Lesser-Known.

Introduction

Lesser-known legume sources are reported to be rich in nutrients such as protein with good array of amino acids and nutritionally needed minerals [1]. Fermentation has been reported to improve the nutritional quality of feed material [2-4]. *Sennaoccidentalis* is one of such wild legume that is under-utilized as protein source in Nigeria. It is a pan-tropical plant species that belongs to the family of *Fabaceae*, subfamily *Caesalpinioide* and genus *Senna*. It is characterized by alternate compound leaves. The pod is about 12.5cm x 0.7cm containing 23-30 seeds. The flower is ovate yellow [5].The chemical composition as revealed by Augustine*et al.*[6] indicated that the seed meal has promising nutritional value but also contains some anti-nutritional factors such as tannins, oxalates, phytates and saponins which will limit its utilization with adverse consequences on animal performance. In view of the above, it has become imperative to detoxify the seeds before feeding to livestock. Fermentation which is a bioprocess is an ideal detoxification method that can improve the utilization of *Sennaoccidentalis* seeds. Many researchers have documented the beneficial effects of fermentation in improving the nutritional quality of feed ingredients [4,7]. Before recommending fermentation as a method of processing *Sennaoccidentalis* seeds, it is important to thoroughly investigate the best fermentation time that will enhance optimal utilization of *Sennaoccidentalis* seeds. At the moment, information on the effects of fermentation time on the chemical composition of *Sennaoccidentalis* seems to be scanty hence the need to bridge such information gap. This study was therefore designed to evaluate the effect of different fermentation period on the proximate composition, amino acid profile and level of anti-nutritional factors of *Sennaoccidentalis* seeds indigenous to Mubi area of Adamawa State, Nigeria.

Materials and Methods

Identification, collection and processing of Senna*occidentalis* seeds

Sennaoccidentalis seeds were identified at the Department of Biological Sciences Adamawa State University, Mubi, Nigeria by a Botanist. The dry seeds were collected in uncultivated areas in Mubi.The seeds were naturally fermented for 0,3,5,7and 9 days in triplicates each in a complete randomized design. The fermented seeds were milled and sieved through a 1mm sieve.

Chemical Analysis

The proximate composition of *Sennaoccidentalis* seeds was determined using the standard procedure of AOAC [8]. The dry matter content was determined using the oven-drying method and crude protein (CP) was determined using the Kjeldahl procedure. Soxhlet extraction method was used for the determination of ether extract (EE)while thecrudefibre (CF) content was evaluated using the Trichloroacetic method and the ash content determined using the murfle furnace ignition method. Nitrogen-free extract (NFE) was computed indirectly by using the formula:

NFE = 100 – (% moisture+CP+CF+EE+ash)

The level of anti-nutritional factors was determined using the standard methods of AOAC [8].The amino acid profile was analyzed using isocratic high performance liquid chromatography (HPLC) equipment model No. BLC 10/11 using the procedure described by Pearson [9].

Results and Discussion

The result of the proximate composition of *Sennaoccidentalis* seeds subjected to different fermentation periods is presented in Table 1. The result indicated significant (P<0.05) increase in the crude protein content as the fermentation period progresses. Similar effects were reported by Igbabul*et al.*[4] and Adebowale and Maliki [7] for *Afzelia Africana* flour and *Cajanuscajan* seed subjected to different fermentation periods. The increase in protein content may be attributed to reasons reported by Anthony and Babatunde [10] who reported that increase in number of lactic acid bacteria during fermentation can increase protein content of the seeds. This may be linked to increase in microbial protein.

Nutrients (%)	T(0day)	T2(3 days)	T3(5 days)	T4(7 days)	T5(9 days)	SEM
Dry matter	92.5	91	91	92	91	4.31^{NS}
Crude protein	19.62^{c}	20.00^{b}	21.67^{a}	22.05^{a}	22.61^{a}	0.21*
Crude fibre	13.80^{a}	8.90^{b}	5.90^{c}	5.00^{c}	4.10^{d}	2.05*
Ether extract	4.03^{a}	2.94^{b}	2.87^{b}	2.97^{b}	1.53^{c}	0.11*
Ash	5.70^{b}	6.82^{a}	6.79^{a}	6.50^{a}	6.47^{a}	1.36*
NFE	49.80^{a}	47.90^{a}	44.20^{b}	44.09^{b}	39.07^{c}	1.09*

Table1: Proximate composition of Sennaoccidentalis subjected to differentfermentation periods

a,b,c =means in the same row with different superscripts are significantly different (P<0.05)

* = Significant at 95% level of confidence, NS = Not significant (P>0.05) SEM = Standard error of the means

NFE = Nitrogen free extract.

The ash content was significantly (P<0.05) influenced by the different fermentation periods. The ash content ranged from 5.70% in the unfermented to 6.82% in the fermented seed meal. The clear trend is that of an increase in the ash content as the fermentation period increases. This finding is in agreement with the report of Uwagbuteet al.[11]and Anthony and Babatunde[10] who reported an increase in the ash content of millet and cowpea as the fermentation period increases. This increase may be linked to the ability of fermentation to lower the dry matter content resulting to an increased concentration of minerals[12].

The crude fiber content was observed to significantly (P<0.05) decrease as the fermentation period increases. Rainbault[13]observed that such reduction might be due to the enzymatic break down of the fiber during fermentation by lactic acid bacteria which utilized them as carbon source and converted them to microbial biomass thereby reducing the fiber content. Similar finding was reported by Magdi[14].

The effect of the different fermentation period on the ether extract was observed to linearly reduce as the fermentation period increases. This decrease might be due to the increase in the activities of lipolytic enzymes during fermentation which hydrolysis fat components into fatty acid and glycerol [15]. Anthony and Babatunde[10]; Chang and Miles [16]and Fudiyasaet al.[17]further stressed that break down of fatty acid is responsible for thearoma, taste,odour and texture of fermented feed ingredient.

The nitrogen free extract was seen to have reduced as the fermentation period advances. This reduction effect was similarly reported by Ojewole and Odunta[18]who attributed such reduction to the utilization of some sugars by the fermenting lactic acid bacteria for their growth and other metabolic activities. This clearly indicated that increase duration of fermentation is likely to reduce the energy value of a feed material.

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The amino acid profile of *Sennaoccidentalis*seed as affected by different fermentation periods is summarized in Table 2. The result revealed that the amino acid content was significantly (P<0.05) affected by the different fermentation periods. There was an increase in the amino acid profile as the fermentation period increases. This finding was supported by Igbabul *et al.* [4]whopointed out that increase in microbial mass as fermentation period progresses can cause extensive hydrolysis of protein molecule to amino acids and other simple peptides. However, fermentation period at day 5, 7 and 9 exhibited similar amino acid profile.

Amino acid	T1(0day)	T2(3 days)	T3(5 days)	T4(7 days)	T5(9 days)	SEM
Lysine	4.20^{b}	4.30^{b}	4.70^{ab}	4.80^{b}	4.76^{b}	1.02*
Methionine	1.35^{c}	1.42^{b}	1.67^{a}	1.79^{a}	1.76^{a}	0.32*
Isoleucine	2.79	2.97	3.24	3.21	3.19	0.62^{NS}
Phenylal-aline	3.60c	4.02b	5.80a	5.94a	6.00a	1.08*
Valine	2.10^{c}	3.31^{bc}	4.25^{a}	4.23^{a}	4.16^{a}	0.67*
Histidine	4.00^{b}	4.20^{b}	4.75^{a}	4.84^{a}	4.77^{a}	0.88*
Arginine	2.30^{b}	3.55^{b}	4.66^{a}	4.61^{a}	3.62^{a}	0.17
Serine	2.01^{c}	3.30^{b}	3.80^{ab}	4.78^{a}	3.89^{ab}	2.42*
Cysteine	2.65^{c}	2.97^{bc}	3.45^{a}	3.61^{a}	3.28^{a}	0.11*
Glycine	6.65^{c}	8.22^{ab}	9.95^{a}	9.00^{ab}	9.45^{ab}	1.09*

Table 2: Effects of Different Fermentation Periods on Some Amino Acid Profile of Sennaoccidentalis Seeds (g/100g) a,b,c,d =means in the same row with different superscripts are significantly different (P<0.05)

* = Significant at 95% level of confidence, NS = Not significant (P>0.05) SEM = Standard error of the means.

The effect of fermentation periods on the level of anti-nutritional factors of *Sennaoccidentalis* seeds is shown in Figure 1. The level of the anti-nutritional factors where observed to be lower as the fermentation period increases. The decrease may be due to the combine effects of cooking resulting to leaching out of these anti-nutritional factors in boiling water and metabolic microbial activity during fermentation. This was buttressed by Ali *et al.*[19] who reported that tannins act as carbon source for microorganism and as inducer of the endogenous synthesis of the enzymes.

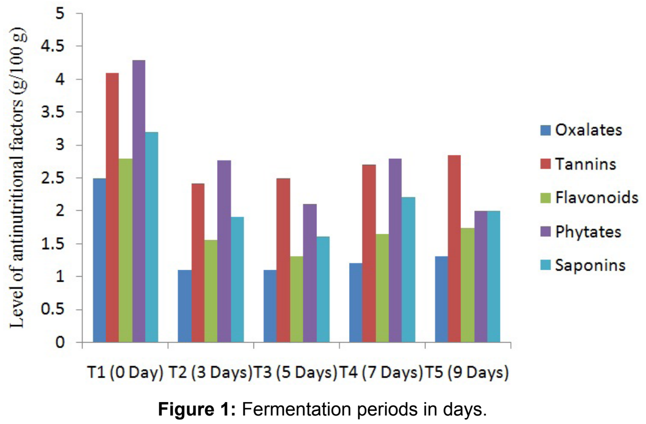

Figure 1: Fermentation periods in days.

Patricia *et al.* [20]further explained that tannin acyl hydrolases have the ability to hydrolyze the ester bond of tannins. The reduction of phylates in fermented feed is attributed to hydrolysis of phylates into lower inositol phosphates [21,22]. Similar observations were made by Igbabul*et al.* [4] and Anthony and Babatunde [10] for mahogany bean and millet subjected to different fermentation periods.

Conclusion

The outcome of this investigation indicated that progressive increase in fermentation periodhas beneficial effect on the nutritional value of *Sennaoccidentalis* seeds. The result indicated that *Sennaoccidentalis* seed can be fermented up to 9 days. However, fermentation 5 days is recommended due to the minimal reduction of ether extract and nitrogen-free extract when compared to 7 and 9 days. The fermented seeds should be used in a feeding trial to evaluate their actual biological value.

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