



Nutritional evaluation and histopathological assessment of unprocessed *Senna Occidentalis* (Coffee Senna) seed meal in broiler chicks

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Abstract

A 21 days feeding trial was conducted to evaluate the effect of unprocessed *Senna occidentalis* seed meal on gross lesions in broiler chickens. One hundred and twenty (120) day-old Anak (2000) broiler chicks were weighed and randomly allotted to four dietary treatments in the deep litter system, replicated 3 times with 30 birds each. *Senna occidentalis* seeds were collected from the environment of Taraba state University Jalingo in Ardo-kola Local Government Area. They were allowed to dry, cleaned of dirt and milled for the feeding trial. Four experimental diets were formulated T1 (0%) contained no *Senna* seed and served as the control while T2, T3 and T4 contained 5, 10 and 15% *Senna* seed. The results of birds fed with 15% unprocessed *Senna occidentalis* showed inflammation in the bursa of fibricious, congestion in the intestine and ulceration, congestion in the caeca and the intestine were pale and distended. The results also showed a decrease in relative weight of bursa of fabricious ($P<0.05$) and spleen ($P<0.05$). Based on the results, *Senna occidentalis* was toxic to chicks. Hence, the need to detoxify the phytochemical properties of the plant in order to enhance its usage in poultry feeds.

Keywords: Histopathological, *Senna occidentalis*, broiler chickens, Phytochemical, unprocessed.

Description of Problem

The soaring food prices have triggered an increase in hunger worldwide, especially in sub-Saharan African countries like Nigeria. The increase in prices of food has been attributed to several factors that include production shortfalls due to drought and floods, impact of climate change, increase demand for bio-fuel, emerging consumption habit of fast growing economics of some nations as well as trade policies to stabilize the food market crises^[8]. The price has aggravated

the already precariously low animal protein food consumption of about 3-5kg/capita/year in developing countries in comparison with the world average of 38kg/capita/year and the U.S.A 124kg/capita/year^[19]. In addition, there is the projected 56% growth in the demand for meat by 2020 especially in developing countries. This may likely heighten the demand against a weak supply.^[7]

In order to increase the consumption of animal protein in developing countries, it is necessary to reduce the cost of producing

meat, egg and milk, thereby making them accessible and affordable to the majority of the people.^[5] Soybean is the main conventional plant protein source for livestock diets in Nigeria. The competition between livestock and human for the consumption of soybean and the increasing role of soybean in the world as a bio-diesel feedstuff. Consequently, the search for a high quality cheap and readily available source of plant protein to replace soybean is now a major concern of livestock nutritionist in many of the developing countries even more than before,^[14]. One of such legumes with great prospect as alternative and replacement for soybean is *Senna occidentalis* (Coffee senna).

Senna occidentalis is an unarmed slender upright and short-lived shrub 0.5-2.5m tall, distinguished by foetid odour. Its flowers (2.3cm across), *Senna* is an ancient Arabic name for these plant, the Latin word *occidentalis* means western. Many species have been used medicinally, these tropical plants have a rich history in natural medicine. The leaves or pods of the plant have been used by Arab physicians for their laxative properties since the ninth century, but in feed, its use in industry is limited. Today, *Senna* is used as food and drug administration approved non prescription drug and an ingredient in several commercial laxatives. Both the leaves and the seed pods (fruit) have laxative activity due to the presence of a compound called anthraquinones, it accelerate defecation. Laxative use, antifungal, decrease fever, cutaneous anti-infective, antispasmodic, anti-rheumatic, anti-inflammatory, used for treatment of urinary infections and hemorrhoids, purgative and cleansing. In Africa and Asia, the leaves and seedpod were used to treat anemia, bronchitis, constipation, jaundice and skin problems.

The knowledge of alternative cheap

feedstuff and their level of inclusions into animals feed without deleterious effect go a long way in solving the problem of high cost in poultry feed production with consequent increase profit margin, increasing scale of production thereby achieving protein availability and improve sustainable intake and higher food security^[12], one of such feed sources that could be used to reduce the problem of high cost of conventional protein and energy source in mono-gastric diets is *Senna occidentalis* seed. This diverse genus is native throughout the tropics, the species was formally placed in the genus cassia, the plant is reported to be poisonous to cattle and chicks, the plant contains anthraquinones, the roots contains emodin and the seed chrysarobin (1,8 dihydroxy-3-methyl-9-anthrone) and (N-methylmorpholine). Despite the claims of being poisonous, *Senna occidentalis* can be used as coffee substitute inspite of the fact that the seeds are reported to be toxic to cattle. It has medicinal and insect repellent properties^[8], the foliage is poisonous and generally avoided by livestock. Ingestion of large amounts of seed has been implicated in death of cows, horses and goats. Poising of pigs fed coffee *Senna* seeds resulted in muscle necrosis^[21]. However, before recommending such feed ingredients as feedstuffs, the nutritional properties and its effects on the performance and gross lesions on chicks should be thoroughly investigated.

The nutritive value of *Senna occidentalis* seeds is found to be rich in crude protein, crude fibre, ether extract, carbohydrates and mineral elements, however, it is shown that with the presence of iron, calcium, potassium, sodium and magnesium as micronutrient serves as a good source of anti-oxidant at 16.44; 3.81; 1.81; 0.11 and 0.81 respectively. From this result it can be deduced that *Senna occidentalis* seed has Fe at high concentration and may be used for the treatment of anemia

when used as supplement. *Senna occidentalis* seeds contain essential amino acid; these include lysine, methionine, leucine, glutamine, histidine and aspergine^[23]. This study therefore is to evaluate the possible effect of unprocessed *Senna occidentalis* seed meal in broiler chicks.

Materials and Methods

The research was conducted at College of Agriculture Poultry teaching and practical farm Jalingo Taraba state. The area is located between latitude 8^o- 50 N of the equator and longitude 11^o- 25E of the Greenwich meridian. With an annual rainfall ranging from 1000-1500mm, the ambient temperature ranged from 20°C in December and 38°C in March.

Source of *Senna* Seeds

Senna occidentalis seed was collected from the matured stand at the commencement of dry season from the environment of Taraba state University Jalingo in Ardo-kola Local Government Area of Taraba. The pods were properly dried and threshed to obtain the seeds; the seeds were properly dried and ground to meal.

Experimental Birds and Management

One hundred and twenty {120} Anak (2000) broiler chicks at day-old were used for

the research. The chicks were provided with anti-stress, glucose and water ad-lib on the arrival. The birds were housed in a deep litter pens and measured quantity of the experimental diets and water were made available at all times. The left over feed was collected and weigh on daily basis in order to know the feed intake. The experiment lasted for 21 days.

Experimental Design

Complete randomized design (CRD) was used for the study. 120 day-old chicks were weighed and randomly allotted to four dietary treatments under deep litter system with 3 replicates containing 30 birds each.

Chemical Analysis

The proximate composition of the seed meal and the experimental diets were carried out using standard procedure of analysis described by ^[2]. The result of the proximate analysis of the seed meal is presented in Table 2

Experimental Diets and Treatments

The ground raw *Senna occidentalis* seed meal was mixed into the broiler rations at concentrations of 0,5,10 and 15% in diets T1, T2, T3 and T4 respectively. 0% (T1) served as control.

Table 1: Composition of Experimental Diets for Starter

Ingredients	T1(0% RSOSM)	T2(5% RSOSM)	T3(10% RSOSM)	T4(15% RSOSM)
Maize	49.90	47.40	44.60	42.60
GNC	34.10	31.60	29.40	26.40
RSOSM	0.00	5.00	10.00	15.00
Maize offal	8.00	8.00	8.00	8.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00
Limestone	2.00	2.00	2.00	2.00
Premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated analysis				
Crude protein	23.02	23.09	23.27	23.17
Metabolizable energy (kcal/kg)	2812.34	2827.28	2840.74	2858.04

RSOSM – Raw *Senna occidentalis* seed meal

GNC – Groundnut cake

Data Collection

Nine chicks from each group were slaughtered weekly for pathological examination. At autopsy all chickens were examined for gross lesions. Representative samples of each of liver, kidney, heart, intestine, gizzard, crop, bursa of fabricious, caeca, proventriculus, lungs, oesophagus and trachea. Fluid accumulation was observed and the skin was also observed for edema. All findings during the autopsy are presented based on summary of each treatment group in Table 3.

Result and Discussion

The result of proximate composition of the experimental diets indicated that, the diets met the nutritional requirement of the growing birds as it is recommended by ^[1]. Some anti-nutritional factors such as tannin reduces feed intake by decreasing palatability of diets because of its astringent effect on oral cavity,

this effect may be attributed to increase in the concentration of residual anti-nutritional factors which are not completely removed. The astringent taste arises due to binding of tannin with salivary glycol-protein which impairs lubricant property to mucin^[10].

The result of gross lesion of birds treated with 15% unprocessed *Senna occidentalis* for 21 days showed inflammation in the bursa of fabricious, congestion in the intestine and ulceration, congestion in the caeca and the intestine were pale and distended. Pathology also revealed the presence of apoptotic cells and immonublasts cells. The cortico-medullar border of the bursa of fabricious follicles was disrupted which indicates marked lymphoid organ atrophy, the diffuse lymphoid tissue, liver, kidneys and other organs from treated birds did not show abnormal lesions.

The results of weight gain and feed conversion ratio followed similar trend to that of feed intake. Treatment one significantly

recorded the highest weight gain. The body weight gain were slightly lower than values reported by^[20], the reduction in body weight at 10 and 15% concentration of raw *Senna occidentalis* seed meal may similarly be attributed to fairly high concentration of residual anti-nutritional factors such as tannin and alkaloids which may limit nutrient

utilization consequently affecting weight gain. This concur with the report of^[19], who reported that anti-nutritional factors such as tannin generally reduce feed palatability, voluntary feed intake, protein and carbohydrate digestibility and thereby reduces the growth rate of animals.

Table 2: Proximate Composition of RSOSM

Parameters	Composition (%)
Dry matter (DM)	92.25
Crude protein (CP)	26.80
Ether extract (EE)	7.30
Crude fibre (CF)	5.20
Nitrogen free extract (NFE)	51.10
Ash	6.10
Calorific value (kcal/100g)	339.70

*Values are means of three replicates

Table 3: Gross lesions in broiler chicks fed varying levels of unprocessed *senna occidentalis* seed meal

Treatments	Findings	Remark
T1 (0% RSOSM)	- Proventriculus normal	Normal
	- Lungs normal	
	- Heart normal	
	- Trachea normal	
	- Bursa of fabricious normal	
	- Intestine normal	
T2 (5% RSOSM)	- Accumulation of fluid under the skin (oedeme)	Abnormal
	- Accumulation of fluid in the abdomen	
	- Bursa of fabricious normal	
	- Intestine congested and shriveled	
	- Lungs and gizzard normal	
	- Heart, proventriculus and oesophagus normal	
T3 (10% RSOSM)	- Congestion of the intestine	Abnormal
	- Heart, proventriculus and oesophagus normal	
	- Lungs and Bursa of fabricious normal	
T4 (15% RSOSM)	- Bursa of fabricious inflamed	Abnormal
	- Congestion in the intestine and ulceration	
	- Congestion in the caeca	
	- Intestine were pale and distended	
	- Gizzard, heart and lungs normal	
	- Proventriculus normal	

The proximate analysis revealed that crude fibre content has the lowest value (5.20%) among all the nutrients composition while dry matter was found to be the highest value (92.25%). This is of the average when compared with that of other legumes ranging from 23.0% in Groundnut 66.0% in Bambara groundnut; this implies that the shelf life for

this seed will likely be longer than that of most legumes. The ash content of (6.10%) for this seed is slightly high with that of other legumes which has been reported to range between 3.0 and 4.8%. While crude protein (26.80%), Ether extract (7.30%) and nitrogen free extract (51.10%) respectively.^[22]

Table 4: Anti- nutrient Composition of RSOS

Phytochemical	Concentration (mg/100g)
Tannins	378.50
Alkaloids	248.60
Phytates	247.20
Saponins	190.30
Oxalates	102.40
Cyanides	4.10

*values are means of three replicates

The effects of dietary *Senna occidentalis* in concentration of 5% (T2), 10% (T3) and 15% (T4) of the basic diet on body weight, weight gain and feed conversion ratios, reveal that *Senna* fed in diet in concentration of 10 and 15% for 3 weeks significantly depressed body weight, weight gain and feed efficiency compare to control chicks in treatment one (T1). During the feeding of *Senna occidentalis*, fluid accumulation in the abdominal cavity was observed and the skin was also observed to be edematous. Inflammation in the bursa of fabricious and less in the spleen, congestion and ulceration were more marked in T4 than T3 and T2. Despite the gross lesions observed in the bursa of fabricious and intestine of chicks treated with *Senna occidentalis* seed meal, no impairment in antibody, anti-NDV production was found. The antibody production occurs mainly in the spleen and in lymphoid tissue dispersed throughout the body and to a lesser extent in the bursea of fabricious and bone marrow^[9]. Xenobiotics tent to cause prominent toxic

effect only in organs which the compound has a high affinity^[15]. Thus, it is suggested that dianthrone has an affinity only for the spleen and bursa of fabricious, consequently there was normal antibody production from the dispersed lymphoid tissue which was not affected by *Senna occidentalis* exposure.

The results, however, show that despite changes in acquired immune responses, antibody production and cellular immune responses were not compromised. Even so, we cannot assume that *Senna occidentalis* seed meal do not have any toxic effects on the immune system because it is possible that immunosuppression occurs at higher doses than used in this study. During the feeding of *Senna occidentalis* diet period, hemorrhages and/or congestion were most frequently in the spleen. Congestion and hemorrhages were more marked in T4, T3 and barely seen in T2. The liver showed vacuolation and shrinkage was observed in the kidneys. It is well known that *Senna occidentalis* cause a variety of lesions in animals among which are skeletal

and/or myocardial degeneration and congestion in the kidneys and liver. The results also showed a decrease in relative weight of bursa of fabricious ($P < 0.05$) and spleen ($P < 0.05$)^[11]. Other change also noticed are lymphoid organs with depletion of lymphoid cells on the spleen and bursa of fabricious, it is possible that mitochondrial damage may have taken place^[11]. Enterohepatonephropathy was indicated by reduction in growth and impairment of the excretory rate of liver and kidneys explain that the plant contain phytochemical constituents.

Conclusion and Application

1. The present study showed that *Senna occidentalis* administration to broiler chicks can promote immunotoxic effect in lymphoid organs such as the spleen and bursa of fabricious, corroborating results from^[17]. Since *Senna occidentalis* is toxic to chicks, a way of detoxifying the phytochemical properties of the plant should be employed to enhance its usage in animal and poultry feeds.
2. Further investigations are required to evaluate the methods of treatment of this underutilized plant with the hope of incorporating an acceptable levels in animal and poultry feeds.

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