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Pathological Changes in the Liver of Albino Rats Fed Raw or Processed Sickle Pod (*Senna obtusifolia*) Seed Meal Based-Diets

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Abstract: A feeding trial was conducted for thirty (30) days to investigate the effects of feeding processed *Senna obtusifolia* seed meal (SOSM) based-diets on the physical appearance and condition of liver of albino rats. Five experimental diets were compounded to contain 0% SOSM and 20% each of the raw, toasted, boiled and fermented SOSM based-diets. Sixty (60) young albino rats with initial average weight of 72.67 g were randomly allotted to the five dietary treatments in a complete randomized designed with three replicates of four rats each. At the end of the thirty (30) days, three (3) albino rats were randomly selected, sacrificed and their livers carefully removed and examined. The result indicated that albino rats fed raw SOSM based-diet showed some forms of liver injuries (dark colour, inflammation and dark spots) on the liver while mild signs of liver injuries (slightly dark colouration and few spots) were observed on the livers of albino rats fed the toasted and boiled SOSM based-diets. The livers of albino rats fed 0% SOSM and 20% fermented SOSM based-diet were observed to be in normal condition. Based on the findings of this study, it can be concluded that incorporation of 20% fermented SOSM in the diets of albino rats had little or no deleterious effects on the liver of albino rat and is therefore recommended for feeding of albino rats.
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Keywords: Pathological changes, albino rats, processed *Senna obtusifolia* seeds.

Introduction

The major problem confronting livestock production in Nigeria is the high cost of conventional feed ingredients such as soya bean, groundnut cake and maize. Rafiu *el al.* (2014) further buttressed that the high cost of animal products in most developing countries especially Nigeria can be attributed to high cost of livestock feeds which generally accounted for 60-70% of the total cost of production. In view of the above, it has become necessary to divert attention into the utilization of unconventional feed resources that are hitherto under-utilized. Lesser-known legumes such as *Senna obtusifolia* seed has emerged as an alternative suitable feed resource for monogastric animals. The use of *Senna obtusifolia* as protein source for chickens has been well documented (Augustine, 2016). The chemical properties of the seed as revealed by Ingweye *et al.* (2010) and Augustine *et al.* (2017) indicated that it has good nutritional value (29.54 and 23.40% crude protein) but also contain some anti-nutritional factors such as tannins, phytates and oxalates which might probably hinder nutrient utilization, cause toxicity and adversely affect overall performance of animal. The presence of anti-nutritional factors in *Senna obtusifolia* seed necessitates some form of processing to eliminate or reduce the concentration of anti-factors to safer threshold. Even if the seeds are processed, the issue of residual anti-nutritional factors cannot be completely ruled out and are therefore believed to cause some form of injury to the liver.

Histopathological and biochemical investigations are reliable means of diagnosing liver injury or liver disease but are often time consuming and require more money. Therefore, it is important to resort to quicker, simpler and cheaper means of investigating liver injury in animals. A quicker, cheaper and fast means of assessing liver injury is to examine the physical appearance and condition of the liver. At the moment, base-line information on the

visible pathological changes in the liver of albino rats fed processed *Senna obtusifolia* seed meal based-diets seems to be scanty hence, the need to conduct more studies and bridge this information gap. It is in view of the above that this study was conducted to evaluate the effects of feeding raw or processed SOSM based-diets on the physical appearance and condition of the liver of albino rats and mortality.

Materials and Methods

The study was conducted at the Animal House of the Department of Biological Sciences, Adamawa State University, Mubi. A total of sixty (60) young albino rats with an average initial weight of 72.67 g were used for this experiment. The rats were managed in constructed metal cages. Five experimental diets were compounded to contain 0% SOSM and 20% each of the raw, toasted, boiled and fermented SOSM, respectively (Table 1). The sixty (60) young albino rats were randomly allotted to the five (5) dietary treatments in a complete randomized design with three (3) replicates of four (4) rats each. At the end of thirty (30) days, three (3) albino rats were randomly selected from each treatment and were sacrificed. Liver from each albino rat was carefully removed, placed on a flat glass and examined using a powerful magnifying hand lens. All observations made were recorded.

Table 1: Ingredient Composition and Calculated Analysis of the Experimental Diets

Inclusion levels of raw or processed SOSM					
Ingredients	**T1 0%SOSM**	**T2 20%RSOSM**	**T3 20%TSOSM**	**T4 20%BSOSM**	**T5 20%FSOSM**
Maize	49.00	48.00	48.00	48.00	48.00
Maize Offal	15.15	14.95	14.95	14.95	14.95
Roasted soya bean	21.80	5.00	5.00	5.00	5.00
GNC	10.00	10.00	10.00	10.00	10.00
PSOSM	0.00	20.00	20.00	20.00	20.00
Salt	1.50	1.50	1.50	1.50	1.50
Bone meal	0.20	0.20	0.20	0.20	0.20
Methionine	0.15	0.15	0.15	0.15	0.15
Premix	0.20	0.20	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis					
Crude protein (%)	18.83	18.01	18.11	18.09	18.97
Energy (kcal/kg)	2911.83	2960.62	2958.23	2948.33	2939.11

Metabolizable energy (ME) calculated according to the formula of Pauzenga, (1985) ME = 37 x % CP + 81 x % EE + 33.5 x % NFE; NFE = Nitrogen–free extract; SOSM = *Senna obtusifolia* seed meal; RSOSM = raw *Senna obtusifolia* seed meal; TSOSM = toasted *Senna obtusifolia* seed meal; BSOSM = boiled *Senna obtusifolia* seed meal; FSOSM = fermented *Senna obtusifolia* seed meal.

Results and Discussion

The observations made on the livers of albino rats from the different treatments are summarized in Table 2. The group of albino rats fed 20% raw SOSM based-diet indicated some forms of liver abnormality (dark colouration, enlarged with dotted dark spots all over). This is a clear signs of liver injuries which might be attributed to the adverse effects of anti-nutritional factors present in the raw seed. This finding is in line with report of Ojokoh (2006) who reported similar toxicological effects of phytotoxins in the calyx of *Hibiscus sabdarifa* on the liver of albino rats. The author, explained that toxic components in plants may cause infiltration which could possibly damage the liver if not properly detoxified.

The groups of rats fed the boiled and toasted SOSM based-diets revealed some forms of mild liver abnormality (Table 2). These mild pathological evidences observed in the groups of albino rats fed the toasted and boiled SOSM based-diets might be due to the effects of residual anti-nutritional factors which adversely affected the liver of the rats. These outcome is in consistent with the findings of Akande *et al.* (2012) who similarly observed some forms of histological changes in the liver of albino rats fed processed castor bean cake and attributed such changes to the adverse effects of residual anti-nutritional factors present in the bean after processing. This outcome therefore suggest that toasting and boiling methods used to process *Senna obtusifolia* seeds only resulted in partial detoxification. This corroborates the report of Vidal-Valverde *el al.* (1997) who pointed out that processing faba beans by single processing method only gave partial detoxification and they concluded that the use of single processing method may not cause the desired removal of anti-nutritional factors.

Table 2: Pathological Conditions of Liver of Albino Rats Fed Raw or Processed *Senna obtusifolia* Seed Meal Based- Diets

Parameters	T1 0% SOSM	T2 20%RSOSM	T3 20%TSOSM	T4 20% BSOSM	T5 20%FSOSM
Colour	Brown and normal	Abnormal dark colour and dark at extreme edges	Brown and normal colour but darkens at extreme edges	Slightly dark on the left lobe	Brown and normal
Physical appearance	Smooth and shinny	Smooth with black spots	Smooth with black spots	Smooth with black spots	Smooth with no spots
Size	Normal not enlarged	Enlarged	Not enlarged	Not enlarged	Not enlarged
Mortality	0.00	2.00	0.00	1.00	0.00

The non-pathological changes observed in the albino rats fed the fermented SOSM based-diet indicated the superiority and effectiveness of fermentation in detoxifying *Senna obtusifolia* seeds. Similar findings were reported by Augustine (2016) for broiler chickens and cockerels. Hong *et al*. (2004) and Feng *et al.* (2007) further supported the effectiveness of fermentation in detoxification of anti-nutritional factors. In addition, many biologically active by-products present in fermented feed materials such as probiotic bacteria and lactic acid may exert beneficial effects on animal (Wang *et al.,* 2012) which might also be a reason for the mild or non-toxic effects on the liver of albino rats fed the fermented *Senna obtusifolia* seed meal based-diet.

Conclusion

The outcome of this investigation revealed that albino rats fed raw SOSM based-diet indicated some forms of liver abnormality an indication of the adverse effects of anti-nutritional factors present in the raw seed. The albino rats fed the boiled and toasted SOSM based-diets indicated some forms of mild liver injuries which was attributed to the adverse effects of residual anti-nutritional factors present in the toasted and boiled SOSM. The normal liver observed in rats fed 20% fermented SOSM based-diet was an indication of the effectiveness of fermentation in detoxification of the seeds and is therefore recommended for processing *Senna obtusifolia* seeds.

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