ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 9, Issue 2, pp: (32-37), Month: April - June 2021, Available at: www.researchpublish.com

Effects of varying processing methods of soya bean on gut development of broiler chickens

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Abstract: **This experiment was conducted to examine the impact of different soya bean processing methods and the effect of processed soya bean on gut development of broiler chickens. For this purpose, a 56-day research was conducted on 400 ROSS 308 broiler chickens which are raised under good intensive system of management in Federal Polytechnic Bali teaching and research farm. In achieving this, birds were assigned to five (5) treatment and sample size of six (6) per pen was used with eight replications. Gut measurement, and carcass analysis was done on the trial day (56). Data were analyzed using ANOVA in SPSS and Likert scaling techniques. Confidence and significance at 95% and P <0.05 respectively was used. The research findings showed that no significant difference p>0.05 was observed in all the parameters tested. Although, there is a significant increase of 1.89cm and 2.1cm in ileum length, 2.92cm and 2.97cm Duodenum width and 87.57cm and 71.00 small intestine in treatment D and E. This suggests an increased surface area for greater absorption of nutrients in treatment D and E. The best mean score observed in Performance, carcass characteristic , organ characteristic , and economics were on treatment A, D and E with a mean score of 2.6, 2.8 and 2.3 respectively. It is therefore recommended that further research need to be conducted on difference processing time of each method.**

Keywords: **Processing methods, soya bean, gut development broilers.**

I. INTRODUCTION

Soya beans (*Glycine max*) is not only known as human source of quality edible oil but a primary source of protein in poultry diet known and widely used (Waldroup, 1982). It is important to process soya bean in order to remove the anti-nutritional factors, which are trypsin inhibitors and lectin which naturally occur in soya bean (Liener and Kakade 1980).

Different methods are used in processing soya bean for its different protein products. Anti-nutritional factors are eliminated or reduced by using different processing methods to improve the nutritional value for animal feed (Araba, 1990). Processing methods have impact on the quality of the products, but it all depends on the method used (Araba, 1990). Heating process has been identified as the only method that affects the protein quality of soya bean. Anti-nutritive factors (trypsin inhibitors and lectins) can be rendered inactive when heating conditions such as moisture content, heating temperature and heating time are properly used (Araba, 1990). Using high heating temperature leads to denaturing of the amino acid and protein content of the soya bean (Hurell, 1990; parsons et al., 1992). The aim of this study was to examine the impact of different soybean processing method and the effect of processed soybean on gut development of broiler chickens

II. METHODOLOGY

Experimental Birds/ Design

Total number of 400 ROSS 308 broiler chicks were ordered from Olam hatchery, which is one of the reputable poultry farms in Jos Plateau state. The experiment was conducted at the Federal Polytechnic Bali teaching and Research poultry farm. In achieving this, Five (5) treatment and sample size of six (6) per pen was used with eight replications.

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Methods of processing / Treatment structure

Treatment A. (Control (Ultima poultry feed)

Treatment B. (Toasted method)

Treatment C. Extruded soya bean)

Treatment D. (Cooked method)

Treatment E. (Steam cooking method)

Source and processing of Soya beans

Soya bean was purchased at the Bali village market. Full fat soya beans was subjected to four different processing methods (Toasted, Extruded, Boiling and steam cooking).

Toasted soya bean mean: Dried soya bean was toasted using a metal pot and fire wood as heat source. The soya bean was stirred consistently with a stir rod to have uniform toast and prevents burning. The toasting was continuous till the color changed to golden brown. The soybean was spread out on concrete floor to cool, then milled and incorporated in the diet.

Soybean extrusion

The extrusion process of grains involve the use of extruding machine set on a high temperature. Grains such as maize, soybean, sorghum and millet are processed into different textures. It is more environmentally friendly and energy efficient when compared with cooking methods. The extrusion process used in this research was the modification of FEFAC, 2007. Using extrusion machine.

Cooked method: Dried soya bean was cooked using a metal pot and water. Firewood was set to supply heat, a metal pot was placed on top of heat and water was poured in to the metal pot until a boiling point was reached and the soya bean changed colour to golden brown. It was allowed to cool before incorporation in the feed.

Steam soya bean meal: Dried soya bean was steamed using force bottom power technology. Firewood was set to supply heat, a metal pot was placed on top of heat and water was poured in to the metal pot, a triple stand in shape of the metal pot was fixed inside the pot so as to prevent the milled beans from contacting water. The triple stand was covered with net and the evaporating and the steaming lasted till the milled soya bean change colour to golden brown. It was allowed to cool before incorporation.

Diet Specification:

Diets was formulated at the polytechnic poultry research farm by using maize as a source of energy. The diet formulations for each phase are shown in table 1. The five treatment diets were included in the starter diets, grower and as well as finisher diets were the same for all birds.

Table 1: Diet composition for starter, grower and finisher phases.

Ingredient	d0-14	d15-28	d28 +
Maize	61.00%	63.00%	66.46%
Soybean	33.43%	30.13%	26.29%
Soya oil	1.57%	2.93%	3.89%
Salt	0.39%	0.51%	0.38%
Limestone	0.16%	0.38%	0.11%
Dicalcium Phos. 18% P	2.18%	1.92%	1.73%
Lysine HCl	0.27%	0.21%	0.24%
DL-Methionine	0.33%	0.28%	0.25%
Threonine	0.16%	0.12%	0.13%
Vitamin & Mineral premix	0.51%	0.51%	0.51%

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Feeding techniques

Diet was weighed into individually labelled bags containing 4kg (one bags for each pen) to allow feed intake to be measured during the starter phase. Initially two bags of 4kg were weighed for each pen for grower stage and two bags of 6kg were weighed for the finisher phase. A formulated bag labelled for each pen and leftover feed was tipped back into the respective bag, and the bags were reweighed to measure feed intake on a weekly basis

Procedure

On arrival of the birds, glucose were added to their water to ease the long distance stress. Feed and water were provided ad *libitum* from feed troughs and drinker within each pen. Vitamin and mineral supplements were also added to the water from day 0-3 using a commercial supplement at the recommended rate.

The experimental diets were fed to the birds up to day 56, with different treatments fed from day 0 -14(starter), 15-28 (grower) and 28-56 days (finisher).

Sample collection and measurement

On the final trial day (day 56), birds were euthanized humanely using cervical dislocation in a separate room. From each pen, digestive tract (small intestine) was carefully separated using Meckels Diverticulum. From the distal portion, the ileum and jejunum, pancreas was collected for measurement. Measurement of weight of pancreas, ileum, jejunum weight and length was taken using precise sensitive digital scale and meter tape respectively (Jia et al., 2009) and a modification of Cornes *et al*. (1974), Parmar *et al.* (1993) and Kitagawa *et al.* (1986) method developed by Asya *et al.* (2004)

Carcass Measurements

On the final trial day of the experiment day 56, birds were weighed, plucked and eviscerated and the weights were recorded.

Statistical analysis

Data collected for gut development, carcass characteristics, were subjected to analyses using ANOVA in SPSS (IBM SPSS Statistics V.23) statistical package, in order to identify if there was any significant difference between the five different diets used, confidence and significant level were set at 95% ($p < 0.05$) respectively. Duncan's Multiple Range Test (DMRT, 1999) was used in mean separation. Similarly, Likert scaling techniques was used in this experiment to weight the treatment means, nutrient digestibility and economics.

Ethics

All procedures that were used in this research trial were based on animal health and welfare guidelines.

III. RESULTS AND DISCUSSION

Table 2: Effects of different processing methods on carcass characteristics.

Carcass characteristics	processing methods				
	A	B	C	D	E
Live wt (g)	2899.0	2450.0	2500.00	2867.0	2727.0
Eviscerated wt (g)	211.22	199.01	199.55	210.11	208.00
Plug wt (g)	269.00	251.00	225.01	267.00	263.00
Plug % (g)	93.7	87.11	89.00	92.00	92.11
Breast (%)	8.70	6.80	8.30	9.20	7.02
Wings (%)	2.47	2.00	3.00	2.77	2.67
Head (%)	0.75	0.75	0.76	0.89	0.71
Neck (%)	1.41	1.34	1.48	2.01	1.36

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Table 3: Effects of different processing methods on gut development

	Treatments				
Parameters	**A**	**B**	**C**	**D**	**E**
Intestine (g)	1.37	1.29	0.84	1.67	1.62
Liver (g)	0.50	0.46	0.63	0.63	0.75
Pancreas (g/kg BW)	1.84	4.46	2.90	1.730	1.88
Spleen (g)	0.03	0.03	0.03	0.12	0.04
Crop oesophagus (g)	15.67	10.02	3.50	4.17	11.33
Gizzard (g)	0.60	0.59	0.78	0.91	1.12
Duodenum length (cm)	16.67	6.07	4.50	5.26	14.20
Duodenum width (cm)	1.49	1.19	2.58	2.92	2.97
Ileum length (cm)	1.07	0.99	1.67	1.89	2.10
Small intestine (cm)	66.57	69.45	70.00	87.57	71.00

As shown in table 3, there is a numerical increase in the pancreas weight of 4.460 and 2.90g/kg on chickens on extruded and toasted soya bean respectively. While a decrease in pancreases weight of 1.84, 1.730 and 1.888 has been shown on birds fed with treatment A, D and E during the experiment. It is reported that there are little information on time-course of response of pancreas and trypsin inhibitors (Madar, 1979). Scientific studies shows that pancreas enlargement in broiler chicken is induced by trypsin inhibitors, this is as the result of a negative feedback of the mechanism regulating the secretion of enzymes in response to trypsin concentration (schneeman and Lyman 1975). The reduced protease activity in the intestine is as a result of the trypsin inhibitors found in the soybeans. It is accepted generally that reduction in the performance of the chickens and pancreatic hypertrophy is as a result of the presence of trypsin inhibitors found in under-processed soybean. (Slaff *et al.* 1984). In evaluating the effects of different methods of processing soybean on intestinal weight and length (jejunum and ileum) no significant relationship ($p>0.05$) was seen in the present research. However, as shown in table 3, there is a significant increase of 1.89cm and 2.1cm in ileum length, 2.92cm and 2.97cm Duodenum width and 87.57cm and 71.00 small intestine in treatment D and E. This suggests an increased surface area for greater absorption of nutrients in treatment D and E. (Almarall et al 1995). On the other hand, the lower figures in gut measurement observed in extrusion method shows reduced absorption of available nutrient this contrary to the report of Iji *et al.,* (2001). Yason (1987) reported that shortening of small intestine particularly villi and crypts lead to poor nutrient absorption.

Table 4: Selection of the best soya bean processing methods

	Processing methods				
Parameter	**A**	**B**	**C**	**D**	**E**
Chemical comp. of seed	-	1	2	3	3
Nutrient digestibility	3	1	2	3	2
Performance trait	3	2	1	3	2
Carcass characteristic	3	2	2	3	2
Organ characteristics	3	2	2	3	3
Economics	1	2	2	2	2
Mean score	2.6	1.6	1.8	2.8	2.3

1= fair 2= good 3 = better, 4 = best

The selection of the best soya bean processing methods is shown in the table 4. The presentations of the above ranking shows the summary of the pooled means of the best selected methods (i.e. control, extrusion, toasting, cooking and steam cooking). The best mean score observed in the parameters tested are treatment A, D and E with a mean score of 2.6, 2.8 and 2.3 respectively, compared to other treatments in the study conducted, such as Performance, carcass characteristic , organ characteristic , and economics was supported by Cain et el (1998) and Matsui (1996). The high mean score of most of the parameters observed in the economics and some performance traits confirmed that cooking and fermentation process converts feeds into more viable financially and structurally stable through the actions of microbial activities Stanbury and Whitaker (1984).

IV. CONCLUSION

In conclusion, the findings of this research showed that no significant difference $p>0.05$ was observed in all the parameters tested. Although, there is a significant increase of 1.89cm and 2.1cm in ileum length, 2.92cm and 2.97cm Duodenum width and 87.57cm and 71.00 small intestine in treatment D and E. This suggests an increased surface area for greater absorption of nutrients in treatment D and E. The best mean score observed in Performance, carcass characteristic , organ characteristic , and economics were on treatment A, D and E with a mean score of 2.6, 2.8 and 2.3 respectively. However, it is therefore recommended that further research need to be conducted on difference processing time of each method.

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