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FEED POTENTIALS OF FERMENTED SPENT SORGHUM GRAINS AND SWEET POTATO LEAVES FOR BROILER CHICKENS

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ABSTRACT

Feed cost has continued to increase in Nigeria. The feed potential of a fermented mixture of spent sorghum grains and sweet potato leaves (FSP) as an alternative feed for broiler chickens was evaluated. A co-culture of Aspergillus niger and Saccharomyces cerevisiae was used to ferment a 1:1 mixture of pulverised spent sorghum grains and sweet potato leaves for 21 days at 26 ± 2 ^{O}C. FSP was used to supplement commercial broiler chicken feed at 0, 5, 10, 15, and 100% levels to produce five experimental diets. The diets were analysed for their proximate contents. Forty day-old broiler chicks were assigned to five experimental diets with eight birds allocated to each dietary treatment having two replicates of 4 birds per cage in a 28-day feeding trial of Complete Randomized Design. Feed intake, weight gain, feed efficiency ratio (FER) and protein efficiency ratio (PER) were determined. Higher amounts of FSP in the diets resulted in significantly higher (P<.05) crude protein and crude fibre contents, lower NFE content, and feed intake. The 5% FSP diet had the highest average weight gain of 23.17g/bird/day, FER (0.62), and PER (2.70). Differences in the performance indices of broilers fed the 5% FSP diet and those fed the commercial broiler feed were not significant (P >.05). It is concluded that conventional chicken feed could be supplemented with FSP at 5% level without negative effects on broiler performance.

Keywords: Broilers, Fermentation culture, Spent sorghum grains, Sweet potato leaves

INTRODUTION

Rising costs of feed ingredients such as maize and soya bean in Nigeria is making the cost of finished feeds to be beyond the reach of many livestock farmers. The use of non-conventional feed resources in animal feeding is being explored as a way out of this nutritional crisis (Amata, 2014). Crop residues and agro-industrial by-products abound in Nigeria (Simonyan and Fasina, 2013). A significant portion of these wastes are left underutilized and become sources of environmental pollution.

The fibrous nature of available fibrous residues and agro-industrial byproducts limits their use as inputs for feed production especially for monogastric animals in which it limits intake and utilization.

Biological treatment is the approach of choice for upgrading of solid agricultural wastes for animal feed uses (Mahesh and Madhu, 2013). The present work sought to determine the feed potential of a 1:1 mixture of spent sorghum grains and sweet potato leaves fermented with a co-culture of *Aspergillus niger* and *Saccharomyces cerevisiae*

MATERIALS AND METHODS

Sample collection and preparation

Spent sorghum grains were collected from the Jos International Brewery in Jos South LGA of Plateau State whereas sweet potato leaves were obtained from a farm in Farin Gada, Jos North LGA of Plateau State. Twenty-gramme weights of a pulverized 1:1 mixture of spent sorghum grains and sweet potato leaves were placed in 250 ml conical flasks and moistened with 35 ml of sterile distilled water. The contents of the flasks were thoroughly mixed using a spatula. An aeration apparatus was fitted into the mouth of each flask. The flasks together with aeration apparatus were autoclaved for a period of 15 minutes at 121 ˚C and 1kgcm^2, after which they were allowed to cool to room temperature.

Fermentation of experimental substrate

Fermentation of the mixture of spent sorghum grains and sweet potato leaves was carried out using the method employed by (Onyimba et al., 2014). Sterilised substrate in each of the flasks were inoculated with 2 ml of inoculum containing 2.14 x 10^6 spores of *A. niger* and 2.64 x 10^6 cells of *Saccharomyces cerevisiae*. The inoculated substrates were mixed thoroughly with the aid of sterile spatulas and allowed to ferment aerobically over a period of 21 days at 26 ± 2^{o}C. The fermented substrate was dried at 60 °C in a hot air oven, blended with the aid of a pre-sterilized domestic blender and stored in sterile air-tight glass jars.

Experimental diets

The experimental diets included two basic diets and three composite diets. The basic diets were commercial broiler chicken feed (CBD) which served as the control diet, and 100% fermented spent sorghum grains and potato leaves mixture diet (FSP). The remaining three diets were obtained by supplementing CBD with FSP at 5, 10, and 15% levels. The proximate contents of all the diets were determined using the method of (AOAC, 1980).

Feeding trials

Forty day-old broiler chicks of about same weight were divided into two equal groups. The first group of 20 birds was subdivided into five groups of four birds each and housed in a cages. Each group of birds was then randomly placed on one of the following five diets: Commercial chicken broiler feed (CBD) which served as the control diet; 100% fermented spent sorghum grains and sweet potato leaves diet (FSP); 5% fermented spent sorghum grains and sweet potato leaves diet (5% FSP); 10% fermented spent sorghum grains and sweet potato leaves diet (10% FSP); and 15% fermented spent sorghum grains and sweet potato leaves diet (15% FSP). Feeding lasted for 28 days within which free access to diet and water was allowed. The whole experiment was repeated with the second group of 20 birds. Records of daily feed intake and weekly weight gains or losses were recorded. Growth rate, Feed Efficiency Ratio (FER) and Protein Efficiency Ratio (PER) were determined using standard formulae.

Statistical analysis

Results obtained were subjected to one-way anova statistical analysis with the aid of Microsoft Excel version 2010 software at 5% level of significance. Least Significant Difference (LSD) was used to compare means.

RESULTS

Proximate composition of formulated diets

Diets that contained fermented spent sorghum grains and sweet potato leaves mixture (FSP) had higher crude protein and and crude fibre contents than the control commercial diet, with crude fibre and crude protein contents increasing as the level of FSP increased in the diets. The crude protein, crude fibre, and nitrogen-free-extract contents of the diets ranged from 21.97-40.59%, 6.50-18.01%, and 14.60-54.51% respectively. Details of the proximate compositions of the different diets fed the birds are presented in Table 1

Growth Performance

The commercial broiler feed (CBD) was the most consumed (37.69g/bird/day) of all the diets. Feed intake decreased as inclusion level of the fermented substrate increased. The highest average weight gain of 23.17g/bird/day was recorded in birds fed fermented spent sorghum grains and sweet potato leaves mixture diet (5% FSP). The 5% FSP diet also brought about the highest Feed Efficiency Ratio (FER) of 0.62 and Protein Efficiency Ratio (PER) of 2.70. Diets which contained above 5% of FSP brought about lower bird performance. Details of feed intake, weight gain, FER and PER values of the experimental broiler chickens is presented in Table 2.

Table 1: Nutrient Composition of diets Fed the Experimental Broiler Chickens.

Nutrients	Diets (% Spent grains and sweet potato substrate)				
	A	B	C	D	E
	0%	5%	10%	15%	100%
Moisture	3.30	3.44	3.57	3.71	6.00
Crude Protein	21.97	22.90	23.83	24.76	40.59
Crude Fibre	6.50	7.08	7.65	8.23	18.01
Total Fat	4.80	4.91	5.03	5.14	7.05
Ash	8.92	9.16	9.40	9.64	13.75
Nitrogen-free-extract	54.51	52.51	50.52	48.52	14.60
	100.0	100.0	100.0	100.0	100.0

Table 2: Effect of Experimental Diets on Performance Indices of Broilers Chickens

Indices	**Diets (% fermented spent grains and sweet potato leaves mixture)**				
	0%	5%	10%	15%	100%
Feed Intake (g/b/d)	37.69±0.11^{a}	37.45± 0.20^{a}	35.15 ±0.20^{b}	33.00 ±0.05^{c}	2.10±0.21^{d}
Protein Intake (g/b/d)	8.28±0.10^{a}	8.58 ± 0.04^{a}	8.38 ±0.04^{a}	8.17 ± 0.05^{a}	0.85±0.08^{b}
Weight Gain (g/b/d)	21.49±0.10^{a}	23.17± 0.52^{a}	17.85 ±0.30^{c}	14.56 ±0.04^{d}	-2.42 ±0.50^{e}
FER	0.57±0.02^{ab}	0.62 ± 0.02^{a}	0.51 ±0.01^{b}	0.44 ± 0.04^{b}	-1.15 ± 0.15^{c}

PER	2.60±0.01^{a}	2.70 ± 0.04^{a}	2.13 ±0.03^{b}	1.78 ± 0. 03^{c}	-2.85 ± 0.03^{d}

Key: g/b/d = grammes/bird/day

DISCUSSION

Proximate Composition of Experimental Diets

The higher crude protein content of these diets was probably due to protein synthesis by the co-culture as they utilize simple sugars resulting from cellulolytic activity of *A. niger* for single cell protein production and cellular growth. Ojokoh *et al*. (2016) and Lawal *et al*. (2017) similarly reported crude protein increases after fungal fermentation of *mucuna* beans flour and brewers spent grains respectively. The observed reduction in crude fibre content was in line with reports of Onyimba *et al*. (2014) and Lawal et al. (2017) who reported crude fibre reductions during solid state fermentation of fibrous agro-industrial byproducts. Crude fibre and crude fat contents of the 5% FSP diet was comparable to that of the control commercial broiler diet. The observed decreases in nitrogen-free-extract (NFE) values which accompanied an increase in the amount of FSP in the diets may be as a result of the lower NFE content of FSP. The NFE values tend to decrease as fermentation progresses because simple carbohydrates are used up by the microbial cells for their metabolic activities. Iyayi and Aderolu (2004) reported a decrease in NFE content of agro-industrial byproducts fermented with species of *Aspergillus* and *Trichoderma*.

Growth Performance

The lower feed intake observed in the broiler chickens fed the diets containing FSP could be attributed to high crude fibre contents of the diets. High crude fibre content reduces digestibility and feed intake. Demeke (2007) similarly reported that incorporation of *Atella*, a local brewing waste, into poultry feed led to a decrease in the feed intake of the birds. The 5% FSP diet was better than all the other diets including the commercial diet, having recorded the highest weight gain, best feed efficiency ratio, and best protein efficiency ratio in the broilers. Above the 5% FSP inclusion level, weight gain, FER, and PER decreased progressively in agreement with the findings of Demeke (2007) and Majeed et al. (2010).

CONCLUSION

Conventional commercial broiler feed supplemented with 5% FSP brought about better broiler performance over all the other diets including the commercial feed and so can be used as a good feed for broiler chickens.

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