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Effect of spice-treated sundried bovine rumen digesta on performance, carcass characteristics and nutrient digestibility of finisher broiler chickens

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ABSTRACT: The study was conducted to investigate the effects of feeding diets containing spice treated Sundried Bovine Rumen Digesta (SDBRD) on growth performance, carcass characteristics and nutrient digestibility of broiler chickens. A total of one hundred and fifty (150) day old broiler chickens were assigned to five (5) diets in triplicates containing ten (10) birds each in a completely randomized design. The diets were; T_1, (control, 0% SDBRD), T_2 (20% SDBRD without spice supplementation), T_3 (20% SDBRD + 200 mg ginger), T_4 (20% SDBRD + 200 mg garlic), and T_5 (20% SDBRD + 200 mg thyme). Data were collected on growth performance, carcass characteristics and nutrient digestibility. The data were analysed using the Analysis of Variance (ANOVA) and differences among mean were separated with the Duncan Multiple range. The results showed that broiler chickens fed diets containing spices-supplemented SDBRD had significantly ($p<0.05$) higher weight gain and better feed conversion ratio (FCR). The live weight and dressing percentage were significantly ($p<0.05$) higher among birds fed spice-supplemented diets compared to the control and the un-supplemented SDBRD diet. However, digestibility for dry matter and crude protein was higher ($p<0.05$) on T_1 and T_2 than on spice-supplemented diets. It was concluded that the combination of sundried bovine rumen digesta and spices such as garlic, ginger and thyme improve growth performance, carcass characteristics and nutrient digestibility, and can therefore be included in the ratio of broiler finisher at 20% level without any deleterious effect.

Keywords: Performance, Carcass characteristics, Nutrient digestibility, Spices, Sundried Bovine Rumen Digesta, Finisher broiler.

INTRODUCTION

The expanding rivalry between man and livestock for available feed ingredients and the insufficient generation of farm crops to meet the requirements of man and his domesticated animals has continued to persist (Esonu *et al*., 2012). Also, advanced intensive farming practices have brought about soils with inadequacies that are reflected in the low nutritional contents of grains grown on them, and in the well-being of domesticated animals raised and kept up on these crops (Barnejee, 2009). This has thus made livestock business, most particularly in developing countries, to be overwhelmed by such hitches, including scarcity of feed ingredients competing with man's nutritional requirement (Otu *et al.,* 2021a).

High cost of feedstuff has contributed to the poor performance and productivity of many poultry farms, and this has led to a shortage in the availability of protein to the populace (Otu *et al*., 2021b). However, to be qualified as a useful alternative (non – conventional) feed ingredient, it must not be a staple food item. Nigeria produces huge amounts of farm and agro – industrial wastes which fill in as elective feed resources that has demonstrated good potentials in supporting the growth of animals (Babatunde and Oluyemi, 2000). One of such alternative feedstuffs, which is not only cheap, but available locally and does not draw rivalry in utilization among people and animals, is bovine rumen digesta.

Research has shown the potentials and possibilities of rumen digesta as a great source of energy in monogastric diets (Adeniji and Balogun, 2002).

The report of Obasi *et al.* (2019) stated that herbs and spices are commonly used for flavour, colour, aroma and preservatives of food or beverages. It has been reported that due to their aromatic characteristics, essential oils derived from herbs and spices have the ability to increase feed intake and could thus be successfully used as growth promoters (Hertrampf, 2001). Spices are herbal products that are incorporated into poultry diets with the end goal of invigorating or advancing the viable utilization of feed supplements which may accordingly result in more quick body weight increase, and enhanced feed efficiency (Al-khdri, 2013).

Rumen digesta is an abattoir by-product which if not properly handled, can cause environmental nuisance. According to Adeniji (2001) and Balogun (2002), the composition and potentials of rumen digesta qualifies it as a good source of energy for monogastric animals. Thus, this study determined the growth performance, carcass characteristics and nutrient retention in diets where maize was partially replaced with spice treated or untreated sundried bovine rumen digesta.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the poultry unit of the Teaching and Research Farm, Federal University of Technology, Minna, Niger State. Minna lies within latitude 09°36'50"'N and longitude 06˚33'25"E (Idowu, *et al.,* 2020). It has an altitude of 700,000 metres above sea level. It falls within the Guinea Savanna agro-ecological zone of the country.

Experimental materials

The bovine rumen digesta was obtained fresh from Niger State Central abattoir, Tayi while slaughtering of animals was in progress. The rumen digesta was collected into a clean bucket, after which it was sundried on a concrete floor for 14 days, milled and stored for mixing with other ingredients. Spices (ginger, garlic and thyme) used were purchased from Kure central market, Niger State and, oven dried at 75°C, grounded into fine powder using pestle and mortal and stored until needed for feed formulation.

Experimental design

A total of one hundred and fifty (150) day-old broiler chicks were used for the study. The birds were randomly divided into five treatment groups in a Completely Randomized Design. Each treatment had three replicates with ten broiler chickens per replicate placed in a deep litter pen of fresh wood shavings. Five experimental diets were formulated as shown in Table 1. Birds in T_1 (control) received basal diet only. Those in T_2 received basal diet with 20% SDBRD inclusion. While birds in T_3, T_4, and T_5 received basal diet with SDBRD and spice supplements. Clean drinking water was offered *ad libitum* and the trial lasted for 56 days (8 weeks).

Data collection, analytical methods and statistical procedure

Live body weight was recorded weekly for each replicate. Feed intake was determined on daily basis by the weigh – back technique while feed conversion ratio (FCR) was calculated as quantity (grams) of feed consumed per unit (grams) weight gain over the same period. Body weight gain was calculated by finding the difference between the final bird weight and initial bird weight. Feed conversion ratio was calculated by dividing total feed consumed by total weight gained. Carcass quality examination was done by visual evaluations for bone maturity, color of the flank muscle, fat streaking in the flank muscle, and conformation of the leg. And apparent nutrient digestibility was calculated using the formula ND = [(Nutrient in feed – Nutrient in feaces) / (Nutrient in feed)] x 100. All measurements were taken in the morning (8: 00 am).

Data obtained in this study were statistically analyzed for variance (ANOVA) with confidence limits set at 95% (significance at $p<0.05$ probability level) using SPSS (2007) software, version 17.0. Treatment means were separated according to Duncan Multiple Range Test (a post hoc interface of SPSS).

RESULTS AND DISCUSSION

Results for laboratory analysis of sundried bovine rumen digesta are shown in Table 2. Values obtained for CP (18.25%), CF (26.25%), EE (2.50%), Ash (7.60%) and NFE (40.00%) were similar to the values reported by Adeniji and Balogun (2000). However, the value for crude protein is lower than 33.81% reported by Dairo *et al.* (2005). This disparity in crude protein content may be due to the type of pasture consumed by the animals and the proportion of the constituents' mixture.

Most of the performance parameters studied were significantly ($p<0.05$) affected. There were significant differences ($p<0.05$) in body weight gain and final body weight (Table 3) of birds fed SDBRD based diets. Broiler chickens fed spice-supplemented SDBRD diets had a better weight gain than those fed SDBRD without spices. This agrees with the findings of Sarıca *et al.* (2005) who fed herbal plants (ginger and garlic) as growth promoters in broiler diets and observed a pronounced improvement

Table 1. Ingredient composition and calculated analysis of the experimental diets at the finisher phase.

Ingredients (%)	T1	T2	T3	T4	T5
Maize	60.64	48.71	48.71	48.71	48.71
Wheat offal	5.27	5.27	5.07	5.07	5.07
SDBRD	0.00	11.93	11.93	11.93	11.93
Soyabean meal	24.56	24.56	24.56	24.56	24.56
Fish meal	4.00	4.00	4.00	4.00	4.00
Palm oil	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.31	0.31	0.31	0.31	0.31
Methionine	0.22	0.22	0.22	0.22	0.22
Bone meal	1.50	1.50	1.50	1.50	1.50
Limestone	1.00	1.00	1.00	1.00	1.00
Premix	0.25	0.25	0.25	0.25	0.25
Ginger	0.00	0.00	0.20	0.00	0.00
Garlic	0.00	0.0	0.00	0.20	0.00
Thyme	0.00	0.00	0.00	0.00	0.20
Total	100.00	100.00	100.00	100.00	100.00
Chemical composition (%)					
Crude protein	21.10	21.01	21.01	21.01	21.01
Crude fibre	3.45	4.08	4.08	4.08	4.08
Calcium	1.10	1.00	1.00	1.00	1.00
Phosphorus	0.84	0.70	0.68	0.80	0.70
ME (Kcal/ kg)	3118.00	3010.00	3010.00	3010.00	3010.00

SDBRD: Sun Dried Bovine Rumen digesta, ME: Metabolizable Energy.

Table 2. Proximate composition of sundried bovine rumen digesta at the finisher phase.

Nutrients	Composition (%)
Moisture	5.40
Crude protein	18.25
Crude fibre	26.25
Ether extract	2.50
Ash	7.60
Nitrogen free extract (NFE)	40.00

Note: SDBRD (Sun dried bovine rumen digesta), ME (Metabolizable).

Table 3. Effects of diets containing spice -treated sundried bovine rumen digesta on growth performance of broiler chickens.

Parameter	T1	T2	T3	T4	T5	SEM
Initial weight at starter (g)	43.33	43.33	43.33	42.33	43.67	0.64
Initial weight at finisher (g)	1493.33^{b}	1390.00^{a}	1676.67^{a}	1716.06^{a}	1675.50^{a}	35.36
Daily weight gain (g)	23.33^{b}	21.72^{c}	26.20^{a}	26.81^{a}	26.18^{a}	0.55
Weekly weight gain (g)	186.67^{b}	173.37^{c}	209.58^{a}	214.50^{a}	209.44^{a}	4.42
Total feed intake (g)	3299.20^{a}	3033.80^{b}	3339.00^{a}	3317.30^{a}	3268.30^{a}	35.95
Daily feed intake (g)	51.52^{a}	47.40^{b}	52.17^{a}	51.83^{a}	51.07^{a}	0.56
Weekly feed intake (g)	412.15^{a}	379.22^{b}	417.38^{a}	414.66^{a}	408.54^{a}	4.50
Final body weight (g)	1536.70^{b}	1433.33^{c}	1720.00^{a}	1758.30^{a}	1719.20^{a}	35.29
Feed Conversion Ratio	2.21^{a}	2.18^{a}	1.99^{b}	1.95^{b}	1.94^{b}	0.04

^{abc} values in the same row with a different superscript differ significantly at $p<0.05$. SEM is the standard error of mean.

Table 4. Effects of experimental diets on carcass traits of broiler chickens.

Parameters	T1	T2	T3	T4	T5	SEM
Live weight (g)	1536.70^{b}	1433.30^{c}	1720.00^{a}	1758.30^{a}	1719.20^{a}	35.29
Slaughter weight (g)	1466.70^{b}	1363.30^{c}	1650.00^{a}	1688.30^{a}	1649.20^{a}	35.29
Dressing weight (%)	87.63^{b}	86.73^{c}	91.85^{a}	92.03^{a}	91.85^{a}	0.63
Head (%)	3.22^{b}	3.76^{a}	2.82^{c}	2.81^{c}	2.85^{c}	0.11
Thigh (%)	12.61^{b}	10.77^{c}	14.84^{a}	14.90^{a}	11.35^{a}	0.46
Drumstick (%)	11.41^{ab}	11.21^{ab}	9.11^{b}	10.52^{ab}	13.31^{a}	0.54
Wings (%)	11.73^{b}	11.66^{b}	14.18^{a}	13.23^{ab}	12.32^{ab}	0.32
Liver (%)	1.77^{b}	2.72^{a}	1.39^{b}	1.82^{b}	1.57^{b}	0.13
Gizzard (%)	2.73^{a}	2.37^{ab}	1.89^{b}	2.34^{ab}	2.05^{ab}	0.11
Heart (%)	0.50^{a}	0.53^{a}	0.42^{b}	0.39^{b}	0.41^{b}	0.01

^{abc} values in the same row with a different superscript differ significantly at $p<0.05$.SEM is the standard error of mean.

Table 5. Effects of spice treated sundried bovine rumen digesta on nutrient digestibility of broiler chickens.

Parameters	T1	T2	T3	T4	T5	SEM
Crude Protein	74.00^{a}	73.33^{a}	60.67^{b}	61.00^{b}	66.67^{b}	1.95
Crude fibre	60.67	65.67	64.67	64.67	60.67	1.70
NFE	73.33	65.67	69.00	66.67	60.33	1.91
Ether Extract	73.00	71.32	63.67	58.33	57.67	2.67
Ash	40.33^{ab}	45.67^{a}	50.33^{a}	38.00^{ab}	26.67^{b}	2.67
Dry Matter	67.00^{ab}	68.50^{a}	60.57^{abc}	56.77^{bc}	54.60^{c}	0.49

^{abc} values in the same row with a different superscript differ significantly at $p<0.05$. SEM is the standard error of mean.

in body weight gain and feed conversion ratio. Final weight of birds on T_4 (1758.30 g), T_3 (1720.00 g) and T_5 (1719.20 g), which were the same, were higher ($p<0.05$) than that of birds on other diets. This could be attributed to the phytochemical content of the spices. For instance, according to Pourali *et al.* (2010), garlic has been reported to promote the performance of intestinal flora thereby improving digestion and enhancing the utilization of energy leading to improved growth.

Carcass analysis revealed a significant ($p<0.05$) influence of diet on parameters (Table 4) Birds on T_3, T_4 and T_5, which were the same, had higher ($p<0.05$) live weight (1719.20 – 1758.30 g), slaughter weight (1649.20 – 1688.30 g) and dressing percentage (91.85 – 92.03%) than those fed other diets. This is contrary to Pourali *et al*. (2010) who stated that carcass indices were not significantly affected by the inclusion of garlic and thyme in broiler chicken diets. It is however in agreement with Raeesi *et al.* (2010) who reported significant effects on carcass parts of broiler chickens fed diets containing garlic. Higher liver weights observed in treatment 2 could be due to higher dietary content of anti nutritional factors which have been reported to produce toxicity effects and inflammation of the friable liver (Koong *et al.*, 2000).

The results of nutrient digestibility are presented in Table 5. The results showed that the inclusion of rumen digesta supplemented with various spices decreased crude protein, ash and dry matter digestibility of diets. This is in contrast with Hosada *et al.* (2006) who reported that nutrient digestibility did not change when animals were supplemented with herbs.

Conclusions

From the results of this study it was concluded that sundried bovine rumen digesta with or without supplementation with garlic, ginger or thyme can replace dietary maize in broiler finisher diets at 20% level without negative effects on performance, carcass indices and nutrient digestibility.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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