EFFECT OF TURKEY BERRY LEAF MEAL (*SOLANUM TORVUM* L.) SUPPLEMENT ON MEAT QUALITY, CARCASS AND INTERNAL ORGAN ON BROILER CHICKEN

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ABSTRACT
The study was carried out to determine the effect of Solanum torvum leaf meal as feed additive on meat quality, carcass and internal organs of broiler chickens. Ninety six (96) Day-old broiler chicks were used for the study. The birds were fed four (4) experimental diets replicated six times. Treatment 1 was control without the addition of Solanum torvum while treatments 2, 3 and 4 contained respectively the addition of Solanum tortum at 0.2, 0.4 and 0.6% levels. At 6 weeks of age, two birds were randomly selected from each replicate and slaughtered for meat quality, carcass and internal organs' study. Data were collected on meat quality such as meat cholesterol, lipid peroxidase, catalase, and glutathione peroxidase activities. The results showed that, the level of inclusion of the additive impacted ($p<0.05$) on the meat quality traits. The lipid peroxidase (LP) was least in treatment 2 at 0.19±0.00mgMDA/kg and highest in treatment 3 at 0.22±0.01mgMDA/kg. The LP contents were similar ($p>0.05$) among Treatments 1, 3 and 4 and among treatments 1, 2 and 4. However, treatment 3 displayed significant difference ($p<0.05$) from treatment 2. The values obtained in enzyme catalase in treatments 1 and 4 were similar ($p>0.05$) and also similar ($p>0.05$) were the values obtained in treatments 2 and 3. The two groups however differed ($p<0.05$) with higher values in the latter than in the former. The meat cholesterol differed ($p<0.05$) among the treatments with the control (4.50±0.02g/dL) showing the least value followed by 4.54±0.01g/dL in treatment 4; 4.62±0.01g/dL in treatment 2, and the highest value at 4.69±0.01g/dL in treatment 3. The Glutathione peroxidase had similar ($p>0.05$) values across the treatments. The result showed that the slaughtered, carcass and head weights differed ($p<0.05$) among the treatments. In slaughtered weight, treatments 1, 2, and 4 on one hand and treatments 1, 2 and 3 were similar ($p>0.05$) on the other hand. The highest value was found in treatment 4 at 2.33±0.13kg and least in treatment 3 at 1.95±0.11kg. In carcass weight treatments 1, 2, and 3on one hand and treatments 2, 3 and 4 were similar on the other hand. The highest value was found in treatment 4 at 1.85±0.11kg and least in treatment 1 at 1.57±0.03kg. However, in head weight, significant differences ($p<0.05$) were obtained among the treatments with treatment 2 recording the highest value at 78.67±2.40g and treatment 3 the least value at 49.33±3.53g which is similar ($p>0.05$) to the value of 50.00±4.62g obtained in treatment 4. The weights of heart, lung, spleen, proventriculus and gizzard had similar ($p>0.05$) values across the treatments. The inclusion of Solanum torvum at 0.6% level in the diet of broiler chickens generally improved the carcass quality and normal functioning of the organs in the birds. Therefore, the 0.6% Solanum torvum can be used without any adverse effect on carcass quality and internal organ of broiler chickens and is capable of reducing deterioration in broiler chicken meat and it is therefore recommended for incorporation in the diets of the birds at any level between 0.2% to 0.6%.
KEYWORDS: Solanum torvum, carcass characteristics and broiler meat

INTRODUCTION

Poultry farming is now a massive industry divided into numerous activities such as hatcheries, broiler farms for meat production, and pullet farms for egg production (Aviagen, 2009). Successful broiler production is contingent on providing the birds with the highest quality feed, in terms of components used, processing processes used, and lastly the form in which the feed is provided to the birds. A broiler can now be delivered to market in 42 days with an average body weight of over 2.80 kg, whereas in 1995 a bird of the same age weighed only 2 kg (National Chicken Council, 2017). High-yielding, quickly-growing, feed-efficient broilers are helpful in fulfilling the rising demand for chicken products, but they could compromise the quality of the meat. Rapid growth has resulted in the development of meat, such as woody breast and white striping, as well as problems with water retention, discomfort, and fat oxidation (Smith *et al.*, 2012; Lyon *et al.*, 2014; Wu *et al.,* 2014). Therefore, it is imperative to develop new, efficient procedures (such as those involving nutrition,

management, and/or selection) to lower the occurrence of certain metabolic illnesses and enhance the quality of meat. The use of direct-feed antibiotics is restricted in many nations, which has increased interest in alternatives like A broiler can now be delivered to market in 42 days with an average body weight of over 2.80 kg, whereas in 1995 a bird of the same age weighed only 2 kg (National Chicken Council, 2017). High-yielding, quickly-growing, feed-efficient broilers are helpful in fulfilling the rising demand for chicken products, but they could compromise the quality of the meat. Rapid growth has resulted in the development of carcass weight and internal organ, as well as problems with water retention, discomfort, and fat oxidation (Smith *et al.*, 2012; Lyon *et al.*, 2014 and Wu *et al.,* 2014). In order to achieve maximum health, better growth performance and high carcass weight phytogenic, a class of all-natural compounds that has been the subject of multiple research in recent years. (Lyon *et al.*, 2014)

Solanum torvum (Family Solanaceae), commonly known as Turkey berry is a bushy perennial plant that presents a feature of spiny, prickly shrub which eventually grows up to a height of 5m. The fruits like green peas grows in clusters of tiny green spheres. They are thin-fleshed and contain numerous flat round, brown seeds. Dried seed, fruit, root, bark or vegetable substance primarily used for flavoring, coloring or preserving food or commercially used as medicine. It's rich in protein, ash, crude fibre and carbohydrate (Cuda *et al*., 2002). Due to these effect plant-derived products have been shown to have a number of positive effects, including antioxidant and antimicrobial properties as well as improvements in gut health and growth efficiency (Bazargani-Gilani *et al.*, 2014; Olnood *et al.*, 2015; Yang *et al.*, 2015). For instance, *Solanum torvum* and other herbal-based products have been incorporated into the meal to enhance the birds' gastrointestinal health and address their coccidiosis difficulties (Mohiti-Asli and Ghanaatparast-Rashti, 2015). Phytogenic (Superliv)-supplemented diets have been proven to enhance body weight (BW) and feed conversion ratio (FCR) in broilers, according to a recent field trial study. It is unknown, though, if these phytogenic additions raise the quality of meat. (Amitav *et al.*, 2013, 2015; Sudhir *et al.*, 2016).

MATERIALS AND METHODS

The experiment was carried out at the Poultry Unit of the Department of Agricultural Technology. The Federal Polytechnic Ado Ekiti, Ekiti state, The *Solanum torvum* leaf meal was plucked from the premises of Federal polytechnic Ado-Ekiti. The leaves was chopped and air dried, and later grinded into powder form.

Experimental animals and management

Ninety six (96) day old broiler chicks were purchased from a reputable farm in Ibadan and used for the study and manage under battery cage system, other management practices were dully carried out.

Experimental design

The experiment was conducted using 96birds in a Completely Randomized Design (CRD). The were randomly allocated into four treatment and each treatment was replicated six (6) times, with 4 birds per replicate.. Data were collected on meat quality, carcass and internal organs treatment one (1) was control diet i.e. diet with no supplement, treatment Two, Three and four was supplemented with *Solanum torvum* leaf meal.

Experimental diet

Diet 1 – control diet without any supplementation., Diet 2 – 0.2% of Mixture *Solanum torvum* leaf meal., Diet 3 – 0.4% of mixture *Solanum torvum* leaf meal., Diet 4 – 0.6% of Mixture *Solanum torvum* leaf meal.

Carcass characteristics

At the end of the experiment four birds were randomly selected from each of the treatment and starved of feed for 12hours but water was provided ad libitum. The birds were subjected to weighing before slaughtering. The chickens were slaughtered by severing the jugular vein with a knife, Hot water was used to scald and defeather the birds, after which each carcass was weighed, eviscerated and cut into different parts i.e head, neck, shank, breast, wings and internal organs(The dressed chickens were eviscerated and the weight of the carcass trait was taken before dissecting out the organs. The following internal organs were weighed., liver, spleen, kidney, gall bladder, proventriculus, gizzard, lung, heart and intestine. All internal organs were expressed as percentage of live weight

Meat quality indices

At day 56 (8 weeks), two birds were randomly selected from each treatment. About 100g of the meat were excised from the breast meat was taken to laboratory for determination of the following parameters meat cholesterol, lipid peroxidation, catalase activity and Glutathione peroxidase activity.

Statistical analysis

Data collected in this study were subjected to analysis of variance using SPSS. Duncan's Multiple Range test of one way ANOVA was used to analyses the mean differences of the same parameter. Significant difference was considered where necessary at a level of (P>0.05).

RESULTS AND DISCUSSION

The Carcass Quality Characteristics of broiler chickens fed the experimental diets

Tables 1 and 2, respectively, show the carcass and internal organs' characteristics of broiler chickens fed diets supplemented with *solanum torvum* leaf meal as feed additive. The slaughtered, carcass and head weights differed ($p<0.05$) among the treatments. In slaughtered weight, treatments 1, 2, and 4 on one hand and treatments 1, 2 and 3 were similar ($p>0.05$) on the other hand. The highest value was found in treatment 4 at 2.33±0.13kg and least in treatment 3 at 1.95±0.11kg. In carcass weight treatments 1, 2, and 3on one hand and treatments 2, 3 and 4 were similar on the other hand. The highest value was found in treatment 4 at 1.85±0.11kg and least in treatment 1 at 1.57±0.03kg. However, in head weight, significant differences ($p<0.05$) were obtained among the treatments with treatment 2 recording the highest value at 78.67±2.40g and treatment 3 the least value at 49.33±3.53g which is similar ($p>0.05$) to the value of 50.00±4.62g obtained in treatment 4.

The internal organs' characteristics of broiler chickens fed the experimental diets

The characteristics of the internal organs of broiler chickens fed experimental diets are presented in Table 4.2. Evident on the table is that the internal organs' parameters examined such as the weights of gizzard, heart, liver, lung, bile, pancrease, proventriculus, intestine and spleen had similar ($p>0.05$) values in both the control and treated groups and also among the treated groups. A range by weight of 33.33g to 37.33g was obtained in gizzard; 9.33g to 11.33g in heart; 46.00g to 49.33g in liver; 11.33g to 16g in lung; 2g to 4g in bile; 8 to 10g in pancrease; 4.67g to 6g in proventriculus; 78g to 82g in intestine and 2g to 2.67g in spleen were recorded.

Table.1: Carcass characteristics of broiler fed diets supplemented with *solanum torvum* leaf meal as feed additive

Parameters	T1	T2	T3	T4	P values
Live weight (kg)	2.19±0.02	2.26±0.12	2.28±0.04	2.42±0.14	0.394
Slaughtered weight (kg)	2.11±0.04	2.19±0.12	1.95±0.11	2.33±0.13	0.155
Eviscerated weight (kg)	1.99±0.05	2.10±0.12	2.09±0.04	2.19±0.13	0.537
Carcass weight (kg)	1.57±0.03	1.72±0.10	1.73±0.04	1.85±0.11	0.178
Head weight (g)	$66.67±5.46^{b}$	$78.67±2.40^{a}$	$49.33±3.53^{c}$	$50.00±4.62^{c}$	0.003
Shank weight (g)	74.67±3.71	72.67±3.71	81.33±6.96	83.33±7.69	0.537

a,b means across the same row with different superscripts are statistically different ($p<0.05$)

Carcass characteristics

Solanum torvum leaf meal supplemented diets significantly influenced carcass characteristics. This result is in line with Omoikhoje *et al.* (2019) who found that carcass characteristics of broiler chickens were significantly affected by herbal supplemented diets while the internal organs were not affected. The highest slaughtered weight obtained in treatment 4 could be due to available protein and metabolizable energy, mineral and low anti-nutrient substances found in this herbal plant (Oloruntola *et al*., 2016). This observation is in line with the report of Ghazalah and Ali (2008); that the use of herbs and its products in livestock feed is capable of having stimulative effect on the use of feed nutrient which may result in more efficiency in feed utilization. This is because leaves contain active substances that can improve digestion and metabolism and possess bacterial and immunostimulant activities. In the light of this, Sultan *et al*. (2015) reported that the use of *Azadirachta indica* leaf extracts in broiler chicken production exhibited better nutrient digestibility of crude protein and ether extract coupled with improved intestinal histomorphology. This therefore suggests that *Solanum torvum* leaf meal increased the ability of the birds to utilize available nutrients in the feed.

Table 2: Internal organs' weights of broiler fed diets supplemented with *solanum torvum* leaf meal as feed additive

Parameters	T1	T2	T3	T4	P values
Gizzard weight (g)	37.33±3.71	37.33±2.40	34.67±5.21	33.33±3.33	0.841
Heart weight (g)	9.33±0.67	10.67±1.76	11.33±1.33	10.00±1.15	0.728
Liver weight (g)	40.67±1.33	49.33±14.11	48.67±2.91	46.00±2.00	0.831
Lung weight (g)	16.00±5.03	11.33±1.33	14.67±0.67	14.00±1.15	0.672
Bile weight (g)	2.00±0.00	4.00±1.15	2.67±0.67	2.67±0.67	0.349
Pancreas weight (g)	8.00±1.15	10.00±1.15	8.00±0.00	7.33±0.67	0.241
Proventriculus (g)	6.00±0.00	4.67±0.67	5.33±1.33	6.00±0.00	0.561
Intestine (g)	82.00±4.61	78.00±5.70	78.67±3.06	80.00±4.94	0.448
Spleen (g)	2.00±0.00	2.67±0.67	2.00±0.00	2.67±0.67	0.596

means with no superscript across the same row are statistically similar ($p>0.05$)

Internal organ characteristics

The similarity in the weight of the gizzard among the treatments suggests that the fibre content of the experimental feeds were normal because increase in high fibre intake could lead to increase in gizzard weight. Besides, gizzard weight must increase due to increased activity of the organ to blend feed (Aderolu *et al*., 2007). This observation disagreed with the findings of Edache *et al*. (2017) on significant variation in the gizzard weights of quails fed varying level of bakery whole meal. The non-significant variation in the values of the liver points to the fact that *Solatum torvum* did not cause any toxicity and abnormal metabolic activity in the organs or system of the birds as observed by Omoikhoje *et al*. (2018). This is because these organs are keys to detoxification and did not undergo any hypertrophy (Tarimbuka *et al*., 2017; Omoikhoje *et al*., 2018)

Karthika*et al.* (2019) found that the average weight of heart, liver, pancreas and spleen of broiler chickens were 8.84±0.30g, 35.05±7.15g, 4.35±0.74g and 2.26±1.34g, respectively. These values were lower than those obtained in this study except the spleen weight which are close to the values recorded in this study. The reason for this might be because of differences in age when the measurements were taken, the strain of the broiler, environmental factors and other extraneous factors which may vary from place to place. The weight of liver obtained in this study (40.67-49.33g) is in line with the findings of Ishi *et al*. (2000, 2001), who observed that liver of broiler weighed between 45 to 60 g and Iqbal *et al*. (2014) who reported that the mean weight of liver without gall bladder of broiler chicken of six week of age was 47.98g. Rodríguez *et al*. (2006) and Gonzalez-Alvarado *et al*. (2007) did not observe any changes in the relative weight of spleen broiler birds which agrees with the findings of this study. All the groups of birds investigated in this study are equally susceptible to heart failure because of the similarities in their weights (Korte *et al*., 1999). The similarity is in line with the findings of Cheriyan (2007) who reported that as a result of advances in genetic selection, management and nutrition, the modern day commercial broiler chicken have fast growth rates, high feed conversion ratios and metabolic rates, thereby putting an increased workload in the cardiovascular system which could result in metabolic, and cardiovascular disorders and sudden death and an increased rate of mortality in broiler chicken.

Effects of *Solanum torvum* leaf meal as feed additive on meat quality of broiler chickens

Table 3: Effects of *Solanum torvum* leaf meal as feed additive on meat quality of broiler chickens

Parameters	**T1**	**T2**	**T3**	**T4**	**P values**
Lipid peroxidase (mg MDA/kg)	0.20±0.00	0.19±0.00	0.22±0.01	0.21±0.01	0.099
Catalase (Mmol/mg protein)	1.88±0.03[b]	2.80±0.02[a]	2.88±0.04[a]	1.83±0.01[b]	0.000
Glutathione Peroxidase (µmole GSH consumed)	245.36±0.79	244.76±0.44	245.89±0.48	245.55±0.57	0.620
Meat cholesterol (g/dL)	4.50±0.02	4.62±0.01	4.69±0.01	4.54±0.01	0.302

[a,b,c,d] means with different superscripts on the same row are statistically different ($p<0.05$)

Table 3 shows the effects of *Solanum torvum* leaf meal as feed additive on meat quality parameters of broiler chickens. The results showed that, the level of inclusion of the additive impacted ($p<0.05$) on the meat quality traits. The lipid peroxidase (LP) was least in treatment 2 at 0.19±0.00mgMDA/kg

and highest in treatment 3 at 0.22±0.01mgMDA/kg. The LP contents were similar ($p>0.05$) among Treatments 1, 3 and 4 and among treatments 1, 2 and 4. However, treatment 3 displayed significant difference ($p<0.05$) from treatment 2. The values obtained in enzyme catalase in treatments 1 and 4 were similar ($p>0.05$) and also similar ($p>0.05$) were the values obtained in treatments 2 and 3. The two groups however differed ($p<0.05$) with higher values in the latter than in the former.

The meat cholesterol differed ($p<0.05$) among the treatments with the control (4.50±0.02g/dL) showing the least value followed by 4.54±0.01g/dL in treatment 4; 4.62±0.01g/dL in treatment 2, and the highest value at 4.69±0.01g/dL in treatment 3. The Glutathione peroxidase had similar ($p>0.05$) values across the treatments.

Lipid oxidation is the main process responsible for the quality deterioration of meat by reducing shelf life (Min and Ahn, 2005). Lipid oxidation affects color, texture, nutritional value, taste, and aroma leading to rancidity, which is responsible for off-flavors and unacceptable taste, which are important reasons for consume's meat rejection (Lima *et al*., 2013). Considering that "quality" and "health" are known as some of the most important factors that influence food choice and that appearance, color, texture, taste, and aroma are the key quality attributes that affect meat acceptance, the control, or at least minimization, of the lipid oxidation process is of great interest to the food industry (Brøndum et al., 2000).It is known that the presence of exogenous antioxidants like *S. tortum* in the animal diet can increase the stability of lipid of meat (Li and Liu, 2012). This is because the antioxidants supplied by the herb probably reduced the impact of some sources of oxidative stress and thereby inhibit their adverse effect on the muscle tissue (Ismail *et al*., 2013). The outcome of this study agreed with the above authorities and outcome of some other studies on herbs like oregano (*Origanum vulgare* L.*),* rosemary (*Rosmarinus officinalis* L.*),* sage (*Salvia officinalis* L.), and thyme (*Thymus vulgaris* L.*)*which have strong antioxidant capacity, primarily due to phenolic -OH groups which can scavenge for H_2O_2 and superoxide radicals (Velasco and Williams, 2011) to reduce the sadverse effect of lipid oxidate

CONCLUSION AND RECOMMENDATION

The inclusion of *Solanum torvum* at 0.6% level in the diet of broiler chickens generally improved the meat quality, carcass quality and normal functioning of the organs in broiler chickens. Therefore, the 0.2 to.6% *Solanum torvum* can be used without any adverse effect on meat quality, carcass quality and internal organ of broiler chickens.

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