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EFFECT OF GRADED LEVEL OF CLOVE (*SYZYGIUM AROMATIC*) POWDER (CP) ON CARCASS CHARACTERISTIC OF BROILER CHICKEN MEAT

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Abstract

The study was designed to evaluate the effects of different levels of clove (*Syzygium aromaticum*) powder (CP) on carcass characteristics, of broiler chicken meat. Two hundred, day-old Ross (308) broilers were allocated to four treatments, namely: Two hundred broiler chicks were randomly allotted to four dietary treatment groups in a completely randomized design (CRD). The dried Clove were ground in to powder form and incorporated into the ration over the top (above 100%). Each treatment consisted of varying levels of CP as 0, 100, 200 and 300g/100kg representing treatments T1, T2, T3 and T4 respectively. The birds were fed the experimental feed for 49 days, at the end of which 5 birds per replicate were sacrificed and their carcasses were evaluated for carcass characteristics. From the results obtained, there was no significant difference ($P > 0.05$) in the mean values obtained for all the carcass characteristics and primal cuts examined. It was concluded that Clove powder inclusion at 0, 100, 200 and 300g/100kg in the diets of broiler chicken did not have any effects on carcass characteristics, of broiler chicken meat.

Keywords: Clove powder, Feed formulation, Broiler Chicken

INTRODUCTION

Herbal medicine is becoming more and more popular as a more safe and effective means of treatment for many different medical conditions and as a feed additive. Herbs are often preferred because they are natural and do not put harmful chemicals into the body (Agrawal *et al.*, 2014). Essential oils enhance the digestive secretions and nutrient absorption, reduce the pathogenic stress in the gut, exert antioxidant properties and enhance the animal's immune status (Zeng *et al.*, 2015). Application of medicinal plant as alternative feed additives is of important values on the performance and the antioxidant status of birds (Ayoub *et al.*, 2011; El-Far *et al.*, 2016). The active principles of essential oils act as a digestibility enhancer, balancing the gut microbial ecosystem and stimulating the secretion of endogenous digestive enzymes and thus improving growth performance in poultry (Ayoub *et al.*, 2011; Barakat *et al.*, 2016). The research was conducted to investigate the impact of clove as a feed supplement to broiler chickens diet through evaluation of the immunity, antioxidant status, and growth performance. (Tengerdy, 1989)

Poultry are raised for their meat and eggs, which are important sources of animal protein. Poultry meat accounts

for 30% of global meat consumption and the per capita poultry meat consumption in the developed world increased from 11kg in 2003 to 58.5kg in 2018; regardless of region or income level (Gomez *et al.*, 2018).

Feed additives could improve texture, flavor, colour, taste, etc of the feed. They include antibiotics, antioxidants, mould inhibitors, enzymes, probiotics and prebiotics etc (Aduku, 2004). A variety of feed additives can be safe and effective when used as indicated on the label specification. Restriction of the use of in organic feed additives like antibiotics in many countries has fueled the interest in alternative products (Jacela *et al.*, 2010). A group of natural products known as phytochemicals has been the focus of several studies in recent years, these are also referred to as phytobiotics or botanicals. Phytochemical feed additives (PFA) are plant derived products used in feed to potentially provide antioxidative effect, enhance palatability, improve gut function or promote growth (Jacela *et al.*, 2010). Phytochemicals comprise a wide range of substances and thus have been further classified according to botanical origin, processing and composition (Jacela *et al.*, 2010).

They include herbs: which are normally non-woody flowering plants known to have medicinal properties, spices; which are herbs with intensive odour or taste, essential oil, which are aromatic oily liquid derived from plant materials such as

flower, leaves, fruits, roots and finally oleoresins; which are extracts derived by non-aqueous solvents from plant materials (Windisch *et al.*, 2008). On the other hand the speculated risk for generating antibiotic resistance in pathogenic microbial is eliminated with the use of phytochemical feed additives, consequently these products may be used on a permanent basis (i.e. during the entire period of production).

Cloves (*Syzygium aromaticum*) are considered one of the most very active spices. They contain a large number of biologically active compound, such as eugenol, eugenol acetate, and B-caryo phycene (Jimoh *et al.*, 2017). Eugenol is the most biologically active compound in cloves and makes up to 70-80% of cloves oil (Al-Shaikh and Perveen, 2017). Cloves have been used as an antiseptic, antimicrobial, analgesic and anesthetic (Boutsogloul, *et al.*, 2002). Clove extract is commonly used in the food industry because of its special aroma and natural safety. In addition, the essential oil from clove also exhibited strong antibacterial properties, antiseptic, appetite and digestion stimulant (Kamel, 2001).

Materials and Methods

Study Area

The study was carried out at the Poultry Production Unit of the Teaching and Research Farm of the Department of Agriculture, Shehu Shagari College of Education, Sokoto. Sokoto is located between latitudes 12 and 13°N, longitudes 4° and 6°E in the north western part of Nigeria and lies on altitude of 350m above sea level (Mamman *et al.* 2000). It is bordered to the north with the Niger Republic, Zamfara state to the East and Kebbi state to the South and West. The state falls within the Sudan savannah vegetation zone with an alternating short and dry season. A short, cool dry period (harmattan) occurs between October and February (Malami *et al.*, 2001). The annual rainfall is about 700mm. The rainy season start from June/July to early October with a peak in August. A maximum temperature of 41°C has been reported in April with an average of 23.8°C in December while a minimum of 13.2°C occurs in January (SEPP, 1996). The people of the state are mostly Hausa, Fulani and Zabarmawa (Mamman *et al.* 2000). According to the 2006 housing and population census, the population of the state is estimated at 3,696,999 million people (NPC, 2006). The occupations of the inhabitants are mostly farming, livestock and trading (FDLPCS, 1992).

Experimental Design

A Completely Randomized Design (CRD) was use in the experiment. A total of 200 broiler chickens were randomly allocated to four treatment groups. Each treatment has five replicates with ten chickens per replicate. Treatment 1 diet served as a control while treatment 2, 3 and 4 diets contained 100g, 200g and 300g respectively clove bud powder. Table 1 respectively

Table 1: Experimental Layout

Clove(g/100kg)	0	100	200	300
Treatments	1	2	3	4

Replication	5	5	5	5
Birds/Replicate	10	10	10	10

Experimental Birds and Management

Day-old broiler chicks for this study were obtained from Agricted farm in Ibadan Oyo State, Nigeria. The house was cleaned, washed and disinfected a week to the arrival of the birds. Feed and water was given to the birds' *ad-libitum*. The clove used for this research was purchased from Sokoto Central Market, and then ground into powder form. The feed ingredients used were also purchased at sokoto central Market, while other ingredients were purchased at Alkanci Farm Ltd.in sokoto.

Feed formulation

Four (4) Treatment diets were formulated with the same Energy and Protein level at both starter and the finisher phases using computer software and were fed to the experimental broiler chickens for seven (7) weeks. However, clove powder was added over the top (above 100%) at 100g, 200g, 300g in treatments 2, 3 and 4 respectively while treatment 1 has served as the control diet with no (0%) clove bud powder.

The selected feed ingredients such as maize, groundnut cake (GNC), Soybean meal (SBM) and bone meal were crushed to reduce the particle size to suit the group of birds that feed was meant for.

The Gross and calculated chemical composition of the experimental broiler starter and finisher diets are shown in Table 2 and Table 3 respectively

Table 2: Gross and Calculated Chemical Composition of Experimental Broiler Starter Diet

Ingredients (Kg)	Treatment 1	Treatment 2	Treatment 3	Treatment 4
	(0g)	(100g)	(200g)	(300g)
Clove	0	100	200	300
Maize	52	52	52	52
SBM	14	14	14	14
GNC	18	18	18	18
W/Offal	11	11	11	11
L/Stone	2.5	2.5	2.5	2.5
Bone meal	1.3	1.3	1.3	1.3
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.45	0.45	0.45	0.45
Total	100	100	100	100

Calculated Composition. Chemical

Crude protein (%)	21.1	21.1	21.1	21.1
Energy (Kcal/Kg)(ME)	3001	3001	3001	3001
Methionine (%)	0.6	0.6	0.6	0.6
Lysine (%)	1.0	1.0	1.0	1.0
Calcium (%)	1.3	1.3	1.3	1.3
Phosphorus (Av) (%)	0.5	0.5	0.5	0.5
Fibre (%)	5.8	5.8	5.8	5.8

Table 3: Gross and Calculated Chemical Composition of Experimental Broiler Finisher Diet

Ingredients (Kg)		Treatment 2		Treatment 3
Treatment 1		Treatment 4		
	(0g)	(100g)	(200g)	(300g)
Clove	(0g)	(100g)	(200g)	(300g)
Maize	50.5	50.5	50.5	50.5
SoyBeans Cake	15.0	15.0	15.0	15.0
Groundnut Cake	13.0	13.0	13.0	13.0
W/Offal	12.0	12.0	12.0	12.0
L/Stone	3.0	3.0	3.0	3.0
Bone meal	3.0	3.0	3.0	3.0
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.45	0.45	0.45	0.45
Total(kg)	100	100	100	100

Calculated Chemical Composition

Crude protein (%)	19	19	19	19
Energy(Kcal/Kg)	2013	2013	2013	2013
Methionine(%)	0.6	0.6	0.6	0.6
Lysine (%)	1.0	1.0	1.0	1.0
Calcium(%)	3.0	3.0	3.0	3.0
Phosphorus	0.8	0.8	0.8	0.8

s (Av)				
Fibre (%)	6.1	6.1	6.1	6.1

Data Collection

At the end of the growth period (49days), data was collected on carcass characteristics. Samples were collected for evaluation according to the treatment groups.

Sampling and Sample Size

Purposive sampling was used to select five (three large, one medium and one small sizes) birds per replicate, making fifteen birds per treatment and a total of (100) birds from the four treatments.

Carcass Analysis

The sampled birds were starved of feed but left with drinking water for 8 hours to obtain fasted weight. Birds were weighed and slaughtered by severing the jugular vein closest to the head according to the halal slaughter procedure. The birds were hoisted for about 10 minutes to obtain the bled weight. Then the birds were skinned and cut into primal cuts for evaluation. Organs such as liver, intestine, lungs, gizzard, etc. were weighed and recorded.

Results

Phytochemical Constituents of Cloves (*Syzygium aromaticum*)

Table 4: Phytochemical constituents of cloves powder fed to the experimental broiler birds

Parameters	Results
Flavonoids	++
Tannins	+++
Saponins	++
Glycosides	++
Alkaloids	+
Cardiac glycosides	+
Steroids	++
Saponin glycosides	+++
Balsams	+++
Anthraquinones	ND
Volatile Oils	++

Keys: ND= Not Detected; + = Trace amount; ++ = Moderate amount; +++ = Concentrated amount . SOURCE laboratory analysis 2026.

The phytochemical composition of the clove used in this study is similar to the report of Sabira *et al.* (2014), who found several classes of compounds including chromones, triterpenes, steroids, flavonoids and tannins. However, it is contrary to the report of Zahoor and Navin (2022) who reported that the phytochemical analysis of *Syzygium aromaticum* (clove) extract revealed the presence of carbohydrates, lipids, alkaloids, flavonoids, tannins, sterols and triterpenes while proteins, saponins, cardiac glycosides and anthraquinones were absent. This variation might be

attributed to the parts of the clove used in the study of the respective researchers

Carcass Performance Characteristics

Results on the fasted weight at slaughter, bled weight, dress weight and dressing percentage of experimental broiler chickens fed graded levels of Clove bud powder (CBP) is presented in Table 5.

Table 5. Fasted weights, bled weights, dressed weight and dressing percentage of broiler chicken as affected by graded levels of Clove Buds Powder

Parameter	CBP Inclusion level (g/100kg)				SEM
	0	100	200	300	
Fasted weight (g)	978.6	1112.5	961.6	1090.5	109.7
	7	0	7	0	0
Bled weight (g)	931.8	1111.8	914.8	1043.8	102.3
	3	3	3	3	0
Dressing weight (g)	679.9	790.60	694.6	109.34	47.78
	9		5		6
Dressing percentage (%)	69.48	71.06	67.56	72.10	3.807

Results on means for fasted weight at slaughter, bled weight, dressed weight and dressing percentage are shown in Table 5. The result showed that they were all statistically similar ($P > 0.05$) for all the treatment groups.

Fasted weight (g)

Fasted weight ranged between, 961.7g - 1112.50g with treatment 2 (100g CBP) having higher values (1112.50g) than treatment 1 (0g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) respectively (Table 5).

Bled weight (g)

Results on Bled weight of experimental birds showed that Bled weight was lowest (914.80) in T3 (200g CBP) and highest (1111.83) was in T2 (100g CBP). The results showed that the bled weight did not differ significantly ($P > 0.05$) for all the treatment groups (i.e. treatment 1, 2, 3, and 4). Bled weight values ranged between, 914.80g – 1111.83g with treatment 2 (100g CBP) having higher values (1111.83g) than treatment 1 (0g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) respectively (Table 5).

Dressed weight (g)

The mean dressed weight of broiler chicken meat fed graded levels of Clove Buds Powder as shown in Table 4, showed that there was no significant difference ($P > 0.05$) for all the treatment groups (i.e. treatment 1, 2, 3, and 4). Dressing weight values ranged between, 649.65g – 790.60g with treatment 2 (100g CBP) having higher values (790.60g) than

treatment 1 (0g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) respectively (Table 5).

Dressing percentage (%)

The results on dressing percentage of broiler chicken meat fed graded levels of Clove Buds Powder as recorded in Table 4, indicates that there was no significant difference ($P > 0.05$) for all the treatment groups. Dressing percentage values ranged between, 67.56% - 72.10% with treatment 4 (300g CBP) having higher values (72.10%) than treatment 1 (0g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) respectively (Table 5).

Primal cuts (g)

Results on primal cuts performance of experimental broiler chickens fed graded levels of

Clove bud powder (CBP) is presented in Table 6

Table 6: Weights of primal cuts of broiler chicken meat as affected by graded levels of Clove Buds Powder.

Primal cuts	CBP Inclusion level (g/100kg)				SEM
	0	100	200	300	
Breast (g)	295.67	257.83	207.50	247.17	55.76
Back (g)	69.33	73.33	69.83	86.00	8.97
Thigh (g)	102.17	117.83	87.83	103.17	15.93
Drum stick (g)	89.83	108.67	89.33	105.83	11.87
Wings (g)	68.67	84.83	72.50	77.67	6.48

The primal cut-up parts recorded under this study include; breast, thigh, back, drumstick and wings. The result of this study showed that inclusion level of CBP had not affected significantly difference ($P > 0.05$) primal cut across all the treatment groups as shown in Table 5. However, the mean weight of these cut-up parts was observed not to follow any particular trend (Table 6).

Breast (g)

Results on Breast weight of experimental birds showed that Breast weight was lowest (207.50) in T3 (200g CBP) and highest (295.67) was in T1 (0g CBP). The results showed that the breast weight did not differ significantly ($P > 0.05$) for all the treatment groups (i.e. treatment 1, 2, 3, and 4). Breast weight values ranged between, 207.50g – 295.67g with treatment T1 (0g CBP) having higher values (295.67g) than treatment 2 (100g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) respectively (Table 6).

Back (g)

Back weight ranged between, 69.33g –86.00g with treatment 4 (300g CBP) having higher values (86.00g) than treatment 1 (0g CBP), treatment 2 (100g CBP) and treatment 3 (200g CBP) the results showed that the back weight did not differ significantly ($P > 0.05$) for all the treatment groups (i.e. treatment 1, 2, 3, and 4) respectively (Table 6).

Thigh (g)

The results on thigh weight of broiler chicken meat fed graded levels of Clove Buds Powder as recorded in Table 4.3, indicates that there was no significant difference ($P > 0.05$) for all the treatment groups. Thigh values ranged between, 87.83g – 117.83g with treatment 2(100g CBP) having higher values (117.83) than treatment 1 (0g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) respectively (Table 6).

Drum Sticks (g)

The Drum sticks weight of broiler chicken meat fed graded levels of Clove Buds Powder as shown in Table 4.3, showed that there was no significant difference ($P > 0.05$) for all the treatment groups (i.e. treatment 1, 2, 3, and 4). Drum stick values ranged between, 89.33g – 108.67g with treatment 2 (100g CBP) having higher values (108.67) than treatment 1 (0g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) respectively (Table 6).

Wings (g)

Wings weight ranged between, 68.67g – 84.83g with treatment 2 (100g CBP) having higher values (84.83g) than treatment 1 (0g CBP), treatment 3 (200g CBP) and treatment 4 (300g CBP) the results showed that the back weight did not differ significantly ($P > 0.05$) for all the treatment groups (i.e. treatment 1, 2, 3, and 4) respectively (Table 6).

Discussion

Phytochemical Composition of Cloves Used in the Experiment

The phytochemical composition of the clove used in this study is similar to the report of Sabira *et al.* (2014), who found several classes of compounds including chromones, triterpenes, steroids, flavonoids and tannins. However, it is contrary to the report of Zahoor and Navin (2022) who reported that the phytochemical analysis of clove (*Syzygium aromaticum*) extract revealed the presence of carbohydrates, lipids, alkaloids, flavonoids, tannins, sterols and triterpenes while proteins, saponins, cardiac glycosides and anthraquinones were absent. This variation might be attributed to the parts of the clove used in the study of the respective researchers.

Carcass Performance Traits

Fasted Weight (FW).

Fasted weight recorded in the present study could probably be as a result of the aromatic and flavorful taste of dried Cloves Buds Powder as well as the presence of less anti-nutritional factors that the Cloves used in the diets contained, which did not affect the feed intake of the birds as the levels of CBP inclusion is increasing which in turn did not affect the fasted/live weight. Suggestive of the reasons given by Ikeme (1990) that birds with higher pre-slaughter weights are

expected to produce higher fasted weight. This result is in agreement with the findings of Mukhtar (2011) which showed that the effect of clove oil on the broiler performance had no significant difference for chicks performance. It is also in agreement with report of Petrovic *et al.* (2012) who studied the effect of diet supplementation with 1% clove buds powder combined with either 0.2% lemon balm extract or 0.2% agrimony extract on the body weight, total feed intake, feed conversion ratio and carcass yield showed no statistically significant differences in the growth performance indices such as body weight, total feed intake, feed conversion ratio, and carcass yield between the groups of chickens. The current results disagree with the findings of Agostini *et al.* (2012), who showed that clove powder improved the growth performance of broiler chickens.

Bled Weight (BW)

Similarly, the bled weight did not affect the feed intake of the birds as the levels of CBP inclusion is increasing which in turn did not affect the live weight likewise, the killed/bled weight, this is line with the statement given by Ikeme (1990) that birds with higher pre-slaughter weights are expected to produce higher live weight and killed weight. This result is in agreement with the findings of Mukhtar (2011) which showed that the effect of clove oil on the broiler performance had no significant difference on performance of the birds.

Dressing Weight and Dressing Percentages

Dressing percentage and dressing weight are a trait of economic importance (Omojola, 2007) the higher the dressing out percent the better in terms of economic returns. As expected dressing percentage and dressing weight also followed the normal trend as in fasted weight and bled weight which supports the statement by Ikeme (1990). The findings of this research are similar to the findings of Azadegan *et al.*, 2014 which show that different levels of clove essential oil and probiotic had not any significant effect on dressing percentage, abdominal fat and internal organs percentage (liver, heart and gizzard) ($P > 0.05$). It is also in line with the finding of Jamroz *et al.*, 2003, who reported in his research (The influence of phytogenic extracts on performance, nutrient digestibility, carcass characteristics, and gut microbial status in broiler chickens) that dressing percentage was similar in all treatment groups (70.6% on average), which is within the value range obtain in this study (67.56 - 72.10).

Weight of Primal Cuts

The weights of primal cuts of birds such as breasts, back, thighs, drumsticks and wings are very important as chicken meat is no longer popular as whole dressed carcass, but now sold as parts. This is importance to retailers and consumers as heavier cuts command higher prices. Inclusion of graded levels of Cloves powder, under the condition of this study, did not influence the weights of these parts significantly. Thus, may be related to the non-significant differences in the fasted weights/live weight of the birds fed graded levels of Cloves powder. This correspond with the findings of Gamaleldin *et al.* (2021), who reported that broiler chicken fortified with cloves seed did not significantly ($p > 0.05$) affects the chicken's carcass characteristics and body composition, also

Azadegan *et al.*, 2014 did not observe any significant improvement in carcass traits in broilers fed with the diet supplemented with Clove oil. Similarly, Amouzmehr *et al.*, (2012) reported that supplementation of garlic extracts in amount of 3.0 and 6.0% did not affect carcass characteristics including carcass yield, breast, thigh and drumstick. In contrast to the findings of this research Tariq *et al.*, 2015 cited an increase in dressing percentage and breast weight of chickens fed with Clove. This discrepancy can be ascribed to the level of Clove inclusion in the diet of the broiler chicken and the part of the Clove used in the study of the respective researchers.

Summary

This study evaluated the effect of graded levels of Clove Buds Powder (*Syzygium aromaticum*) on carcass characteristics of broiler chicken meat during forty-nine (49) days feeding trial period using a total of 200 broiler chickens comprises of four (4) treatments replicated five (5) times with ten (10) birds per each replicate (n=50 per treatment) were allotted to four dietary treatments consisting of four graded levels (0g, 100g, 200g, and 300g) Clove Buds Powder per 100Kg of feed. The experimental birds were subjected to the same management practices and data on carcass characteristics, were collected and subjected to statically analysis. The results of the study indicated no significant differences ($P>0.05$) in the mean fasted weight at slaughter, bled weight, dressed weight, dressing percentage, weights of primal cuts

Conclusions

1. Inclusion of graded levels (100g, 200g, and 300g per 100kg) of Clove Buds Powder did not elicit negative response on the carcass characteristics of broiler chicken

Recommendations

Based on the responses of birds (broiler chicken) to the different inclusion levels of Clove Buds Powder in the feed, the following are recommended:

1. Livestock farmers should be enlightened on the medicinal value and potentials of Clove (*Syzygium aromaticum*) and other plant products as a, natural and safe ingredient for inclusion in the feeding of broiler chicken in the livestock industry.
2. Broiler chicken diets supplemented with Clove Buds Powder could be a safe alternative to antibiotics as growth promoters and produce harmless meat, with numerous beneficial effects on consumer health.
3. Further researches should be carried out by increasing the inclusion level (CBP) above the current inclusion level, since current levels have no influenced on the parameters measured.

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