Original Research Article

EFFECT OF DIETARY SUPPLEMETATION OF TERMITES (*MACROTERMES BELLICOSUS*) ON THE PERFORMANCE OF BROILER CHICKENS

ABSTRACT

Eight weeks feeding trails were conducted with 120 broiler chickens at poultry production unit of the Department of Animal Science, Usmanu Danfodiyo University Sokoto. The aim is to determine performance characteristics of broilers fed termite supplemented diet *(Macrotermes bellicosus)* at starter and finisher stage. A commercial diet was compared with two other diets; fishmeal diet and termite supplemented diet. Each of the three treatments was replicated four times, with ten chicks per replicate in a Complete Randomized Design (CRD). Broilers were fed regularly throughout the period of the experiment. Results of Carcass evaluation showed significant ($P<0.05$) difference in weight of broiler parts like; breast, drum stick and liver, but there was no significant ($P>0.05$) difference in back, thigh, wings and gizzard in all treatment diets. Other parts; feet, head, and spleen showed significant ($P<0.05$) difference. But neck, heart, lungs, intestine and crop shows no significant ($P>0.05$) difference in their weights. Proximate analysis showed no significant ($P>0.05$) difference in nutrient composition in all the treatment diets, only ash showed significant ($P<0.05$) difference in fishmeal. Mineral composition showed significant ($P<0.05$) difference in almost all treatment diets except in phosphorus, copper and zinc. It was concluded that termite supplemented diet can successfully and economically replace fishmeal as protein source in the diets of broilers without deleterious effect on their health and carcass quality.

Key words: *Macrotermes bellicosus*, Broilers, Carcass, Nutrients and mineral composition.

INTRODUCTION

Termites are social land dwelling insects. They are cosmopolitan and polymorphic mainly found in tropical and sub-tropical areas, comprising some 21,000 to 30,000 species [1]; [2]. They are further divided into seven Families namely; Mastotermitidae, Termopsidae, Kalotermitidae, Hodotermitidae, Rhinotermitidae, Semitermitidae and Termitidae [2]. The first six families are referred to as lower termites and the remaining family of the termites is referred to as higher termites [3].

[4], stated that, insects are more promising alternative protein source to rearing animals. To a larger extent hundreds of insect species, have been used as animal protein supplements with some more important groups including, termites, grasshoppers, caterpillars, beetle grubs and

adults, bees etc [5]; [6]. Termites are a delicacy in the diet of some human cultures. In many cultures, termites are used as food particularly the alates type (reproductive forms) [7]; [8]. The use of insects as human food and animal feed is widely spread in tropical and sub-tropical countries and is the cheapest source of animal protein [9].

Poultry farming has expended rapidly in developing countries in last two decades. Termites are used as complementary feed sources for poultry and they are used as feed for chicken and guinea fowl in Togo and Burkina Faso [10]. In some Countries of West Africa they already have a primitive way of rearing termites on crop residues (on inverted clay pots or baskets) for food and poultry feed supplement, many developing countries termites are used as feed, locally to supply day old chicken or guinea fowls and in Togo termites are bred for this purpose [10]. *Macrotermes bellicosus,* this species simply called termites in most Nigerian communities are the commonest and has high composition of mineral elements; vitamins [11]. Nutritive potentials and utilization of termites as poultry feed ingredients have been documented in Botswana and recommend termites as source of protein in poultry diets in poultry production [12]. The protein content of termites has been reviewed to vary from 20.00 to 46.3 per cent [13], while [9], reported termites to have protein percentage of about 81.66 per cent and 87.33 for workers and sexual forms respectively, and they could help in maintaining acidity and water balance in the body of poultry.

This work incorporated termites (*Macrotermes bellicosus*) in poultry feed as protein supplement, collected in four agricultural zones of Kebbi State, North-Western Nigeria.

MATERIALS AND METHODS

Experimental site: The study on feeding trial of broilers was conducted at poultry production Unit of Department of Animal science, Usmanu Danfodiyo University Sokoto, which is located at state Veterinary Centre along Aliyu Jodi road, and Sokoto lies between latitudes 12^0 and 13^0 05'N and longitudes 4^0 $8^{'}$ and 6^0 4'E [14].

Collection and processing of test materials: Termites (*Macrotermes bellicosus)* were collected including workers, soldiers in selected areas both dry land and wet land alike. Mounds were excavated using diggers, spade, shovels and hoes causing termites to come out. They were

collected into plastic containers and sacs as in method reported by [11]. Termite samples were randomly collected from mounds in different locations within the study area. They were collected with sand and separation of termites was done in the Laboratory by flotation methods as reported by [11]. Mound soils were transferred into buckets separately and water was poured into them and floating termites were skimmed using a sieve (2.0 mm), sandy water was poured into a sieve (2.00 mm) for further separation of the sunken termites. After separating them from sand, they were then washed with clean water and sun-dried. They were ground into powder and package in plastic containers and kept in the laboratory until the time of used.

Experimental animals and management: Day old broilers were obtained from Sokoto market. The birds were sourced from a commercial hatchery Ibadan, Oyo State; they were purchased according to the number of treatments and replicates. A total of one hundred and twenty birds were used for this study. They were divided into three treatments and four replicates, ten birds per replicate; they were further divided into three dietary groups. Experimental birds were randomly selected as in the method of [13]; [8]. They were fed with three different diets, that is termite-protein supplemented meal, fishmeal and commercial feeds as control.

Poultry House: It was well cleaned and sprayed with fumigants and disinfectants to avoid infection of various diseases. This was done before the arrival of the birds and the house was partitioned into pens according to the replicates. Experimental birds were kept for three days after arrival to take care of stress. Within these three days, they were administered with anti-stress drugs after which they were weighed and allocated to their replicate groups. Each group was replicated four times. Vaccines were administered according to the routine; antibiotics and Coccidiostats were administered according to recommendations of [15]. Experimental birds were kept in a cross ventilation of open side walls house and were kept on deep litter house.

At the end of experiment that is at 8^{th} week, six birds from each treatment (three birds per replicate) were taken at random tagged for carcass analysis. They were weighed separately and slaughtered Plucked carcass was dissected and eviscerated. The head, breast and internal organs (i.e. intestine, crop, gizzard, liver, lungs, heart, spleen) were weighed separately, eviscerated carcass was then cut into parts (i.e. back, breast, thigh, drum stick, neck, wings, feet) weighed separately.

The results obtained were tested for significance of differences between treatments that is carcass evaluation and proximate composition using Start View Statistical Analysis Software [16].

Results

Experimental broilers chickens were randomly grouped into three treatment groups and fed with three different diets; that is commercial diet (obtained from the market), termite supplemented diet and fishmeal diet.

Results of slaughtered broiler chickens weight was observed in all treatment diets and there was no significant ($P<0.05$) difference. Similarly results of cuts parts such as breast, back, drumstick, thigh, wings, liver and gizzard in all the treatments is shown in table 1. From the results, breast weight of broiler chickens for commercial diet was significantly ($P<0.05$) higher compared to those on fishmeal and termite supplemented diet. However, Back weight, thigh weight, wings and gizzard weight of all treatment diets were similar ($P>0.05$). The weight of drumstick of broiler chickens on the control diet and termite supplemented diets were similar ($P>0.05$) and significantly ($P<0.05$) differed than those broiler chickens on fishmeal. Weight of liver of those broiler chickens for the control groups was observed to be heavier ($P<0.05$) compared to those for fishmeal and termite supplemented diet respectively.

Results of broiler parts such as; feet, head, neck, heart, lungs, spleen, intestines and crop are presented in table 2. Significant ($P<0.05$) difference between treatment diets was observed in feet weight. Commercial based diet was observed to be the highest ($P<0.05$) followed by termites supplemented diet than that of fishmeal. Head weight was significantly ($P<0.05$) different, commercial diet was higher than was observed in termite supplemented diet and fishmeal.

The result of the nutrient compositions of the experimental broiler chickens at finisher stage (Table 3) showed that carbohydrate, protein, fats, moisture contents of the meat of broiler chickens on all treatment groups were significantly ($P>0.05$) different. Fibre varied ($P<0.05$) between treatments, fishmeal was observed to have the highest content followed by termite

supplemented diet and commercial diet. Broiler chickens fed commercial diets were observed to record the lowest (P<0.05) values of the sodium (Na), potassium (K), and calcium (Ca). However, broilers on fish meal (P>0.05) and termite supplemented diets were similar for these elements.

Table 1: Carcass evaluation of experimental birds (Primal cuts)

	Parameters						
Treatments	Breast	Back	Drumstick	Thigh	Wings	Liver	Gizzard
Commercial diet	410.43^{a}	159.95^{a}	152.10^{a}	160.73^{a}	127.10^{a}	95.98^{a}	41.88^{a}
Fishmeal diet	348.60^{b}	152.20^{a}	117.43^{b}	134.75^{a}	104.20^{a}	34.78^{b}	36.13^{a}
Termite diet	269.35^{b}	149.98^{a}	132.73^{a}	147.13^{a}	101.85^{a}	36.13^{b}	36.98^{a}
SEM	**9.479**	**5.935**	**2.66**	**3.209**	**2.076**	**0.735**	**0.796**

Means along the same column with similar superscripts are not significantly (P>0.05) different from one another
SEM = Standard error of means

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Table 2: Carcass evaluation of the experimental birds (Other cuts)

	Parameters							
Treatments	Feet	Head	Neck	Heart	Lungs	Spleen	Intestine	Crop
Commercial diet	70.45^{a}	47.59^{a}	65.33^{a}	7.93^{a}	8.83^{a}	2.60^{a}	113.15^{a}	9.05^{a}
Fishmeal diet	52.93^{b}	38.65^{b}	49.70^{a}	6.80^{a}	7.90^{a}	1.75^{b}	95.65^{a}	8.25^{a}
Termite diet	55.58^{b}	40.30^{b}	51.15^{a}	7.73^{a}	7.63^{a}	1.75^{b}	121.65^{a}	7.95^{a}
SEM	**0.815**	**0.674**	**1.340**	**0.101**	**0.209**	**0.065**	**2.942**	**0.174**

Means along the same column with similar superscripts are not significantly (P>0.05)

different from one another
SEM = Standard error of means

Table 3: Nutrient composition of experimental birds (percentage)

Treatments	Parameters					
	Carbohydrate	Protein	Fat/Lipids	Moisture	Fibre	Ash
Commercial diet	44.22[a]	34.56[a]	9.67[a]	11.38[a]	2.30[b]	8.42[b]
Fishmeal diet	50.38[a]	33.01[a]	10. 17[a]	11.17[a]	3.92[a]	12.90[a]
Termite diet	47.76[a]	29.04[a]	10.63[a]	12.96[a]	2.43[a]	10.17[b]
SEM	**0.819**	**0.754**	**0.245**	**0.160**	**0.052**	**0.193**

Means along the same column with similar superscripts are not significantly (P>0.05) different from one another
SEM = Standard error of means

Table 4: Mineral composition, sodium, potassium, magnesium, phosphorus, zinc, copper and iron of experimental birds (mg)

Treatments	Parameters							
	Na	K	Ca	Mg	P	Zn	Cu	Fe
Commercial diet	127.08[b]	155.00[b]	1.467[b]	1.158[b]	5.408[a]	0.034[a]	0.081[a]	2.357[a]
Fishmeal diet	160.31[a]	221.38[a]	1.877[a]	1.104[b]	5.868[a]	0.007[b]	0.075[a]	2.767[a]
Termite diet	163.75[a]	182.08[a]	1.254[b]	1.588[a]	5.605[a]	0.002[b]	0.072[a]	1.955[a]
SEM	**2.456**	**3.986**	**0.030**	**0.023**	**0.109**	**0.002**	**0.005**	**0.119**

Means along the same column with similar superscripts are not significantly (P>0.05) different from one another
SEM = Standard error of means

Discussions

Species of termites were collected in selected sites of the study areas. *Macrotermes bellicosus* that include workers, soldiers and queens were collected, collected termites were washed very well with clean water and sun dried and ground into powder which was used for feed formulation.

Weight of broiler parts fed with commercial feed was significant ($P<0.05$) higher compared to fishmeal and termite supplemented diet. However, weights of back, thigh, wings and gizzard were not significantly ($P>0.05$) different in all treatments. Drum stick weight was similar in commercial and termite supplemented diet, results showed that feeds were relatively consumed by broilers in all treatment groups. This was similar to [9], who reported in his findings that insects are used as animal feed in tropical and sub-tropical regions and are the cheapest source of animal protein. [12], also reported that nutritive potentials and utilization of termites as poultry ingredients have been in use and documented. Results of carcass evaluation followed the same trend of performance of experimental broilers. The results of this finding demonstrated no significant ($P>0.05$) difference of the experimental broilers placed on different diets, there seems to be relationship of weight of broiler parts, which agrees with [17] findings who reported that, carcass and organs of measurement of broilers fed with different meals most cases followed the same trend.

Nutrients such as carbohydrate, protein, fats, fibre, ash and moisture were observed. Mineral elements were in good composition in all the treatments at finisher stage. This can be attributed to the fact that both diets are good for poultry feed and termites can now be used to replace fish meal. This shows that broilers fed with termite meal have a very good composition of nutrients and minerals this was similar to [18]; [19] findings who reported that, insects are very nutritious and rich in minerals such as potassium, calcium, Magnesium, Zinc, Phosphorous and iron and also various vitamins. [13], reported that, termites have crude lipids and gross energy, and also have a good percentage of crude protein, crude lipids than fishmeal. He also reported that, termite have good protein content. [9], also reported termites to have protein percentage that can support good performance in broilers. Nutrients and mineral composition of broilers was also observed at finisher stage in all treatment groups. Result obtained showed no significant ($P>0.05$). This was similar with [12], who reported that insects are capable of replacing fishmeal completely for

growing chickens. [20], reported that, termites (*Macrotermes bellicosus*) a reproductive have good composition of moisture, crude protein, crude fibre, crude lipid, ash, carbohydrate and energy.

Conclusion :

Conclusively, from the results of the study of feeding trails of broilers chickens, it could be concluded that termite species (*Macrotermes bellicosus*) could be used in feeding of broilers at both starter and finisher level without any adverse effect on the performance characteristics. Termites can serve as a good protein supplement in the diet of broilers chickens without any deleterious effect on performance of birds, which can replace not only fishmeal but can also replace animal protein, soybean meal and can perform very well.

AUTHORS' CONTRIBUTION

The research work was carried out in colorations with all Authors. Authors S H A designed the study, managed the literature searchers and wrote the protocol and the first draft of the manuscript. Authors HMB, MMY and AA finished the design, protocol and check the draft report. All Authors read and approved the final manuscripts.

Competing interests

All Authors have declared that no competing interests exist.

Ethical :

As per international standard informed written ethical approval has been collected and preserved by the author(s).

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