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Effects of varying Dietary Energy and Protein on the Reproductive Performance of Turkeys (*Meleagrisgallopavo*) in Bali, Taraba State

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Abstract: *This study evaluates the reproductive and productive performance of three strains of Nigerian indigenous turkeys fed different levels of dietary energy and protein at the Teaching and Research farm of the Federal Polytechnic Bali, Taraba State. A total of 120 day-old poults of Three strains of indigenous turkeywere used for the experiment. The experiments lasted for 11 months (July, 2018 –August, 2019), where poults were brooded on commercial feed for the period of 8 weeks. At the age of 64 days the birds were randomly allotted into four treatment dietary levels for growers;T1-control (Commercial feeds), T2-low energy high protein(LEHP), T3-high energy low protein(HELP), and T4-high energy high protein(HEHP). Data on weight gains was collected at the age of 75 to 97 days, and at the age of 98 days the birds were changed from growers to layers' diets for egg laying. At the age of 196 days, eggs laid was recorded from T1 of all the three strains of turkey. Eggs were collected in batches after every 8days for 5 sets only. Eggs were candled for fertility and hatchability at the day 7of laying. Reproductive parameters considered were, egg hatch, embryo mortality and hen day egg production which did not differ($P<0.05$)significantly among the strains and treatments, except for the egg set and fertile eggs. In conclusion, the varying dietary levels on different strains of indigenous turkeys used in this study, account for differences in growth rate, egg production and reproductive parameters. The preliminary results reported in this paper are a beginning and more in-depth research is required.*

Key Words: ***Effects, Diets, Energy, Protein, Reproduction, production and Turkeys***

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I. Introduction

The turkey (*Meleagrisgallopavo*), is a well-known bird in western countries, but it is not commercially established in the rest of the World especially in developing countries (Gabriel, *et al*., 2014). Commercial turkey farming is becoming popular in some developing countries and farmers started to develop interest in keeping the birds (Ann Anandh*et al*.,2011).

The turkey is considered one of most efficient biological machines for white meat production; its meat is lean and has relatively low cholesterol content compared to other domestic livestock. In addition, turkey can be fed on forage crops and pastures thus decreasing feed costs and increasing productivity (Ann Anandh*et a*l., 2011).The production per turkey bird has been doubled during the last four decades, mainly due to high selection pressure imposed for commercially important traits: body weight, meat quality and egg production (Aslam*et al.*,2012).The recent study conducted by McCrea *et al*.(2012) compared the performance; weight gain, bodyweight feed conversion ratio, carcass weights and yield, between commercial turkey and one of the heritage turkey (Bourbon red) and observed significant differences between two varieties for live performances and carcass traits. Commercial turkey performed better than Bourbon red for feed intake, weights gain, live weighs, carcass weights and carcass yield. Thus, further improvement of domesticated turkeys to meet the human demand is dependent on within and between variations among turkeys, such as phenotypic variations among individuals or variations of turkey provide ample opportunities to select the best for breeding purposes.

The primary objective of the present study was to compare the growth and reproductive performance among three commercially reared varieties of turkeys and to specifically determine the hatching traits of fertile eggs, brooding and growth performance of turkey poults under guinea savanna condition.

II. Materials and Methods

Experimental site, birds and Management

The experiment was conducted at the Teaching and Research farm of the Federal Polytechnic Bali. A total of one hundred and twenty day-old poults of both sexes in the ratio of 90:30(Females and Males) of three strains (White, Black/Bronze and Grey/Mottle) were obtained from two hatchery units (Fidan and Sabtch), both in Ibadan, Nigeria. The birds were brooded on commercial chick mash (Vital feeds) for the periods of 8weeks and were fed on commercially growers mash. At the age of 64 days the birds were randomly allotted into four

dietary formulated growers mash (experimental diets) for all the three strains with five replicates each in three blocks as follows; experimental diets for growers (control; Lower energy high protein; High energy lower protein, and High energy high protein) and the birds started to receive the graded formulated feeds of varying energy and protein levels. The collection of data on weight gains commences at age 75days and ends at the age of 97 days. At the age 98 days the feeds of birds were changed to layers' experimental diets, similar to previous formulation pattern. Then at the age of 196 days the birds started to drop eggs, where measurements on various parameters commences.

Data collection and analysis

Daily weight gains were taken using weighing balance scale in kilogrammes(kg). Daily feed intake was calculated by subtracting the left over from 1kg feeds being offered to each treatment group on daily basis.

Chick quality was measured based on chick weight, chick length and Pasgar score at hatch. Weight was measured using an electronic balance to the nearest 0.01g while chick length was measured from the point of the beak to the middle toe (nail excluded) to the nearest centimeter. Pasgar score was obtained by scoring chick vitality (place the chick on its back, if it sits up immediately - Score 0; if it takes more than 3 seconds to sit up - score 1), quality of navel (when it is completely closed and all the yolk is absorbed - score 0 but if it is open and/or one can see a dried cord - score 1), hock joint (is not enflamed and have a normal colour - score 0, if enflamed and/or red - score 1), beak (if clean and the nostrils are closed - score 0, if dirty and/or has a red dot - score 1) and abdomen (if soft abdomen - score 0, if hard abdomen and/or skin stretched score 1). For each individual, the different scores were added up and then deducted from the maximum score of 10 and the average for each group calculated.

All data collected were analyzed for variance as a Randomized Complete Block Design using the linear function of Statistix 9.0 (2008). Treatment means were compared using least square difference (LSD).

Table 1: Experimental diets for laying Turkeys

INGREDIENTS	CONTROL	LEHP	HELP	HEHP
Maize	57.1	55.2	59.1	58.3
Maize bran	13	15.3	14.5	6.3
Soybean	20.7	22	17	26
Bone meal	3	3	3	3
Limestone	6	6	6	6
Salt	0.2	0.2	0.2	0.2
Methionine	0.2	0.2	0.2	0.2
Calculated Analysis				
ME(Kcal kg)	2500	2300	2700	2700
Crude Protein	16.5	18.2	13.7	18.2
Calcium	3.5	3.3	3.6	3.5
Phosphorus	0.4	0.74	0.76	0.71
Methionine	0.38	0.35	0.35	0.45
Lysine	0.8	0.69	1.02	1.02

LEHP-Low energy high protein, HELP-High energy low protein, and HEHP-High energy high protein

$$FCR\ (egg\ production) = \frac{Feed\ intake\ (kg)}{dozens\ egg\ produced}$$

The birds were reared on deep litter in ratio of 1:5(male to females) for natural mating. Experimental breeder diets (Table1) and water were given without restrictions. The birds were weighed at beginning of the experiment and each week to determine the weights change and recorded differences between two consecutive weighing. Feed intake, hen day egg production(HDEP) were obtained each day, while feed conversion ratio (feed/dozen egg) was recorded.

$$HDEP = \frac{Total\ number\ of\ eggs\ produced\ on\ a\ day}{Total\ number\ of\ hens\ present\ on\ that\ day} \times 100$$

Data collection and Analysis

A total of 629 eggs were collected and used to evaluate the reproductive performance and egg quality of the experimental flock in 5 batches of 35 days. In each cycle, eggs were collected for seven days from each replicate and labelled accordingly. They were sorted on the 7^{th} days to remove abnormal egg size and cracked ones, before setting. In a 600 –egg capacity incubator. Temperature and relative humidity were maintained at 37.6^{O} C and 55-70%. Eggs were tuned every 90 minutes. Candling was done on the 10^{th} and the 18^{th} day of incubation and all clear eggs and dead embryo were removed.

All unhatched eggs were inspected for evidence of embryo development and embryo mortality. Embryo death were calculated as a percent of total embryo death in each batch.

III. Results and Discussion

Table 2: Influence of Varying Dietary Energy and Protein on Reproductive Performance of Three Strains of Turkey

Parameters	Control	LEHP	HELP	HEHP	SEM	P
Body Weight(Kg)	2.27[a]	2.00[c]	2.31[a]	2.21[b]	1.36	0.0000
Daily Feed intake(Kg)	1.28[a]	1.09[ab]	1.12[a]	1.07[ab]	0.044	0.0035
HDEP(%)	32.92[a]	26.62[b]	28.90[b]	26.31[b]	0.124	0.0096
FCR(per dozen)	3.12[a]	3.04[ab]	2.78[b]	3.00[ab]	9.900	0.2219
Mortality(%)	13.87[b]	14.80[b]	19.48[a]	20.33[a]	2.365	0.2067

LEHP-Low energy high protein, HELP-High energy low protein, and HEHP-High energy high protein.amebic means bearing different superscript within the row are significantly different. SEM-Standard Error of the Mean HDEP-Hen day egg production. FCR- Feed conversion ration

Table 2, depicts the influence of varying dietary energy and protein on the reproductive performance of three strains (white, Black/ Bronze and Grey/mottle) of turkey. The results revealed that the different dietary levels have significantly affected, daily weight gain of the birds with those under control performed better, while those under HELP and HEHP did not differ from one another, but differs($P<0.05$) significantly from those on LEHP, which did not have an increase in weight gains. Daily feed intake also did not differ among the treatment groups. However, those under control tend to put on higher weight gain, followed by those under LEHP. Similarly, hen day egg production (HDEP) differs ($P<0.05$significantly among the treatment groups, with control group having the highest percentage, while the remaining treatment did not differ from each other.

Feed conversion ratio on the other hand, also did not differ statistically, except the control group differs from those under HELP. Mortality rate among the breeding birds was also observed where the percentage mortality rate did not differ among those under control and LEHP, then HELP and HEHP, while those under HEHP and HELP had the highest percentage mortality. These result on body weight gain concurred with the earlier work carried out by Adikari*et al*. (2016), who reported that change in body weight with age in different lines of turkeys was similar with present finding under the influence of different nutrient levels. This indicating that different dietary levels affect weight gain over a period of time.Adikari*et al* (2016), also compared their work with the earlier work (Havenstein*et al*., 2007) and observe change in body weight between two different years (1966 vs 2003) among different types of turkey at different ages (day old-196 days) and found similarity to their (Adikari*et al*., 2016) work.

Table 3: Effects of Diets on Egg Fertility of Turkey

Variable	N	Egg Set	Fertile Egg	Egg Hatch	Embryo mortality
Overall	60	19.35	72.75	70.98	29.05
Breed					
White	20	21.85[a]	74.95[a]	71.68[a]	28.33[a]
Black/Bronze	20	19.25[b]	72.72[ab]	72.44[a]	27.56[a]
Grey/Mottle	20	16.95[c]	70.59[b]	68.84[a]	31.26[a]
Treatment					
Control	15	18.67[a]	75.37[a]	73.55[a]	26.45[a]
LEHP	15	18.47[a]	70.23[b]	70.17[a]	29.88[a]
HELP	15	18.43[a]	73.51[b]	68.56[a]	31.44[a]
HEHP	15	20.33[a]	71.91[ab]	71.63[a]	28.41[a]
Weeks of Setting					
1	12	21.75[a]	75.80[a]	70.08[a]	30.00$_a$
2	12	19.83[ab]	74.50[ab]	67.06[a]	32.94[a]
3	12	19.75[ab]	71.51[ab]	70.89[a]	29.12[a]
4	12	18.42[ab]	72.23[ab]	72.85[a]	27.18[a]
5	12	17.00[c]	69.72[b]	74.04[a]	25.99[a]

a,b,c means bearing different superscript within the row are significantly different.

LEHP-Low energy high protein, HELP-High energy low protein, and HEHP-High energy high protein

Table 3, presents the influence of dietary energy and protein on the reproductive performance of breeder turkeys. The result reveals that, the dietary levels did not differ in terms of fertility rate of the eggs, except for the control, which differs from the other treatment (diets) groups. Similarly, statistically the percentage hatchability and embryo mortality did not differ among the dietary levels. This indicate that the result obtained in this study (70-75%) is not in agreement with a similar work of Gabriel, *et al* (2014) and Nancy (1997), who reported their findings (98.83% and 89.0%) in bronze turkey under Sudan condition during the hot season respectively. Breed differences and incubation conditions were the possibility behind these differences. Similarly, Choudhry*et al.* (2004) reported decreased in egg fertility in (hot) season when the temperature was generally high, which agrees with the present study, that was also carried out during the rainy season in the Southern guinea savannah, Nigeria, where the temperature and humidity were at per.

In a similar development different levels of diets did not differ in terms of hatchability of the eggs, with mean percentage of 68.56-73.55, with those in control group having the highest hatchability rate and the lowest in HELP group. This finding was observed to be within the range of 60-80% in the tropics (Turkey management guide), Website: hpp://www.cpdosrbng.kor.nic.in(accssed in June,2012). However, it is higher than that found by Hahiye*et al* (2006), who reported 56.61%for bronze turkey and lower than 88.8% suggested by Nancy (1987) for turkey. Embryo mortality (26.45-31.44%)was also on the high side in the present study, which is brought about by relative high temperature and humidity, which also agrees with Van Krey*et al* (1987).

Table 4.Effects of Dietary Energy and protein on Reproductive performance and Poults quality of Turkeys Strains.

Parameters	Control	LEHP	HELP	HEHP	SEM
Poults weight	34.6^{a}	33.7^{b}	33.9^{b}	32.2^{b}	0.63
Poults length	16.8^{a}	14.9^{b}	15.8^{a}	15.3^{a}	0.41
Pasgar Score	9.79	9.42	9.69	8.75	0.22

a,b,c means bearing different superscript within the row are significantly different LEHP-Low energy high protein, HELP-High energy low protein, and HEHP-High energy high protein

The dietary energy and protein on Poults weight and length was influenced by maternal dietary treatment. Poults from the high energy low protein(HELP) and low energy high protein (LEHP)groups were shorter. The lower the protein in the former and lower energy utilization could have accounted for this observation.

Pasgar score was not affected by maternal dietary treatment that suggesting that maternal energy or protein status does not affect Pasgar value.

IV. Conclusion

In conclusion, the varying dietary levels on different strains of commercial turkeys used in this study, account for differences in growth rate, egg production and reproductive parameters, suggesting that this differences would serve as reference point for intending turkey farmers as well as academia and could be useful for future breeding programme to improve the existing productive and reproductive performance among turkey strains particularly in the southern Guinea savannah of Nigeria. No scientific studies were carried out on turkey production and reproduction performance under guinea savannah condition. The preliminary results reported in this paper are a beginning and more in-depth research is required.

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