



Effect of Different Feeding Patterns on Carcass Characteristics and Primal Cuts of Broilers Chickens

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Authors' contributions

This work was carried out in collaboration between both authors. Author GOA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author RTB managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

An experiment was conducted to assess carcass characteristics and offals of broilers fed on varying forms of feeding regimes. 240, 1-day old broiler chicks were randomly allotted to four feeding regimes each in 6 replicates of 10 birds per replicate designated as treatments as follows: *ad libitum*, twice a day split feeding, thrice a day split feeding and 3 hours restriction feeding. Birds were slaughtered on day 42 to determine the relative weights of the primal cuts and visceral organs. Significant differences ($P < 0.05$) were obtained on carcass parameters measured. Birds on *ad libitum* feeding had the highest bled (87.6), dressed (61.9), eviscerated (67.0) and de-feathered weights (82.5%) while the least values were obtained from birds fed thrice a day, though the values were not significantly different ($P > 0.05$) from those of birds on twice a day split feeding regime. Birds fed *ad-libitum* had the highest drumstick weight (8.84%) and wing percentages (6.73%). The neck percentages were 4.47, 4.22, 3.04 and 2.84 for *ad-libitum*, twice a day, 3 hour restriction and thrice a day feeding respectively. Liver, abdominal and crop weights were similar ($P > 0.05$) for ad

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libitum and twice feeding regime but were different ($P < 0.05$) from thrice and restricted feeding regime. Broilers on *ad libitum* and twice a day feeding regimes gave the best results for carcass, primal cuts and organ weights measured.

Keywords: *Ad-libitum; carcass characteristics; offals; restricted feeding; primal cuts.*

1. INTRODUCTION

One of the major problems facing the poultry industry today is the high cost of feed. In commercial broiler production system, profit can be maximized by minimizing feed cost which accounts for more than half (60-70%) of the total cost of production [1].

Feed cost can be minimized through reduction in feed consumption brought about by varying feeding patterns in chickens with targeted benefits of feed savings, lean meat production and a more uniform growth and enhanced feed conversion efficiency. Quantitative and qualitative feed restrictions have therefore been introduced to achieve this aim. This is carried out by reducing the birds to feed access time or by reducing the nutrient content of the feed. Restricted feeding can be done in early life of chickens [2]. Feed restriction during the growing period in broiler chickens lowers body weight [3] and carcass fat and improves feed efficiency with compensatory growth during refeeding [3]. In laying traits, feed restriction during rearing decreases adult body weight, delays age of sexual maturity and decreases mortality [4] and decreases the number of heavy follicles at the onset of laying [5]. Feed restriction in brown layers between 6-18 weeks of age increases egg production with a little increase in feed consumption in the laying period and without affecting egg quality traits [6]. Different methods of feed restriction programmes are applied in practice such as reduced nutrients intake by means of diet dilution, appetite suppressant, limiting the time of the feed access such as skip-a-day feeding, split feeding [7] or limiting quantity of feed offered to the birds daily [2,7]. Feed restriction may help reduce cost of production with little or no effect on carcass and primal cuts of chickens [8]. This study was therefore conducted to investigate the influence of different feeding regimes on carcass characteristics and primal cuts of broiler chickens.

2. MATERIALS AND METHODS

The research was carried out at the Poultry unit, Teaching and Research Farm of the University of

Ibadan, Ibadan Oyo state, Nigeria. Ibadan lies on the longitude 4°15' East of the Greenwich Meridian and latitude 80 15' North-East of the Equator. The altitude is between 300 and 600 meters above sea level. The mean annual temperature is about 27°C while that of rainfall is 247 mm. 240 unsexed day old Abor acre breed of broilers were purchased from CHI farms limited located in Ibadan and randomly allotted to four feeding regime with 6 replicates and 10 birds per replicate. The feed was prepared at the feed mill of the teaching and research farm of the University of Ibadan, Ibadan Oyo state, Nigeria. The feed materials were processed, milled and mixed thoroughly. Two basic diets comprising of the starter and the finisher diets were formulated and prepared at the feed mill. All diets were analyzed for chemical composition at the laboratory of the department of animal science, university of Ibadan, Ibadan, Oyo state, Nigeria. The gross composition of the experimental diets is shown in Tables 1 and 2.

Table 1. Gross composition of starter diet

Ingredients	Quantity
Maize	58.00
Groundnut cake	33.00
Soyabean meal	4.60
Fish meal (72%)	0.50
Full fat soya	3.00
Oyster shell	0.50
Di-calcium phosphate	2.50
Salt	0.25
Methionine	0.15
L-lysine	0.25
Preix	0.25
Total	100.00
Calculated values	
Crude protein (%)	23.10
Metabolizable energy (kcal/kg)	3010
Crude fibre (%)	3.82
Calcium	1.02
Ether extract	3.86
Available phosphorus (%)	0.55

The four feeding regimes were designated as treatments as follows: *ad-libitum*, twice a day split feeding, thrice a day feeding and 3hours restriction feeding. The treatments were applied

starting from day 14 to day 28 of age and thereafter they were all placed fed *ad libitum* for compensatory growth till 42nd day. Feed and clean water was given after the daily routine of observation, removal of dead birds if available and leftover of the feed and water offered to each replicate the previous day was withdrawn daily. The birds were weighed on commencement of the experiment to obtain their initial weights. Treatment 1- *Ad-libitum*, Treatment 2-Morning and Evening (twice/split/meal feed), Treatment 3-Morning, afternoon and evening (thrice) and Treatment 4-Restricted feeding (3 hour interval). The experimental design was completely randomized design.

Table 2. Gross composition of finisher diet

Ingredients	Quantity
Maize	56.50
Groundnut cake	9.50
Wheat offal	10.00
Fish meal (72%)	0.30
Full fat soya	20.00
Oyster shell	1.00
Di-calcium phosphate	1.95
Salt	0.25
Methionine	0.15
L-lysine	0.10
Premix	0.25
Total	100.00
Calculated values	
Crude protein (%)	19.7
Metabolizable	3000
Energy (kcal/kg)	
Crude fibre (%)	3.79
Calcium	1.12
Ether extract	5.51
Available phosphorus (%)	0.45

2.1 Carcass Characteristics of Broilers

2.1.1 Carcass evaluation in broilers

The birds were sacrificed on day 42 of the research. Four birds per treatment were randomly selected for carcass evaluation. The selected birds were starved overnight to empty their guts. The live weight of the birds were taken and then sacrificed by severing the jugular vein and bled properly before the dead/bled weights were obtained. The birds were then de-feathered manually without hot water to preserve the physical characteristics of the carcass and the plucked weights were obtained. The eviscerated weights (weight of carcass after offal have been removed) and dress weights (weight of the

carcass after internal offal, head, neck and shank have been removed) were obtained using a digital scale. The breast, thigh, drumstick, shank, back, abdominal fat, neck, wings and organs like gizzard, spleen, liver and crop were removed, weighed and recorded. The weights of different cut parts were expressed as percentages of the live weights.

2.2 Statistical Analysis

Data generated were subjected to one-way analysis of variance (ANOVA) using the SAS [9] package and means were separated using SAS MICRO of the same software at 5% level ($p < 0.05$) of significance.

3. RESULTS

Table 4 shows the summary of the primal cuts of broiler expressed as percentage of the live weight. There were significant differences ($P < 0.05$) in live weight with birds fed *ad-libitum* and twice daily having a higher live weight mean value of 1350 g and 1290 g respectively with birds fed thrice having the least live weight of 918 g. Similar trend was observed for bled weight. The effect of feeding regime on the dressed weights across all parameters ranged from 39.1% to 61.9%. Birds fed *ad-libitum* had the highest dressed weight 61.9% with the least dressed weight in birds on thrice feeding regime. Eviscerated weight (67.0%) was highest in birds on *ad-libitum* feeding while the least eviscerated weight was observed in birds fed thrice daily. Defeathered, bled and live weights of birds on *ad-libitum* and twice daily feeding were similar ($P > 0.05$) and were not different ($P > 0.05$) from those of birds on 3 hours restricted feeding but differ significantly ($P < 0.05$) from birds on thrice a day feeding regime. Bled weight however ranged from 59.4 (thrice feeding) to 87.6 (*ad-libitum*). The effect of feeding regime on organ weight of broiler chickens is shown in Table 5. Feeding regime had no significant effect ($P > 0.05$) on the parameters observed except for weights of the drumstick, neck and wings. Birds fed *ad-libitum* had the highest drumstick weight (8.84) followed by those fed twice daily (7.52), 3 hour restriction (6.45) and thrice daily (4.85) respectively. Drumstick weights of those fed *ad-libitum* and twice feeding were not significantly different ($P > 0.05$). The feeding regime showed statistical difference ($P < 0.05$) in the neck weight as a percentage of the live weight from highest to lowest mean values for *ad-libitum* (4.47%), twice (4.22%), 3 hour restriction 3.04% and 2.84% for

thrice feeding respectively. The wings weight of birds fed *ad-libitum* (6.73) had the highest weight though not significantly different ($P>0.05$) from those on twice feeding regime (6.51).

The effect of feeding regimes on organ weights is shown in Table 5. Weights of full gizzard, weight spleen and empty gizzard were not affected by the feeding regimes, but statistical significance ($P<0.05$) was observed in liver weight, abdominal fat weight and crop weight of the birds. Birds fed *ad-libitum* had the highest liver weight (4.12%) while birds fed thrice daily had the least mean value (2.41%). Weights of liver, abdominal and crop were similar ($P>0.05$) for *ad-libitum* and twice a day feeding regime while those of birds fed twice and thrice daily were similar ($P>0.05$).

4. DISCUSSION

The birds on *ad libitum* feeding exhibited high eviscerated carcass yield weight with fat compared to birds on the restricted feeding system. The results were in agreement with earlier findings of Etalem [10] though differences in de-feathered weights from this work were contrary to observation from their findings on a skip- a- day feed restriction program in chickens. One would have expected *ad-libitum* feeding and thrice a day feeding to compete favourably. The possible explanation for the lower carcass cut from birds on thrice feeding regime could be that the quantity of feed given in the morning could not meet up with their metabolic needs and by the time another portion is served in the

Table 3. Effect of different feeding regimes on carcass characteristics of broilers

Parameter	<i>Ad-libitum</i>	Twice	Thrice	3 hours restriction	SEM
Live weight (g)	1350 ^a	1290 ^a	918 ^b	1060 ^{ab}	99.5
Bled weight (%)	87.6 ^a	84.8 ^a	59.4 ^{ab}	69.2 ^{ab}	6.65
Dressed weight (%)	61.9 ^a	58.6 ^{ab}	39.1 ^c	44.2 ^{bc}	5.52
Eviscerated weight (%)	67.0 ^a	65.6 ^a	45.1 ^b	51.5 ^{ab}	5.35
De feathered weight (%)	82.5 ^a	81.8 ^a	55.4 ^b	65.3 ^{ab}	6.60

Means with same superscript are not significantly different from each other ($P>0.05$)

Means with different superscript are significantly different from each other ($P>0.05$)

SEM = Standard error means

Table 4. Effect of different feeding regimes on carcass cuts of broilers

Parameter (%)	<i>Ad-libitum</i>	Twice	Thrice	3 hours restriction	SEM
Breast weight	13.60	15.80	10.10	12.90	1.19
Thigh weight	9.71	8.78	6.21	6.72	0.67
Drumstick weight	8.84 ^a	7.52 ^{ab}	4.85 ^c	6.45 ^{bc}	0.85
Shank weight	4.12	4.15	2.96	3.52	0.28
Back weight	12.6	13.0	9.64	9.47	0.94
Neck weight	4.47 ^a	4.22 ^{ab}	2.84 ^c	3.04 ^{bc}	0.41
Wings weight	6.73 ^a	6.51 ^{ab}	4.47 ^b	4.51 ^b	0.62

Means with the same superscript are not significantly different from each other ($P>0.05$)

Means with different superscript are significantly different from each other ($P>0.05$)

SEM = Standard error means

Table 5. Main effect of feeding regime on organ weight of broilers

Parameter (%)	<i>Ad-libitum</i>	Twice	Thrice	3 hours restriction	SEM
Full gizzard	3.40	3.47	2.81	2.72	0.20
Spleen	0.17	0.12	0.11	0.17	0.20
Empty gizzard	1.97	1.92	1.68	1.80	0.06
Liver	4.12 ^a	3.67 ^a	2.41 ^b	3.15 ^{ab}	0.37
Abdominal fat	0.66 ^a	0.44 ^{ab}	0.07 ^b	0.10 ^b	0.14
Crop weight	3.30 ^a	2.52 ^{ab}	1.72 ^b	2.22 ^{ab}	0.33

Means with the same superscript are not significantly different from each other ($P>0.05$)

Means with different superscript are significantly different from each other ($P>0.05$)

SEM = Standard error means

afternoon, they would have been under heat stress coupled with stress of in satiety thus problem with protein accretion. Differences however observed in the primal cuts of birds on ad libitum feeding and twice a day feeding regime indicated that the two feeding regimes were better for improved primal cut percentages and going outside these two regimes affected the percentage cuts obtainable from the carcasses. Although, the occurrence of compensatory growth in feed restricted birds have been reported to affect the deposition of more muscle in affected parts in some studies [10]. This was not the case as observed in this study.

The insignificant effect observed on spleen, full and empty gizzard when compared with ad-libitum feeding during feed restriction programs was similar to earlier findings on the effect of feed restriction on the spleen and gizzard weights [11,12] although Katanbaf [13] and Al-Talib [3] did obtain a significant increase in gizzard weight and reduction in relative weight of the heart at 56 days of age following short term restriction. The results of Al-Talib [3] and Etalem [10] discovered that body fat was depressed when chickens were exposed to feed restriction. [14] Inconsistently observed an increase in the level of abdominal fat percentage with advancing slaughter age. However, findings of several investigators [11] and [15] virtually indicated no change in absolute quantity of abdominal fat in 42 to 49 days old broiler chicks subjected to feed restriction from 35 to 39 days of age.

5. CONCLUSION

Most carcass characteristics measured indicated differences between the *ad libitum*, twice a day treatments being significantly different from the others. *Ad libitum* and twice a day feeding regimes gave the best values for carcass, primal cuts and organ weights measured.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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