International Journal of Research Studies in Science, Engineering and Technology
Volume 4, Issue 9, 2017, PP 10-16
ISSN : 2349-476X

Effects of Strain and Skip-a-Day Feed Restriction on Carcass and Meat Quality Characteristics of Broiler Chickens

Kehinde Akinsola and Simeon Olawumi

Department of Animal Production and Health Sciences, Ekiti State University, Ado-Ekiti, Nigeria.

***Corresponding Author:** Simeon Olawumi, Department of Animal Production and Health Sciences, Ekiti State University, Ado-Ekiti, Nigeria.*

ABSTRACT

The price of poultry products has been on the increase in recent time due to rising cost of feeds, drugs and other inputs. In order to make the products affordable and cheaper for the populace, there is an urgent need to adopt measures which will reduce the cost of production, increase efficiency and final output and profit.A total number of 300 day-old broiler chicks comprising 100 chicks each of Arbor Acre, Hubbard and Marshall were purchased from reputable hatcheries. They were allotted to four different treatments having three replicates each (8 chicks/replicate) as follows: T1 (control), T2 (2nd week), T3 (3rd week) and T4 (4th week) skip-a-day feed restriction. At 56th day, two birds per replicate were selected for carcass and meat quality evaluation. Theresult showed that there was no significant effect of strain on live weight regardless of the feed restriction methods applied. However, all carcass traits were significantly affected by strain of broilers. In addition, there was no significant effect of feed restriction regimen on carcass traits except live and dressed weights of broiler chickens regardless of strain of broilers. With regards to meat quality, no significant effect of strain was observed except aroma and texture, while feed restriction affected flavour only. Arbor Acre strain appeared tolerant to feed restriction due to its superior live and carcass weights when compared with Hubbard and Marshall. Second week feed restriction could also be employed to reduce production cost without any adverse effect on the bird's performance.

Keywords: *Arbor Acre, skip-a-day, strain, meat quality, carcass.*

INTRODUCTION

In Nigeria, the demand for white meat and its products has increased appreciably in recent time due to health concerns arising from red meat consumption. According to MOA (2007), red meat production is about 28%, while self-sufficiency of broiler meat (white meat) is approximately 96%. The success of poultry production has been strongly related to the improvements in growth performance and carcass yield and composition. Present commercial broiler chicken strains such as Arbor Acre, Anak Titan, Ross, Lohmann, Pawl, Hubbard and Kucborwere the results of successful selection programme for rapid growth and body conformation (Idahor *et al*., 2013). These strains had been bred to acclimatize very well that they can attain table size of 1.6 – 2.0 kilogram live weight in 8 – 12weeks with minimal death rate (Idahor *et al*., 2013).

Researchers and producers are always interested in evaluating the performance of the commercially available strains, taking into consideration the weight and yield of the breast meat as the most important variables (Scheuermann *et al*., 2003). This improvement in growth performance and carcass characteristics have resulted to physiological, immunological, biochemical and anatomical changes in broiler (Schmidt *et al*., 2009). In addition, Julian (2005) emphasized that rapid growth rate of modern broiler chickens was associated with series of physiological disorders resulting to increase in the rate of mortality during grow-out.

The high cost of production and reduction in profit margin had been major challenges in the past (Idahor *et al*., 2013). The authors asserted that despite these challenges, poultry enterprise has contributed immensely to the development of the national economic indicators such as job creation, gross development product (GDP), as well as food security to the extent that 10% of Nigerians are directly engaged in the supply of poultry inputs, establishment of hatcheries, feed mills, farms and cottage industries producing egg, meat and their products.

Feed accounts for 60-70% of the cost involved in poultry production (Sahraei, 2012). In an

attempt to reduce this cost, feed restriction has been suggested as a management tool designed to limit bird's access to feeds during a definite period of time which could be quantitative or qualitative(Olawumi, 2015). Quantitative feed restriction occurs when the time birds have access to feed in a day is limited, while qualitative feed restriction is the denial of birds to certain nutrients by mixing the compounded feed with inert fibres such as wheat offals (Fanooci and Torki, 2010). Quantitative feed restriction includes intermittent feeding, skip-a-day feeding, appetite suppression with glycolic acid, time of restriction and diet dilution (Benyi*et al*., 2011).

Previous studies had used the concept of feed restriction in broilers to reduce the incidence of metabolic disorders and high mortality (Balog*et al*., 2000). Reports had also shown that feed restriction helped in arterial oxygenation by reducing metabolic demands during critical periods of the life span of a bird (Arce *et al*., 1992) and enhanced efficiency of feed utilization, reduced feed cost and mortality rate (Zubair and Lusson, 1996).

There is scarce information in literature as regards the impact of feed restriction on carcass and meat quality characteristics of broiler chickens. The present investigation was therefore, undertaken to determine the effects of strain and skip-a-day feed restriction on carcass and meat quality characteristics of broiler chickens.

MATERIALS AND METHODS

The study was carried out at the poultry unit of the Teaching and Research Farm, Faculty of Agricultural Sciences, Ekiti State University, Ado-Ekiti, Nigeria. Ekiti State is situated entirely within the tropics. It is located between longitudes 40° 51' and 50° 451' East of the Greenwich meridian and latitudes 70° 151' and 80° 511' North of the Equator. The State enjoys a tropical climate with two distinct seasons. These are the rainy season (April - October) and the dry season (November - March). Temperature ranges between 21^0C and 28^0C with high humidity.

Management and Feeding Practices

A total number of 300 day-old broiler chicks comprising 100 chicks each of Arbor Acre, Hubbard and Marshall were purchased from reputable hatcheries. Prior to arrival of the birds, the pens were properly cleaned, washed with soap and fumigated thoroughly with 40% formaldehyde in water solution and allowed to rest for one week. The house was properly covered and pre-heated before the arrival of the birds so as to raise the temperature of the brooding environment to keep the chickens warm.

The chicks were vaccinated against Newcastle and Infectious Bursa diseases at recommended doses, and at specified ages. During the adaptation period (1-7 days), all the chicks were fed *ad libitum*. They were thereafter allotted to four different treatments having three replicates each (8 chicks/replicate) as follows:

Treatment 1 – Control- *ad libitum*

Treatment 2 – Skip-a-day method across the three strains at 2nd week and *ad libitum* thereafter.

Treatment 3 – Skip-a-day method across the three strains at 3rd week and *ad libitum* thereafter.

Treatment 4 – Skip-a-day method across the three strains at 4th week and *ad libitum* thereafter.

The birds were fed starter mash (1-4 weeks) containing 22%CP and 3000Kcal ME Kg^{-1}, while between 4-7 weeks they were given finisher feed containing 20%CP and 3100Kcal ME Kg^{-1}.

Carcass Evaluation

At 56th day of age, two birds per replicate, that is, six birds per treatment on strain basis were randomly selected after starving them overnight for carcass evaluation. The birds were numbered and weighed individually to obtain live body weight and thereafter, slaughtered, bled, scalded and plucked. After defeathering, the carcasses were eviscerated and dissected manually into various parts such as breast muscle, back muscle, drumstick, thigh muscle, wings, legs and giblets (heart, liver and gizzard). The different parts were weighed using sensitive scale and were expressed in grammes.

Data collected at 56th day of age included live body weight, slaughter weight, dressing weight, eviscerated weight, carcass weight, breast weight, back muscle weight, drumstick and

thigh weights, neck and head weights, wing and intestinal weight, liver, lung, heart and gizzard.

Sensory Evaluation

Samples for sensory evaluations were taken from the breast muscle and cooked to an internal temperature of 72^0C. Total of 12 trained individuals aged between 22 and 35 years males and females were employed to assess the coded meat samples. Equal bite size from each treatment was coded, replicated thrice and served for evaluation by the trainees on a 9-point hedonic scale for colour, flavour, tenderness, juiciness, texture and overall acceptability.

Statistical Analysis

The data collected were analyzed by the analysis of variance technique in completely randomized design, while the differences between means were separated by Duncan New Multiple Range Test as per SAS (2001).

The appropriate statistical model used was:

$Y_{ijk}= \mu + G_i + R_j + \varepsilon_{ijk}$

Y_{ijk} = observation on k^{th} population, of i^{th} strain and j^{th} feed restriction

μ = common mean

G_i = fixed effect of strain (i=3)

R_j = fixed effect of feed restriction (j=4)

ε_{ijk} = error term

Results And Discussion

Table 1 presents the effect of strain on live weight and carcass characteristics of broiler chickens. The result showed that there was no significant (P>0.05) effect of strain on live weight regardless of the feed restriction methods applied. This means that the three strains possessed genetic abilities tolerant to feed restriction regimen, and the birds across the three strains demonstrated 'catch up' growth by reaching the same mature live weight following refeeding after feed restriction. This was in agreement with the findings of Makram *et al.* (2010) and Hossain *et al.* (2011), but contradicted those of Chukwuka *et al.* (2010) who reported significant differences between strains of broiler chickens in live weight. However, all carcass traits were significantly (P<0.01) affected by strain of broilers. For slaughter weight, dressed weight and eviscerated weight, there was significant (P<0.01) effect of strain on these traits. Arbor Acre strain recorded the superior mean values, while Marshal showed the lowest mean values of slaughter weight. In addition, breast weight and thigh + drumstick were significantly (P<0.01) affected by strain. Arbor Acre showed the highest mean value of breast weight, while Hubbard and Marshall recorded similar (P>0.05) mean values.

As regards back weight and wing weight, there was significant (P<0.01) effect of strain on the traits. Arbor Acre strain recorded the superior mean value, while Hubbard strain showed the least mean value for the traits. This means that Arbor Acre strain produced more kilogram of meat than the other two strains. The strains should be strain of choice for farmers who want better performance and higher profit. The non-significant differences in carcass traits reported in this study were in agreement with the findings of Olawumi (2014) who reported non-significant strain differences in carcass traits of broiler chickens.Similarly, there was significant (p<0.01) effect of strain on non-carcass traits such as head and neck of broiler chickens. Hubbard strain showed superior mean value compared to other strains, while Arbor Acre recorded the lowest mean value at the end of 8 weeks. There was no significant (p>0.05) effects of strain on the heart, liver and proventriculus + gizzard at age 8 weeks. But there was significant (p<0.01) effect of strain on the weight of the intestine. Hubbard strain recorded the superior mean value of intestinal weight, while Arbor Acre and Marshall showed similar (p>0.05) mean values. The genetic differences in non-carcass traits reported in this study contradicted the findings of Olawumi (2014) who reported non-significant strain differences in non-carcass traits of broiler chickens.

Table 2 shows the effect of skip-a-day feed restriction regimen on broiler chickens live weight and carcass characteristics. The result showed that there was significant (p<0.01) effect of feed restriction regimen on live weight of broiler chickens regardless of strain of broilers. Birds on full feed (*ad libitum*) recorded the highest mean value of live weight and dressed weight, while birds on third week feed restriction showed the lowest mean value. For slaughter weight, thigh + drumstick weight and wing weight, there was no significant (p>0.05) effect of feed restriction on these traits. With

eviscerated weight, there was significant ($p<0.01$) effect of feed restriction on the trait. Birds on full feed (*adlibitum*) recorded superior mean value, while birds on fourth week feed restriction had intermediate value. However, birds on second and third week feed restriction had the least values of the trait at 8 weeks.

In the same vein (Table 2), breast weight was significantly ($p<0.01$) affected by feed restriction. Birds on fourth week feed restriction had the highest mean value, while birds on second and third week feed restriction recorded the lowest values of the trait. In addition, there was significant ($p<0.01$) effect of feed restriction on back weight at 8 weeks. Birds on third week and fourth week feed restriction showed superior mean values, while birds on full feed (*ad libitum*) and second week feed restriction recorded the lowest value. The obtained results could be attributed to the fact that full-fed birds had unrestricted access to feed and water, which were successfully converted to meat (flesh). The significant differences in carcass traits as affected by feed restriction reported in this study contradicted the findings of Olawumi (2014) who reported non-significant effect of feed restriction on carcass traits of broiler chickens.

Pertaining to non-carcass traits, there was significant ($p<0.01$) effect of feed restriction on head of broiler chickens at 8 weeks. Birds on full feed (*ad libitum*) had superior value, while birds on second week feed restriction showed the lowest mean value of broiler chicken head at age 8 weeks. In this study, feed restriction has no significant ($p>0.05$) effect on heart, liver, intestinal weight and neck. On the other hand, proventriculus + gizzard was significantly ($p<0.01$) affected by feed restriction. Birds on full feed (*ad libitum*) recorded the highest mean value, while other feed restriction regimen showed similar ($p>0.05$) mean values. The result of this study was in contrast to the findings of Olawumi (2014) who reported non-significant effect of feed restriction on non-carcass trait in broiler chickens. The differences noted in this study and previous studies could be attributed to different strains of broilers used, type of feed restriction, location, health status and management practices.

Table 3 shows the effect of strain on broilers meat quality characteristics at 8 weeks. The result revealed that there was significant ($p<0.01$) effect of strain of broilers on Aroma regardless of skip-a-day feed restriction applied. Arbor Acre strain recorded the highest mean value of Aroma, while Marshall showed the least mean value of Aroma at 8 weeks. Similarly, there was significant ($p<0.01$) effect of strain on broiler chickens texture. Arbor Acre strain had superior mean value, while Hubbard strain recorded the lowest mean value at 8 weeks.

However, there was no significant ($p>0.05$) effect of strain of broilers on colour, flavour, tenderness, juiciness, saltiness and overall acceptability at 8 weeks. This could be due to the better welfare conditions that reduced pre-slaughter stress and thus consumption of glycogen (Castellini*et al.*, 2002). Visual appraisal of products is one of the most important characteristics of food, and determines whether a consumer chooses or rejects products. According to Van Oeckel *et al*. (1999) and Bell and Weaver (2002), colour is a major indicator of quality of meat, as the appearance influences consumer acceptance. The non-significant difference in colour of the products from this study was an indication that the three strains have similar genetic background.

Table 4 shows the effect of feed restriction regimes on broiler meat quality at 8 weeks. The result revealed that there was no significant ($p>0.05$) effect of feed restriction regimes on Aroma, colour, tenderness, juiciness, texture and saltiness. This implies that the feed restriction regimes had no effect on these sensory parameters. However, there was significant ($p<0.01$) effect of feed restriction on flavour. Birds on full feed (*ad libitum*) and third week feed restriction recorded superior mean values, while birds on fourth week feed restriction showed the lowest mean value at 8 weeks.

Furthermore, there was significant ($p<0.01$) effect of feed restriction on the overall acceptability of broiler chickens. Birds on second week feed restriction had superior mean value of acceptability, while birds on fourth week feed restriction recorded the lowest mean value. This result was in agreement with the findings of Gonzales *et al.* (1998) who reported significant effect of feed restriction on some sensory parameters. However, Schedle *et* al (2006) reported that length of feed withdrawal could have positive effect on the sensory quality

of the final product. In this study, strain × feed restriction interaction effect was significant for flavour, texture and overall acceptance. This implies that the traits are strain and feed restriction dependent.

Table1. *Least squares means showing the effect of strain on live weight and carcass characteristics of broiler chickens.*

Traits (g)	Arbor Acre	Hubbard	Marshall
Live Weight	2416.67 ± 46.38	2393.75 ± 46.38	2308.33 ± 46.38
Slaughter Weight	2351.25 ± 45.38^{a}	2285.42 ± 45.38^{ab}	2212.50 ± 45.38^{b}
Dressed Weight	2260.42 ± 44.99^{a}	2156.25 ± 44.99^{ab}	2106.25 ± 44.99^{b}
Eviscerated Weight	1844.54 ± 40.80^{a}	1734.25 ± 40.80^{ab}	1671.71 ± 40.80^{b}
Breast Weight	604.58 ± 29.72^{a}	485.00 ± 29.72^{b}	493.75 ± 29.72^{b}
Back Weight	469.17 ± 25.56^{a}	377.50 ± 25.56^{b}	410.63± 25.56^{ab}
Thigh + drumstick	542.92 ± 14.05^{a}	454.17 ± 14.05^{b}	485.42 ± 14.05^{b}
Wing Weight	250.00 ± 11.81^{a}	208.75 ± 11.81^{b}	220.00 ± 11.81^{ab}
Head	64.64 ± 2.46^{b}	72.73 ± 2.46^{a}	70.03 ± 2.46^{ab}
Heart	12.14 ± 0.55	13.35 ± 0.55	13.05 ± 0.55
Liver	44.22 ± 2.10	46.24 ± 2.10	43.88 ± 2.10
Proventiculus + Gizzard	64.21 ± 2.23	65.81 ± 2.23	66.05 ± 2.23
Intestine Weight	98.10 ± 4.41^{b}	115.72 ± 4.41^{a}	102.19 ± 4.41^{b}
Neck	124.58 ± 7.31^{b}	105.83 ± 7.31^{b}	146.67 ± 7.31^{a}

Note: *a, b, c means with different superscripts along rows are significantly different (p<0.01)*

Table2. *Least squares means showing the effect of skip-a-day feed restriction on broilers' live weight and carcass characteristics*

Traits (g)	Control (*ad libitum*)	2ndWeek feed restriction	3rdWeek feed restriction	4thWeek feed restriction
Live Weight	2472.22 ± 53.55^{a}	2358.33 ± 53.55^{ab}	2300.00 ± 53.55^{b}	2361.11 ± 53.55^{ab}
Slaughter Weight	2377.78 ± 52.41	2261.11 ± 52.41	2221.11 ± 52.41	2272.22 ± 52.41
Dressed Weight	2286.11 ± 51.96^{a}	2161.11 ± 51.96^{ab}	2111.11 ± 51.96^{b}	2138.89 ± 51.96^{ab}
Eviscerated Weight	1875.00 ± 47.10^{a}	1691.67 ± 47.10^{b}	1681.89± 47.10^{b}	1752.11 ± 47.10^{ab}
Breast Weight	535.00 ± 34.32^{ab}	482.78 ± 34.32^{b}	486.11 ± 34.32^{b}	607.22 ± 34.32^{a}
Back Weight	407.22 ± 29.51^{b}	385.28 ± 29.51^{b}	383.33 ± 29.51^{a}	500.56 ± 29.51^{a}
Thigh + drumstick	522.22 ± 16.23	486.11 ± 16.23	477.78 ± 16.23	490.56 ± 16.23
Wing Weight	235.00 ± 13.64	223.89 ± 13.64	230.56 ± 13.64	215.56 ± 13.64
Head	75.51 ± 2.83^{a}	65.50 ± 2.83^{b}	67.41 ± 2.83^{ab}	68.12 ± 2.83^{ab}
Heart	12.86 ± 0.63	13.19 ± 0.63	12.27 ± 0.63	13.06 ± 0.63
Liver	42.57 ± 2.42	45.41 ± 2.42	46.12 ± 2.42	45.02 ± 2.42
Proventiculus + Gizzard	73.48 ± 2.58^{a}	63.43± 2.58^{b}	59.97 ± 2.58^{b}	64.54 ± 2.58^{b}
Intestine Weight	100.56 ± 5.09	109.78 ± 5.09	111.26 ± 5.09	100.94 ± 5.09
Neck	126.67 ± 8.44	130.00 ± 8.44	128.89 ± 8.44	117.22 ± 8.44

Note: *a, b, c means with different superscripts along rows are significantly different (p<0.01)*

Table3. *Least squares means showing the effect of strain on broilers meat quality at week eight*

Sensory Values	Arbor Acre	Hubbard	Marshall
Aroma	53.46^{a} ± 1.75	50.00^{ab} ± 1.75	46.79^{b} ± 1.75
Colour	61.13 ± 1.06	60.17 ± 1.06	58.46 ± 1.06
Flavour	57.58 ± 1.20	57.92 ± 1.20	57.00 ± 1.20
Tenderness	61.08 ± 1.04	58.38 ± 1.04	59.38 ± 1.04
Juiciness	61.46 ± 0.99	59.21 ± 0.99	59.21 ± 0.99
Texture	60.75^{a} ± 1.04	55.17^{b} ± 1.04	57.92^{ab} ± 1.04
Saltiness	55.08 ± 1.31	55.96 ± 1.31	57.71 ± 1.31
Overall Acceptability	62.67 ± 1.09	60.92 ± 1.09	59.83 ± 1.09

Note: *a, b, c means with different superscripts along rows are significantly different (p<0.01)*

Table4. *Least squares means showing the effect of feed restriction on Broiler meat quality.*

Sensory Values	Control (*ad libitum*)	2nd Week feed restriction	3rdWeek feed restriction	4th Week feed restriction
Aroma	59.00 ± 2.02	61.28 ± 2.02	59.78 ± 2.02	59.61 ± 2.02
Colour	49.28 ± 1.22	50.72 ± 1.22	50.06 ± 1.22	50.28 ± 1.22
Flavour	58.72 ± 1.39^{a}	57.50 ± 1.39^{ab}	59.56 ± 1.39^{a}	54.22 ± 1.39^{b}
Tenderness	58.56 ± 1.20	60.94 ± 1.20	60.61 ± 1.20	58.33 ± 1.20
Juiciness	59.67 ± 1.15	61.78 ± 1.15	59.28 ± 1.15	59.11 ± 1.15
Texture	57.61 ± 1.19	57.61 ± 1.19	58.39 ± 1.19	58.17 ± 1.19
Saltiness	54.67 ± 1.51	58.11 ± 1.51	57.17 ± 1.51	55.06 ± 1.51
Overall Acceptance	60.67 ± 1.26^{ab}	63.39 ± 1.26^{a}	61.44 ± 1.26^{ab}	59.06 ± 1.26^{b}

Note: *a, b, c means with different superscripts along rows are significantly different (p<0.01)*

CONCLUSION

The findings in this study indicated non-significant differences in live weight of broiler strains to skip-a-day feed restriction regimen at maturity. This implies that the birds demonstrated catch-up growth following refeeding. However, the strains differed in some carcass traits with Arbor Acre having superior mean values to Hubbard and Marshall. As regards the effect of skip-a-day feeding regimen, only the fourth week restriction recorded lower values in live weight at maturity when compared to *ad libitum*, second and third week feed restriction. This suggest that skip-a-day feed restriction is practicable for broilers before the fourth week of age without any accompanying economic losses to farmers. The feed restriction employed also significantly affected all carcass traits considered. For meat quality traits, the strains differed only in aroma and texture with Arbor Acre having higher mean values than Hubbard and Marshall. In addition, fourth week skip-a-day feed restriction had lowest mean values in flavor and overall acceptance when compared to *ad libitum*, second and third week feed restriction.

ACKNOWLEDGEMENT

The authors expressed their deep appreciation to Management and Staff of Teaching and Research Farm, Ekiti State University for their support and technical assistance in the course of the study.

REFERENCES

[1] Arce J, Berger M and Coello CL. Control of ascites syndrome by feed restriction techniques. J. Appl. Poult. Res. 1992; 1: 1 – 5.

[2] Balog MJ, AnthonyNB, CooperMA, Kidd BD, Huff G.R, Huff WE and Rath NC. Ascites syndrome and related pathologies in feed restricted broilers raised in a hypobaric chamer. Poult. Sci. 2000; 79: 318 – 323.

[3] Bell DD and Weaver WD. Commercial Chicken Meat and Egg Production. 2002; 5th ed. Kluwer Academic Publishers.

[4] Benyi K, Acheampong-Boateng O and Norris D. Effect of strain and different skip-a-day feed restriction periods on growth performance of broiler chickens. Trop. Anim. Health Prod. 2011;43: 871-876.

[5] Castellini C, Mugnai C and Dal BoscoA. Effect of organic production system on broiler carcass and meat quality. Meat Sci.2002; 60: 219 – 225.

[6] Cukwuka OK, Oscar OM, Apeh O and OgbuewuO. Effect of strain on growth, carcass characteristics and meat quality of broilers reared for 12 weeks. New York Sci. J. 2010; 3(5)

[7] Fanooci M and TorkiM. Effects of dietary restriction on performance, carcass characteristics, white blood cell count and humoral immune response of broiler chicks. Global Vet. 2010.;4(3): 277 – 282.

[8] Gonzales E, Buyse J, Loddi MM, Takita TS, BuyiN and Decuypere E. Performance, incidence of metabolic disturbances and endocrine variables of food restricted male broilers. Br. Poult. Sci. 1998; 39 : 671 – 678.

[9] Hossain MA, SuvoKB and Islam MM. Performance and economic suitability of three fast-growing broiler strains raised under farming condition in Bangladesh. Int. J. Agril. Res. Innov. and Tech. 2011; 1 (1&2): 37-43.

[10] Idahor KO, Yakubu A, Egalu JO,Gwaza DS, AhmaduGB and Tham AP. Growth performance, carcass characteristics and cost benefits of four broiler strains on restricted feeding regimes in North Central Nigeria. J. Anim. Sci. Adv. 2013; 3(9): 449 – 452.

[11] Julian R.J., 2005. Production and growth related disorders and other metabolic diseases of poultry - A review. Vet. J., 169: 350-369.

[12] Makram A, Galal A, Fathi MM, El-Attar AH. Carcass characteristics and immune-competence parameters of four commercial

broiler strain chickens under summer season of Egypt. Int. J Poult. Sci. 2010; 9(2):171-176.

[13] Ministry of Agriculture (2007). The annual report of the Animal Production Department. Amman, Jordan.

[14] Olawumi SO. Carcass characteristics of broiler chicken strains fed different levels of feed restriction during eleven to seventeen days of age. South Pacific J. Tech. and Sci. 2014; 2(1): 261-268.

[15] Olawumi SO. Effects of strain and Feed Restriction at starter phase on performance of Broiler Chickens in the Humid Tropics. Int. J. Agric. Sci. and Natural Res. 2015; 2(1): 1 – 5.

[16] Sahraei M. Feed Restriction in Broiler Chickens Production. Biotechnology in Animal Husbandry. 2012; 28(2): 333 – 352.

[17] Scheuermann GN, Bilgili SF, Hess JB and Mulvaney DR. Breast muscle development in commercial broiler chickens. Poult. Sci. 2003; 82:1648-1658.

[18] Schmidt CJ, Persia ME, Fejerstein E, Kingham B and Saylor WW. Comparison of a modern broiler line and a heritage line unselected since the 1950s. Poult. Sci. 2009; 88: 2610 – 2619.

[19] Schedle K, Haslinger M, Leitgeb R, Bauer F, Ettle T and WindischW. Carcass and meat quality of broiler chickens at different starving periods before slaughter. *VeterinarijaIr Zootechnika T.* 2006; 35: 85-88.

[20] Statistical Analysis System (2001). *SAS Users Guide. Statistics*, 8th edition, SAS Institute Cary, NC, USA.

[21] Van Oeckel MJ, Warnants N, Boucque CV. Pork tenderness estimation by taste panel, Warner-Bratzler shear force and on-line methods-Optical methods pros and cons. Meat Sci. 1999; 53:259–267.

[22] Zubair AK, Lusson S. Compensatory growth in broiler chicken: A Review. World's Poult. Science.1996.

Citation: *K Akinsola and S Olawumi, " Effects of Strain and Skip-a-Day Feed Restriction on Carcass and Meat Quality Characteristics of Broiler Chickens", International Journal of Research Studies in Science, Engineering and Technology, vol. 4, no. 9, pp. 10-16 2017.*