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Preliminary study on effect of access to pasture of finished broilers on their abdominal fat and carcass contents

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Abstract

Access to pasture improves poultry welfare, as it provides fresh grass, insects and worms which lead to enhanced product quality. The increased locomotor activity in the pasture system can improve leg health and lower the proportion of body fat. The objective of this study therefore, was to determine the effect of access to pasture on abdominal fat content and carcass characteristics of finished broilers. Eighteen (18) mature Hubbard-classic broilers at eight (8) weeks of age were used for the study. The birds were separated into two treatments with nine birds per treatment. Treatment 1 was the birds placed on pasture, while treatment 2 was the birds kept indoors on deep litter. Data from both treatments were analyzed as from a completely randomized design and compared using t-test. The result shows that there was no significant difference ($t_{0.05}$) between the two treatments in all the parameters considered. Hence, it was concluded that pasture access for finished broilers has no effect on abdominal fat content and carcass traits compared with finished broilers on deep litter.

Key Words: Finished broilers, pasture access, carcass characteristics.

Introduction

Access to pasture improves animal welfare as it provides fresh grass, insects and worms (Glatz *et al*., 2005) as well as exercise which leads to enhanced product quality and leg health (Walker and Gordon, 2003). In addition, the presence of a range of bioactive compounds in the forage, such as xanthophylls and several hypocholesterolemic and anti-carcinogenic compounds, may lead to improvements in meat quality (Ponte *et al*., 2004).Under range conditions, birds show typical signs of calmness and comfort, such as dust and solar bathing, wing stretching and beak cleaning (Olsson and Keeling, 2005). Consumer preferences for organic poultry products is related to a perceived greater quality and safety of meat derived from such systems coupled with high standards of animal welfare, although there is little evidence supporting these perceptions (Napolitano *et al*., 2013).

Although outside access is associated with pasture and invertebrate consumption, the nutritional value derived from the intake of such products is unknown and will vary dramatically with the system in use (Walker and Gordon, 2003). According to Sossidou *et al*.,(2015), providing poultry with pasture can reduce the need for dietary vitamins and minerals and support gut fill since poultry are able to consume 10-20% of their dietary requirements as fresh, dried, or ensiled grass. However, pasture intake depends on several factors, such as strain, age, and foraging ability. Also, pasture intake may limit nutrient utilization, growth rates and feed efficiency due to its high fibre content. Thus, birds raised on pasture still require a grain-based ration formulated for their stage of growth (Sossidou *et al.*, 2015).

Birds on pasture show an increased locomotor activity which can lower their total body fat (Olsson and Keeling, 2005). Cardiovascular diseases, which are among the most important causes of human mortality, have been linked to high

cholesterol and fat content in meat. Sonaiya (1985) reported that the abdominal fat weight and abdominal fat thickness can be used as predictors of total body fat in broilers. If finished broilers are kept on pasture for a maximum of three weeks, can they lose significant body fat, rearrange body parts and so result in a more profitable product? Therefore, the objective of this preliminary study was to determine the effect of access to pasture for a maximum of three weeks on the abdominal fat and carcass portions of finished broilers.

Materials and Methods

The study was carried out at the Teaching and Research Farm and the Poultry Meat Laboratory of the Obafemi Awolowo University, Ile-Ife, between 7th and 29th December, 2015.

Eighteen (18), 2200g mean weight Hubbard-Classic broilers were obtained at eight (8) weeks of age and utilized for the study. Birds were tagged for easy identification and following a completely randomized design, were randomly allocated into two treatments (treatment 1 was birds placed on pasture while treatment 2 was birds kept on deep litter), with nine birds per treatment. Both treatments were given a proprietary broiler finisher feed (at 90 grams/bird/day) throughout the experimental period. Prior to use, the pasture plot (30m x 30m) containing mainly *Panicum maximum,* and *Ipomoea involucrate* was mowed and a subplot (30m x 6m) was furnished with a roofed wooden shelter (1.9m x 1.2m). In the deep litter house, the pen was washed, disinfected and dry wood shavings spread after the floor was dry. All cone feeders and bowl drinkers were washed and disinfected before use on the pasture and deep litter pens.

Three (3) birds were randomly selected each week from each treatment, using the Table of Random Numbers and sacrificed after weighing to determine the abdominal fat content and other carcass characteristics. Prior to slaughter, the randomly selected birds were fasted for 12 hours to empty the crop and thus reduce variability in body weight due to intestinal content. Following slaughtering and defeathering, the shanks and head were removed, the birds were placed in polyethylene bags and stored at 18 ^{0}C until processed. The freezing of the carcass is to ensure that the abdominal fat becomes solid and hence aid its measurement. The carcasses were not eviscerated until processed and all birds were processed within 7 days of slaughter.

Upon removal from the freezer, carcasses were air-thawed for one hour before dissection. The thighs plus drumsticks (T+D) were removed from the carcasses, then the body was separated into the keel portion and cloacal portion by a slanted cut (45^0 to the backbone) made from 3cm above the cloaca down to the backbone. The abdominal fat thickness (AFT) was then measured (perpendicular to the keel bone) with the aid of a ruler, after which the abdominal fat was then dissected out from around the rectum (in the cloacal portion) and from the gizzard, ending with the proventriculus (in the keel portion). All the dissected fat was weighed with the aid of a sensitive scale (CAMRY model). Finally, the entire carcass was then separated into the breast, back, wings, T+D, head and neck, while the major internal organs (liver, gizzard and heart) were carefully dissected out and all portions and organs were weighed. All data were subjected to t-test using SAS.

Results and Discussion

The abdominal fat weight (AFW) and abdominal fat thickness (AFT) observed on weekly basis over the course of three weeks

are presented in Fig 1 and Fig 2, respectively. In the first week, the birds on pasture had a considerably higher AFW (70g, 3.14% of body weight) and higher AFT (13mm) than those on deep litter (36g, 1.60% AFW; 11mm AFT). In the second week, the birds on pasture had a much lower AFW (38g, 1.56%) and AFT (8mm) compared to those on deep litter (64g, 2.63%; 14mm, respectively). In the third week, the birds on pasture had a relatively lower AFW (62g, 2.48%) and AFT (13mm) compared to those on deep litter (73.5g, 2.87%; 14mm).

In the first week (Fig 1 and Fig 2), the higher fat content of the birds on pasture may be attributed to their reduced activity, as they were still trying to acclimatize and adapt to the new environment. So, for a number of days upon introduction to the pasture, they mostly sat together under the shade provided, consuming the concentrate feed, without moving around to forage. For the birds in deep litter, however, the reverse was the case. Due to a change of location as well, they demonstrated an unusual level of fright and nervousness, thereby jumping around at the slightest provocation, this increased activity is believed to have resulted in their reduced abdominal fat content.In the second week (Fig 1 and Fig 2), The reduced abdominal fat for the birds on pasture can be attributed to the increased activity of the birds, that seemed to have adapted well to the new environment. The increased space and natural environment is believed to have stimulated the birds into foraging and "running around."By this time, the birds on deep litterhad also adapted well to the new environment. They were showing signs of calmness and lack of anxiety, hence were expending less energy and this is believed to have resulted in their increased abdominal fat content.In the third week (Fig 1 and Fig 2), the result obtained was unexpected for the birds on pasture which deposited more fat in this week (than the second week) while those on deep litter had slightly higher figures than the preceding week (as expected). The inconsistency of the data for abdominal fat across the weeks could be due to the effect of sex, as female birds generally deposit more fat than male (Nikolova *et al*., 2007).But in this study, sex was not used as a factor.

Bogosavljević-Bošković *et al*., (2006) working on Hybro G broilers, reported abdominal fat proportion of 1.88% on the free-range and 1.98% indoor, while Dou *et al*., (2009) reported 3.0% abdominal fat in free-range broilers and up to 6.5% in those housed indoors. Castellini *et al*., (2002) compared ecological rearing with conventional rearing of Ross broilers and reported abdominal fat proportion of 0.9% vs 1.9% after 56 days and 1% vs 2.9% at 81 days of age.

Table 1: Means and standard deviations of the live weight, abdominal fat and carcass portions

Variable	T1 (Pasture)	T2 (Deep litter)	t-value ($t_{tabulated}$ =3.25)
Live weight(g)	2388±53	2395±51	0.08
EBW (g)	2053±46	2030±35	0.39
AFT(mm)	11±1.5	14±1.5	1.14
AFW (g)	57±6.9	56±9.1	0.07
Back (g)	336±14	354±8	1.11
Breast (g)	525±25	526±14	0.05
Wings (g)	219±5	213±6	0.77
T+D (g)	499±11	477±16	1.10
Dressing (%)	86±0.8	85±1.3	0.75

EBW- Empty body weight AFW- Abdominal fat weight
AFT- Abdominal fat thickness T+D- Thigh plus Drumstick

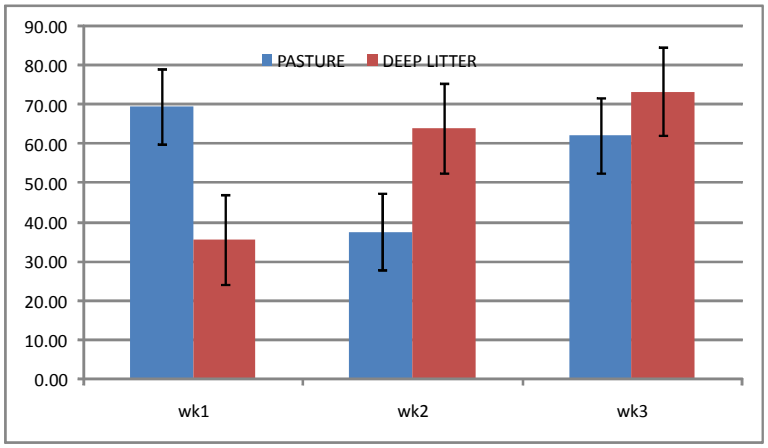

Fig 1: Abdominal fat weight (g) of finished broilers kept on pasture or deep litter for three weeks

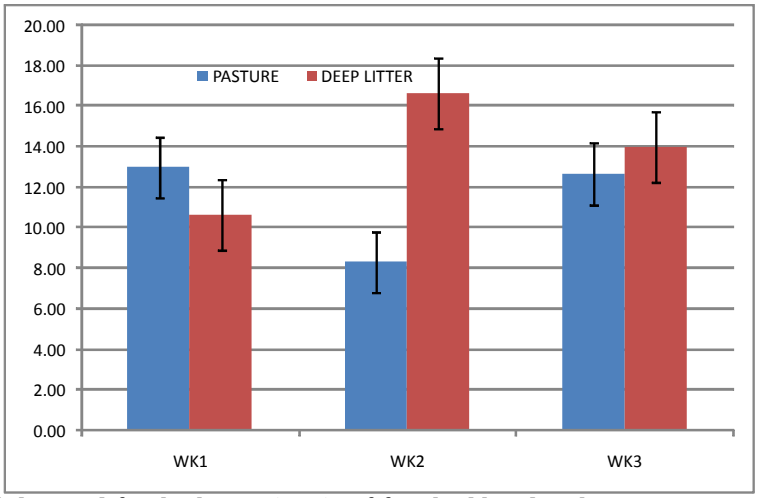

Fig 2: Abdominal fat thickness (mm) of finished broilers kept on pasture or deep litter for three weeks

Table 1 shows the carcass characteristics of the broilers. There was no significant difference ($>t_{0.05}$) in all the parameters considered for both treatments. The broilers on pasture treatment in this study had a 1% advantage in dressing percentage over the birds on deep litter. Poltowicz and Doktor (2011) found that free-range Ross 308 chickens had 0.64% higher dressing percentage compared with broilers housed indoors. Dou *et al*. (2009), however, reported a 0.02% advantage in dressing percentage for broilers, in favor of intensive rearing over pasture rearing.

In this study there was a non-significantly higher proportion of T+D in the pasture treatment birds. Many authors give different explanations of the effect of the housing system on the proportion of carcass parts. Castellini *et al*.(2002) and Dou *et al*., (2009) reported that chickens under a free-range system are characterized by a higher proportion of breasts and thighs. Lei & Van Beek (1997) had observed that an increased

proportion, especially in leg muscles, is connected with increased motor activity. However, Poltowicz and Doktor (2011), noted a higher proportion of breasts, thighs and drumsticks in Ross 308 chickens under a conventional indoor housing compared with free-range broilers (P>0.05).

Conclusion

Based on the results of this study, it was concluded that access topasture had no effect on the abdominal fat content and carcass portions of broilers finished at 8 weeks before pasture access. However, it is expected that introducing broilers to the pasture at a younger age before reaching slaughter weight will possibly reduce total body fat and increase carcass portions in favour of more economic parts such as thighs and drumsticks.

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