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SELECTED WELFARE PARAMETERS OF BROILER CHICKENS ON DIFFERENT FEED QUANTITY AND TIME

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ABSTRACT

This study was conducted to determine welfare of broiler chickens fed *ad libitum* and restricted feed during early (08.00hour) and late (16:00hour) of the day. One hundred and eighty (21d old) broiler chickens were randomly allocated to 4 treatments in a 2x2 factorial arrangement comprising of *ad libitum* and restricted feeding (75% of *ad libitum*) quantity at 8 and 16 hours feeding time in three replicates. Data were collected on leg problem, dust bathing, body temperature, mortality and haematology. Result revealed that neither feed quantity nor time had significant (P>0.05) effect on leg problem, dust bathing and mortality of broiler chickens. Broiler chickens under *ad lib* feed quantity and 16:00hours feeding time had (P<0.05) highest body temperature (40.93^{o}C) while those under *ad libitum* morning (08:00hours) recorded the least (40.75°C). Pack Cell Volume had similar (P>0.05) increase from 26.75% at the beginning (21d) to 31.25 (%) at 56d with broiler chickens under restricted feeding and fed at 16:00hours feeding time. Basophil count reduced from a range of 0.5-2% (P<0.05) to 1% (P>0.05) with restricted feeding. Also eosinophil reduced from 2-4% (P<0.05) range to 0-2.5% (P>0.05) with restricted feeding while birds under *ad lib* increased from 0-1% (P<0.05) at 21d to 2.75% (P>0.05) at 56d. Better welfare (good body temperature) of broiler chicken could be achieved with early feeding time irrespective of quantity. However, restricted feeding could be explored in broiler production where reduced basophil, eosinophil and stress are vital for enhanced welfare and performance.

Keywords*: broiler chicken; feed quantity; feeding time; welfare*

INTRODUCTION

Poultry birds that render economic importance to man and reproduce under his care are referred to as domestic fowls (chickens), ducks, turkeys, geese, guinea fowls, quail etc. They are kept for meat or egg or both and are good sources of animal protein to man. With the active work on breeding and selection for productive and adaptive traits, scientists have been able to develop fast growing chickens with very good growth and meat yield without sacrificing adaptation to their perceived environment. Broilers are the main meat type bird

for the poultry industry as they have been selected over time for improved meat production. They are intensively and selectively bred to have very large appetites in order to reach slaughter weight of about 2 kg in 6 weeks.

The poultry industry has the largest animal population. It is the most highly modernized and intensified of the animal production industries. It provides quick and cheap source of animal protein which cut across wide cultural background. As a result of utilization and diversification, there is a lot of public concern about the welfare of poultry.

Welfare has been reported to influence broiler performance, the resultant meat and quality of the meat (FAWC, 1992; SCAHAW, 2000). Good welfare helps in the maintenance of good health and production. Equally, it is important in many regulatory systems. It provides the ability to adapt to or cope with the constraints an animal is exposed to, and considered in relation to the housing and management conditions, and nutrition (Puppe 1996).

Many factors are considered when evaluating the welfare in poultry and of particular importance is the management procedure, including the health, physiology, and behavior of the animal. Therefore, in order to safeguard welfare and avoid suffering or stress, a wide range of needs such as good quality diet in good quantity, good medication, good management and the entire enabling environment must be provided.

Welfare is clearly a characteristic of an individual animal and is concerned with the effects of all aspects of its genotype and environment (Duncan, 1981). It is total well being and ability to cope with the environment (Broom, 1986). Welfare therefore, includes the extent of failure to cope, which may lead to disease and injury, but also ease of coping or difficulty of coping and the associated disease and injury, including mental states and unpleasant states such as fear and frustration. Hence, welfare varies from very poor to very good and can be scientifically assessed (Fraser and Broom, 1990).

In commercial broiler production, the conventional feeding practice has been to provide space, feed and water *ad libitum* from day old to market weight as a means of enhancing their growth rate and early maturity. This has led to a lot of criticism on the general welfare, meat quality, increased fat deposition, leg problems, ascites and sudden death syndrome (SDS) in broiler production (FAWC, 1992; SCAHAW, 2000). The success of rearing broilers for maximum weight gain does not only depends upon the strain of the birds and management but also on feed quantity and quality. It is believed that 70 to 75% of total cost on broiler production is incurred on feed. It therefore suffices that any improvement in the performance of broilers due to diet can inevitably have a profound effect on broiler farming and consumption of poultry products. Animal welfare is not accorded desired consideration in poultry production in Nigeria and most developing countries of Africa. Currently, there is no explicit or implied policy that governs broiler production and management in Nigeria and other developing countries compared with Europe and the USA. This study therefore aimed to examine some welfare indices in broiler chickens fed varying feed quantities at different times of the day.

MATERIALS AND METHODS

The experiment was carried out at the Poul-

try Unit of Ogun-Osun River Basin Development Authority (OORBDA) poultry farm located along Alabata Road, Odeda Local Government Area, Ogun State. The area lies in the South-western part of Nigeria. The vegetation represents an inter-phase between the tropical rain forest and derived savannah. The area lies in a tropical climate with annual rainfall of 1100m and a mean ambient temperature of about 35ºC, relative humidity of 80%, between latitude 6.25°N and 9.25°N of Equator and between longitude 2.70°E and 5.0°E of Greenwich Meridian.

The housing used was a deep litter system with concrete floor. Prior to the arrival of the birds, the pen and other equipment such as feeders, drinkers, coal pot, buckets, brooder etc., were thoroughly washed and disinfected.

One hundred and eighty 3week (21days) old Marshal Strain broiler chicks were randomly allocated to four treatments of forty five (45) birds each in a 2 (*ad libitum* and 75% of *ad libitum)* by 2 (08:00 and 16:00 hours feeding time) factorial arrangement. Each treatment was replicated three times (15 birds each). The birds were reared on deep litter shed with wood-shaving litter floor. The brooding pen was also equipped with both water drinkers and feeders and the birds were supplied with fresh feed and water daily. The birds on *ad libitum* were served 08:00 and 16:00 hours daily while those on restricted (75% *ad libitum)* were served same 08:00 and 16:00 hours daily from day one of study. All necessary medication and vaccination were administered. The trials lasted for 35 days.

Data were collected on leg abnormalities using the gait scoring model (Kestin *et al.,* 1992). Ambient temperature (°C) of the pen between 9.00hr and 10.00hr and between 16.00hr and 17.00hr (GMT +1) was recorded. Body temperature (°C) of individual birds was also determined with the aid of digital rectal thermometer by inserting the thermometer into rectum of the chicken until a beep sound is made. The thermometer is then withdrawn and the body temperature of the chicken was read and recorded as displayed on the screen. Records of dust bathing and mortality were taken and expressed as percentage of number stocked per replicate.

Blood samples (5ml per bird) were obtained from three (3) birds per replicate via the wing vein puncture (Frandson, 1986) using sterilized needle and syringe at days 1 and 33 of the experiment when the birds were 21 and 54days old, respectively and emptied into EDTA bottle labeled accordingly. Red Blood Cell (RBC), Haemoglobin (Hb), Packed Cell Volume (PCV), Mean Corpuscular Haemoglobin (MCH), White Blood Cell (WBC) count and differential white blood cell count were determined according to methods described by Edingston and Gilles (1981).

All data collected were subjected to analysis of variance (ANOVA) in a 2 x 2 factorial randomized complete block design using SAS (2004) and significant means at 5% were separated using Duncan Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

Table 1 shows the selected welfare parameters of finished broiler chickens under different feed quantity and time. All the parameters measured were not significantly different (P>0.05) with feed quantity except the body

temperature ($P<0.05$) with feeding time. Birds fed different feed quantity had similar ($P>0.05$) body temperature. However, birds under different feeding time had significant ($P<0.05$) variation in body temperature. Birds fed in the morning (08:00hour) recorded low body temperature (40.80°C) while birds fed in the evening (16:00hour) had higher body temperature (40.91°C). Timing of feeding had been reported as an important factor in alleviating heat stress effects on feed intake and utilization (Esmail, 2012). Esmail (2012) opined that diet should be made accessible to broiler chickens at times of relatively low temperature (early morning and late evening) as broiler chickens are more responsive to the timing of feeding than laying hens. Also, early hour of the day feeding had been reported to alleviate many problems associated with heat stress in broilers (Esmail, 2012). Therefore, higher body temperature recorded among broiler chickens reared under 16:00 hour feeding time could be as a result of physiological stress being experienced by the birds. However, body temperature still fall within the normal range (41.5°C) recommended for healthy chickens. The values recorded support the findings of Swick (1989) who reported a body temperature range of between 40.0°C and 41.5°c for birds and Bello, *et al.* (2011) who reported between 41.14°C and 41.48°C for healthy birds. Generally, ambient temperature increases during the day and goes down towards the evening. Therefore, low ambient temperature made the birds to be calm and thus had low body temperature in early hour of the day compared to higher ambient temperature and higher activities with resultant higher body temperature and stress level due to increased metabolic activities at later hour of the day.

Table 1: Effect of different feed quantity and time on selected welfare parameters of finished broiler chickens

Parameters	Feed Quantity			Feeding Time		
	Ad libitum	Restricted	SEM	Morning (08:00 hour)	Evening (16:00 hour)	SEM
Leg Problem (%)	0.12	0.09	0.06	0.17	0.05	0.06
Dust Bathing (%)	1.55	0.36	1.71	1.30	0.60	1.71
Ambient Temperature (°C)	31.48	31.50	0.04	31.48	31.50	0.04
Body Temperature (°C)	40.84	40.88	0.03	40.80b	40.91a	0.03
Mortality (%)	0.07	0.07	0.04	0.09	0.04	0.04

a, b: Means with different superscripts within the same row differ significantly ($P<0.05$)

Table 2 shows the interaction between feed quantity and time on selected welfare parameters of finished broiler chickens. There were no significant (P> 0.05) effects of interaction between feed quantity and time on leg problem, dust bathing, ambient temperature and mortality percentage of the birds. However, interaction between feed quantity and time significantly (P< 0.05) influenced the body temperature of finished broiler chickens. Birds fed *ad libitum* in the morning (08:00 hour) recorded the least (P<0.05) body temperature (40.75°C). This was however, similar (P>0.05) with body temperature (40.86°C) of birds fed restricted feed in the morning (08:00 hours) while birds fed *ad libitum* and restricted in the evening recorded significantly (P<0.05) higher body temperature (40.93°C) and (40.89°C), respectively. Whether the birds are fed with restricted or *ad libitum* feed quantity, the birds showed elevated body temperature when fed in the evening (16:00 hour). This shows that feeding time is an important index of welfare and birds should be fed early enough to improve or maintain their health status. Esmail (2012) gave credence to this opinion. Early hour feeding had been employed by commercial broiler farms as one of the strategies to reduce heat stress in broiler in production particularly during the hot dry season (Basilio *et al*., 2001 and 2003; Esmail, 2012).

Table 2: Effect of interaction between feed quantity and time on selected welfare parameters of finished broiler chickens

Parameters	Ad libitum		Restricted		SEM
	Morning (08:00hour)	Evening (16:00hour)	Morning (08:00hour)	Evening (16:00hour)	
Leg Problem (%)	0.19	0.14	0.05	0.05	0.06
Dust Bathing (%)	2.61	0.48	0.00	0.73	1.71
Ambient Temperature (°C)	31.47	31.49	31.49	31.51	0.04
Body Temperature (°C)	40.75b	40.93a	40.86ab	40.89a	0.03
Mortality (%)	0.09	0.04	0.09	0.04	0.04

[a, b]; Means with different superscripts within the same row differ significantly (P<0.05)

Table 3 shows the haematology of finished broiler chickens under different feed quantity and time. The haematological parameters (PCV, RBC, WBC, Heterophil, Lymphocyte, Eosinophil, Monocyte and Basophil) measured both at the initial (3rd week) and final stage (8th week) were not significantly different (P>0.05) except initial basophil (P<0.05) of broiler chickens under different feed quantity. Broiler chickens fed *ad libitum* had lower (P<0.0%) initial basophil (0.00%) compared to those reared under restricted feeding which recorded basophil of 1.25%. However, the difference evened out at the end of the study. Hocking *et al*. (1993) stated that increase level of basophil during restricted feeding is correlated with the level of restriction in feed imposed and would lead to physiological stress. Mitchell and Kettlewell (1998) also reported that physiological and behavioural indices of birds have been used as important indicators of welfare and stress

and less extreme behaviours such as pecking and panting have been associated with milder forms of stress. Similar findings in broiler and layer chickens showed increased level of heterophil/lymphocyte level, basophil and plasma corticosterone with restricted feeding compared with those fed *ad libitum* (Maxwell *et al*., 1992; Hocking *et al*., 1993). Equally, basophil numbers had been reported to increase during stress and tissue injury (Cynthia, 2005) which could be the consequence of pecking and litter scratching. These opinions were contrary to the finding of this study as the basophil which was significant at the beginning of the study disappeared at the later stage of the study. Variation in the result obtained could be as a result of the extent of restriction as opined by Hocking *et al*. (1993) who reported 60-80% of *ad libitum* feed quantity for birds under feed restriction. Maxwell *et al*. (1992) recommended slight degree of feed restriction in broilers, turkeys and ducks. Therefore, level of feed restriction (75% of *ad libitum* feed) in this study was probably mild to cause pronounce stress in the experimental birds. This finding was also corroborated by Hocking *et al*. (2002) who reported that mild feed restriction could be used as strategy to prevent stress in broiler chicken and also recommended feed restriction in broiler breeders (Hocking, 2011). Thus restricted (75% *ad libitum*) feeding could be employed as a management strategy to reduce stress in broiler production.

Table 3: Main effect of feed quantity and time on haematology of finished broiler chickens

Parameters	Feed Quantity			Feeding Time		
	Ad libitum	Restricted	SEM	Morning (08:00 hour)	Evening (16:00 hour)	SEM
Initial PCV (%)	26.63	26.00	0.73	25.88	26.75	0.73
Final PCV (%)	30.63	30.13	1.02	29.50	31.25	1.02
Initial RBC (x1012/l)	2.33	2.28	0.06	2.28	2.33	0.06
Final RBC (x1012/l)	2.61	2.59	0.14	2.51	2.68	0.14
Initial WBC (x103mm3)	28.19	29.77	0.95	28.34	29.62	0.95
Final WBC (x103mm3)	28.18	28.43	3.64	28.33	28.27	3.64
Initial Heterophil (%)	29.63	25.75	9.99	21.25	34.13	9.99
Final Heterophil (%)	26.75	30.38	7.09	30.75	26.38	7.09
Initial Lymphocyte (%)	69.25	69.63	9.88	74.88	64.00	9.88
Final Lymphocyte (%)	66.88	65.63	6.75	65.13	67.38	6.75
Initial Basophil (%)	0.00b	1.25a	0.35	1.00	0.25	0.35
Final Basophil (%)	1.88	1.00	1.17	1.88	1.00	1.17
Initial Eosinophil (%)	0.50	3.00	1.15	2.50	1.00	1.15
Final Eosinophil (%)	2.75	1.25	1.89	1.38	2.63	1.89
Initial Monocyte (%)	0.63	0.38	0.84	0.38	0.63	0.84
Final Monocyte (%)	1.75	0.50	0.87	0.88	1.38	0.87

[a, b]: Means with different superscripts within the same row differ significantly (P<0.05).

PCV = Packed Cell Volume; RBC = Red Blood Cell; WBC = White Blood Cell

Table 4 shows the interactive effect of feed quantity and time on haematology of finished broiler chickens. Interaction of feed quantity and time was not significant (P> 0.05) on the initial and final PCV, RBC, WBC, heterophil, lymphocytes and monocytes, and final basophil and Eosinophil. However, significant effect (P<0.05) of interaction was observed in the initial basophil and initial eosinophil. Birds on restricted feed in the morning recorded significantly (P<0.05) higher basophil (2.00%) than broiler chickens fed *ad libitum* in the morning (0.00%), *ad libitum* in the evening (0.00%) and restricted feed in the evening (0.05%). Also, broiler chickens fed restricted feed in the morning had significantly (P<0.05) higher eosinophil (4.00%) than broiler chickens fed *ad libitum* in the morning (1.00%), *ad libitum* in the evening (0.00%) and restricted feed in the evening (2.00%). Concurrent response in leukocytes; eosinophils and basophils as well as heterophil/ lymphocyte ratio had been indicated to be on the increase during fasting or restricted feeding in broilers and turkey (Maxwell *et al*., 1991, 1992; Pires *et al*., 2007). This implies that bird's immune reactions change in response to feed restriction or any form of stress they are being exposed to. Variation in the result obtained could be as a result of strain used, the environment in which the study was carried out or in sample size as eosinophil also evened out at the final stage of the study.

Table 4: Interactive effect between feed quantity and time on haematology of broile chickens

	Ad libitum		Restricted		SEM
Parameters	Morning (08:00hour)	Evening (16:00hour)	Morning (08:00hour)	Evening (16:00hour)	
Initial PCV (%)	26.50	26.75	25.25	26.75	0.73
Final PCV (%)	30.00	31.25	29.00	31.25	1.02
Initial RBC (x1012/l)	2.33	2.33	2.23	2.34	0.06
Final RBC (x1012/l)	2.55	2.67	2.48	2.70	0.14
Initial WBC (x103mm3)	26.85	29.53	29.83	29.71	0.95
Final WBC (x103mm3)	28.99	27.36	27.68	29.18	3.64
Initial Heterophil (%)	21.75	37.50	20.75	30.75	9.99
Final Heterophil (%)	30.75	22.75	30.75	30.00	7.09
Initial Lymphocyte (%)	77.25	61.25	72.50	66.75	9.88
Final Lymphocyte (%)	62.00	71.75	68.25	63.00	6.75
Initial Basophil (%)	0.00b	0.00b	2.00a	0.50b	0.35
Final Basophil (%)	2.75	1.00	1.00	1.00	1.17
Initial Eosinophil (%)	1.00ab	0.00b	4.00a	2.00ab	1.15
Final Eosinophil (%)	2.75	2.75	0.00	2.50	1.89
Initial Monocyte (%)	0.00	1.25	0.75	0.00	0.84
Final Monocyte (%)	1.75	1.75	0.00	1.00	0.87

[a, b]: Means with different superscripts within the same row differ significantly (P<0.05)

PCV = Packed Cell Volume; RBC = Red Blood Cell; WBC = White Blood Cell

CONCLUSION

Early morning (08:00hour) feeding time could be applied as an effective tool to reduce and maintain optimum body temperature of broiler chickens irrespective of the feed quantity for good welfare and consequent production performance. However, restricted feeding if employed in broiler production could help reduce basophil and eosinophil in broiler chicken for reduced stress/allergy condition and consequently improved welfare. Restricted feeding (75% *ad lib* feed quantity) and morning (08:00hour) feeding is therefore recommended for enhanced welfare in broiler chicken production.

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STATEMENT OF ANIMAL RIGHTS

The animal rights were all observed throughout the conduct of this research.

CONFLICT OF INTEREST STATEMENT

No conflict of interest of any kind in the conduct of this study.

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