THE EFFECTS OF PRE-SLAUGHTER WITHHOLDING OF FEED AND WATER ON CARCASS YIELD AND MEAT QUALITY OF INDIGENOUS GUINEAFOWL *(Numida meleagris galeata Pallas)*.

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ABSTRACT

Ninety indigenous pearl guineafowls, *(Numida meleagris galeata Pallas)* with average weight of 1.1kg were allocated at random to one of ten treatments to assess the effects of withholding feed alone or feed together with water on carcass shrinkage and meat quality. The ten treatments were slaughter from the feed lot (control), and sampling times of 6, 12, 18 and 24 hour. Weights of live and carcass were taken to monitor shrinkage along with relevant meat quality parameters.

Live and carcass weights, weights of head, liver, kidneys and heart decreased progressively as the length of fasting period increased. The progressive decreases in weights were found to be more pronounced in animals from which feed together with water were withdrawn. After 6 hours of fasting, decreases in weights were found to be significant ($P<0.05$). Ultimate pH and index of water holding capacity of the meats also increased with the increase in length of fasting period, with a concomitant decrease in cooking losses. The fat ratio of the carcass component decreased with increase in length of fasting. The implications of the effect of these observations on commercial guineafowl meat production in the tropics are discussed.

Key Words: Timed withdrawal, Feed and water; Carcass yield, Meat quality, Guineafowl.

INTRODUCTION

There has been an increased interest in the raising of indigenous guineafowl to meet the dire need to supplement the source of animal protein in Nigeria (Ayorinde and Ayeni, 1987; Ayorinde, 1989). This might be due to the fact that the meat of guineafowl is reported to be more acceptable to consumers when compared to other birds like duck and domestic fowl in Nigeria (Ayorinde, 1989; Joseph, *et al,* 1992).

It is common practice among producers and meat processors to fast animals prior to sale or slaughter to reduce production cost (producers) and to reduce the faecal contamination of the meat (Processors). These periods of fasting, in most cases, arbitrarily range between 12 - 48h (Ayorinde, 1989; Ayorinde and Ayeni, 1987; Kahlenberg, *et al,* 1960). Varying periods of fasting have been found to decrease live and eviscerated weights Smidt, *et al,* 1964; Wabeck, 1972); yield of salable products (Veerkamp, 1978; Lyon, *et al,* 1991) and shear value of meat (Lyon, *et al,* 1991). Pre-slaughter fasting has also been reported to lower faecal contents along digestive tract thereby lessening the possibility of faecal contamination (Wabeck, 1972, May, *et al,* 1988; Papa, 1990), increase shear strengths and decrease moisture contents of the various gastrointestinal tract segments (Bilgiri, 1988) and improve effectiveness of the rigor mortis acceleration techniques (such as electrical stimulation and high temperature conditioning) (Same and Mills, 1993) of broiler chickens. While fasting has been indicated to influence meat quality parameters such as meat colour, the effects have been assumed to be quite small and generally believed to have little commercial importance.

There is dearth of information in literature on the effect of fasting (withdrawal of feed or feed and water) on the carcass yield and meat quality of indigenous guineafowl. This study is therefore to determine the effects of withholding feed alone or feed and water for varying time periods prior to slaughter on guineafowl's carcass yield and meat quality.

TABLE 1: THE EFFECTS OF TIMED WITHDRAWAL OF FEED ON CARCASS CHARACTERISTICS OF *INDIGENOUS GUINEAFOWL.*

Measurements	Duration of withdrawal (hrs)					
	0(control)	6	12	18	24	SEM
Live weight (g)	1130.5^{a}	1121.4^{a}	1100.8^{b}	1091.8^{bc}	1070.2^{c}	1.12
Carcass weight (g)	750.7^{a}	735.6^{a}	694.6^{b}	664.9^{c}	643.1^{d}	1.14
Dressing out percentage	66.4a	65.6^{a}	63.1^{b}	60.9^{bc}	60.1^{c}	0.57
Head weight (g)	28.9a	28.4^{a}	27.8^{ab}	27.1^{b}	27.0^{b}	0.35
Liver weight (g)	15.8^{a}	15.4^{ab}	14.7^{b}	14.2^{bc}	13.9^{c}	0.12
Kidneys weight (g)	6.0^{a}	5.9^{ab}	5.5^{b}	5.2^{bc}	5.0^{c}	0.04
Heart weight (g)	5.8^{a}	5.7^{ab}	5.5^{ab}	5.4^{b}	5.3^{b}	0.05
Gizzard weight (g)	27.0^{a}	26.8^{a}	26.5^{a}	26.1^{ab}	26.0^{b}	0.41
Lean meat (%)**	66.3^{a}	66.0^{ab}	64.3^{b}	61.8^{c}	59.8^{d}	0.61
Bone (%)**	30.4^{a}	31.0^{a}	33.1^{b}	35.7^{c}	37.9^{d}	0.31
Fat (%)**	2.8^{a}	2.6^{a}	2.3^{b}	2.0^{c}	1.9^{c}	0.01
Meat colour score*	5.0^{a}	6.0^{b}	6.3^{bc}	6.4^{bc}	6.5^{c}	0.04
Meat wetness score*	3.2^{a}	3.6^{b}	4.0^{c}	4.4^{d}	4.5^{d}	0.06
Dry matter (%)	32.9^{a}	33.6^{ab}	35.9b	36.4^{bc}	37.0^{c}	0.37
Crude protein (% dry wt.)	80.7	81.9	82.7	83.1	83.4	0.47
Crude fat (% dry wt.)	13.7^{a}	12.5^{b}	11.6^{bc}	11.0^{c}	10.8^{c}	0.21
Ash (% dry wt.)	3.8^{a}	3.8^{a}	4.0^{ab}	4.1^{ab}	4.2^{b}	0.04
Ultimate pH	5.6^{a}	5.9^{ab}	6.0^{b}	6.2^{b}	6.3^{b}	0.03
Index of water holding capacity (%)	58.8^{a}	59.1^{a}	61.4^{b}	62.3^{bc}	62.9^{c}	0.81
Cooking losses (%)	33.0^{a}	31.9^{a}	30.0^{b}	29.8^{b}	27.5^{c}	0.61

*Rated on scale of 7 = deep colour or dry, 1 = pale or wet, ** All percentages were computed as a ratio of carcass weight. Different superscripts on means within a row indicate significant difference ($P < 0.05$).

MATERIALS AND METHODS

Carcass Evaluation:

Ninety male indigenous pearl guineafowl *(Numida meleagris galeata Pallas)* (twenty weeks old) raised under uniform conditions of feeding and management (Ayorinde and Ayeni, 1987) to an average market weight of 1.1kg to minimize initial differences in carcass composition were used in this study. One week before slaughter commenced, all birds were weighed and allocated to ten treatments of: T1 - withdrawal from the feed lot followed by slaughter (duplicated), T_2 - T_3 consisted of 6, 12, 18 and 24h periods without feed alone but with water, while T_6 - T_9 consisted of treatments for the same period but without feed and water prior to slaughter.

The birds were slaughtered by severing the carotid artery and the jugular veins. Prior to slaughtering, live weight of each bird was taken. Each bird was dipped in hot water (about 60°C) for a minute and all feathers removed manually. After weighing, the defeathered bird was dissected and all internal organs and abdominal fat were carefully removed after which the carcass was weighed to obtain eviscerated weight and dressing out percentage computed as ratio of live weight (Joseph, *et al,* 1992). The weights of head, gizzard, liver, kidney and heart were taken. Each eviscerated carcass was weighed and carefully dissected into skin, fat, bone and lean meat. The lean meat, fat, and bones were then weighed separately and percentage lean meat, fat and bone calculated as a ratio of carcass weight. Visual assessment of colour and wetness of the lean meat were made as

TABLE 2: THE EFFECTS OF TIMED WITHDRAWAL OF FEED AND WATER ON CARCASS CHARACTERISTICS OF *INDIGENOUS GUINEAFOWL*

Measurements	Duration of withdrawal (hrs)					
	0 (Control)	6	12	18	24	SEM
Live weight (g)	113.1^{a}	1119.2^{ab}	1092.6^{b}	1068.1^{c}	1039.4^{d}	1.12
Carcass weight (g)	747.7^{a}	726.4^{b}	678.5^{c}	640.9^{d}	603.9^{e}	1.14
Dressing out percentage	66.1^{a}	64.9^{ab}	62.1^{b}	60.0^{bc}	58.1^{c}	0.57
Head weight (g)	29.0^{a}	28.1^{a}	28.1^{a}	26.4^{b}	26.2^{b}	0.35
Liver weight (g)	15.8^{a}	15.1^{ab}	14.0^{b}	13.8^{bc}	13.1^{c}	0.12
Kidneys weight (g)	5.9^{a}	5.7^{ab}	5.3^{b}	5.1^{b}	4.9^{b}	0.04
Heart weight (g)	5.7^{a}	5.7^{a}	5.2^{ab}	5.1^{b}	5.0^{b}	0.05
Gizzard weight (g)	27.1^{a}	26.5^{b}	26.3^{b}	26.0^{bc}	25.8^{c}	0.41
Lean meat (%)**	66.3^{a}	63.7^{b}	61.2^{c}	60.0^{cd}	58.6^{d}	0.61
Bone (%)**	30.3^{a}	33.4^{b}	36.4^{c}	37.6^{cd}	39.3^{d}	0.31
Fat (%)**	2.9^{a}	2.5^{b}	2.1^{c}	1.9^{cd}	1.7^{d}	0.01
Meat colour score*	5.0^{a}	6.0^{b}	6.3^{bc}	6.5^{c}	6.5^{c}	0.04
Meat wetness score*	3.3^{a}	3.6^{b}	4.1^{c}	4.6^{d}	4.9^{d}	0.06
Dry matter (%)	33.0^{a}	34.4^{ab}	36.0^{b}	37.1^{bc}	38.4^{c}	0.37
Crude protein (% dry wt.)	80.8	82.0	83.0	83.2	84.1	0.49
Crude fat (% dry wt.)	13.6^{a}	12.3^{b}	11.1^{bc}	10.6^{c}	9.8^{c}	0.21
Ash (% dry wt.)	3.8^{a}	3.9^{a}	4.2^{b}	4.4^{b}	4.5^{b}	0.04
Ultimate pH	5.6^{a}	5.9^{ab}	6.3^{b}	6.4^{b}	6.4^{b}	0.03
Index of water holding capacity (%)	59.0^{a}	60.1^{a}	62.0^{b}	62.9^{bc}	63.3^{c}	0.81
Cooking losses (%)	33.0^{a}	30.4^{b}	29.1^{b}	27.3^{c}	25.8^{d}	0.61

* Rated on scale of 7 = deep colour or dry, 1 = pale or wet.

** All percentage were computed as a ratio of carcass weight.

Different subscripts on means within a row indicate significant difference ($P < 0.05$).

described by McDougall and Disney (1967).

Analytical procedures

pH readings were taken after overnight storage (pH ultimate) by sticking the electrodes of a standardised Kent EIL 7020 pH meter into the thigh muscles. Dry matter, fat, crude protein and ash contents were determined as described by AOAC (1980). Water holding capacity of the muscles were assessed using the filter press method as described by MacDougall and Disney (1967). Cooking losses were determined by comparing weight of meat before and after 30 minutes broiling (Wood, *et al,* 1981).

Nine birds were sampled per treatment for each of the ten experimental treatments with the control experiment duplicated. Statistical analysis of variance was based on 2 x 5 factorial design with two types of fasting (withdrawal of feed alone or feed and water) and five length of fasting periods (0, 6, 12, 18 or 24 hours). Least significant difference between sample means were determined by Duncan's multiple range test (Duncan, 1955).

RESULTS

Live and carcass weights, weights of head, liver, kidneys and heart of the birds decreased progressively as the length of fasting period increased (Tables 1 and 2). The dressing out percentage also decreased as the length of fasting period increased. The withdrawal of both feed and water had a great effect on all the parameters measured. After 12 hour of fasting the decreases in weights determined

became significant ($P < 0.05$).

Percentage dry matter, ash and crude protein content of the meat of the experimental birds increased as the length of fasting period increased (Tables 1 and 2). Significant ($P < 0.05$) increase in ultimate pH and water holding capacity of the meat was also oberved as the length of fasting period increased, while crude fat and cooking losses of the meat decreased as the length of fasting period increased. Variation in tested parameters was found to be significant ($P < 0.05$) after 12h of fasting, with observable differences between experimental treatments (withdrawal of feed alone or feed together with water).

Length of time of fasting was found to influence muscle colour and wetness, with birds without feed or feed and water after 12h pre-slaughter having darker and drier meat (Tables 1 and 2). Carcass component proportions changed as the length of time without feed or feed and water pre-slaughter increased. Percentage fat and lean meat decreased significantly ($P < 0.05$) as length of fasting increased. Significant increase ($P < 0.05$) in carcass bone ratio was observed after 12h of fasting.

DISCUSSION

The observed decrease in the live and carcass weights and weights of the organs could be attributed to the removal of feed and faeces from the intestine of the birds and carcass shrinkage due to dehydration. The decrease could also be attributed to the fact that, in the absence of feed or feed and water, the birds body was forced to switch to wasting metabolism, drawing on its stored reserves of carbohydrates and fat and within a day or so, on its protein tissues as well, in order to meet the maintainance metabolic energy requirement (Stryer, 1981; Whitney and Hamilton, 1981). It appears that the substantial increase in weight losses in birds with water and feed withdrawn as compared to those with withdrawal of feed alone is due to dehydration. This result is in line with the observation of May and Brunson (1955) that losses in carcass weight became significant in birds starved for 24 hours prior to slaughter but that there was no effect on yield from shorter starvation periods.

The percentage dry matter, crude protein and ash content of the meat which appeared to be on the increase as the period of fasting increased could be attributed to carcass shrinkage and dehydration with a concomitant decrease in moisture and fat content, which led to the change in body component ratio. The increase in ultimate pH as the period of fasting increased could be due to a decrease in glycogen content of the muscle leading to a lower lactic acid production post-slaughter, and hence a higher ultimate pH of the muscle. The increase in ultimate pH of the meat may be linked with the decrease in percentage cooking losses of the meat because it is not easy to express juice from meat with high pH (Lawrie, 1985).

The result of the sensory scores for muscle colour and wetness may be associated with shrinkage of the muscle and the lower pre-slaughter glycogen reserves as fasting period increased, which might have led to higher ultimate pH and consequently darker meat (Lawrie 1985). The decrease in the ratio of fat component of the carcass is in line with earlier explanation that in order for the body cells to continue to function during starvation it will draw on its fat reserves when the stored glycogen is depleted or almost depleted (Whitney and Hamilton, 1981; Lawrie, 1985).

In conclusion, it appears that the usual practice in the poultry industry to withdraw feed and water from market age birds several hours (arbitrarily taken) prior to processing is not a good practice. The recommended eight to ten hour withdrawal (feed and water) period for broilers (Wabeck, 1972) may not be applicable to guineafowl considering the fact that guineafowls are known to be shy, easily frightened and restless (Ayorinde and Ayeni, 1987). This then means more rapid catabolism of assimilated carbohydrates and fat during

restless movements (Ayorinde and Ayeni, 1987). From the current study with guineafowl the effect of fasting the animals on measures of edible meat qualities studied became pronounced ($P<0.05$) after 6 hours of feed and water withdrawals. It is therefore suggested that guineafowl for commercial meat supply should be slaughtered after a short period of fasting between 4 hours and 6 hours for minimal processing losses and good quality meat production.

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