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GUINEA FOWL (NUMIDA MELEAGRIS) AS A MEAT BIRD

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Abstract: *Purpose*: The purpose of this study was to determine the meat chemical composition, meat quality attributes and the sensory attributes of the guinea fowl cuts.

Design/methodology/approach: Five diets designated as A (20.5 per cent CP, 2990 kcal ME), B (high protein 26 per cent high energy (3150 kcal), C (high protein 26 per cent: low energy 2800 kcal), D (low protein 16 per cent: high energy 3150 kcal) and E (low protein 15 per cent: low energy 2750 kcal) were used for feeding five groups of guinea fowl keets. Group (A) served as the control ration.

Finding: Meat chemical composition and meat quality attributes were reported. Meat quality parameters of selected cuts were not significantly ($P>0.05$) similar in colour. Water holding capacity of group B (1.537±1.03) and E (2.22±0.10) were not significantly ($P>0.05$) higher than the control and test groups, while water holding capacity of group C (0.88±0.11) was the lowest ($P>0.05$). Cooking loss in group D (22.85±3.28) was significantly ($P<0.01$) higher than the other

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test groups. Shear force in groups D (3.009±0.1) and E (3.57±0.32) were not significantly (P>0.05) higher than the control and the test groups. There were also non-significant (P>0.05) differences in the sensory evaluation among the control and test groups.
Originality/value: Guinea fowl can be managed for a fair level of meat production under feeding up to energy and protein requirements. Nutritionally, guinea fowl meat is proving to be a potential competitor in the meat industry; it is rich in crude protein and is classified as white meat. The findings of this study indicate that the crude protein values of guinea fowl ranged between 87.42±3.16 - 83.04±1.58. These findings are in agreement with the results of Ayorinde (2004) and Sharma and Singh (2006), who reported that guinea fowl contain higher protein (80-87 per cent), more essential amino acids, and lower cholesterol contents than broilers. The findings of this study show that the overall acceptability of guinea fowl meat by the panellists was good. This is in agreement with the results of Mareko *et al.* (2006) who found that most of the parameters evaluating meat rankings were over 60 per cent (fair to good), showing that guinea fowl meat can be marketed successfully as one of the meat alternatives. Guinea fowl meat is served as a delicacy. The relatively low fat, cholesterol and sodium content of guinea fowl meat, as well as the higher contents of some vitamins, will be a promising tool in the marketing strategies of this meat type as a healthy food.

Keywords: *Guinea fowl; Meat quality; Meat chemical composition; Sensory evaluation.*

INTRODUCTION

Guinea fowl (*Numida meleagris*) is a poultry species suitable for use in meat production (Mandal *et al.*, 1999a). During the last 20 years, much of Europe has switched to this bird to produce meat for luxury markets, and there is still a vast, untapped future for its meat. Guinea fowl can be kept for both meat and egg production and the meat is served extensively in hotels and restaurants because of its wild game flavour. Guinea fowl can be raised under both intensive and extensive management systems (Nsoso *et al.*, 2006). The carcasses have less fat than broilers and pullets and their mineral composition is higher. Guinea meat might be a more nutritionally desirable alternative to consumers than meat from other livestock (Santiago *et al.*, 2007). Sharma and Singh (2006) suggested that guinea fowl meat is preferred on account of its dark gamey taste and colour. Guineas provide meat with higher protein, more essential amino acids, lower fat and lower cholesterol contents than broilers (Cappa and Casati, 1978; Singh and Raheja, 1990). Guinea fowl meat could be an excellent and healthy alternative for consumers, and little research has been done on its quality.

MATERIALS AND METHODS

One hundred and fifty day-old guinea fowl (*Numida meleagris galeata*) keets were used and raised under a typical poultry intensive pen system. The keets were weighed and randomly allotted to five groups: A, B, C, D and E, each with 30 birds. Food and water were provided *ad libitum*. The feeding period was continued up to seven weeks, allowing for an initial ten days adaptation period. The experimental diets were formulated to meet the nutrient requirement of broiler chicks according to the National Research Council (NRC) (1984). Crumbled five diets A, B, C, D and E were formulated as in Table 1. The levels of protein and energy were set as follows: high protein high energy, high protein low energy, low protein high energy and low protein low energy for diets B, C, D and E respectively. Diet A served as the control diet. Five birds from each group were randomly slaughtered and meat quality was determined. Detection of the colour ordinates (L lightness, a, redness and b, yellowness) were recorded using a portable Spectrocolorimeter-Hunter Lab, colour Flex (model No45/0-USA). Water holding of total lean was determined according to Grau and Hamm (1953). Cooking loss was carried out on the right side breast muscle. Shear force value of cooked breast muscle was prepared according to Babiker

(1981) for shearing using a QTS Texture analyser (CNS farnell, Essex CM19STG- England). Shear force value (kg/cm2) was calculated as the mean from five successive cuts. Ultimate pH was read via a combined electrometer pH meter (a Thermo Orion, model 900A –USA). The chemical analysis for proximate determination of moisture, crude protein, fat content and ash was carried out according to A.O.A.C. (1980). Results were expressed as per cent composition. Meat samples for sensory evaluation were taken from the drumstick cut. The sample was kept in the deep freezer for test panel

Item	**Diets**				
Ingredient	A	B	C	D	E
Yellow corn	59.80	39.70	33.46	61.35	58.70
Soybean meal	32.00	46.20	50.34	24.63	21.24
Fishmeal	03.0	03.20	_	_	_
Wheat (grains)	_	_	07.0	05.0	5.00
Wheat bran	_	_	_	_	11.20
Vegetable oil	01.50	06.90	05.1	04.42	_
Mineral	03.60	03.90	04.0	04.50	03.76
Vitamins	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100
Components					
Dry matter	88.0	89.0	89.0	88.0	88.0
Crude protein	20.50	26.0	26.0	16.0	15.0
Crude fat	04.20	09.00	05.80	07.0	02.70
Crude fibre	02.70	02.00	02.90	02.60	03.60
Ash	06.50	07.00	10.50	06.20	05.80
Energy ME (Kcal/kg)	2990	3150	2800	3150	2750

Table 1: Per cent inclusion rate (by weight) of ingredients and chemical composition (on dry matter bases) of experimental diets

evaluation of colour, tenderness, flavour and juiciness. Ten semi-trained panellists were selected (Cross *et al.*, 1978). The meat samples were cut into small pieces and randomly served warm on coded plates to the panellists. The panellists were asked to score colour, tenderness, flavour and juiciness from an eight-unit scale.

Statistical analysis: The results were statistically subjected to one-way analysis of variance ANOVA (Snedecor and Cochran, 1967).

RESULTS

The helmeted guinea fowl objective meat quality attributes are presented in Table 2. Treatment groups were not significant ($P<0.05$) except for the cooking loss percentage (22.85±3.28) of group D. The percentage of cooking loss for group D (22.85±3.28) was higher and significantly ($P<0.05$) different when compared with the control group A (15.52± 1.16). Group B had ($P<0.05$) lighter value than the control. Lightness values in two experimental groups (C and E) were not significantly ($P<0.05$) similar. The water holding capacity value (2.22±0.10) in the test group E was not significantly higher than the control value (1.31±0.78), while cooking loss values in the test group D (22.85±3.28) were significantly higher than the control (15.52± 1.16). Higher non-significant values were recorded for groups B, D and E.

Items	F-value#	A	B	C	D	E
Colour						
L	1.69	57.24± 2.93	59.22± 3.85 NS	55.04± 3.38 NS	52.27± 4.79 NS	**55.8± 1.14** NS
a	0.76	13.32± 1.32	12.94± 2.00 NS	11.94± 0.71 NS	13.39± 1.92 NS	**11.93± 0.53** NS
b	2.33	17.56± 0.53	17.73± 0.93 NS	15.81± 1.45 NS	17.73± 0.93 NS	**17.56± 0.53** NS
Water holding capacity	2.32	1.31± 0.78	1.537± 1.03 NS	0.88± 0.11NS	1.087± 0.13NS	**2.22± 0.10** NS
Cooking loss %	6.61	15.52± 1.16	16.9± 1.89NS	14.74± 2.09 NS	22.85± 3.28* *	**19.73± 2.27** NS
Shear force value kg/cm²	**0.64**	**1.83± 0.77**	**2.90± 0.9** NS	**1.69± 0.59**NS	**3.009± 0.1**NS	**3.57± 0.32**NS

(L) = Lightness (a) = redness (c) = yellowness
\# with (4,20) degrees of freedom
* * denotes F-value significance at (P<0.01)
NS = Non-significant difference means (P>0.05)

Table 2: Average (mean ± SD) values of meat objectives quality attributes of guinea fowl chicks

The proximate analysis of helmeted guinea fowl meat is presented in Table 3. Dry matter of group C (24.19±0.76) was non-significantly (P>0.05) higher than the control. The crude protein values of groups C (87.42±3.16) and E (85.74±1.36) were non-significantly higher than the control (83.04±1.58). The ether extract value of group C (5.55±3.05) was non-significantly (P>0.05) the lowest. The ultimate pH of all groups were non-significantly (P>0.05) similar, except group B (6.12±0.026) which was significantly different (P<0.0).

Table 3: Guinea fowl meat proximate analysis

Ingredient	F-value#	A	B	C	D	E
Dry matter	6.382	23.53± 0.4	22.32± 0.3 NS	24.19± 0.76 NS	21.95± 0.98 NS	**21.66± 0.98***
Crude protein	1.081	83.04± 1.5	84.31± 3.55 NS	87.42± 3.16 NS	84.28± 3.48 NS	**85.74± 1.36 NS**
Ether extract	1.079	8.75± 1.64	8.16± 2.38 NS	5.55± 3.05 NS	9.33± 3.23NS	**7.96± 0.98 NS**
Ash	5.664	4.09± 0.22	3.27± 0.12*	3.81± 0.08 NS	3.36± 0.19*	**3.45± 0.46***
Ultimate pH	**3.493**	**5.94± 0.05**	**6.12± 0.026***	**6.02± 0.09 NS**	**6.06± 0.08 NS**	**6.08± 0.05 NS**

NS = Non-significant difference means (P>0.05)
* denotes means values significant (P<0.01)

The subjective assessment of meat quality of guinea fowl is shown in Table 4. All parameters were not significantly (P>0.05) different. Values for D (6.7±1.16) and E (6.8±0.92) tenderness were not significantly (P>0.05) higher than the control group (6.2±1.03), while the group B tenderness value (5.5±1.58) and colour (5.8±1.48) were not significantly the lowest. Juiciness for all the test groups were non-significantly (P>0.05) similar to the control value.

DISCUSSION

In general, meat colour is perceived by consumers as an indicator of freshness. Colour variation in poultry meat depends on primary production factors (breed, age and nutritional status), pre-slaughtering and slaughtering conditions, and subsequent storage (Berri, 2000). The colour results in the present study are supported by the findings of Jaturasitha *et al.* (2008), who reported that breast and thigh meat colour in

Items	F-value #	A	B	C	D	E
Tenderness	1.357	06.2± 1.03	05.5± 1.58 NS	06.3± 2.00 NS	06.7± 1.16 NS	**06.8± 0.92 NS**
Flavour	2.344	06.0± 1.41	5.3± 1.64 NS	06.0± 1.5 NS	07.0± 0.94 NS	**06.4± 0.7 NS**
Colour	1.318	6.6± 0.97	5.8± 1.48 NS	6.1± 1.79 NS	6.5± 0.97 NS	**07.0± 0.94 NS**
Juiciness	**0.2913**	**5.8± 1.03**	**5.6± 1.84 NS**	**5.5± 2.07 NS**	**6.2± 1.75 NS**	**5.6± 1.27 NS**

# with (4,20) degrees of freedom
Ns = Non-significant difference means (P>0.05)

Table 4: Average (mean ± SD) values of meat subjective quality attributes of guinea fowl chicks

terms of L*, a* and b* values displayed significant differences among genotypes (P<0.001). The rate of discolouration in fresh meat is related to the rate of pigment oxidation, oxygen consumption and the effectiveness of the metmyoglobin reducing system (O'Keefe and Hood, 1982; Ledward, 1991; Greene *et al*., 1971). Water-holding capacity of meat is affected by species, age and muscular function. The present study shows high WHC (1.537±1.03, 0.8867±0.11, 1.087±0.13, 2.22±0.10) compared with poultry (0.33±0.01, 0.32±0.01) (Musa *et al*., 2006). Water-holding and shear force capacity are affected by the processing conditions used and period of cold storage. Usually, muscles with a high content of intramuscular fat tend to have a high water-holding capacity (Saffle and Bratzler, 1959). The enhanced loss of water-holding capacity is partly due to increased denaturation of the muscle proteins and partly to enhanced movement of water into the extracellular space (Penny, 1977). Shear force values were linearly related to tenderness scores with high regression coefficients. Shear force values can be used to determine whether meat products vary in texture by measuring the variability in total cutting force. These were highly correlated with overall tenderness of muscle. The present study shows similar values of shear force to those obtained by Costa *et al.* (2007). This value is a highly variable characteristic, depending on many intrinsic and extrinsic factors of the meat and on their interactions (Miller, 1994; Destefanis *et al*., 2008). Low shear force indicates muscle tenderness. Cooking loss increases by increasing temperature (Sanderson and Vial, 1963). In the present study, cooking loss was higher than that reported by Costa *et al*. (2007). This may be due to the high muscle moisture content. A quick pH fall will increase moisture loss during cooking (Sayre *et al*., 1964).

Guineas are characterized by high meat protein, more essential amino acids, lower fat, and lower cholesterol contents than broilers (Ayorinde *et al*., 1988; Singh and Raheja, 1990). The present study showed a high meat protein range between (83.04±1.5, 84.31±3.5, 87.42±3.16, 84.28±3.48, 85.74±1.36). These values are higher than those reported by the Titi Tudorancea Bulletin (2008, [20.6 per cent]).This may be due to physiochemical properties of meat that are affected by intrinsic factors (Carragher and Mathews,1996; Pearson and Gillet, 1999) and may also be due to sample preparation and analytical methods (Holland *et al*., 1997). Ultimate pH in the present study ranged between (5.94±0.05, 6.12±0.026, 6.02±0.09, 6.06±0.08 and 6.08±0.05) and concords with the results reported by Jaturasitha *et al.* (2008). These results are lower (5.72±0.01, 5.68±0.01) than those reported by Musa *et al.* (2006). The lower pH of chicken could be due to better welfare conditions that reduce pre-slaughter stress and the consumption of glycogen (Castellini *et al*., 2002). It could be proposed that genetic strain has a role in the improvement of customer appraisal of poultry meat (Abeni and Bergoglio, 2001).

Intramuscular fat plays a major role in broiler meat quality, flavour and juiciness (Chizzolini et al., 1999). In the present study, similar results for tenderness, flavour and juiciness were reported by Jaturasitha et al. (2008). High ratings of tenderness, juiciness and acceptability were associated with samples processed using low a smokehouse temperature (80°C) or high relative humidity (85 per cent).

BIOGRAPHY

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Prof. Ali Saad Mohamed graduated from the University of Khartoum in 1971 as a veterinary surgeon. He was promoted to District Veterinary Officer in 1973 and worked as a Zoo Veterinary Officer from 1973-1975. In 1975 he was admitted to the college of Forestry and Natural Resources, Colorado State, USA, where he was awarded his MSc in 1977. He joined Sudan Agricultural Corporation and was promoted to associate research scientist in 1991. He attained his PhD (1994) from the Gezira University, Sudan. In 1997 he joined Sudan University of Science and Technology, where he was promoted to professor status in 2000. He has published about twenty-five papers in the field of wildlife and supervised four PhD candidates and ten MSc candidates. He is a member of the Sudan Veterinary Association, Sudan Environmental Society and Sudanese Wildlife Society.

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