Influence of sex on carcass and physicochemical quality of indigenous turkey breed.

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Abstract

Physicochemical and carcass characteristics of matured Indigenous Turkey Breed (ITB) as influenced by sex was investigated using completely randomized design. A total of ten ITB were distributed into two treatments. Each treatment was replicated five times. The turkeys were slaughter in batches of two under the prevailing commercial condition and dissected into primal cuts. Samples for cooking loss, shear force, water holding capacity, chilling loss and proximate composition evaluations were taken from the breast and thigh portion. Results obtained showed that the live male indigenous turkey (MIT) was heavier (P<0.05) (5.43 kg) than the female indigenous turkey (FIT) 3.78 kg. However, dressing percentages were similar (P>0.05) but higher in MIT 67.09% than in FIT 65.91%. The percent lean was highest in MIT breast thigh and drumsticks with the values 84.49%, 82.21% and 76.66% respectively. All percentage primal cuts were not influenced (P<0.05) by sex except percent back of FIT 14.98% that was higher (P<0.05) than MIT 12.12%. Shear force, water holding capacity and cooking loss values were not affected by sex for thigh and breast meat evaluated. Chilling loss of MIT breast and thigh meat were significantly higher (P<0.05). Ether extracts showed significant differences (P<0.05) with higher values in MIT thigh 6.47% and FIT breast meat 7.86% similarly, ash content of FIT breast meat 0.94% and thigh meat 1.38% and crude protein of FIT thigh meat 21.23% were significantly higher. High proportion of lean meat for the breast, thigh and drumsticks of ITB irrespective of sex showed that indigenous turkey can be packaged in primal cuts and commercialized.

Keywords: Commercial, Indigenous turkey breed, Physicochemical, Primal cuts, Sex.

Introduction

Poultry meat production has been very dynamic, over the last decade the poultry sector has been growing at more than 5 percent per annum (compared to 3 percent for pig meat and 1.5 percent for bovine meat) and its share in world meat production increased from 15 percent three decades ago to 30 percent currently [1]. Out of the poultry species in Nigeria, local turkey production has largely remained at the small holder [2] and its population is estimated to be around 1.05 million [3].

As a result, there has been massive importation of frozen turkey although being exotic turkey which provides essential substances as other meat; rich in unsaturated fatty acids, essential fatty acid but low in cholesterol, it is also an excellent protein source and has a good price-quality ratio [4], turkey meat also has exceptional meat quality such as the leanness of the meat, the relatively low amount of connective tissue, and high availability of functional meat proteins that make it a choice in further processed products.

In the light of this, the potential of local turkeys cannot be overlooked considering the huge foreign exchange implication of the importation of improved exotic stock [5] and the detection of heavy metals in imported frozen turkey [6] which may cause toxicity-related mutagenesis and other severe health hazards, up till now in Nigeria there is no known discriminatory attitude towards the production and consumption of turkeys but then they are very scarce to find this is due partly to the fact that chickens are so familiar and grow so well that there seems to be no reason to consider any other poultry.

Therefore, this research was conducted to determine the nutritional quality and to provide information on primal cuts of indigenous turkey species for consumers of poultry meat products both individually and foodservice operators.

Materials and Methods

Experimented animal

A total of ten matured Indigenous Turkey Breed (ITB) with an average weight of 5800 ± 6.89 g for male and 3838 ± 6.89 g for female were used for the study. ITB was purchased from reputable turkey farmers in Ibadan metropolis.

Experimental design

The birds were distributed into two treatment groups. Each group consisted of birds of the same sex, and a completely randomized design was employed.

Slaughtering

Prior to slaughtering, the birds were deprived of feed for eight hours while they had access to fresh cool water. The birds were slaughtered in batches of two (a male and a female). The birds were slaughtered under the commercial condition and were immediately hoisted to permit thorough bleeding. The bled weight was taken and recorded. Scalding was done in hot water (85°C) immediately after bleeding. The defeathered birds were manually deboned-out and each primal cut packed.

Dressing percentage was determined as:

$$\frac{Hot\ \ carcass\ \ weight}{Live\ \ weight}\ \ x\ \ 100 \quad (1)$$

Cooking loss

Samples for cooking loss were taken from the breast muscle, weighed and cooked in moist heat to an internal temperature of 72°C and allowed to equilibrate to room temperature (27°C).

Cooking loss:

$$\frac{Weight\ of\ sample\ before\ cooking - Weight\ of\ sample\ after\ cooking}{Weight\ \ of\ sample\ \ before\ \ cooking}$$

$$x100$$

(2)

Cooking loss was measured by weighing approximately 10 g meat.

Water holding capacity

This was determined following a slightly modified method of Suzuki [7]. Approximately 1 g sample was taken from the breast portion and weighed onto two filter papers (Whatman No. 1 filter) and pressed between two (10.2 × 10.2 cm) plexi glasses for a minute using a vice. The area of the free water was measured using a compensator planimeter (Planix 5000, Tamaya Technics Inc. Tokyo, Japan) and percent free water was calculated based on sample weight and moisture content [8] percent bound water (WHC) was calculated as:

100 – Free water percent (3)

Shear force

The objective evaluation of tenderness was performed using the modified Warner Bratzler shear force procedure [9]. Three cores of 0.5 cm in diameter were removed from the sample used for cooking loss using an electric coring machine. The coring was done parallel to the orientation of muscle fiber and each core was sheared perpendicular to the muscle fiber orientation at three locations using a Warner Bratzler Instron blade attached to an Instron universal testing machine (Model 5543, Instron, UK Ltd) at a crosshead speed of 50 mm/min.

Chilling loss

The breast and thigh muscles were chilled at 2°C for 24 hours immediately after cutting up into primal cuts. The chilling loss was determined as the difference between the warm weight and the chilled weight.

Proximate analysis

Proximate was carried out on selected raw meat primal cuts (thigh and breast) according to the method described by AOAC 2000 [10].

Statistical analysis

Two sample student T-test was performed on the results, descriptive analysis was done for primal cut and where statistical significance was observed, the mean values were separated using Duncan multiple range test. The SAS computer software package (SAS, 2012) was used for all statistical analysis.

Results and Discussion

Carcass characteristics of indigenous Turkey breed as influenced by sex

The result on Table 1 showed the carcass characteristics of both sexes of Indigenous Turkey Breed (ITB). The mean value of life, bled, defeathered, featherd, eviscerated and hot carcass weights for tom were significantly higher (P<0.05) than FIT.

The live weight values ranged between 3.838-5.800 g, this value is about the same live weight with the bronze breed with a male average live weight of 5.445 kg and female 3.548 kg. Isguzar [11] reported a higher live weight value of 13.101 kg for male and 9.676 kg for female, both slaughtered at 18 weeks.

Comparing with other poultry species ITB live weights are higher than the live weights of three breeds of duck (Rouen, Pekins and Muscovy) with an average live weight of 2.000 kg for male and 1.470 kg for female as reported by Omojola [12] and hot carcass weight of ITB ranged between 2.528-3900 kg.

However, there was no significant difference (P>0.05) in percent feather of MIT (5.162%) and FIT (3.289%), this reveals that feather cover at maturity is directly proportional to the body area even though adult male has a larger body size yet its feather cover is proportional to the feather cover of adult female, while dressing percentage for MIT (67.689%) was not significantly different (P>0.05) from dressing percentage of FIT (65.905%), these values were higher than dressing percentages of local hen of 56.19% [13] and 58.35-61.66% in male-female Fulani ecotype chicken but lower than the dressing percentage of pigeon 72.50% [14].

Meat yield

All the primal part of ITB were significantly higher (P<0.05) in MIT than FIT as reported in Table 2. The percent values evaluation showed that there were no differences (P>0.05) in indigenous turkey primal cuts except the percent back of MIT (12.12%) that was surprisingly lower (P<0.05) than FIT (14.07%). Wings percent was lowest in FIT 8.49% and 9.00% in MIT followed by drumstick 9.56% in FIT and 10.17% in MIT, thigh of ITB was 10% of live weight for both sex, this value exceed 6.31-6.64% in male-female pigeon reported by

Omojola [15], while the whole breast is the largest primal cuts of ITB with 22.73% in FIT and 25.58% in MIT.

Table 1: Carcass Characteristics of Indigenous Turkey Breed As Influenced by Sex.

Parameter	MIT	FIT	SEM
Live weight (kg)	5.800^{a}	3.838^{b}	0.287
Bled weight (kg)	5.463^{a}	3.600^{b}	0.262
Defeathered weight (kg)	5.163^{a}	3.475^{b}	0.248
Featherweight (kg)	0.300^{a}	0.125^{b}	0.031
Feather%	5.162	3.289	0.624
Eviscerated weight (kg)	4.763^{a}	3.250^{b}	0.24
Hot carcass weight (kg)	3.900^{a}	2.528^{b}	0.226
Dressing%	67.089	65.905	1.271

a,b: means in the same row with different superscripts are significantly different ($p<0.05$).

MIT: Male indigenous turkey.

FIT: Female indigenous turkey.

SEM: Standard error of mean.

Whole breast weight was 1.5 kg and 0.87 kg in MIT and FIT respectively, whole breast portion is the largest among the primal parts of Indigenous turkey which is in line with the work of Havenstein [16], who reported that breast muscle weight intensely exceeds that of the thighs. The reported percent value in this study accounts for about one-quarter of the live weight of matured indigenous turkey and is greater than the breast value of 17.81-18.00% obtained by Yisa [17] on carcass fed graded levels of boiled and dried pigeon pea seed meal. Thigh weight of ITB ranged from 0.388-0.588 kg, drumstick weight has a similar range value between 0.368-0.587 kg in MIT-FIT respectively while the weight for wings was the lowest 0.325-0.525 kg.

The lower value of the wings as a result of possession of interclavicle air sac that enhances buoyancy while its lower value in female explains why the female is more flighty than male.

External offals include head, neck and shank. Variation ($P<0.05$) exist in the meat weights of head and neck as a mean value for a head of MIT was 232 g and 160 g for FIT. There were no significant differences ($P>0.05$) in the percent value of external offals. The percent value of indigenous turkey head was lowest among the external offals and was between the range of 4.29-4.37% for percent neck was invariably higher in FIT 7.7% than in MIT 7.0% though the weight was significantly higher ($P<0.05$) in MIT 386 g than in FIT 286 g, likewise the percent FIT shank 5.04% was significantly higher ($P<0.05$) than MIT shank 3.06% similar to the trend in the mean values of shank that was significantly similar ($P>0.05$) in both sexes but higher 206 g in FIT than in MIT 196 g shank.

Even though the body mass of MIT was higher and its shank was lower compared to the opposite sex and this poses no threat to its anatomical configuration. Report of the descriptive analysis of the percentage of individual primal parts relative to carcass weight for both sexes showed that dressed carcass of matured MIT comprises 34.77% whole breast which is the highest in proportion among the primal parts, back is 23.05%, the thigh is 15-29%, drumstick was 14.5% while wings were least with 12.5%. Similar trend was observed in FIT which also had the whole breast as its highest primal part proportion followed by back with the same value as that of MIT back. However, drumstick proportion for FIT was higher 14.8% than thighs 14.7% wings was also with least proportion for FIT.

Table 2: Relative and absolute value of indigenous turkey breed Primal Cuts.

Primal Cuts	MIT	FIT	Sem
Breast (kg)	1.500^{a}	0.873^{b}	0.136
%Breast	25.549	22.733	1.15
Thigh (kg)	0.588^{a}	0.388^{b}	0.024
%Thigh	10.176	10.146	0.486
Drumstick	0.587^{a}	0.368^{b}	0.026

%Drumstick	10.176	9.558	0.328
Back	0.700^a	0.575^b	0.001
%Back	12.119	14.975^a	0.344
Wings	0.525^a	0.325^b	0.025
%Wings	9.07	8.493	0.353
External offals			
Neck	0.386^a	0.286^b	0.03
%Neck	7.005	7.736	0.566
Shank	0.196	0.206	0.11
%Shank	3.601^b	5.440^a	0.364
Head	0.232^a	0.160^b	0.023
%Head	4.37	4.29	0.021

a,b: means in the same row with different superscripts are significantly different (p<0.05).

MIT: Male indigenous turkey.

FIT: Female indigenous turkey.

SEM: Standard error of mean.

Meat to bone ratio

Further analysis on meat to bone ratio for breast, thigh, and drumstick of ITB showed that percent breast meat to the whole breast for MIT is 84.56%, this value is significantly higher (P<0.005) than 73.39% in FIT. Higher breast muscle mass in turkey can be attributed to a positive balance between the rates of muscle protein synthesis and muscle protein breakdown which is responsible for muscle growth.

During early life, more tissue protein is deposited and this is responsible for by growth hormone, insulin-like growth factor-I and insulin. The meat to bone ratio of MIT is as high as 12.7:1 and FIT are 10.3:1. Therefore, it can be concluded that the pectoralis major muscle of indigenes turkey in both sexes is ten times heavier than the bones (64.05 g) present in this region. The value of FIT breast skin (134.19 g) is significantly higher (P<0.005) than MIT (83.00 g), though the surface area and weight of MIT breast is higher the weight of the FIT. Breast skin cover is higher meaning that FIT skin is thicker than MIT skin which can be a favorable adaptation for brooding of eggs and poults.

The proportion of meat in MIT thigh (83.21%) is significantly higher (P<0.005) than FIT thigh (75.86%). However, thigh meat to bone ratio for FIT 8.14:1 was higher than the MIT 6.98:1 counterpart. Thigh bone weight of FIT was significantly lower (P<0.005) (17.892), this may be attributed to withdrawal of calcium which is an important bone structural component for the formation of eggshell during reproduction.

Female skin weight was higher than male skin weight in thigh and drumstick. Among the three most economic primal cuts analyzed in this study drumstick meat has the lowest meat proportion and it ranges significantly (P<0.005) between 63.68% in FIT to 76.66% MIT. FIT skin was higher 23.03 than MIT, as it appeared in thigh and breast portion while meat to bone ratio of female thigh was higher 8.14:1 than male 6.98:1, this is lower due to the fact that female turkey bone weight was slower 21.33 g than male thigh bone weight 31.61 g although both sexes (Table 3).

Table 3: Meat to Bone Ratio of Indigenous Turkey Breed as Influenced by Sex.

Parameter	**MIT**	**FIT**	**SEM**
%Thigh Meat	82.213	75.861	1.878
Whole Thigh (g)	263.50^a	185.62^b	0.009
Thigh Skin (g)	14.360^b	26.031^a	0.002
Thigh Bone (g)	31.612^a	17.892^b	0.002
Thigh Meat (g)	215.28^a	143.01^b	0.012
Thigh M: B	6.982	8.142	0.957
%Breast Meat	84.491^a	73.393^b	2.305

Breast (g)	1500[a]	873.00[b]	0.136
Breast Skin (g)	83.00[b]	134.19[a]	0.012
Breast Bone (g)	95.530[a]	64.051[b]	0.009
Breast Meat (g)	1187.80[a]	614.80[b]	0.139
Breast M: B	12.71	10.3	2.007
%Drumstick Meat	76.663[a]	63.676[b]	0.942
Whole Drumstick (g)	274.01[a]	173.80[b]	0.014
Drumstick Bone (g)	40.88[a]	21.33[b]	0.002
Drumstick Meat (g)	211.80[a]	112.80[b]	0.011
Drumstick Skin (g)	21.32[b]	39.67[a]	0.002
Drumstick M: B	5.12	5.377	0.21

a,b: means in the same row with different superscripts are significantly different (p<0.05).

MIT: Male indigenous turkey.

FIT: Female indigenous turkey.

SEM: Standard error of mean.

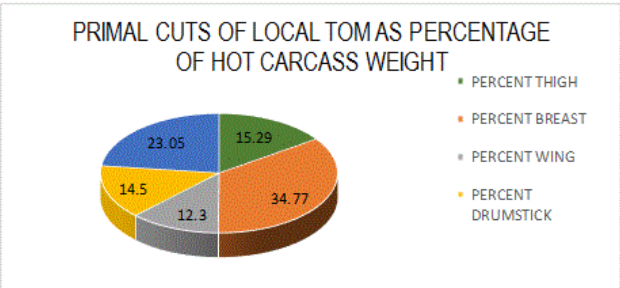

Figure 1: Primal cuts of male indigenous turkey as a percentage of hot carcass weight.

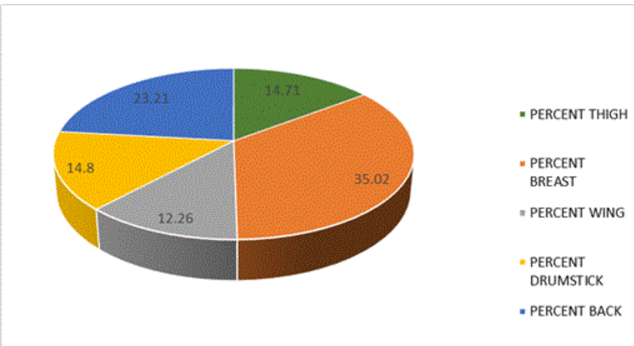

Figure 2: Primal cuts of female indigenous turkey as percentage of hot carcass weight.

Physicochemical characteristics

No Significant variation (P>0.005) in WHC, Shear force value and Cooking loss in the thigh and breast meat of MIT and FIT. Water in muscle tissue is found in extracellular, interfacial and constitutional [18], 90-95% of total tissue fluid is in extracellular phase, 5-10% is bind to muscle protein surfaces, while 0.1% bound within muscle protein molecules. WHC is a quantitative measurement of water difference in muscle tissue and excess muscle water loss is unappealing to meat processor and consumers. From this study WHC was lowest in breast meat of FIT followed breast meat of MIT, thigh meat of FIT and thigh meat of MIT with the values 44.90% , 56.03%, 57.08% and 60.98% respectively (Figure 1). This work agrees with the result on WHC of breast and thigh meat of three commercial lines of broiler chickens who also reported a higher values for thigh meat (69.2-71.6%) and lower values for breast meat (57.9-65.2%) the lower WHC of ITB will enhance microbial safety of meat (Figure 2).

The cooking loss is the heat-induced shrinkage of meat which can be both transverse and longitudinal resulting in moisture loss through boiling and or evaporating or fat loss. The Higher cooking loss was found in ITB breast (P>0.05) (30.26-32.43%) and thigh meat (P>0.05) (33.93-38.69%) the increased cooking loss was because of the WHC that is generally low in Indigenous turkey.

There is room for the expulsion of sarcoplasmic fluid from the muscle fiber. The exceptionally lower cooking loss in indigenous turkey thigh meat was due to higher fat content which produces the percentage fat loss during cooking and abundance of connective tissue (collagen), an increase in temperature leads to breakage of hydrogen bonds which serves as structure stabilizer between hydroxyl groups and hydroxyproline in the collagen surrounding the myofibrils which cause waste to expelled from the muscle structure [19].

Table 4 showed that shear force value (SFV) of FIT thigh 2.48 was lowest and it compared well with the result for raw duck breast meat. SFV increased in MIT thigh to 3.38, the result was the same with the result of pectoralis major muscle of duck cooked at 40°C. SFV of indigenous turkey breast meat was comparatively higher than thigh meat. MIT pectoral major SFV was 5.25, this result is lower than meat from duck pectoralis cooked at 90°C which is 5.68 while SFV of FIT breast was highest 6.36. Higher shear force value shows the toughness of meat which is a manifestation of textural changes in myofibrillar and connective tissue for both thigh and breast muscle subjected to heat treatment. This toughness in meat develops through initial thermal shrinkage of the connective tissues that increase the concentration of collagen fibers to denaturation of myofibrils protein which ultimately increases the load bearing ability and produces toughness which is objectively measured by using Warner Bratzler shear Force Machine.

Chilling loss% increased significantly (P<0.005) from FIT thigh meat (0.333%) to MIT thigh meat (0.542%) and from FIT breast meat (0.750%) to MIT breast meat (1.433%). In poultry, thigh muscle for walking and standing is made up of type I muscle fiber [20] this type I muscle also called 'red muscle' is susceptible to cold shortening because of inefficient calcium recapture ability by sarcoplasmic reticulum which regulates calcium uptake/because regulating ability or potential of sarcoplasmic reticulum is not well developed.

The moisture content of thigh meat was similar (P>0.05) in both sexes between 72.3-72.7% while significant difference (P<0.05) was revealed in breast meat for the two sex MIT (73.073%) FIT (68.033%) these values fall within the general moisture contents of meat which is 65-75%. Turkey meat is an excellent protein source and has a good price-quality ratio similar values (P>0.05) within the range 21.5-21.6% were recorded for crude protein of breast meat, crude protein of MIT thigh 17.43% was significantly lower (P<0.05) to FIT thigh meat 21.23%, this work is below the values of broiler chicken fed levels of distillers dried grain with soluble which ranged between 22.90-23.90%.

Crude protein in male-female bronze turkey's breast muscles turkey was higher as much as 23-26.1% and lower 16.5-17.4% in male-female white turkey breast muscles meat. In thigh muscle meat crude protein for males-females of Bronze and White turkey's leg muscle meat were 19.0 to 21.2% and 13.3 to 14.8%.

Significant variation (P<0.05) exist in fat percentage in the thigh and breast meat and for both sexes, as MIT thigh was significantly higher 6.47 than FIT thigh 4.15%, while the reverse was the case FIT breast meat 7.86% and 3.63 in MIT. Isguzar [11] reported average percentages of 1.04 to1.46% and 0.15 to 0.44% for breast and also 2.10 to 3.58% and 0.65 to 0.64% for legs respectively at 18 weeks for crude fat.

A similar trend was observed in the ash of breast and thigh meat for both sexes. FIT breast meat 0.935% was significantly higher (P<0.05) than MIT breast meat 0.425 and FIT thigh meat 1.375 was higher (P<0.05) than MIT thigh meat 0.55% for the two meat location ash percentage was higher in FIT and the ash percent of FIT thigh meat was higher than ash percent of Ugandan local chicken raised in deep litter system as reported by Magana [21]. Because of the leanest nature turkey meat, its unique energy values of 162 calories per 100 g of meat. Mineral-like potassium, calcium, magnesium, iron, selenium, zinc and sodium are present. It is also rich in essential amino acids and vitamins like niacin, vitamin B6 and B12. It is rich in unsaturated fatty acids and essential fatty acid and low in cholesterol.

Table 4: Physico-chemical characteristics of indigenous Turkey breed as influenced by sex.

Meat Location	Thigh			Breast		
Parameters%	MIT	FIT	SEM	MIT	FIT	SEM
WHC%	60.98	57.08	7.882	56.025	44.9	4.494
Shear force	3.388	2.488	0.351	5.25	6.363	1.077
Cooking loss%	33.93	38.69	1.845	30.26	32.43	1.03
Chilling loss%	0.542^a	0.330^b	0.031	1.433^a	0.750^b	0.146
Moisture content%	72.8	72.325	0.43	73.075^a	68.338^b	0.767
Crude protein%	17.425^b	21.225^a	0.367	21.608	21.51	0.471
Ether extract%	6.473^a	4.645^b	0.199	3.363^b	7.860^a	0.268
Ash%	0.545^b	1.375^a	0.028	0.425^b	0.935^a	0.03

a,b: means in the same row with different superscripts are significantly different (p<0.05).

MIT: Male indigenous turkey.

FIT: Female indigenous turkey.

SEM: Standard error of mean.

Conclusion

The result from this study showed that the live weight of ITB of both sexes was higher than other poultry species such as broiler chicken, duck and pigeon this makes turkey a larger domesticated bird. The FIT thigh is very tender and there is a higher lean proportion of breast, thigh, and drumstick for both sexes. External offal of ITB from this study can be processed as restructured meat. Primal cuts and edible internal offal of ITB such as gizzards, the liver can be packaged and commercialized. This will reduce the influx of frozen turkey importation which discourages local poultry farmers; consequently reducing the gross domestic products (GDP) of the country.

References

1. FAO, World Agriculture Towards 2030/2050 interim report. Rome 2006.
2. Ojewola G, Udokainyang A, Obasi V. Growth, Carcass and Economic response of Local Turkey Poults to various levels of Dietary Energy. In: Aletor VA, Onibi GE (eds.) Increasing Household Protein Consumption through Livestock Products. Proceeding of the 27th Annual Conf. of Nigeria Society for Animal Production, Akure, Nigeria 2002;167-169.
3. FAOSTAT-Food and Agricultural Organization of the United Nations 2011.
4. Roberson KD. Use of Dried Distillers' Grains with Solubles in Growing Finishing Diets of Turkey Hens. Inter J Poul Sci 2003;2:389-393.
5. Ibe SN. Utilizing Local Poultry Genetic Resources in Nigeria. Proceeding of 4th World Congress on Genetics Applied to Livestock Production 1990;108-112.
6. Okoghenum J. Between Smuggled Frozen Chickens and Health Of Nigerians. The guardian 2015.
7. Suzuki A, Kaima N, Ikeuchi Y. Carcass Composition and Meat Quality of Chinese Purebred and European x Chinese Crossbred Pigs. Meat Sci 1991;9:31-41.
8. Tsai T, Oeckerman H. Water Holding Measurement of Meal. Meat Sci 1981;46:697-701.
9. Bouton P, Haris P. Factors Affecting Tensile and Wanner-Bratzler Shear Values of Raw and Cooked Meat. J Texture Studies 1978;9:395-413.
10. AOAC (2000). Official Methods of Analysis, 19th Edition AOAC International, Inc.Washington, DC.
11. Isguzar A, Testik A. An Investigation on Growth, Carcass Characteristics and Meat Quality of Bronze Turkeys with every day herding in Extensive Conditions as Primitive in Turkey. GAP II Agricultural Congress 2003;2:1125-1131.
12. Omojola AB. Carcass and Organoleptic Characteristics of Duck Meat as Influenced by Breed and Sex. Inter J Poul Sci 2007;6:329-334.
13. Omojola AB, Fagbuaro SS. Carcass Characteristics of Broilers Spent Layers and Local Fowls. In: Proceedings of the 10th Annual Conference of Animal Science Association of Nigeria. 2005;176 -178.
14. Yasser J, Ali M, Mohammed A. Study of Carcass Characteristics in Pigeons Administration Fish Oil. Inter J Sci Nature 2015;6:459-461.
15. Omojola A, Isa A, Jibir M, Ajewole S, Garba O, et al. Carcass Characteristics and Meat Attributes of Pigeon (Columbia Livia) as Influence by Strain and Sex. J Anim Sci Adv 2012;2:475-480.
16. Havenstein G, Toelle V, Nestor K, Bacon W. Estimates of genetic Parameters in Turkeys. Body Weight and Carcass Characteristics. Poul Sci 1988;6:388-1399.
17. Yisa A, Edache J, Oyawoye E, Diara S, Yakubu B. The Effect of Graded Levels of Boiled and Dried Pigeon Pea Seed Meal on the Carcass of Cockrels. J Environ Issue in Dev Country 2010;2:125-131.
18. Honikel KO, Hamm R. Measurement of Water-Holding Capacity and Juiciness. In:Quality attribute and their Measurement in Meat. Poultry and Fish Products: Advances in Meat Res 1994;9:125-159.
19. Christensen L, Bertram L, Aaslyng M, Christensen M. Protein denaturation and water-protein interactions as affected by low temperature long time treatment of porcine Longissimus dorsi. Meat Sci 2011;49:447-457.
20. Honikel P, Vejsada R, Goldspink F, Kasicki S, Krekule I. Quantitative Evaluation of Electromyogramactivity in Rat Extensor and Flexor Muscles Immobilized at Different Lengths. Exp Neurol 1985;88:515-528.
21. Magana H, Kugonza D, Kwizera H, Kyarisiima C. Influence of Management System on Growth and Carcass Characteristics of Ugandan Local Chicken. J Anim Sci Adv 2012;2:558-567.

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