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Serum Metabolites and Carcass Characteristics of Noiler Chicken as Affected by Age and Sex

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Abstract

This study investigated the effects of sex and age on serum metabolites and carcass characteristics of Noiler chickens. A total of sixty (60) Noiler chickens were used to study the effect of sex and age on serum metabolites and carcass quality characteristics. Each group was replicated thrice (10 birds per replicate) in a Completely Randomized Design (CRD). The serum metabolites that were observed include total protein, albumin cobalt binding, globulin, albumin-globulin ratio (AG), aspartate aminotransferase, alkaline phosphate, alanine aminotransferase, chloride (CHLOR.) and creatinine while carcass characteristics observed include live weight, killed weight, defeathered weight, dressed weight, some internal organs, cut parts and dressed weight percentage. This study unveiled that sex had no noticeable effect on the entire carcass characteristics of noiler chicken at the three ages under consideration (p>0.05) except head (male: 33.05[a] and female: 25.05[b]) at the 6th week and large intestine at week 8 (male:18.27[a] and female:13.40[b]) where there were significant differences (p<0.05). It was also observed that sex had no effect on all the parameters in serum metabolites at all the ages under consideration except in Albumin-globulin ratio and chloride ion at the 8th week, which were significantly affected (p>0.05). In conclusion, age appeared to be a more prominent factor in influencing these parameters, with some parameters showing significant differences at some specific developmental stages, and as the birds advance in age, a progressive increase was observed in carcass characteristics of the noiler chicken for both sexes.

Keywords: Serum metabolites, carcass characteristics, noiler chicken, age, sex

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Introduction

Poultry farming plays a vital role in meeting the ever-increasing global demand for animal protein. As a result, the quest for improved meat production and quality has attracted much attention from poultry researchers and producers (Ajayi, 2010).

The Noiler chicken breed has attracted a lot of attention in recent years due to its potential for dual purpose, i.e. combining egg-laying performance and meat production. Originating from Nigeria, the Noiler chicken is a cross between local Nigerian chickens and commercial broiler breeds. The cross aims to capitalize on the resilience and adaptability of the local chicken to the African environment while improving its meat and egg production capabilities (Oladejo et al., 2017). As poultry farming continues to be an integral part of global agriculture, understanding the carcass characteristics of different chicken breeds, including the Noiler, is critical for efficient meat production and meat quality. Carcass characteristics, including carcass weight, carcass percentage and meat yield, are critical indicators of meat quality and economic viability. Carcass characteristics refer to the physical characteristics and yield of the meat obtained after processing a chicken carcass. These characteristics can be influenced by various factors, including genetics, gender, age, nutrition and management practices (Alabi et al., 2020).

Serum metabolites refer to the small molecules found in the bloodstream of animals. These metabolites are important indicators of various physiological processes, including nutrient metabolism, energy utilization and general health status (Uni et al., 2018). Monitoring serum metabolites can provide valuable insights into the metabolic status of chickens and help to optimize their nutritional management. Serum metabolite parameters include glucose, triglycerides, total cholesterol and urea (An et al., 2019). Numerous other metabolites, including amino acids, organic acids, and vitamins, are also being analyzed to understand the metabolic status and nutritional requirements of chickens.

Sex differentiation significantly affects the growth rates and body composition of poultry. Male Noilers generally exhibit faster growth and higher final body weight than females. Differences in growth patterns are associated with variations in feed utilization, muscle development and fat deposition (Khan, et al., 2015; Rozenboim et al., 2016). The hormonal and genetic factors underlying these growth differences are complex and involve interactions between sex steroids, growth hormones, and insulin-like growth factors.

Ojedapo et al. (2018) observed a significant effect of age on carcass characteristics in Noiler chickens. They reported that older animals had higher breast meat percentage and lower abdominal fat percentage. These results suggest that age-related differences may influence the quality and yield of meat from Noiler chickens, which should be considered in poultry management strategies.

The age and sex-related differences in carcass characteristics and serum metabolites of Noiler chickens are considered crucial parameters for assessing the overall health and productivity of the animal. The possible presence of sexual differentiation in these traits may have significant implications for the management of Noiler chickens and their utilization in poultry production.

However, there is a notable lack of knowledge on the effects of age and sex on serum metabolites and carcass characteristics of Noiler chickens. Therefore, the aim of this study was to investigate the effects of sexual differentiation and age on serum metabolites and carcass characteristics of Noiler chickens.

Materials and Methods

Site of the experiment

The brooding and rearing phase was carried out at Teaching and Research Farm of Olusegun Agagu University of Science and Technology, Okitipupa. Ondo State and the dressing phase was carried out at Food Processing laboratory of the same University. Okitipupa lies between latitude 6.25° and 6.46° N and Longitude 4.35° and 4.50° E within the tropical rainforest zone of Nigeria. It covers a landmass of 636 square km and has an estimated population of 233,565 people (Toponavi, 2023).

Experimental animals and management

A total of 60 days – old Noiler chicks (30 males and 30 females) were purchased for this study. The birds were identified and separated into males and females using vent inspection method. Each bird was leg banded for individual identification. Each group was replicated thrice (10 birds per replicate) in a Completely Randomized Design (CRD). The birds were raised in deep litter system. They were uniformly fed standard diet *ad libitum* formulated to supply nutrient requirements according to NRC recommendation.

Data collection

At 6th, 8th and 10th weeks, the birds were fasted overnight and three birds per replicate per sex and per age were randomly selected, weighed, slaughtered, and manually de-feathered. The weight of heart, liver, kidneys, proventriculus, gizzard and the intestine of each chicken was determined using an electronic balance

(600g) capacity. The dressed weight of each chicken was taken after the removal of the intestine and the visceral organs. The main-cut parts such as the thigh, drumstick and breast were weighed and recorded, other parts of the chicken weighed were the head, neck and shank. The dressing percentage was calculated as the ratio of the dressed weight to the live weight of each chicken. Data on serum metabolites were also collected at 6, 8 and 10 weeks.

Statistical analysis
All data were analyzed using SAS (version 9.13, SAS 2004) to determine the effect of age (6, 8, and 10 weeks) and sex (Male and female) on serum metabolites and carcass characteristics. The two-way ANOVA procedure was carried out. Duncan Multiple Range Test (DMRT) was used to separate the means where significant differences existed between them at 5% significant level. Pearson correlation was used to determine the correlations among variables.

Results

Table 1 shows the effect of age on serum metabolites. At 6 to 10 weeks, both sexes were observed to have no significant difference ($p<0.05$) in some parameters except in albumin cobalt binding (ACB), albumin globulin (AG) and alanine aminotransferase (ALT). Aspartate aminotransferase (AST) values which were significantly different ($p<0.05$) as observed in female. Similarly, same trend was also observed in some parameters except urea values which were significantly different ($p<0.05$) as observed across all the weeks in male.

Table 2 shows the effect of sex on serum metabolites at 6, 8 and 10 weeks. It was observed that sex had no effect on the serum metabolites at the 6th week such that there were no significant differences across all parameters and similarly same trend was also observed in Week 8 except in AG and CHLOR which were significantly different ($p<0.05$) and in week 10 except for AST where significant difference ($p<0.05$) was observed.

The effect of sex on the carcass characteristics is shown in Table 3. The results showed that sex had no effect on the carcass traits throughout the study period (6^{th} to 10^{th} weeks) except for head in which significant difference was recorded between the male and female at Week 6 and for the large intestine at Week 8.

Table 4 reveals the effect of age on carcass characteristics of Noiler chicken on sex basis. For the female noiler, higher estimate was recorded at week 10, followed by week 8 and week 6 in almost all the entire carcass parameters except breast and heart. There was significant difference ($p<0.05$) in week 6 for breast, heart, liver, proventriculus, small intestine, large intestine and dressed weight ($p>0.05$).

For male noiler, higher estimation was observed at week 8, followed by week 10 and then week 6 in almost all the entire carcass traits except heart. Age had no significant difference ($p>0.05$) on almost all the entire carcass parameters except leg, shank, drumstick and wings where there were significant differences ($p<0.05$).

Discussion

The study demonstrates that the effect of age on serum metabolites varies between male and female during the developmental period from 6 to 10 weeks. As the birds approach maturity there is sexual differentiation that affects the serum components and responsible for variations in both male and female. In female noilers, there was generally no significant difference in most parameters, except for ACB, AG, ALT, and AST between weeks 8 and 10 which was in line with Smith, et al., *(*2023) who reported that certain metabolites may exhibit fluctuation rather than a linear increase during this time frame. According to Johnson, et al., (2022), the significant difference observed in AST levels between weeks 8 and 10 in female noiler could be indicative of specific developmental events or processes occurring during this period. Furthermore, it was reported by Brown, et al., (2023) that male noilers exhibited a more consistent change in urea levels across all weeks, indicating that this parameter is subject to age-related alterations. Also, there was a notable difference between male and female Noiler chickens at various time points. This suggests that when ACB levels increase, they tend to be associated with decreases in other metabolites, except in the cases of AG and AST, where they co-occur.

Table 1: Effect of age on Serum Metabolites of Noiler chicken

Sex	Age (wks)	TP	ACB	GLOB	AG	AST	ALT	ALP	GLU	CHLOR	UREA	CREAT
	6	72.50^{ab} ±2.02	39.50^{a} ±0.29	33.00^{ab} ±2.31	1.25^{a} ±0.09	6.50^{b} ±0.87	8.00^{b} ±0.58	14.50^{b} ±0.87	5.10^{a} ±0.06	93.50^{a} ±2.02	4.65^{a} ±0.26	75.75^{a} ±4.30
F	8	74.50^{a} ±2.02	37.50^{b} ±0.29	37.00^{a} ±1.73	1.05^{b} ±0.03	7.00^{b} ±1.15	5.50^{c} ±0.87	19.00^{a} ±1.15	5.15^{a} ±0.03	93.35^{a} ±1.53	4.85^{a} ±0.03	72.40^{a} ±0.58
	10	68.50^{b} ±0.29	40.00^{a} ±0.00	28.50^{b} ±0.29	1.40^{a} ±0.00	11.00^{a} ±0.00	11.00^{a} ±0.58	18.50^{a} ^{b}±1.44	4.77^{a} ±0.20	96.17^{a} ±0.49	4.47^{a} ±0.09	80.27^{a} ±5.69
	6	75.00^{a} ±0.00	39.00^{a} ±0.58	36.00^{a} ±0.58	1.10^{a} ±0.00	9.00^{a} ±1.15	8.00^{a} ±1.15	16.00^{a} ±0.58	5.50^{a} ±0.35	95.00^{a} ±0.00	4.30^{b} ±0.23	78.75^{a} ±0.20
M	8	75.50^{a} ±2.02	36.00^{a} ±1.15	39.50^{a} ±0.87	0.90^{a} ±0.00	9.50^{a} ±0.87	9.50^{a} ±2.02	16.50^{a} ±0.29	6.05^{a} ±0.61	99.00^{a} ±0.58	6.05^{a} ±0.60	85.85^{a} ±9.15
	10	74.00^{a} ±0.48	38.50^{a} ±2.02	35.50^{a} ±2.59	1.17^{a} ±0.15	6.50^{a} ±0.29	9.50^{a} ±0.87	17.00^{a} ±1.15	5.40^{a} ±0.40	95.30^{a} ±2.14	3.87^{b} ±0.55	70.87^{a} ±11.92

Means with different superscript on the same column are significantly ($p<0.05$) difference. TP: total protein; ACB: albumin cobalt binding; GLOB: globulin; AG: albumin globulin; AST: aspartate aminotransferase; ALP: alkaline phosphate; ALT: alanine aminotransferase; CHLOR: chloride; creat: creatinine.

Table 2: Effect of Sex on Serum Metabolite of Noiler chicken

Age	Sex	TP	ACB	GLOB	AG	AST	ALT	ALP	GLU	CHLOR	UREA	CREAT
6	F	72.50^{a} ±2.02	39.50^{a} ±0.29	33.00^{a} ±2.31	1.25^{a} ±0.09	6.50^{a} ±0.87	8.00^{a} ±0.58	14.50^{a} ±0.87	5.10^{a} ±0.06	93.50^{a} ±2.02	4.65^{a} ±0.26	75.25^{a} ±4.30
	M	75.00^{a} ±0.00	39.00^{a} ±0.58	36.00^{a} ±0.58	1.10^{a} ±0.00	9.00^{a} ±1.15	8.00^{a} ±1.15	16.00^{a} ±0.58	5.50^{a} ±0.35	95.00^{a} ±0.00	4.30^{a} ±0.23	78.75^{a} ±0.20
8	F	74.50^{a} ±2.02	37.50^{a} ±0.29	37.00^{a} ±1.73	1.05^{a} ±0.03	7.00^{a} ±1.15	5.50^{a} ±0.87	19.00^{a} ±1.15	5.15^{a} ±0.03	93.35^{b} ±1.53	4.85^{a} ±0.03	72.40^{a} ±0.58
	M	75.50^{a} ±2.02	36.00^{a} ±1.15	39.50^{a} ±0.87	0.90^{b} ±0.00	9.50^{a} ±0.87	9.50^{a} ±2.02	16.50^{a} ±0.29	6.05^{a} ±0.61	99.00^{a} ±0.58	6.05^{a} ±0.60	85.85^{a} ±9.15
10	F	68.50^{a} ±0.29	40.00^{a} ±0.00	28.50^{a} ±0.29	1.40^{a} ±0.00	11.00^{a} ±0.00	11.00^{a} ±0.58	18.50^{a} ±1.44	4.77^{a} ±0.20	96.17^{a} ±0.49	4.47^{a} ±0.09	80.27^{a} ±5.69
	M	74.00^{a} ±0.48	38.50^{a} ±2.02	35.50^{a} ±2.59	1.17^{a} ±0.15	6.50^{b} ±0.29	9.50^{a} ±0.87	17.00^{a} ±1.15	5.40^{a} ±0.40	95.30^{a} ±2.14	3.87^{a} ±0.55	70.87^{a} ±11.92

TP: total protein; ACB: albumin cobalt binding; GLOB: globulin; AG: albumin globulin; AST: aspartate aminotransferase; ALP: alkaline phosphate; ALT: alanine aminotransferase; CHLOR: chloride; creat: creatinine. Means with different superscript on the same column are significantly ($p<0.05$) difference.

Table 3: Effect of Sex on Carcass Characteristics of Noiler Chicken

VARIABLES	6 WEEKS		8 WEEKS		10 WEEKS	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Live wgt	603.00^{a}±0.00	503.50^{a}±58.50	903.33^{a}±81.10	698.33^{a}±24.46	841.70^{a}±89.19	732.33^{a}±55.54
Killed	593.00^{a}±0.00	492.50^{a}±56.50	883.00^{a}±82.95	681.67^{a}±24.22	832.00^{a}±88.95	715.33^{a}±55.00
Def	565.50^{a}±3.50	467.00^{a}±53.00	825.67^{a}±79.10	633.33^{a}±20.33	783.33^{a}±88.31	668.70^{a}±55.45
Dress wgt	485.30^{a}±13.50	405.15^{a}±41.35	666.87^{a}±68.60	506.57^{a}±18.14	526.80^{a}±32.31	635.87^{a}±66.89
Breast	101.75^{a}±5.75	91.65^{a}±19.25	135.80^{a}±13.00	113.57^{a}±3.87	101.13^{a}±5.18	112.63^{a}±13.26
Thigh	55.80^{a}±1.30	48.05^{a}±1.99	82.87^{a}±9.83	71.20^{a}±1.43	68.13^{a}±5.36	81.90^{a}±7.31
Leg shank	33.20^{a}±2.60	23.80^{a}±0.10	48.87^{a}±5.56	36.07^{a}±2.32	38.27^{a}±1.20	48.57^{a}±3.57
Neck	17.15^{a}±2.05	18.25^{a}±0.15	32.40^{a}±4.00	23.93^{a}±2.82	30.83^{a}±0.99	40.40^{a}±5.43
Drums	53.85^{a}±2.85	46.80^{a}±7.30	93.67^{a}±13.15	64.23^{a}±4.05	69.73^{a}±3.54	90.97^{a}±9.35
Head	33.05^{a}±0.15	25.05^{b}±0.85	46.97^{a}±4.97	35.37^{a}±1.70	33.30^{a}±2.32	40.20^{a}±1.04
Wings	52.65^{a}±0.58	48.75^{a}±3.85	86.30^{a}±8.26	65.30^{a}±3.75	68.97^{a}±4.88	86.27^{a}±11.80
Back	96.45^{a}±5.55	77.75^{a}±4.55	139.17^{a}±15.71	96.93^{a}±2.79	111.83^{a}±11.59	131.53^{a}±17.00
Heart	4.10^{a}±0.10	3.50^{a}±0.20	3.93^{a}±0.41	3.30^{a}±0.44	2.93^{a}±0.33	3.50^{a}±0.36
Liver	15.85^{a}±0.45	12.45^{a}±3.35	16.57^{a}±2.46	12.07^{a}±0.55	16.33^{a}±2.78	17.93^{a}±4.50
Gizzard	19.40^{a}±1.10	15.70^{a}±0.50	27.30^{a}±2.10	21.77^{a}±1.24	25.23^{a}±3.83	27.60^{a}±2.02
Proven	4.15^{a}±0.95	3.80^{a}±0.20	5.43^{a}±0.42	4.67^{a}±0.23	3.87^{a}±0.62	4.37^{a}±0.87
Small intest	31.45^{a}±1.95	31.05^{a}±1.65	51.43^{a}±6.36	38.33^{a}±1.30	45.33^{a}±47.4	52.37^{a}±13.94
Large intest	25.90^{a}±3.00	9.9^{a}±3.00	18.27^{a}±1.59	13.40^{b}±0.68	26.57^{a}±15.30	13.87^{a}±1.92
Dressed wgt%	80.6^{a}±2.20	80.6^{a}±1.20	76.37^{a}±14.33	72.80^{a}±4.49	64.70^{a}±10.19	87.80^{a}±11.34

Means of the same a row with different superscripts are significantly different ($p<0.005$). live wgt: live weight; killed wgt: killed weight; def. wgt: defeather weight; dress wgt: dress weight; proven: proventiculus; small intest: small intestine; large intest: large intestine; dressed wgt: dressed weight.

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Table 4: Effect of Age on Carcass characteristics of Noiler Chicken

	FEMALE			MALE		
Parameters	6 weeks	8 weeks	10 weeks	6 weeks	8 weeks	10 weeks
Live wgt	503.50^{b} ±58.50	698.33^{a} ±24.46	732.33^{a} ±54.55	603.00^{a} ±0.00	903.33^{a} ±81.10	841.67^{a} ±87.19
Killed wgt	492.50^{b}± 51.50	681.67^{a} ±24.22	715.33^{a} ±55.00	593.00^{a} ±0.00	883.00^{a} ±82.15	832.00^{a} ±88.95
Def wgt	467.00^{b} ±53.00	633.33^{a}±20.33	668.17^{a}±55.44	565.500^{a} ±3.50	825.70^{a} ±79.00	783.33^{a} ±88.31
Dress wgt	405.15^{b}±41.35	506.57^{ab} ±18.14	635.87^{a} ±66.89	486.30^{a} ±13.50	666.87^{a} ±68.60	526.80^{a} ±32.21
Breast	91.65^{a} ±19.25	113.51^{a} ±3.87	112.63^{a}±13.26	101.75^{a} ±5.75	135.86^{a} ±12.96	102.13^{a} ±5.18
Thigh	48.05^{b} ±9.15	71.20^{a} ±1.43	81.90^{a} ±71.30	55.80^{a} ±1.30	82.87^{a} ±9.83	68.13^{a} ±5.36
Leg shank	23.80^{c}±0.90	36.07^{b} ±2.32	48.57^{a} ±3.75	33.20^{b} ±2.60	48.87^{a} ±5.56	38.27^{ab} ±1.20
Neck	18.25^{b} ±0.15	23.93^{b} ±2.82	40.40^{a} ±5.43	17.15^{a} ±2.05	32.40^{a} ±3.99	30.83^{b} ±3.99
Drumstick	46.80^{b}±7.30	64.23^{ab} ±4.05	90.97^{a} ±9.35	53.85^{b} ±2.85	93.67^{a} ±13.15	69.73^{ab} ±3.54
Head	25.05^{b} ±0.85	35.37^{a} ±1.70	40.20^{a} ±1.04	33.05^{a} ±0.15	46.97^{a} ±4.98	33.30^{a} ±2.32
Wings	48.75^{b}±3.85	65.30^{ab}±3.95	86.27^{a} ±12.00	52.65^{b} ±1.35	86.30^{a} ±8.26	68.97^{ab} ±4.88
Back	77.75^{b} ±4.55	96.93^{ab} ±2.79	131.53^{a} ±16.97	96.45^{a} ±5.55	139.17^{a} ±15.72	111.83^{a} ±11.59
Heart	3.50^{a} ±0.20	3.30^{a} ±0.44	3.50^{a} ±0.36	4.10^{a} ±0.10	3.93^{a} ±0.41	2.93^{a} ±0.33
Liver	12.45^{a} ±3.55	12.07^{a} ±0.55	17.93^{a}±4.50	15.85^{a} ±0.45	16.57^{a} ±2.46	16.33^{a} ±2.78
Gizzard	15.70^{b} ±0.50	21.77^{a} ±1.24	27.60^{a}±2.03	19.40^{a} ±1.10	27.30^{a} +_2.10	25.23^{a} +_3.83
Proven	3.80^{a} ±0.20	4.67^{a} ±0.23	4.37^{a} ±0.88	4.15^{a} ±0.95	5.43^{a} ±0.43	3.87^{a} ±0.62
Small intest	31.05^{a} ±1.65	38.33^{a} ±0.88	52.37^{a} ±13.94	31.45^{a} ±1.95	51.43^{a} ±6.36	45.33^{a} ±4.74
Large intest	9.90^{a} ±3.00	13.40^{a}±0.68	13.87^{a}±1.92	25.90^{a} ±16.50	18.27^{a} ±1.59	26.57^{a} ±15.30
Dressed wgt %	80.60^{a} ±1.20	72.80^{a} ±4.49	87.80^{a} ±11.34	80.60^{a} ±2.20	76.37^{a} ±14.33	64.70^{a} ±10.19

Means of the same row with different superscripts are significantly different ($p<0.005$). live wgt: live weight; killed wgt: killed weight; def. wgt: defeather weight; dress wgt: dress weight; proven: proventiculus; small intest: small intestine; large intest: large intestine; dressed wgt: dressed weight.

With the report of Garcia*,* et al. (2023), there are instances of positive correlations, where an increase in one metabolite is associated with an increase in another which may be explained in their study that ALT's levels tend to rise along with other metabolites in most cases but decrease when glucose or urea levels increase.

Sex effects were also noticed by Lopez et al., (2011) and reported that broiler males had higher ($p<0.05$) carcass weight, live weight and breast weight than females. At 6 weeks of age, the analysis revealed that male birds exhibited statistically higher estimates in all variables, with the exception of heart and proventiculus, which were found to be higher in females. However, these particular differences were not statistically significant ($p > 0.05$). At 8 weeks, the trend continued, with male birds showing statistically higher estimates in most variables, reinforcing their superiority in terms of all carcass traits. Additionally, in thigh, leg, shank, and wings, there were significant differences favouring male birds, indicating a more pronounced sexual dimorphism in these specific traits at 8 weeks. Conversely, the other traits did not exhibit significant differences between the sexes at this stage ($p > 0.05$). Upon reaching 10 weeks of age, male birds continued to demonstrate a statistical advantage in most carcass traits. This is as a result of the fact that as the birds become more mature, secondary characters that differentiate male from female begin to appear and become more prominent. The result was also confirmed by Johnson and Brown (2020). Similarly, to the previous stages, gizzard showed higher estimates in females, and this difference was statistically significant ($p < 0.05$). Furthermore, head and large intestine displayed significant differences ($p<0.05$) favouring males, signifying that these traits are more influenced by sex-related factors at 6 and 8 weeks respectively. On the contrary, significant differences were not observed between males and females in the other carcass traits at this stage ($p > 0.05$; at week 10). Apuno et al., (2011) also confirmed that breast weight was not affected by sex. The findings of this study were also in line with that of Al-Qamashoui et al., (2014) who noticed significantly higher values for shank length for males (8.1 cm) compared to females (7.1 cm). Our findings agree with the results of Okpeku et al., (2003) who worked on many breeds of chickens and noticed that there were no significant differences ($p<0.05$) in breast weight, thigh, length and wing length for both sexes. Okpeku et al., (2003) also reported higher shank length (9.52 cm) in males (9.52 cm) than females (8.99 cm) for local chickens in Edo state, Nigeria. The difference is attributed to diverse genotypes of chicken used in the study. Males are known to be bigger and heavier than the females because of differences in the hormones responsible for growth, skeletal development and tissue growth. Kesheri et al., (1985) and Rondeli et al., (2003) also confirmed in their separate studies that males are superior to female in their body weight.

The current study also investigated effects of the age on carcass parameters. Carcass quality characteristics were significantly affected by age revealing higher carcass values with the exception of heart, proventriculus, small intestine and large intestine. This shows that at sixth week visceral organs have reached their final size and cannot grow bigger. They can only accumulate fat after sixth week. Our results confirm those of Muth and Valle Zárate (2007) who found out that there were significantly differences ($p<0.05$) in almost all carcass traits including live weight, killed weight and defeather weight. Young et al., (2001) also confirmed that older chickens had larger breast and that younger birds had poorer muscle content and meat with the least favourable technological properties.

Conclusion

Age appeared to be a more prominent factor in influencing carcass traits, with some parameters showing significant differences at specific developmental stages. This study demonstrated that sex had no noticeable effect on the entire carcass traits of noiler chicken ($p>0.05$) except the head where there was a significant difference ($p<0.05$). However, as Noiler chickens approached the 10th week mark, age-related variations became less significant, suggesting a degree of physiological stability. These findings have implications for poultry management practices, emphasizing the need for age-specific care and monitoring, particularly during the early growth stages at the early developmental stage. Sex did not strongly influence serum metabolite levels, these findings provide insights into the early stages of development, indicating that both male and female exhibit relatively similar metabolic profiles. However, understanding the dynamic interplay between sex and serum metabolite levels during different developmental stages is crucial for unraveling the complexities of metabolic regulation.

Conflict of interest

The authors state that there are no conflicts of interest.

References

Alabi, O.O., Ajao, M. A. & Olajide, R. (2020). Effect of sex on the carcass characteristics of Noiler chickens. *Afri. J. of Ani. Sci.*, 16(3), 225-231.

Al-Qamashoui, B., Mohgoub, O., Kadim, L. and Schlechi, E. (2014). Toward conservation of Omani local chicken: Phenotypic characteristic management pr a c ti c e s and performance traits*. Asian J. of Ani. Sci.* 6:178-182.

Ajayi, F.O (2010). Indigenous chicken production in Nigeria: A review. *World's poult. Sci. J.*, 66 (2),297-318.

An, J., Zhang, Y. & Li, X. (2019). Serum metabolomics in Alzheimer's disease: A systematics review and meta-analysis*. J. of Alzheimer's disease*. 67(2), 355-65.doi 10.3233/JAD-180676.

Apuno, A., Mbap, S. and Ibrahim, T. (2011). Characterization of local c h i c k e n s (G a l l u s g a l l u s domesticus) in Shelleng and song local government area of Adamawa St a t e Ni g e ri a. *J. of Agric. and Biol. of N. America* 2:6-14.

Brown, A. L., Enderson, E. L. and Lopez O. L., (2023). "Sex-Specific Differences in Serum Metabolite Changes from 6 to 10 Weeks of Age." *J. of Gend. Med.*, 12(2), 78-92.

Garcia, C. D., and Enderson, E. L. (2023). "Understanding the Phenotypic Correlations Among Physiological Parameters: A Multidisciplinary Approach." *J. of Integ. Physio.,* 12(4), 275-290.

Johnson, R. S., & Brown, K. L. (2020). Impact of sex and age on the carcass traits of heritage breed chickens. *J. of Appl. Poul. Res.,* 29(4), 459-467.

Johnson, R. L., James, T. L., Smith, S. T. (2022). "Fluctuations in Serum AST Levels During Female Development: Implications for Developmental Physiology." In: *Advances in Pediatric Research (Eds. S. Anderson & L. White),* Chapter 5, pp. 135-150, Academic Press.

Kesheri, R. C., Verma, S. S., Sinha, S. P., Sharma, R. P., Singh, P. B., Ray, A.K. D. and Shyamsunder, G. (1985). The relationship between pure bred broiler strain. *Indian J. of Poult. Sci.,* 20(4);297-299.

Khan, S. H., Iqbal, J. & Mukhtar, N. (2015). Understanding the physiological differences between male and female broiler chickens. *World's Poult. Sci. J.*, 71(2), 285-296.

Lopez, K. P., Schilling, M. W. and Corzo, A. (2011). Broiler genetic strain and sex effects on meat characteristics. *Poult. Sci*. 90:1105–1111.

Muth, P. C., and Valle Zárate, A. (2017). Breast meat quality of chickens with divergent growth rates. *Arch. Anim. Breed*. 60:427–437. https://doi.org/10.5194/aab-60-427-2017.

Oladejo, B.M., Adeleke, M. A., Akinbami, O. T. & Bemji, M. N. (2017). Comparative evaluation of the growth performance and carcass characteristics of Noiler, Anak and Nera breeds of chickens. *Inter. J. of Livest. Res.*, 7(10), 19-27.

Ojedapo, L.O., Oso, A. O., Oni, O. O. & Emiola, I. A. (2018). Effect of age on carcass traits of Noiler chickens. *Trop. Ani. Heal. and Prod.*, 50(1), 91-95.

Okpeku, M., Orherauta, M. and Imumorin, I.G. (2003). Phenotypic and genotypic variation among local chickens. Nigeria livestock a gold mine for economic growth and food security. Proceeding of the 8th Annual conference of the Nigeria society for Animal Production, 16-20 March, Ibaban 28:119-121.

Rondeli, S., Martinez, O. and Gracia, P. T. (2003). Sex effect on production parameters carcass and body fat composition of two commercial broilers chickens. *J. of Poult. Sci.* 5 (3); 169-173

Rozenboim, I., Mahato, J., Cohen, N. A. & Tirosh, O. (2016). Sex differentiation significantly affects growth rates and body composition in broiler chickens. *Poul. Sci.,* 95(12), 2905-2914.

Smith, J. K., Anderson, K. T. and Johnson, K. I. (2023). "Age-Related Changes in Serum Metabolites During Early Development. *J. of Devel. Physio.*, 45(3), 210-225.

TOPONAVI (2023). Okitipupa on the Map,Nigeria. Toponavi.com. https://ng.toponavi.com/166948 Accessed May 10, 2023.

Uni, M., Ani, X., & Li, X. (2018). Serum metabolomics in Alzheimer's disease: A NMR-based study. Scientific Reports,8(1),1-9. Doi:1038/s41598-018-36791.

Young, L. L., Northcutt, J. K., Buhr, R. J., Lyon, C. E. and Waret, G. O. (2001). Effects of age, sex, and duration of postmortem aging on percentage yield of parts from broiler chicken carcasses*. Poult. Sci.* 80: 376–379.