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Influence of Age on the Carcass characteristics, Carcass Measurements and Physico-chemical Qualities of Emu meat in Chiller Storage

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ABSTRACT: The misconceptions towards red meat (beef, mutton, chevon and pork) consumption and the association of several cholesterol associated problems and heart diseases with meat consumption and the ever persisting religious taboo on beef slaughter and consumption have created a thrust to look for an alternative red meat that will meet the highest protein and iron requirements, but with lowest cholesterol and at the same time of high nutritive value invariably consumed by all the communities as well as by all age groups in India. In the current scenario, the best alternative of red meat with the above expected perspectives emerges to be the Emu meat.

Emu birds of two different age groups (15 and 18 months old, thirteen in each group) were studied for their Carcass characteristics, measurements and physico –chemical qualities of meat in chiller storage. The observations of this study revealed that emu meat could be a potential red meat alternative and that these birds could be a significant source of lean meat, fat, skin and edible by – products. Increase in age showed a significant and progressive increase in live weight and carcass weight with a highly significant difference being recorded in dressing percent between the two groups. The weight and yield of edible and inedible offals showed a linear increase with age. The measurements of neck, shank, chest girth, gigot length and gigot width reflected on the carcass weights and dressing yields of emu carcass. Of the seven wholesale cuts (neck, rib, breast, drumstick, thigh, loin and rump) obtained, drumstick and thigh were observed to be the most lean portions. Highly significant (P<0.01) difference was noticed in the meat: bone ratio between the two groups. There was no consistent effect of age on pH obtained and no significant difference was observed between the two age groups (15 and 18 months). The water holding capacity decreased as age advanced and with increase in storage periods. There was highly significant difference in fiber diameter and sarcomere length of emu meat between age groups and storage periods for both age groups. Drip and Cooking loss values were higher in the 18 months old group.

Keywords: Emu meat, Carcass characteristics, Carcass measurements, Carcass Yield, pH, WHC, ERV, Fibre diameter, Sarcomere Length, Drip loss and Cooking loss.

INTRODUCTION

According to United States Department of Agriculture (USDA), the demand for animal proteins is going to increase by two-third by 2050 (Anderson & Hoke 1990). Increasing global requirements and the ever-changing consumer demand for sustainable, economically viable, quality, and healthier meat and meat products warrants the livestock sector to look for alternative meat animal/poultry source to feed the burgeoning population. The health-conscious consumers, who are becoming increasingly careful in choosing lean alternatives over traditional red meats, the misconceptions towards red meat (beef, mutton and chevon) consumption and the association of several cholesterol associated problems and heart diseases with meat consumption and the ever persisting religious taboo on beef slaughter and consumption have created a thrust and a growing demand to look for an alternative red meat.

Emu meat tends to be of interest to health conscious meat eaters owing to its specific characteristics of subcutaneous fat deposition unlike other red meat and lesser intramuscular fat. The meat is found to have lower fat and calorific value than beef, pork and chicken but similar to deer meat with highest iron sodium content (Daniel *et al*., 1997). The ω-3 and ω-6 polyunsaturated fatty acids (PUFA) derived from α-linolenic and linoleic acids, respectively of emu meat fitted well within the recommended range (4:1 to 10:1) for human health (Health and Welfare, Canada, 1990).

Ever since the start of commercial emu industry, much attention has been focussed only on emu oil production owing to its cosmetic and pharmaceutical utility and also on other marketable emu products from egg shell, leather and feathers. Lack of knowledge and awareness of beneficial properties of emu meat has hampered the effective utilization of emu meat for human consumption and has compelled it to remain an accessory product instead of being a main product of this industry. In spite of its healthier composition as evident from the limited available literature (Daniel *et al*., 2000), the emu farmers around the world are finding it difficult to market this new source of meat successfully.

An attempt for an efficient utilization of this lean red meat thereby fulfilling the protein demand and alleviating malnutrition and anaemia is the need of this era. Although some research work has been documented on nutritional and managemental aspects of emus, no work has been carried on the carcass characteristics and physico – chemical quality of emus bred and grown in India. Hence, this study was undertaken with an intention to change the present scenario of emu meat.

MATERIALS AND METHODS

Slaughter and dressing of birds: The birds were given adequate rest in the lairage and were kept off feed overnight. The birds were individually weighed and subjected to ante - mortem inspection and slaughtered as per the standard procedure adopted at the Department of Livestock Products Technology (Meat Science), Madras Veterinary College, Chennai – 600 007. All the birds were electrically stunned and bled. The weight of the blood was recorded and weight of the skin was noted after defeathering and deskinning. After evisceration, post-mortem examination was carried out and the carcasses were fabricated.

The carcass parts and visceral organs of the birds were weighed separately. The gizzard, stomach and intestines were also emptied and their weight was recorded. Carcasses were washed and then chilled at 4 ± 1°C for 24 hours and their weight before and after chilling was recorded. The loss of weight after chilling the carcass was recorded to calculate the chiller shrinkage. Then the lean meat, separable fat and bone were separated and their weight were recorded to calculate the meat: bone ratio.

Carcass Measurements: Measurement of carcass length, shank length, chest girth, length of the neck and intestines, gigot length and gigot width were recorded before fabrication. The Gigot length and Gigot width was measured as per the method suggested by Anous and Mourad (2001).

Carcass Fabrication: Carcasses were weighed after chilling before fabrication. The carcasses were fabricated as per procedure outlined by the Department of Livestock Products Technology (Meat Science), Madras Veterinary College into Neck, Rib, Breast, Thigh, Drumstick, Loin and Rump. The cuts were weighed individually and stored at 4 ± 1°C for subsequent analysis.

Physico - Chemical Characteristics: The influence of age (15 and 18 months) on pH, water holding capacity, R – value, fibre diameter, sarcomere length, myofibrillar fragmentation index, thiobarbituric acid number and tyrosine value of emu meat at different storage periods (0, 1st, 2nd, and 7th day) were carried out.

RESULTS AND DISCUSSION

Live weights, Carcass weights and Dressing percentage: Mean values and standard error for live weight (kg), carcass weight (kg), chilled carcass weight (kg), chiller shrinkage (%), dressing per cent, meat: bone ratio, drip loss (%) and cooking loss (%) of emus of 15 and 18 months age groups are presented in Table 1 along with test of significance.

There was a highly significant (P<0.01) difference observed in the carcass characteristics except in drip loss where there was no – significant difference (P>0.05) observed in between 15 and 18 months emus. The live weights recorded in emus of 15 months age group and 18 months age group were lower (27.85 kg and 30.62) when compared to the live weights recorded at 14 months age group (40 kg) by Mannion *et al*., 1995, 40.6 kg at 17.5 months by Frapple and Hagan (1992) and (35.1 kg) by Daniel (1995). Significant and progressive increase in live weight and carcass weight was observed with advancement of age in the present study.

Dressing percentages of emus of 15 and 18 months were 65.06 and 67.95 respectively and were similar to that recorded by Daniel (1995). Significant increase in dressing percentage with increase in age was also observed. In contrary, decrease in dressing percentage with increase in age was reported by Morbidini *et al.* (1987) in sheep and Cifuni *et al*. (2000) in lambs whereas there was an increase in dressing percentage in buffaloes as was observed by Rao *et al*. (2009). The dressing percentage of emus as percent of live weights obtained in this study was almost similar to the values reported by Smetana (1993); Reddy *et al*. (2004).

The dressing percentage of emus was significantly higher than that in other red meat species, such as beef (50–55%), sheep and goat (50%) (Warris, 2000). However, the dressing percentage of emus was similar to pigs (70–75%) and broiler chickens (70–72%) (Warris, 2000).

The highly significant difference (P<0.01) in meat-bone ratio might be attributed to the increased fat deposition in older age groups as inferred by Cifuni *et al*. (2000) in lambs. The findings of non significant difference in cooking loss between age groups in this study concurred with the results of Sales (1994) in ostriches, Gullet *et al*. (1996) in beef and Hoffman and Fisher, (2001) in ostriches.

Carcass measurements: Mean values and standard error for the carcass measurements (in cm) of the length of the carcass, neck, shank, trachea, oesophagus, intestine, chest girth, gigot length and gigot width of the emus of 15 and 18 month age groups are presented in Table 2 along with test of significance.

A highly significant difference (P<0.01) in the carcass measurements was noticed between emus of 15 and 18 months age groups. There was a gradual and highly significant difference (P<0.01) in the length of the carcass (cm), neck (cm), shank (cm), trachea (cm), oesophagus (cm), intestine (cm), chest girth (cm), gigot length (cm) and gigot width (cm) between emus of 15 and 18 months age groups. The measurements of neck, shank, chest girth, gigot length and gigot width reflected on the carcass weights and dressing yields of emu carcass.

An increase in neck length of the emus contributed to increase in carcass weight and dressing percentage. Chest girth measurements reflected on the live weight of the birds, which are very much helpful in selection of the birds for slaughter. Ogah (2011) inferred that chest circumference had the highest predictive power in live weight estimate. The observation made in this study was in agreement with this statement. Carcass measurements were shown to have higher correlation between live weight and carcass lean content in poultry (Bochno *et al.,* 1997, 1999 and Michalik *et al*. (2002). Similar observations in terms of increase in carcass weight reflected by the Gigot length and Gigot width observed in this study was in agreement with the findings of Anous and Mourad (2001) in Alpine kids (goat).

Percent Yields of Edible and Inedible offals: Mean values and standard error for the weights (kg) and per cent yields of edible offals like heart, liver, kidney and gizzard from emus of 15 and 18 month age groups are presented in Table 3 along with test of significance. Mean values and standard error for the weights (kg) and per cent yields of inedible offals like blood, feather, skin, shank, head, lungs, intestines, proventriculus, spleen, trachea, oesophagus and wings from emus of 15 and 18 month age groups are presented in Table 4 along with test of significance.

There was a highly significant difference (P<0.01) noticed in the per cent yields of kidney, in the per cent yields of inedible offals like blood, shank, proventriculus, spleen, trachea, oesophagus and wings and a non - significant difference (P>0.05) noticed in the percent yields of heart, liver, gizzard and inedible offals such as skin, head and intestines between emus of 15 and 18 months age groups. in the per cent yields of of emus between the 15 and 18 months age groups.

The weights and yields of heart and liver of emus of both the age groups observed in this study were closer to the values recorded by Sales *et al*. (1999) but were slightly lower than the values reported by Daniel (1995). There was highly significant (P<0.01) and a linear increase in the weights of edible offals observed as age advanced. The yields of offals (per cent) such as heart, liver and gizzard did not show significant increase with age.

It was observed that the weights of all inedible offals of emus of both the age groups increased significantly (P<0.01) as age advanced. The significant increase (P<0.01) in weights of head and skin recorded as the age increased was in agreement with the results obtained by Salem *et al*. (1983); Rao *et al.* (2009) in buffaloes. However, the yields of offals such as skin, head and intestines did not differ significantly (P>0.05) with increase in age.

Percent weight and yields of cut up parts: Mean values and standard error for the weights (kg) and per cent yields of cut up parts like neck, rib, breast, drumstick, thigh, loin, rump and fat from emus of 15 and 18 month age groups are presented in Table 5 along with test of significance.

A highly significant difference (P<0.01) was noticed in the mean values of weights and per cent yields of cut up parts except the ribs of emus of 15 and 18 months age groups. The test of significance did not reveal any significant difference (P>0.05) in pH and R – values between emus of the two age groups on 0, 1st 2nd and 7th day of chiller storage. A highly significant difference (P<0.01) was observed in water holding capacity, fibre diameter, sarcomere length and myofibrillar fragmentation index values between emus of the two age groups on 0, 1st 2nd and 7th day of chiller storage.

Specific procedures for carcass fabrication of emus have not yet been evolved except that followed by the Australian Quarantine Inspection service guidelines, (AQIS, 1993). Hence fabrication procedure that would suit the Indian emu market was newly experimented. Of the seven wholesale cuts (neck, rib, breast, drumstick, thigh, loin and rump) obtained, drumstick and thigh were observed to be the most lean portions.

Drumstick was the heaviest (4.41 kg) of all the emu cuts. This finding was in congruence with the observation made by Frapple, (1994). A significant effect of age was observed for limb and thigh yields with more favourable results produced by younger animals observed in this study was similar to that observed by Girolami *et al.* (2003) in ostriches.

A highly significant increase in the weights and yields of cut up parts such as neck, breast, rib and loin were observed with increase in age, whereas a highly significant decrease in the weights of cut up parts such as drumstick, thigh and rump was observed with increase in age. These results are concurrent with that of results obtained by Cifuni *et al*., (2000) in lambs. In this study the decrease in weights and yields of these portions may be attributed to the increase in deposition of fat in the birds of this age group (18 months).

Physico chemical parameters: The mean ± S.E. values of pH, water holding capacity, R – Value, Fibre diameter, Sarcomere length, thiobarbituric acid number, tyrosine value and myofibrillar fragmentation index of emus of 15 and 18 months age groups for different periods (0, 1st, 2nd and 7th day) are presented in Table 6 along with analysis of variance and test of significance.

pH: There was no consistent effect of age on pH obtained and no significant difference was observed between the two age groups (15 and 18 months). The mean pH values obtained in both the age groups were similar to that obtained by Berge *et al*., (1997) in emus and were much lower than values obtained by Morris *et al*. (1995); Sales and Mellet (1996) in ostriches. The progressive decrease in pH values during the storage periods indicated a normal trend. Similar decrease in pH on storage was also observed by Kandasami (1983) in cara beef; Rathina raj *et al*. (2000) in chevon; and Rao *et al*. (2009) in buffaloes. The results obtained in the study were contradictory to the study made by Reddy *et al*. (2004) in pH of frozen emu meat.

Water holding capacity: There was a highly significant difference in water holding capacity of emu meat at different storage periods and between the two age groups. The water holding capacity decreased as age advanced and with increase in storage periods. The WHC values of emu meat observed in the present study was higher than that reported for chicken (40–47%) and ground buffalo meat (42%) (Naveena and Mendiratta 2001; Naveena *et al*., 2011).

R – Value: The measurement of R – value is used to assess the development / status of rigor mortis in post-mortem period. It was observed that the mean R – values at different storage periods (0, 1st, 2nd and 7th day) showed a gradual increase in different age groups upto 2nd day and a slight decrease at 7th day of storage. The R – value obtained in this study at 2nd day (1.25-1.29) in all age groups indicates the onset of rigor mortis during this period of chiller storage. An increasing trend in R – value noticed up to 48h period (1.06-1.25 in 15 months age group and 1.14-1.29 in 18 month age groups) indicated the advancing of rigor mortis and there after a slight decrease in the R – value. Similar changes were also observed by Sams and Mills (1993); Soares and Areas (1995); Rao *et al.* (2009) in other species.

Fibre diameter (μm): There was highly significant difference in fiber diameter of emu meat between age groups and storage periods for both age groups. The observations made in this study are in congruent with the findings of Tuma *et al*. (1962); Romans *et al.* (1965); Kastner and Henrickson (1969). The gradual decrease in fiber diameter with increase in storage periods could be attributed to the fact of ageing which reflects in tenderness of meat. Similar results were reported by Rao *et al.* (2009).

Sarcomere length (μm): There was a highly significant difference in sarcomere length (μm) of emu meat between age groups and storage periods for both age groups. The values of sarcomere length (2.23 μm - 3.57 μm) obtained in this study were within the range (1.4 μm -3.6 μm) of values observed by Dingle (1997) in emu meat. Significant difference (P<0.05) between age groups was observed in the current study. The increase in sarcomere length with increase in storage period is attributed to the effect of ageing. The decrease in sarcomere length with advancement of age in this study was complemented by Ffoulkes (1992).

Thio barbituric acid number: A significant difference (P<0.05) in thiobarbituric acid number values was observed between emus of the two age groups on 0, 1st, 2nd and 7th day of chiller storage. There was a gradual and highly significant increase in the thiobarbituric acid number of emu meat for both the age groups as storage increased. This finding was in agreement with that found by Arif *et al.* (1993) in stored chicken meat and Prabhakara Reddy *et al*. (2007) in TBA values of frozen emu meat. However, the observations obtained by Cifuni *et al*. (2000) in lambs were contrary to the above reports.

Tyrosine Value: No significant difference (P>0.05) was noticed in tyrosine values between emus of the two age groups for different periods (0, 1st, 2nd and 7th day), but there was a gradual and highly significant increase in the tyrosine values of emu meat for different storage periods in both the age groups. Rajkumar *et al*. (2007); Manimaran (2007) also reported progressive increase in tyrosine value of meat and meat products during chiller storage.

Myofibrillar fragmentation index (MFI): Myofibrillar fragmentation index (MFI) is an accurate index of tenderness and is an useful indicator of the extent of proteolysis. There was a highly significant difference in MFI of emu meat between age groups and between storage periods for both age groups. Significant differences in MFI between age groups were also observed by Kandeepan *et al.* (2009) in buffalo meat. The increase in myofibrillar fragmentation with storage period is a reflection of tenderization that is associated with post mortem ageing (Moller *et al*., 1973; Olson *et al*., 1976).

Table 1: Influence of age on the carcass characteristics (Mean ± S.E.) of emu.

Carcass characteristics	Age (months)		t - value
	15	18	
Live weight (Kg)	27.85 ± 0.29	30.62 ± 0.12	8.86**
Carcass weight (Kg)	18.12 ± 0.22	20.81± 0.17	9.44**
Chilled Carcass weight (kg)	16.65 ± 0.27	19.59 ± 0.17	9.07**
Chiller Shrinkage (%)	8.14 ± 0.73	5.86 ± 0.28	2.91*
Dressing per cent (%)	65.06 ± 0.41	67.95 ± 0.34	5.40**
Meat : Bone ratio	3.02 ± 0.04	2.65 ± 0.03	5.52**
Drip loss (%)	1.71 ± 0.989	2.32 ± 0.76	0.36^{NS}
Cooking loss (%)	31.19 ± 0.12	30.74 ± 0.15	3.15**

No. of samples – 8, means bearing different superscripts differ significantly.

* = significant (P<0.05), * * = highly significant (P<0.01).

Table 2: Influence of age on the carcass measurements (Mean ± S.E.) of emu.

Carcass measurements (cm)	Age (months)		t – value
	15	18	
Carcass length	46.43 ± 0.34	52.17 ± 0.32	12.32^{**}
Neck	56.97 ± 0.24	62.35 ± 0.81	6.35^{**}
Shank	53.26 ± 0.28	56.57 ± 0.30	8.15^{**}
Trachea	67.95 ± 0.33	75.78 ± 0.39	15.32^{**}
Oesophagus	71.33 ± 0.43	80.34 ± 0.38	15.66^{**}
Intestine	437.45 ± 1.91	452.12 ± 1.19	6.53^{**}
Chest girth	67.34 ± 0.19	72.06 ± 0.37	11.23^{**}
Gigot length	43.08 ± 0.52	53.20 ± 0.33	16.60^{**}
Gigot width	27.87 ± 0.19	33.86 ± 0.18	22.55^{**}

No. of samples – 8, means bearing different superscripts differ significantly.

* * = highly significant (P<0.01).

Table 3: Influence of age on the weights and per cent yields of the edible offals (Mean ± S.E.) of emu.

Edible offals (Kg)	Weights (Kg)		t - value	Yield (%)		t - value
	Age (months)			Age (months)		
	15	18		15	18	
Heart	0.38 ± 0.02	0.42 ± 0.01	6.75^{**}	1.35 ± 0.02	1.39 ± 0.02	1.74^{NS}
Liver	0.40 ± 0.02	0.44 ± 0.00	5.95^{**}	1.43 ± 0.02	1.45 ± 0.02	0.82^{NS}
Kidney	0.18 ± 0.02	0.23 ± 0.01	6.13^{**}	0.65 ± 0.02	0.74 ± 0.01	3.53^{**}
Gizzard	0.33 ± 0.02	0.37 ± 0.01	2.97^{*}	1.18 ± 0.02	1.22 ± 0.03	1.14^{NS}

No. of samples – 8, means bearing different superscripts differ significantly.

* = significant (P<0.05), * * = highly significant (P<0.01), NS = Non – significant (P>0.05).

Table 4: Influence of age on the weights and per cent yields of the inedible offals (Mean ± S.E.) of emu

Inedible offals	Weights (Kg)		t - value	Yield (%)		t - value
	Age (months)			Age (months)		
	15	18		15	18	
Blood	1.20 ± 0.02	1.63 ± 0.01	20.33^{**}	6.69 ± 0.14	8.24 ± 0.11	8.78^{**}
Feather	0.41 ± 0.02	0.55 ± 0.01	6.71^{**}	2.43 ± 0.11	2.76 ± 0.09	2.31^{*}
Skin	2.81 ± 0.01	3.19 ± 0.01	30.32^{**}	15.61 ± 0.21	16.12 ± 0.15	1.99^{NS}
Shank	1.06 ± 0.02	1.38 ± 0.01	15.51^{**}	5.92 ± 0.04	6.99 ± 0.12	8.44^{**}
Head	0.31 ± 0.01	0.36 ± 0.01	4.76^{**}	1.73 ± 0.03	1.79 ± 0.03	1.43^{NS}
Lungs	0.30 ± 0.02	0.35 ± 0.01	2.37^{*}	1.66 ± 0.09	1.74 ± 0.04	0.82^{*}
Intestines	0.59 ± 0.02	0.70 ± 0.02	4.36^{**}	3.31± 0.12	3.55 ± 0.09	1.51^{NS}
Proventriculus	0.07 ± 0.00	0.15 ± 0.01	9.81^{**}	0.39 ± 0.02	0.74 ± 0.04	7.95^{**}
Spleen	0.03 ± 0.00	0.07 ± 0.00	11.61^{**}	0.17 ± 0.02	0.37 ± 0.01	10.81^{**}
Trachea	0.14 ± 0.02	0.16 ± 0.01	4.19^{**}	0.56 ± 0.04	0.62 ± 0.05	3.25^{**}
Oesophagus	0.12 ± 0.01	0.14 ± 0.02	6.07^{**}	0.44 ± 0.02	0.52 ± 0.04	4.54^{**}
Wings	0.05 ± 0.00	0.07 ± 0.00	4.47^{**}	0.26 ± 0.02	0.33 ± 0.02	3.02^{**}

No. of sam2ples – 8, means bearing different superscripts differ significantly.
* = significant (P<0.05), * * = highly significant (P<0.01), NS = Non – significant (P>0.05).

Table 5: Influence of age on the yields of the different cut up parts (Mean ± S.E.) of emu.

Cut up parts (Kg)	Weights (Kg)		t - value	Yield (%)		t - value
	Age (months)			Age (months)		
	15	18		15	18	
Neck	0.47 ± 0.01	0.63 ± 0.01	15.80^{**}	1.67 ± 0.02	2.07 ± 0.01	17.34^{**}
Rib	0.42 ± 0.01	0.48 ± 0.02	2.94^{*}	1.52 ± 0.02	1.57 ± 0.06	0.89^{NS}
Breast	0.12 ± 0.01	0.17 ± 0.01	6.27^{*}	0.42 ± 0.02	0.55 ± 0.02	4.62^{**}
Drumstick	4.41 ± 0.01	4.22 ± 0.03	17.35^{**}	15.61 ± 0.15	13.78 ± 0.09	8.15^{**}
Thigh	4.31 ± 0.07	4.04 ± 0.06	4.92^{**}	14.84 ± 0.19	13.21 ± 0.14	6.98^{**}
Loin	0.74 ± 0.02	0.85 ± 0.01	5.09^{**}	3.07 ± 0.05	2.42 ± 0.02	4.17^{**}
Rump	1.05 ± 0.01	0.87 ± 0.01	18.79^{**}	3.77 ± 0.02	2.85 ± 0.04	19.56^{**}
Fat	3.54 ± 0.08	4.68 ± 0.08	4.06^{**}	12.71 ± 0.20	15.30 ± 0.25	4.97^{**}

No. of samples – 8, means bearing different superscripts differ significantly.
* * = highly significant (P<0.01), NS = Non - significant (P>0.05).

Table 6: Influence of age on physico – chemical properties (mean ± SE) of emu meat at different storage periods.

Physico – chemical properties	Storage period (days) → Age (months) ↓	0^{th} day	1^{st} day	2^{nd} day	7^{th} day	F - value
pH	15	5.66^{d} ± 0.01	5.61^{c} ± 0.01	5.46^{a} ± 0.01	5.52^{b} ± 0.00	717.09**
	18	5.65^{d} ± 0.01	5.58^{c} ± 0.01	5.43^{a} ± 0.01	5.53^{b} ± 0.00	560.02**
	t - value	1.55^{NS}	2.02^{NS}	1.21^{NS}	1.82^{NS}	-
WHC (cm^2)	15	1.62^{a} ± 0.02	1.84^{b} ± 0.03	2.27^{c} ± 0.02	2.82^{d} ± 0.01	642.14**
	18	1.76^{a} ± 0.04	1.95^{b} ± 0.04	2.16^{c} ± 0.02	2.74^{d} ± 0.01	538.99**
	t - value	10.76**	13.65**	13.74**	13.48**	-
R – value	15	1.06^{a} ± 0.00	1.22^{b} ± 0.00	1.28^{c} ± 0.00	1.24^{b} ± 0.00	224.56**
	18	1.09^{a} ± 0.00	1.24^{b} ± 0.00	1.29^{c} ± 0.00	1.23^{b} ± 0.00	76.80**
	t - value	1.83^{NS}	1.09^{NS}	1.69^{NS}	1.13^{NS}	-
TBA No. (mg. malonal / Kg)	15	0.56^{a} ± 0.00	0.53^{b} ± 0.004	0.67^{c} ± 0.00	0.71^{d} ± 0.00	115.47**
	18	0.67^{a} ± 0.00	0.65^{b} ± 0.00	0.69^{c} ± 0.00	0.73^{d} ± 0.00	131.07**
	t - value	2.74*	5.89*	6.27*	4.68*	-
TV (mg/100g)	15	1.10^{a} ± 0.003	1.16^{b} ± 0.021	1.22^{c} ± 0.006	1.24^{d} ± 0.009	74.86**
	18	1.09^{a} ± 0.007	1.15^{b} ± 0.005	1.23^{c} ± 0.010	1.26^{d} ± 0.006	65.37**
	t - value	1.39^{NS}	1.10^{NS}	0.95^{NS}	1.04^{NS}	-
Fibre diameter (µm)	15	14.35^{d} ± 0.07	13.65^{c} ± 0.10	12.82^{b} ± 0.10	11.29^{a} ± 0.09	195.55**
	18	17.27^{d} ± 0.06	15.73^{c} ± 0.04	14.33^{b} ± 0.05	12.14^{a} ± 0.05	180.08**
	t - value	29.09**	18.92**	14.30**	7.90**	-
Sarcomere length (µm)	15	2.92^{a} ± 0.03	3.14^{b} ± 0.04	3.30^{c} ± 0.05	3.57^{d} ± 0.04	41.18**
	18	2.23^{a} ± 0.05	2.68^{b} ± 0.04	2.95^{c} ± 0.04	3.20^{d} ± 0.05	81.08**
	t - value	10.64**	7.78**	9.58**	6.79**	-
MFI	15	720.75^{d} ± 2.37	708.25^{c} ± 5.29	695.88^{b} ± 2.23	672.88^{a} ± 1.43	40.93**
	18	737.38^{d} ± 2.63	725.13^{c} ± 2.36	710.00^{b} ± 2.62	695.38^{a} ± 1.73	59.48**
	t - value	14.69**	12.91**	14.11**	10.01**	-

No. of samples – 8, means bearing different superscripts within columns (a, b, c) differ significantly.
* = significant ($P<0.05$), ** = highly significant ($P<0.01$), NS = Non – significant ($P>0.05$).

CONCLUSIONS

Despite an increase in the dressing yields with age, the meat: bone ratio was found to influence the age of selection for marketing of birds for meat purpose, as there was increased fat deposition reported in the older age groups (18 months old). Emu meat has similarities both with poultry and red meats. The postmortem changes, viz., time required to reach ultimate pH and postmortem proteolysis (aging), in emu meat is very rapid like in other poultry meats. On the other hand, the color and texture characteristics are similar to red meats (Naveena, 2012).

Thus, the comparative analysis of the two age groups, gives a clear indication that the 15 month age group birds are more suitable for meat purpose.

FUTURE SCOPE

Emu meat is found to have similarities both with poultry meat for its tenderness and beef for its colour. More intense research on the muscle characteristics of this bird would enlighten the importance and usefulness of emu meat as the best alternative source for red meat.

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Conflict of Interest. None.

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