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Comparative serum biochemical characteristics of broiler and Kuttanad ducks

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Abstract

Comparative serum biochemical profiles of creatine kinase (CK), alanine transaminase (ALT), aspartate transaminase (AST) and lactate dehydrogenase (LDH) of meat type broiler and native Kuttanad ducks reared under normal farm conditions were evaluated. A total of 72 birds comprising twelve birds each of either sex from Vigova Super M broiler ducks aged six to eight weeks, Kuttanad ducks aged six to eight weeks and spent Kuttanad ducks aged above 72 weeks selected at random were used for the study. The levels of CK, ALT, AST and LDH were found to be in normal range in all the groups studied. The CK level were significantly higher in broiler ducks compared to Kuttanad ducks ($p < 0.01$). The levels of ALT and AST in spent Kuttanad ducks showed significant difference between males and females ($p < 0.05$). Also, there was no significant difference ($p > 0.05$) among the three groups for lactate dehydrogenase enzyme observed during the experiment. The results of present study provide the normal values of enzymes that can be used as a determinant of meat quality in broiler and Kuttanad ducks.

Keywords: Alanine transaminase, aspartate transaminase, broiler, creatine kinase, Kuttanad ducks, lactate dehydrogenase

Introduction

Serum biochemical profiles represent the injury occurring in the muscle tissue. Various muscular disorders could cause the sarcolemma's integrity to be compromised, allowing several enzymes to leak into the plasma or serum, including creatine kinase (CK), alanine transaminase (ALT), aspartate transaminase (AST) and lactate dehydrogenase (LDH) (Hochleithner, 1994; Hoffman and Solter, 2008) [4, 5]. Damage to the liver or muscles was associated with elevated ALT, AST, and LDH levels (Hochleithner, 1994; Lumeij, 2008) [4, 7]. Hoffman and Solter (2008) [5] stated that creatine kinase, an enzyme that was more specific for skeletal muscle and often used to distinguish whether increased concentrations of AST and ALT are from either liver or muscle damage. Thorstensson (1976) [17] suggested that the fibre type composition of skeletal muscle (the greatest component of lean body mass) may influence the amount of CK present in the serum especially since fast twitch (FT) fibres have been shown to have a higher CK activity than slow-twitch (ST) muscle fibres. Novak and Tillery (1977) [12] have shown that serum CK was strongly related to total lean body mass. Sinha *et al.* (2017) [15] studied the serum creatine kinase activity in Assam Pati ducks aged from two to 40 weeks and observed the activity as increasing with age. The present study was envisaged to investigate the normal levels of serum enzymes in Kuttanad and broiler ducks at six to eight weeks of age and spent Kuttanad ducks above 72 weeks of age, fed under age as well as production dependant feed regime to form a basis for the evaluation of quality of duck meat in these groups.

Materials and Methods

Sample collection

Comparative analysis of serum biochemicals of broiler and Kuttanad ducks were studied at the Department of Veterinary Anatomy, College of Veterinary and Animal Sciences (CVAS), Mannuthy. A total of 72 birds comprising twelve birds each of either sex from Vigova Super M broiler ducks aged six to eight weeks, Kuttanad ducks aged six to eight weeks and spent Kuttanad ducks aged above 72 weeks selected at random were used for the study (Table 1). The Vigova SuperM (White Pekin x Aylesbury) were purchased from M/s Moon Valley farm, Marathakkara whereas Kuttanad ducks from UPDF, Mannuthy. The study was approved by the Institutional Animal Ethics Committee and all procedures were performed in accordance

with the guidelines of “Committee for the Purpose of Control and Supervision of Experiments on Animals” for birds.

Blood samples were collected from six birds from each group at the time of slaughter or euthanasia. Blood was collected from the jugular vein in sterile centrifuge tubes without anticoagulant to separate the serum. After keeping the sample at room temperature for half an hour for the clot formation, it was kept in the refrigerator for half an hour. Serum was separated by centrifugation at 3000 rpm for 10 minutes and

the clear serum obtained was pipetted out for estimation of biochemical parameters such as creatine phosphokinase (CPK), lactate dehydrogenase (LDH), alanine transaminase (ALT) or serum glutamic pyruvic transaminase (SGPT) and aspartate transaminase (AST) or serum glutamic oxaloacetic transaminase (SGOT). Serum biochemical parameters were estimated in a fully automated blood analyzer using ready-to-use diagnostic kits made by Agappe Diagnostics Ltd, Ernakulam, Kerala.

Table 1: Experimental groups under study

Groups	Group I		Group II		Group III	
	Spent Kuttanad Ducks		Kuttanad Ducklings		Broiler Ducks	
Sex	Male (n=12)	Female (n=12)	Male (n=12)	Female (n=12)	Male (n=12)	Female (n=12)
Group ID	KDM	KDF	KDLM	KDLF	BDM	BDF
Age	>72 weeks	>72 weeks	6-8 weeks	6-8 weeks	6-8 weeks	6-8 weeks

All data were analysed by the two-way ANOVA model followed by Duncan's multiple-range tests using SPSS 24.0 for Windows statistical software package (Statistical Product and Service Solutions, Inc., USA) with each duck as the experimental unit.

Results and Discussion

Creatine kinase

Mean serum creatine kinase level was significantly higher for broiler duck both in males (108.03 ± 10.46 U/L) and females (120.53 ± 8.50 U/L) compared to other two groups. This might be due to increased type IIB fibres with higher CK activity in broiler ducks (Thorstensson, 1976) [17]. Even though the CK levels were higher in spent Kuttanad ducks than Kuttanad ducklings in both males and female groups, there was no significant difference between spent Kuttanad ducks and Kuttanad ducklings. However, Sinha *et al.* (2017) [15] studied the serum creatine kinase activity in Assam Pati ducks aged from two to 40 weeks and observed the activity increasing with age. This was due to the increased muscular activity with age, reflecting in the probable increased level of CK. Males and females within groups showed no significant difference between them among all the groups. Kuttanad duckling's male had a CK level of 40.48 ± 6.98 U/L and females had a CK level of 43.60 ± 1.13 U/L. Males and females of spent Kuttanad ducks had a CK levels of 50.28 ± 7.75 U/L and 57.10 ± 8.39 U/L respectively. Females of all the groups showed a slightly higher level of creatine kinase than males but the difference was not significant. The level of CK was within the normal level in all the birds studied and these observations were in accordance with the reports in normal captive waterfowl (Bollinger *et al.*, 1989) [1]. Bollinger *et al.* (1989) [1] stated that the CK levels in normal captive waterfowl were usually in the range of about 50 to 200 U/L, while the concentrations reported for waterfowl with myopathy were more than 1000 U/L. Mitchell and Sandercock (1994) [8] observed that the serum creatine kinase activities were increased with age in chicken, with commercial broilers showing greater activity values than their genetic predecessors.

Alanine transaminase

Mean serum alanine transaminase level was significantly lower in Kuttanad ducklings when compared to the other two groups in both males and females. The mean serum ALT values of males of spent Kuttanad ducks, Kuttanad ducklings

and broiler ducks were 28.59 ± 5.31 U/L, 14.13 ± 2.10 U/L and 27.73 ± 4.70 respectively. The mean serum ALT values of females of spent Kuttanad ducks, Kuttanad ducklings and broiler ducks were 19.16 ± 3.61 U/L, 11.65 ± 2.96 U/L and 34.50 ± 2.92 U/L respectively. The ALT levels observed were in partially accordance with the study of Campbell (2004) [2] and Lumeij (2008) [7]. In most species, variations in ALT activity were between 19 to 50 U/L (Campbell, 2004; Lumeij, 2008) [2, 7]. The maximum serum ALT was given by broiler duck females without any significant difference between broiler males. Males and females among all the groups showed similar values without any significant differences between them. These reports were in accordance with Mulley (1979) [9] who observed no significant difference between the sexes for serum ALT levels in black ducks. A study by Jerabek *et al.* (2018) [6] also observed minimum sex-related effect on ALT activity in hybrid mallard ducks. Spent Kuttanad ducks males showed significantly higher levels of ALT than Kuttanad ducklings males. These observations tally with the reports in young ones and adult drakes (Sreekumar *et al.*, 2009) [16], where the ALT values for the young ones was significantly lower than adult drakes. According to Sinha *et al.* (2017) [15], the level of serum ALT increased with age from two to 40 weeks-old birds.

Aspartate transaminase

The serum AST level was significantly higher for Kuttanad duckling males (72.70 ± 6.71 U/L) than spent Kuttanad duck males (62.59 ± 6.61 U/L) and broiler ducks males (61.52 ± 2.34 U/L). In females, spent Kuttanad ducks (78.29 ± 4.95 U/L) showed significantly higher serum AST than broiler ducks (45.88 ± 14.20 U/L) and similar to Kuttanad ducklings (74.70 ± 2.26 U/L). Sinha *et al.* (2017) [15] reported that the serum AST level increased with age in ducks. However, the present study showed significantly lower values in males of spent Kuttanad ducks than Kuttanad ducklings and in females, both groups showed similar values without any significant difference. Higher AST activities in females of Kuttanad ducklings and spent Kuttanad ducks than males. But in broilers, males had higher values than females. There was no significant difference between males and females in broiler ducks and Kuttanad ducklings. Mulley (1979) [9] also observed no difference in the values of serum AST in males and females. The mean values of AST showed no differences between either sex. On the contrary, spent Kuttanad ducks showed significant difference between males and females.

These observations were in par with the observations of Hochleithner (1994) [4]. Hochleithner (1994) [4] reported that the level of AST values was dependent on age and species. Sribhen *et al.* (2006) reported higher values of AST in males than in females in Siamese fighting fowl. The serum AST concentrations of pheasants were lower than the values in Japanese quail reported by Scholtz *et al.* (2009). Sreekumar *et al.* (2009) [16] noticed the values of AST for young ones (32.50 ± 1.03 U/L) as significantly lower than those of adult drakes (36.90 ± 1.59 U/L). Sinha *et al.* (2017) [15] reported that the serum AST level increased with age in ducks.

Lactate dehydrogenase

There was no significant difference observed between males and between females in the LDH levels among all the groups. Females had relatively higher values than males. Woodard *et al.* (1983), reported males with a significantly lower LDH than females. The level of LDH was within the normal range. Findings were in accordance with Nazifi *et al.* (2011) [10]. Nazifi *et al.* (2011) [10] reported that the mean values of LDH

showed no differences between either sex, but male Iranian chukar partridges had a lower LDH than females, and also, LDH levels in partridges were much higher than in chickens. Serum LDH values of sixteen-weeks-old male and female Iranian chukar partridges were 1878.92±119.95 U/L for males and 1987.13±114.95 U/L for females. The serum LDH level of male spent Kuttanad ducks, Kuttanad duckling and broiler ducks were 950.97 ± 144.88 U/L, 940.50 ± 63.48 U/L and 882.67 ± 186.86 U/L respectively. The serum LDH level of female spent Kuttanad ducks, Kuttanad duckling and broiler ducks were 1225.17 ± 118.14 U/L, 952.17 ± 49.84 U/L and 903.57 ± 115.88 U/L respectively. Newman *et al.* (1997) [11] noticed that the LDH levels significantly differed among marine avian species and was 1304±345 U/L, 1055±799 U/L and 1010±877 U/L for Common Murre, Crested Auklet and Glaucous winged Gull respectively. Silva *et al.* (2007) [14] reported that LDH and CK activities were higher at older ages in chicken. Guo *et al.* (2011) [3] proposed that the energy metabolism related enzymes, like LDH, may be related to meat quality.

Table 2: Blood biochemical parameters between groups and sexes (Mean±S.E.), U/L

Parameters	Sex	Spent Kuttanad ducks	Kuttanad ducklings	Broiler ducks	p-value		
					G	S	G x S
CK	Male	50.28 ± 7.75 ^b	40.48 ± 6.98 ^b	108.03 ± 10.46 ^a	< 0.001 (**)	0.248 (ns)	0.832 (ns)
	Female	57.10 ± 8.39 ^b	43.60 ± 1.13 ^b	120.53 ± 8.50 ^a			
ALT	Male	28.59 ± 5.31 ^a	14.13 ± 2.10 ^b	27.73 ± 4.70 ^a	< 0.001 (**)	0.580 (ns)	0.114 (ns)
	Female	19.16 ± 3.61 ^b	11.65 ± 2.96 ^b	34.50 ± 2.92 ^a			
AST	Male	62.59 ± 6.61 ^b	72.70 ± 6.71 ^a	61.52 ± 2.34 ^b	0.024 (*)	0.909 (ns)	0.120 (ns)
	Female	78.29 ± 4.95 ^a	74.70 ± 2.26 ^a	45.88 ± 14.20 ^b			
LDH	Male	950.97 ± 144.88	940.50 ± 63.48	882.67 ± 186.86	0.386 (ns)	0.390 (ns)	0.590 (ns)
	Female	1225.17 ± 118.14	952.17 ± 49.84	903.57 ± 115.88			

** Significant at 0.01 level; * Significant at 0.05 level; ns non-significant

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Means having different capital letter as superscript differ significantly within a column for each parameter

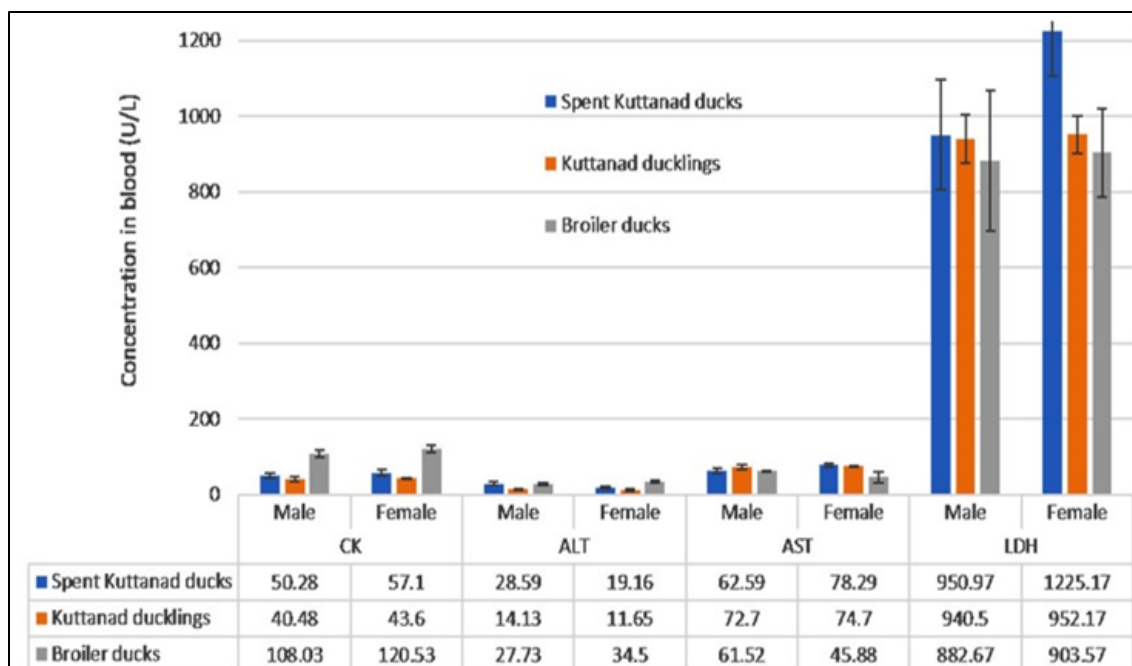


Fig 1: Serum biochemical analysis of spent Kuttanad ducks, Kuttanad ducklings and broiler ducks (U/L)

Conclusion

In the present study, significantly higher CK activity in broiler ducks were observed and the result attributed to the presence of more type IIB fibres in broiler ducks. Spent Kuttanad

ducks and Kuttanad ducklings showed similar levels of CK in blood without significant difference depicting the minimum change in the level of creatine kinase upon ageing. The level of ALT was significantly higher in broiler ducks compared to

other two groups and the ALT level in blood increased with age in spent Kuttanad duck males. Whereas the level of AST was significantly lower in broiler ducks compared Kuttanad ducklings of same age. There was no significant difference observed between males and between females in the LDH levels among all the groups.

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Conflict of interest

The authors declare that they have no conflict of interest.

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