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Study on effect of age on slaughter traits and carcass characteristic of black Bengal goats in different agro-climatic condition of West Bengal

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Abstract
The study was conducted on sixteen nos. of castrated male Black Bengal goats from four different agro climatic zones of west Bengal at the age group of 6-9 month, 9-12 month and above 12 month age were selected from registered farmer under "AICRP on goat improvement, Black Bengal field unit-Kolkata" to compare the slaughter traits and carcass characteristics of Black Bengal goats. In the present study, there is a highly significant ($p<0.01$) variation of body length (cm) of Black Bengal goats observed among the three age groups as well as the different clusters. It was found that the carcass weight (kg) of Black Bengal goats from different clusters namely Nadia, Murshidabad, Jhargram and Sundarban under four different agro-climatic zones at different age groups *viz.* 6-9 month, 9-12 month and above 12 month were 4.47±0.20, 6.14±0.20 & 8.39±0.20 in Nadia; 5.60±0.20, 7.82±0.20 & 8.85±0.20 in Murshidabad; 4.26±0.20, 6.30±0.20 & 7.40±0.20 in Jhargram and 4.37±0.20, 6.04±0.20 & 7.23±0.20 in Sundarban cluster respectively. At 6-9 months age, significantly higher body height (cm), heart girth (cm) and paunch girth (cm) were recorded in Jhargram cluster, followed by Murshidabad, Nadia and lastly Sundarban cluster. The carcass weight of Black Bengal goat in Murshidabad cluster at 6-9 month age group was significantly higher ($p>0.01$) than other three districts and lower ($p<0.01$) in Jhargram cluster. The optimum age for slaughtering of Black Bengal goats is 9-12 month because at this stage dressing % of slaughtering of Black Bengal goats as well qualitative parameters of chevon is better than other ages in all the clusters.

Keywords: Black Bengal goat, age, slaughter traits, carcass characteristics, agro-climatic zones

Introduction

Black Bengal goat is primarily a meat type breed, although it is also valued for its skin. Relatively a fewer studies conducted on meat production characteristics of Black Bengal goat (Chowdhury and Faruque, 2004) [2]. Consumers' highly expect that the products they purchase are of high quality and this is especially true for meat and meat food products (Thulasi, 2006) [12]. Consumers prefer meat cuts with high lean meat yield to carcass with higher proportions of fat (Johnson *et al.,* 1995) [7]. Chevon consumption in India, unlike beef and pork, has special socio-cultural prestige since it has no religious taboos (Verma *et al.,* 1996) [13]. Choosing a particular meat cut of a specific fatness level, prior to cooking and consuming it without added high energy condiments, as well as trimming on the plate, can make a significant contribution to decrease energy intake, from a total diet perspective (Schonefeldt and Gibson, 2008) [9]. Knowledge of the carcass composition is necessary to provide the preferred cut to the consumer as such or by further trimming of the cut to the consumers' preference (Hopkins *et al.,* 1995) [6]. Accurate nutrient composition data are essential in communicating nutrition information to consumers (Cobiac *et al.,* 2003) [3]. In this context, the present research work had been carried out in four different agro-climatic zones of West Bengal to compare the slaughter traits and carcass characteristics of chevon at different age groups under field condition at farmers door step.

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Material and Methods

A pilot survey for designing data collection format was conducted during the month of September, 2017 to March, 2018. All Parameters were studied at the Department of Livestock Products Technology, F/O-Veterinary and Animal Sciences, West Bengal University of Animal and fishery Sciences. The research programme was carried out in four adopted clusters of the ongoing project "AICRP on Goat Improvement, Black Bengal Field Unit - Kolkata" distributed in four agro-climatic zones (Coastal Saline Zone: Sundarban; Gangetic Alluvial Zone: Nadia; Undulating Red and Lateritic Zone: Jhargram and Old alluvial zone: Murshidabad) of West Bengal. In the present study, 6 nos. of castrated male Black Bengal goats from each agro climatic zone at the age group of 6-9 month, 9-12 month and above 12 month age were purchased from registered farmer under AICRP. Goats were weighted and kept off-feed overnight with free access to water and were slaughtered and dressed by the halal method in different local slaughter booths in the study areas. Immediately after dressing, chest circumference, carcass length and leg circumference of the carcass hanging with Achilles tendon were recorded using a measuring tape in centimetre. Carcasses were washed thoroughly using tap water after taking measurements. All the samples were weighed, covered with plastic wrap to prevent moisture loss and kept in chilled with ice pack and transported to departmental laboratory for storage and further study at 4+1 °C. Slaughter traits of Back Bengal goats like body length, body height, heart girth, paunch girth, loin width, and leg circumference and loin-eye area were estimated by graduated tape in centimetre and body weights were taken by digital weighing balance. All the data which were obtained during the present investigation were analyzed statistically to draw valid conclusion in SPSS (Version 16.0) software.

Results and Discussion

In the present study, there is a highly significant ($p<0.01$) variation of body length (cm) of Black Bengal goats observed among the three age groups as well as the different clusters (Table-1). The body length (cm) in four clusters (namely Nadia, Murshidabad, Jhargram and Sundarban in four different agro-climatic zones) at three different age groups viz. 6-9 month, 9-12 month and above 12 month were found to be 56±0.56, 61.83±0.56 & 69.50±0.56 in Nadia; 56.00±0.56, 65.00±0.56 & 73.00±0.56 in Murshidabad; 55.17±0.56, 62.33±0.56 & 69.00±0.56 in Jhargram; and 52.00±0.56, 62.00±0.56 & 68.33±0.56 in Sundarban cluster

respectively. At 6-9 months age, significantly higher body lengths were recorded in Nadia & Murshidabad cluster, followed by Jhargram and lastly Sundarban cluster. At 9-12 months age, the body length was found to be significantly higher in Murshidabad cluster than other three clusters. At above 12 months age, significantly higher values were observed in Murshidabad cluster, followed by Nadia & Jhargram and lastly Sundarban cluster. At 6-9 months age, significantly higher body height (cm) was recorded in Jhargram cluster, followed by Murshidabad, Nadia and lastly Sundarban cluster. At 9-12 months and above 12 months age, similar trend were also observed. At 6-9 months age, significantly higher heart girth (cm) was recorded in Murshidabad cluster, followed by Nadia, Jhargram and lastly Sundarban cluster. At 9-12 months age, significantly higher heart girth (cm) was recorded in Murshidabad cluster than others and above 12 months age, similar trend was also found. At 6-9 months age, significantly higher paunch girth (cm) was recorded in Murshidabad cluster, followed by Nadia and lastly Jhargram & Sundarban cluster. At 9-12 months age, similar trend were also recorded, but above 12 months age, significantly higher paunch girth was found in Murshidabad cluster and no significant differences were recorded in other three clusters. At 6-9 months age, significantly higher body weight (kg) was recorded in Murshidabad cluster, followed by Nadia and lastly Sundarban & Jhargram cluster. At 9-12 months age, the body weight was found to be significantly higher in Murshidabad cluster than other three clusters. At above 12 months age, similar trend were also noticed. Mursheda *et al.,* (2014) [8] also recorded the body length-54.66±0.67, body height-60.58±2.24, hearth girth-59.66±0.44, punch girth-73.66±0.44, body weight 19.03±0.26 of Black Bengal goat at two years age. Similar observations were also recorded by Chowdhury and Faruque, (2004) [2]. Das and Rajkumar, (2010) [4] also reported that the height, body length, heart girth, paunch girth, body weight in three Indian goat breed like barbari, marwari, jamunapari. Sikdar *et al.,* (2015) [10] also reported that the body weight of Black Bengal goat at 6-9 month was 11.046±0.088 and at 9-12 month &above was 11.282±0.130. Mursheda *et al.,* (2014) [8] reported that the body characteristics of Black Bengal goat mean value were Body length (cm) 54.66, Height at Wither (cm) 60.58, Heart girth (cm) 59.66 Paunch girth (cm) 73.66, and Body weight (kg) 19.03 respectively. The deviation of the results of our study may be due to age of the animal as well as geographical location and agro-climatic condition.

Table 1: Age wise variation of Slaughter Traits of Black Bengal goats

Parameter	Cluster	Age Group			
		6-9 month	9-12 month	Above 12 month	Overall
Body Length (cm)	Nadia	56.00±0.56[ar] (6)	61.83±0.56[bq] (6)	69.50±0.56[bp] (6)	62.44±0.33[b] (18)
	Murshidabad	56.00±0.56[ar] (6)	65.00±0.56[aq] (6)	73.00±0.56[ap] (6)	64.67±0.33[a] (18)
	Jhargram	55.17±0.56[br] (6)	62.33±0.56[bq] (6)	69.00±0.56[bp] (6)	62.17±0.33[b] (18)
	Sundarban	52.00±0.56[cr] (6)	62.00±0.56[bq] (6)	68.33±0.56[cp] (6)	60.78±0.33[c] (18)
	Overall	54.79±0.28[g] (24)	62.79±0.28[f] (24)	69.96±0.28[e] (24)	
Body Height (cm)	Nadia	41.67±0.50[cr] (6)	44.50±0.50[cq] (6)	45.50±0.50[cp] (6)	43.89±0.29[c] (18)
	Murshidabad	43.00±0.50[br] (6)	47.00±0.50[bq] (6)	48.00±0.50[bp] (6)	46.00±0.29[b] (18)
	Jhargram	43.61±0.50[ar] (6)	47.50±0.50[aq] (6)	49.45±0.50[ap] (6)	46.86±0.29[a] (18)
	Sundarban	40.00±0.50[dr] (6)	44.00±0.50[dq] (6)	45.00±0.50[dp] (6)	43.00±0.29[d] (18)
	Overall	42.07±0.25[g] (24)	45.75±0.25[f] (24)	46.99±0.25[e] (24)	
Heart Girth (cm)	Nadia	50.17±0.77[br] (6)	52.83±0.77[bq] (6)	56.67±0.77[bp] (6)	53.22±0.44[b] (18)
	Murshidabad	51.00±0.77[ar] (6)	56.00±0.77[aq] (6)	60.00±0.77[ap] (6)	55.67±0.44[a] (18)
	Jhargram	48.17±0.77[cr] (6)	53.67±0.77[bq] (6)	57.00±0.77[bp] (6)	52.94±0.44[b] (18)
	Sundarban	47.00±0.77[dr] (6)	53.00±0.77[bq] (6)	57.00±0.77[bp] (6)	52.33±0.44[b] (6)

Parameter	District	6-9 month	9-12 month	Above 12 month	Overall
	Overall	49.08±0.38^g (24)	53.88±0.38^f (24)	57.67±0.38^e (24)	
Paunch Girth (cm)	Nadia	55.67±0.57^{br} (6)	57.50±0.57^{bq} (6)	58.50±0.57^{bp} (6)	57.22±0.33^b (18)
	Murshidabad	57.00±0.57^{ar} (6)	59.00±0.57^{aq} (6)	60.33±0.57^{ap} (6)	58.78±0.33^a (18)
	Jhargram	53.17±0.57^{cr} (6)	56.67±0.57^{cq} (6)	58.83±0.57^{bp} (6)	56.22±0.33^c (18)
	Sundarban	53.00±0.57^{cr} (6)	56.00±0.57^{cq} (6)	58.33±0.57^{bp} (6)	55.78±0.33^c (18)
	Overall	54.71±0.29^g (24)	57.29±0.29^f (24)	59.00±0.29^e (24)	
Body Weight (kg)	Nadia	9.11±0.40^{br} (6)	11.90±0.36^{bq} (6)	15.84±0.31^{bp} (6)	12.28±0.22^b (18)
	Murshidabad	11.54±0.62^{ar} (6)	15.49±0.37^{aq} (6)	16.92±0.12^{ap} (6)	14.65±0.22^a (18)
	Jhargram	8.37±0.47^{bcr} (6)	12.21±0.21^{bcq} (6)	14.54±0.15^{cp} (6)	11.71±0.22^{bc} (18)
	Sundarban	8.70±0.56^{cr} (6)	12.00±0.33^{cq} (6)	14.24±0.16^{cp} (6)	11.64±0.22^c (18)
	Overall	9.42±0.19^g (24)	12.90±0.19^f (24)	15.39±0.19^e (24)	

#Means ± SE brief with super scripts a, b, c, p, q, r & g, r, e, significant within different cluster and different age group.

In the present study, there is a highly significant ($p<0.01$) variation of carcass weight (kg) of Black Bengal goats have been observed among the three age groups as well as the different clusters (Table-2a), it was found that the carcass weight (kg) of Black Bengal goats from different clusters namely Nadia, Murshidabad, Jhargram and Sundarban under four different agro-climatic zones at different age groups viz. 6-9 month, 9-12 month and above 12 month were 4.47±0.20, 6.14±0.20 & 8.39±0.20 in Nadia; 5.60±0.20, 7.82±0.20 & 8.85±0.20 in Murshidabad; 4.26±0.20, 6.30±0.20 & 7.40±0.20 in Jhargram; 4.37±0.20, 6.04±0.20 & 7.23±0.20 in Sundarban cluster respectively (Table-2a). The carcass weight of Black Bengal goat in Murshidabad cluster at 6-9 month age group was significantly higher ($p>0.01$) than other three districts and lower ($p<0.01$) in Jhargram cluster. Similarly in age group of 9-12 months and above 12 months, significantly ($p>0.01$) higher values were observed in Murshidabad cluster and lower in Sundarban cluster respectively. The carcass weight was significantly higher in Murshidabad cluster in all age groups. Table-2a represented the dressing percentage (%) of Black Bengal goats of different age groups and clusters. In 6-9 month age groups, the dressing percentage (%) was found to be significantly lower in goats from Nadia cluster and higher in Murshidabad cluster. In 9-12 month age groups, the dressing percentage (%) was found to be significantly lower in goats from Sundarban and higher in Murshidabad cluster. In above 12 month age groups, the dressing percentage (%) was found to be significantly lower in goats from Sundarban cluster and higher in Murshidabad cluster. The dressing percentage (%) was significantly higher in Murshidabad cluster in all age groups. Regarding Fore quarter (kg) of Black Bengal goats significantly higher values were recorded in Murshidabad cluster irrespective of 6-9 month and 9-12 month age group and above 12 month age group. But in 6-9 month age group lower values were observed in Jhargram cluster and in 9-12 month & above 12 month age group lower values were observed in Sundarban cluster. Similar trends were observed in hind quarter (kg), but lower chest circumference was noticed in Sundarban cluster and higher in Murshidabad cluster in all age groups.

Table 2a: Age wise variation of Carcass Traits (Mean ± SE) of Black Bengal goats

Parameter	District	Age Group			
		6-9 month	9-12 month	Above 12 month	Overall
Carcass Weight (kg)	Nadia	4.47±0.20^{br} (6)	6.14±0.20^{bq} (6)	8.39±0.20^{bp} (6)	6.33±0.12^b (18)
	Murshidabad	5.60±0.20^{ar} (6)	7.82±0.20^{aq} (6)	8.85±0.20^{ap} (6)	7.52±0.12^a (18)
	Jhargram	4.26±0.20^{br} (6)	6.30±0.20^{bq} (6)	7.40±0.20^{cp} (6)	5.99±0.12^c (18)
	Sundarban	4.37±0.20^{br} (6)	6.04±0.20^{bq} (6)	7.23±0.20^{cp} (6)	5.88±0.12^c (18)
	Overall	4.74±0.10^g (24)	6.58±0.10^f (24)	7.97±0.10^e (24)	
Dressing percentage (%)	Nadia	49.16±0.44^r (6)	51.61±0.44^q (6)	52.91±0.44^p (6)	51.22±0.25 (18)
	Murshidabad	51.06±0.44^q (6)	52.53±0.44^r (6)	53.29±0.44^p (6)	51.30±0.25 (18)
	Jhargram	50.87±0.44^q (6)	51.63±0.44^p (6)	50.87±0.44^q (6)	51.13±0.25 (18)
	Sundarban	50.20±0.44^q (6)	50.24±0.44^q (6)	50.72±0.44^p (6)	50.39±0.25 (18)
	Overall	50.32±0.22^g (24)	52.00±0.22^f (24)	53.70±0.22^e (24)	
Fore Quarter (kg)	Nadia	2.00±0.09^{br} (6)	2.70±0.09^{bq} (6)	3.52±0.09^{bp} (6)	2.74±0.05^b (18)
	Murshidabad	2.66±0.09^{ar} (6)	3.46±0.09^{aq} (6)	3.73±0.09^{ap} (6)	3.28±0.05^a (18)
	Jhargram	1.93±0.09^{br} (6)	2.77±0.09^{bq} (6)	3.10±0.09^{bcp} (6)	2.60±0.05^{bc} (18)
	Sundarban	1.97±0.09^{br} (6)	2.66±0.09^{bq} (6)	3.04±0.09^{cp} (6)	2.56±0.05^c (18)
	Overall	2.14±0.05^g (24)	2.90±0.5^f (24)	3.34±0.05^e (24)	
Hind Quarter (kg)	Nadia	1.63±0.07^{br} (6)	2.28±0.07^{bq} (6)	3.15±0.07^{bp} (6)	2.35±0.04^b (18)
	Murshidabad	2.14±0.07^{ar} (6)	2.89±0.07^{aq} (6)	3.31±0.07^{ap} (6)	2.78±0.04^a (18)
	Jhargram	1.58±0.07^{cr} (6)	2.33±0.07^{bq} (6)	2.77±0.07^{cp} (6)	2.23±0.04^c (18)
	Sundarban	1.59±0.07^{cr} (6)	2.23±0.07^{cq} (6)	2.71±0.07^{cp} (6)	2.18±0.04^c (18)
	Overall	1.73±0.04^g (24)	2.43±0.04^e (24)	2.30±0.04^f (24)	

#Means ± SE brief with super scripts a, b, c, p, q, r & g, e, r, significant within different cluster and different age group

In 6-9 month age group lower loin width (cm) was recorded in Sundarban cluster and higher values were recorded in Murshidabad cluster. At 9-12 month age group lower loin width was recorded in Jhargram & Sundarban cluster which was higher in Murshidabad cluster. At above 12 month of age group Nadia, Jhargram & Sundarban cluster showed lower values than Murshidabad cluster. The leg circumference (cm) and loin eye area (cm) of goats in all age group were lower in Sundarban cluster and higher values were recorded in Murshidabad cluster. Dressed carcass and edible portions were collectively considered as total edible portion. The dressing percentage observed in this study is similar to the value of 41.48% to 43.73% reported by Abedin *et al.,* (2005) [1] and Das *et al.,* (2011) [5] reported that dressed carcass and

edible portions were collectively considered as total edible portion. The dressing percentage observed in this study is similar to the value of 41.48% to 43.73%. Singh and Khan (1989) [11] reported that lower dressing percent of Black Bengal goats (38.61%). Chowdhury and Faruque (2004) [2] reported dressing percent of Black Bengal goat between 181 and 365 days of age was 46.4%. The variation in dressing percentage of Black Bengal goats observed by different investigators might be due to variation in age, body condition and nutritional status of the slaughtered animals. Mursheda *et al.,* (2014) [8] reported that the Carcass weight 7.48, and Dressing % 37.22, of Black Bengal goat. The deviation of the results of our study may be due to age of the animal as well as geographical location and agro-climatic condition. Das and Rajkumar (2010) [4] also reported that the fore quarter, hindquarter, chest circumference, loin width, leg circumference and loin eye area in three different Indian goat breed Barbari, Marwari and Jamunapari. The deviation of the results of our study may be due to age of the animal as well as geographical location and agro-climatic condition.

Table 2b: Age wise variation of Carcass Traits (Mean ± SE) of Black Bengal goats

Parameter	District	Age Group			
		6-9 month	9-12 month	Above 12 month	Overall
Chest Circumference (cm)	Nadia	37.17 ± 0.58^{br} (6)	41.50 ± 0.58^{bcq} (6)	43.83 ± 0.58^{bp} (6)	40.83 ± 0.33^{b} (18)
	Murshidabad	39.00 ± 0.58^{ar} (6)	44.00 ± 0.58^{aq} (6)	46.00 ± 0.58^{ap} (6)	43.00 ± 0.33^{a} (18)
	Jhargram	36.00 ± 0.58^{br} (6)	42.00 ± 0.58^{bq} (6)	43.67 ± 0.58^{bcp} (6)	40.56 ± 0.33^{bc} (18)
	Sundarban	35.00 ± 0.58^{cr} (6)	41.00 ± 0.58^{cq} (6)	43.00 ± 0.58^{cp} (6)	39.67 ± 0.33^{c} (18)
	Overall	36.79 ± 0.30^{g} (24)	42.12 ± 0.30^{f} (24)	44.12 ± 0.30^{e} (24)	
Loin Width (cm)	Nadia	9.92 ± 0.36^{br} (6)	10.40 ± 0.36^{bq} (6)	11.00 ± 0.36^{bp} (6)	10.44 ± 0.21^{b} (18)
	Murshidabad	11.00 ± 0.36^{aq} (6)	11.00 ± 0.36^{aq} (6)	13.00 ± 0.36^{ap} (6)	11.67 ± 0.21^{a} (18)
	Jhargram	9.00 ± 0.36^{cq} (6)	9.00 ± 0.36^{cq} (6)	11.00 ± 0.36^{bp} (6)	9.67 ± 0.21^{c} (18)
	Sundarban	8.00 ± 0.36^{cr} (6)	9.00 ± 0.36^{cq} (6)	11.00 ± 0.36^{bp} (6)	9.33 ± 0.21^{c} (18)
	Overall	9.48 ± 0.18^{g} (24)	9.85 ± 0.18^{f} (24)	11.50 ± 0.18^{e} (24)	
Leg Circumference (cm)	Nadia	10.67 ± 0.65^{br} (6)	14.00 ± 0.65^{bq} (6)	16.00 ± 0.65^{bp} (6)	13.56 ± 0.38^{b} (18)
	Murshidabad	17.00 ± 0.65^{ar} (6)	17.00 ± 0.65^{aq} (6)	17.00 ± 0.65^{ap} (6)	16.00 ± 0.38^{a} (18)
	Jhargram	11.00 ± 0.65^{br} (6)	13.00 ± 0.65^{bq} (6)	15.00 ± 0.65^{bp} (6)	13.00 ± 0.38^{b} (18)
	Sundarban	9.50 ± 0.65^{cr} (6)	12.00 ± 0.65^{cq} (6)	14.00 ± 0.56^{cp} (6)	11.83 ± 0.38^{c} (18)
	Overall	11.29 ± 0.33^{g} (24)	14.00 ± 0.33^{f} (24)	15.50 ± 0.33^{e} (24)	
Loin Eye Area (sq cm)	Nadia	32.83 ± 0.61^{br} (6)	34.33 ± 0.61^{bq} (6)	41.17 ± 0.61^{bp} (6)	36.11 ± 0.36^{b} (18)
	Murshidabad	34.00 ± 0.61^{ar} (6)	36.00 ± 0.61^{aq} (6)	43.00 ± 061^{ap} (6)	37.67 ± 0.36^{a} (18)
	Jhargram	31.00 ± 0.61^{br} (6)	34.17 ± 0.61^{bq} (6)	41.00 ± 0.61^{bp} (6)	35.39 ± 0.36^{b} (18)
	Sundarban	30.00 ± 0.61^{cr} (6)	33.00 ± 061^{cq} (6)	40.00 ± 0.61^{cp} (6)	34.33 ± 0.36^{c} (18)
	Overall	31.96 ± 0.30^{g} (24)	34.36 ± 0.30^{f} (24)	41.30 ± 0.30^{e} (24)	

#Means ± SE brief with super scripts a, b, c, p, q, r & g, e, r, significant within different cluster and different age group

Conclusion
At 6-9 months age, significantly higher body height, heart girth and paunch girth were recorded in Jhargram cluster, followed by Murshidabad, Nadia and lastly Sundarban cluster. The carcass weight, fore quarter and hind quarter of Black Bengal goat in Murshidabad cluster at 6-9 month age group was significantly higher (p>0.01) than other three districts and lower (*p*<0.01) in Jhargram cluster. The carcass weight and dressing percentage was significantly higher in Murshidabad cluster in all age groups. At 9-12 month age group lower loin width was recorded in Jhargram & Sundarban cluster which was higher in Murshidabad cluster. In conclusion, agro-climatic zones showed no significant effect (p>0.05) on improvement of slaughter traits and carcass characteristic but all these parameters changes, more specifically increases (*p*<0.05) with the advancement of age. So, slaughtering of 6-9 months and above age groups of goats may be appropriate for both economy and quality point of view.

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