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Effect of grazing and stall feeding on the productive performance, carcass traits and meat quality attributes of Jamuna basin lambs

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Abstract

The aim of this study was to evaluate the productive performance, carcass traits and meat quality under two rearing system of Jamuna basin lambs. Twenty selected lambs were divided into two treatments like T_1 (grazing) and T_2 (stall feeding) having ten lambs per treatment. Data was analyzed with unpaired t-test along with GLM procedure of SAS statistical packages. Traits evaluated were carcass traits, proximate components *viz.* dry matter (DM), crude protein (CP), ether extract (EE) and ash, physicochemical (Ultimate pH, cooked pH, cooking loss, drip loss, water holding capacity-WHC), sensory analysis (color, flavor, tenderness, juiciness, overall acceptability) and instrumental color value (L*, a* and b*). Average daily gain (ADG), hot carcass, skin, viscera, head, pluck, neck, heart, lung, and spleen wt. were found significantly differed ($p<0.05$) in both treatments. Dressing% and EE% was significantly ($p<0.001$) higher in grazing than stall feeding. Instrumental color values CIE L*, a* and b* were found significantly higher ($p<0.001$) in grazing. It may be concluded that grazing group had positive effects on ADG, carcass traits, proximate components, physicochemical, sensory evaluation and instrumental color value in Jamuna basin lamb.

Introduction

Sheep is the important small ruminant species which is widely distributed throughout the world (FAO, 2008). Good nutrition and management play a significant role on lamb production (Sarker et al., 2017; Sun et al., 2020; Hossain et al., 2021a). During the last twelve years sheep population increased 2.5 times, with annual growth rate of 5% (Murshed et al., 2014; Rana et al., 2014). Lamb is softer than chevon which easily digests (Haque et al., 2020). Sheep rearing is directly involved with poverty alleviation, employment generation and good quality nutrients supply (Hossain et al., 2018). Most of the sheep are indigenous, with few crossbreds and are capable of bi-annual lambing and multiple births (Rashid et al., 2013). The characteristics of Jamuna basin lamb is small body size (male-18.25 kg, female-15.22 kg) which is widely distributed to both sides of Jamuna River in Bangladesh. It has creamy white wool all over the body but head and belly contain black wool. Less wool found in legs and belly (Hashem et al., 2020, Hossain et al., 2021b). These lambs successfully adapted with local grass, tree leaves along with some concentrate feed (Rahman et al., 1998 and 1999). This species is widely adapted to different climatic condition and is found all livestock production system (Berihulay, 2019). Lamb farming is also significant in the development and economic growth in different developed countries (Hashem et al., 2020). Color of mutton has a critical influence on consumer's purchasing decisions (Mancini and Hunt, 2005). It is an indicator of quality and freshness for consumers (Boby et al., 2021). Consumers treated red meat as fresher and higher quality whereas, pale and discolored meat is treated by consumers as poor quality (Hashem et al., 2013). Oxygen exposure causes the appealing bright red color of meat by converting deoxymyoglobin to red pigment known as oxymyoglobin. The continuation exposure of meat surface to oxygen causes oxidative metabolism and subsequent generation of free radical by-products which cause the oxidation of myoglobin into brown pigment metmyoglobin (Reneree, 1999). The feeding habits of meat consumers were characterized by important changes last decade. They search healthier foods and higher demands of quality products have led part of the market niche to consume meats of better nutritional and sensory quality (Costa et al., 2011). The lamb meat is the best options for consumers to pay for a high-quality product; but failure in gaining market space due to lack of standardization and quality when it reaches to the consumers table (Cirne et al., 2018). Many authors studied the effect of rearing systems particularly pasture with concentrate feeding on meat quality suckling lambs showing that weaned lamb fed on concentrate fed had higher intramuscular fat content lambs fed on pasture (Hajji et al., 2014). In grazing system natural antioxidants is present in green grass which can assist to limit meat oxidation (Wood et al., 2004). The influence of green grass on sensory proprieties, meat color and texture has been studied by various authors with different results (Priolo et al., 2002) and WHC (Santos- Silva et al., 2002). Farmers want to know what rearing system of lamb is suitable in village condition between grazing and stall feeding. The carcass characteristics, proximate, physicochemical, sensory analysis, and color value for village level farm of lambs in Bangladesh have not been studied to date. From this hypothesis, the study was conducted to evaluate the feeding system on the carcass characteristics and meat quality in Jamuna basin lambs.

Materials and Methods

Experimental animals and management

The study was carried out for three months from October 2019 to December 2019. Twenty Jamuna basin lambs were selected on the basis of same age, management, feeding and vaccination with two grouped: $T_1 \leq 9$ and $T_2 \leq 9$ months having ten lambs per group. The diet was supplied uniformly for all lambs. In grazing (T_1 group), lambs were grazed for 6-7 h in grazing land for eating road side green grasses during the day and kept inside the shed at night. Cut and carry methods were applied for supplying green grass like road side grass for stall feeding (T_2 group). Stall feeding lambs were kept in the stall for 24 h at BAU Sheep, Goat and Horse farm, Mymensingh. This study was approved by the Animal Welfare and Ethical Committee of Bangladesh Meat Science Association (BMSA). The diet was supplied uniformly to all lambs. Green grass and fresh water were provided *ad libitum* with 1.5% concentrate feed that contained 18% CP and 12 MJME/kg DM. The ingredients of diets formulated were crushed wheat 68%; soybean meal 30%; di-calcium phosphate (DCP) 0.5%; vitamin-mineral premix 0.5% and iodine salt 1% which provided twice a day to the lambs (morning and evening).

Slaughter procedure and carcass sampling

At the end of the growth and feeding trial, twenty lambs from two treatments were slaughtered. All the selected lambs were fasted for 24 h and slaughtered according to the "Halal" method. Fasted live weights of lambs were recorded prior slaughtering and individual hot carcass weights were recorded immediately after evisceration. Non-carcass components (skin, head, liver, spleen, lung, shank, heart, kidneys, and viscera) were removed and measured weight. Dressing % was calculated as hot carcass weight relative to fasted body weight. The 100-120g sample was taken from Longissimus dorsi (LD) area for the analyses of proximate, physicochemical, sensory and instrumental color values. Different parameters like ADG, carcass characteristics and meat quality of lambs were recorded. Live weight of each lamb was recorded at the onset of trial and later on monthly basis.

Proximate components

The proximate analysis regarding to DM, EE, CP and ash was carried out according to AOAC (2005).

Sensory evaluation

Different sensory attributes were examined in this study. Each meat sample was evaluated by a trained 8-members panel. The sensory questionnaires measured intensity on a 5- point balanced semantic scale for the attributes *viz.* color, flavor, tenderness, juiciness, and overall acceptability. Eight training sessions were held to familiarize the judges with the attributes to be evaluated and the scale to be used (Jahan et al., 2018; Saba et al., 2018). Prior to sample evaluation, all panelists participated in orientation sessions to familiarize with the scale attributes (color, flavor, juiciness, tenderness, overall acceptability) of meat using intensity scale. All samples were served in the Petri dishes.

Physicochemical traits measurement

Drip loss

Drip loss was measured as per Rahman et al. (2020). Approximately 20 g meat samples were cut from the collected sample, immediately weighed and hung in a covered plastic bag for 24 hours at 4°C. After 24 hours, samples were removed, gently blotted dry and reweighed. Drip loss was calculated as the percentage of weight loss. The difference in weight expressed to the drip loss and showed as the percentage of the initial weight.

$$\text{Drip loss (\%)} = \frac{(\text{Weight of sample} - \text{weight after 24 hours chilling})}{\text{Weight of sample}} \times 100$$

Cooking loss

Thirty (30) g lamb meat sample was taken in a poly bag and heated it into water bath until the temperature rises to 71°C in the meat sample. Lamb meat with 71°C was taken out from the water bath and soaked it with tissue paper. Weight loss of the sample was measured during cooking lamb meat. The CL was calculated using following formula:

$$\text{CL (\%)} = \frac{(\text{Weight before cooking of sample} - \text{weight after cooking})}{\text{Weight before cooking of sample}} \times 100$$

Ultimate pH measurement

Meat pH value was measured 24 h after slaughter (ultimate pH) using a digital pH meter. The pH was measured by inserting electrode at three different points of the meat which was calibrated prior to use at pH 7.0 by pH meter (Hanna HI99163). Triplicate measurements at one cm depth on the medial portion of meat were averaged.

Cooked pH

Samples were cooked to an internal temperature of 71°C for 30 minutes. Then the meat samples were taken out after cooling at room temperature. After cooling meat sample pH was measured as the same way of ultimate pH system.

Water holding capacity (WHC)

WHC% was measured according to Choi et al. (2018). Thawed samples (1 g each) were wrapped in absorbent cotton and placed in a 1.5 ml eppendorf tube. The tubes with samples were centrifuged in a centrifuge separator (H1650-W Tabletop high speed micro centrifuge) at 10,000 RPM for 10 min. at 4º C temperature, following which the samples were weighed. The WHC% of the sample is expressed as following formula:

$$\text{WHC (\%)} = \frac{(\text{Weight of sample after centrifugation})}{(\text{Weight of sample before centrifugation})} \times 100$$

Instrumental color values measurement

Instrumental color values measurement was carried out on lamb meat from longissimus muscle. Color was measured at 24 h post-slaughter using Konica Minolta Chroma Meter (CR 410, Konica Minolta Sensing, Inc., Osaka, Japan), a Miniscan Spectro colorimeter programmed with the CIE Lab, (International Commission on Illumination) L*, a*, and b* system, where L* represents lightness, a* redness and b* yellowness (CIELAB, 2014). The analysis was carried out on the medial surface (bone side) of the meat at 24 h post-mortem (Rahman et al., 2020).

Statistical analysis

Grazing and stall-feeding data were analyzed with unpaired t-test along with GLM procedure of SAS statistical package. Duncan's Multiple Range Test (DMRT) was used to determine the significant differences between two treatments means at values ($p<0.05$).

Results and Discussion

Effect of feeding system of the performance on carcass traits of Jamuna basin lamb

Carcass trait is one of the important characters for determining quality of meat. Various parts of lamb were found some variations in contributing meat production of lamb. The effect of grazing and stall feeding on carcass traits of lamb is shown in Table 1. The ADG of grazing lambs was found significantly ($p<0.01$) higher than stall feeding lambs. The ADG was 35 and 79 g in sole grazing and concentrate supplementation groups, respectively reported by Chellapandian and Balachandran (2003) which was not in accordance with the result found in present study. These findings were higher than the present study. Yeaman et al. (2013) reported that the ADG was 340 g for Dorper lambs and 346 g for Rambouillet lambs in intensive feeding system. This result was not in close agreement with the present study. Kawsar et al. (2006) and Sarkar et al. (2008) found a much lower ADG of Black Bengal (BB) goat with a supplementation of 300 g UMB with 6 hours grazing. Moniruzzaman et al. (2002) found a higher ADG in stall fed BB goats as compared to grazing system. Huq et al. (1996) found that ADG of BB goats were 52 and 47 g with a supplementation of 120 g fish meal and UMB, respectively along with pasture grazing. Hot carcass (kg) was significantly higher ($p<0.05$) in T_1 whereas, dressing% had no statistical significance ($p>0.05$). Ahmed et al. (2018) found that hot carcass (kg) and dressing% were 8.5 and 48.93 which were not similar to the present study. Skin, viscera, head and neck% were found significantly ($p<0.05$) higher in grazing lambs than that of stall feeding lambs. Pluck, heart, lung and spleen% were found significantly ($p<0.05$) higher in grazing lambs than that of stall feeding lambs.

Table 1. Effect of feeding system of the performance on carcass traits of Jamuna basin lamb

Parameters	Treatments (Mean ± SE)		Level of significance
	T_1	T_2	
Initial body wt. (kg)	$11.19^a \pm 0.21$	$10.94^a \pm 0.14$	0.34
Final body wt. (kg)	$16.73^a \pm 0.22$	$15.78^b \pm 0.17$	0.003
ADG (g)	$61.61^a \pm 1.65$	$53.79^b \pm 1.58$	0.003
Hot carcass wt. (kg)	$7.81^a \pm 0.15$	$7.35^b \pm 0.09$	0.02
Dressing wt. (%)	$46.65^a \pm 0.40$	$46.59^a \pm 0.14$	0.88
Blood wt. (%)	$4.70^a \pm 0.18$	$4.64^a \pm 0.05$	0.76
Skin wt. (%)	$12.01^a \pm 0.66$	$10.32^b \pm 0.11$	0.02
Viscera wt. (%)	$15.23^a \pm 0.19$	$14.42^b \pm 0.10$	0.001
Head wt. (%)	$5.88^a \pm 0.08$	$5.53^b \pm 0.06$	0.003
Leg wt. (%)	$11.34^a \pm 0.28$	$10.71^b \pm 0.12$	0.05
Half carcass wt. (kg)	$3.91^a \pm 0.76$	$3.68^a \pm 0.09$	0.27
Pluck wt. (%)	$7.08^a \pm 0.14$	$6.62^b \pm 0.07$	<0.0001
Neck wt. (%)	$3.87^a \pm 0.06$	$3.60^b \pm 0.04$	<0.0001
Shoulder wt. (%)	$8.97^a \pm 0.27$	$8.64^a \pm 0.09$	0.26
Rack wt. (%)	$10.15^a \pm 0.19$	$9.77^a \pm 0.11$	0.09
Loin wt. (%)	$6.08^a \pm 0.06$	$4.45^a \pm 0.02$	0.08
Kidney wt. (%)	$1.61^a \pm 0.12$	$1.67^a \pm 0.02$	0.66
Liver wt. (%)	$3.86^a \pm 0.15$	$3.73^a \pm 0.05$	0.41
Heart wt. (%)	$1.03^a \pm 0.11$	$0.78^b \pm 0.01$	0.04
Lung wt. (%)	$1.73^a \pm 0.06$	$1.57^b \pm 0.02$	0.02
Spleen wt. (%)	$0.85^a \pm 0.04$	$0.72^b \pm 0.01$	0.01
Shank wt. (%)	$1.99^a \pm 0.11$	$2.09^a \pm 0.02$	0.37

Mean in each row having different superscript varies significantly at values $p<0.05$, T_1= Grazing, T_2= Stall feeding

Effect of feeding system of the performance on proximate components of Jamuna basin lamb meat

The proximate components analysis is very important to determine the meat quality of lambs. This test indicates the chemical composition of meat which estimates the more or less than actual amount of quantity of various chemical compositions of meat. The DM, CP and ash in T_1 and T_2 treatments were non-significant ($p>0.05$) (Table 2). The EE was found 3.34 and 1.80% in T_1 and T_2 treatments, respectively which was statistically significant ($p<0.001$). The DM was less and CP was higher in grazed lambs than stall feeding lambs. The CP and ash% (grazing) were found higher than stall feeding lambs which difference was not statistically significant ($p>0.05$). The EE% were found significantly ($p<0.001$) higher than stall feeding lambs. The EE was very low for both fresh meats because the sample was free from subcutaneous and additional fat. These results were not in agreement with the study of Ahmed et al. (2018) where they showed DM (26%) and CP (20%), respectively. Murshed et al. (2014) found CP and EE of goat and sheep were 24.34, 27.99% and 4.14 and 4.03%, respectively in their study. These findings were not in agreement with the present study.

Table 2. Effect of feeding system of the performance on proximate components of Jamuna basin lamb meat

Parameters (%)	Treatments (Mean ± SE)		Level of significance
	T_1	T_2	
DM	$26.12^a \pm 0.39$	$26.57^a \pm 0.22$	0.32
CP	$24.38^a \pm 0.16$	$24.20^a \pm 0.13$	0.40
EE	$3.34^a \pm 0.15$	$1.80^b \pm 0.09$	<.0001
Ash	$1.08^a \pm 0.07$	$1.00^a \pm 0.04$	0.31

Mean in each row having different superscripts varies significantly at values p<0.05, T_1= Grazing, T_2= Stall feeding

Effect of feeding system of the performance on physicochemical traits of Jamuna basin lamb meat

Physicochemical traits indicate the ultimate pH, cooked pH, drip loss, cooking loss and WHC which justify the meat quality of lambs. Ultimate pH and cooked pH were found 6.22 & 6.64 and 6.01 & 6.54 in T_1 and T_2 treatments, respectively (p>0.05) (Table 3). Cetin et al. (2012) found ultimate pH of lamb and goat 6.19 and 6.32 which were very similar to the present study. Drip loss and cooking loss were found 2.92 & 29.88 and 2.56 & 30.02% in T_1 and T_2 treatment, respectively which was non-significant. The WHC was found 87.75 and 87.42%, in T_1 and T_2 treatments, respectively (p>0.05). Drip loss% was found higher and cooking loss% was lower than stall feeding lambs which was non-significant (p>0.05). The WHC% was higher than stall feeding lambs. Water inside the muscle fiber goes to vapor form while cooking and finally full vaporized. This is the possible reason for weight loss. When temperature reaches 75°C at the time of heating, meat protein started to denature. Longitudinal and transversal shrinkage of muscle fiber and connective tissue shrinkage happened at that time. Myofibrils in the muscle tissue contain most of the water. While cooking the structural changes happened and thus the WHC % was reduced. The fresh lamb sample showed the greater value of weight loss percentage. The possible explanation of the greater value for fresh samples is that the fresh samples were not properly fresh and those were also kept in the frozen condition before the analysis. The thawing loss of meat depends on the thickness and cut of meat. In this experiment ambient thawing was done which is actually not recommended by the food codes and regulation because of the risk of microbial spoilage (Met et al., 2013). There is a general agreement in the scientific literature that water binding capacity of meat is gradually reduced due to freezing, frozen storage and thawing (Vieira et al., 2009). The WHC % had marked influence on the development and appreciation of sensory traits, nutritional and commercial value of meat, in addition to determining its juiciness (Ordonez and de Alimentos, 2005). Cooking losses occurred during the process of preparation the meat for consumption as cell membrane is ruptured and alterations in the structure of proteins are responsible for these losses (Inam et al., 2017). Higher WHC% leads to lower cooking loss. Endo et al. (2014) found the WHC and CL were 57.08, 43.51% respectively, whereas Zeala et al. (2011) found very close WHC and CL such as 55.27 and 44.23%, respectively. These results were not similar to the present study. The WHC quality attributes the fresh meat, because it influences consumer's acceptance and the final weight of the product. The loss caused by evaporation can be up to 2% of total carcass weight and occurs during chilling of the carcasses, through differences in vapor pressure between hot carcass surface and cold air. The amount of water lost due to evaporation depends on the temperature of carcass and the velocity, humidity, and temperature of air in chilling room. Pre-slaughter stress is an important cause of aberrant water-holding of meat. After slaughtering lamb oxygen supply ceases, while ATP is still used for energy consuming processes. Under such conditions, the muscle cell re-synthesizes ATP by anaerobic breakdown of glycogen into lactate. Under normal circumstances the production of lactate leads to a decrease in muscle pH from 7.0 to about 5.4 and to the formation of irreversible cross-bridges between myosin and actomyosin. This condition is known as rigor mortis. Lower pH of muscle protein indicates the lower ability to bind water. Since most of the muscle water is present within myofibrils, a general hypothesis for explaining drip loss originates from shrinkage of myofibrils after death causing the water to be expelled into the extracellular space (Offer and Trinick, 1983). The influences of the rate and the extent of post mortem decrease in pH. Ultimate pH and cooked pH were found higher than stall feeding lambs which was non-significant (p>0.05).

Table 3. Effect of feeding system of the performance on physiocochemical traits of lamb meat

Parameters	Treatments (Mean±SE)		Level of significance
	T_1	T_2	
Ultimate pH	$6.22^a \pm 0.08$	$6.01^a \pm 0.09$	0.11
Cooked pH	$6.64^a \pm 0.07$	$6.54^a \pm 0.05$	0.49
Drip loss %	$2.92^a \pm 0.10$	$2.56^a \pm 0.20$	0.29
Cooking loss %	$29.88^a \pm 0.18$	$30.02^a \pm 0.08$	0.06
WHC %	$87.75^a \pm 0.30$	$87.42^a \pm 0.17$	0.93

Mean in each row having different superscripts varies significantly at values p<0.05, T_1= Grazing, T_2= Stall feeding, WHC= Water holding capacity

Effect of feeding system of the performance on sensory attributes of Jamuna basin lamb meat

Sensory attributes are the important criteria of meat quality estimated by the sense organs of eye, nose, mouth and taste buds of tongue. Color, flavor, tenderness, juiciness and overall acceptability were found variation from panel member to member during evaluation time of meat quality. Color, tenderness, juiciness and overall acceptability in T_1 and T_2 treatments were not statistically significant (p>0.05), whereas flavor had significant effect (p<0.05) (Table 4). The color and juiciness of grazing lambs were found lower than that of stall feeding which was non-significant (p>0.05). Fernandes et al. (2013) stated that the aroma, texture, juiciness, flavor and overall quality of four months frozen stored vacuum-packed lamb meat were 6.32, 7.08, 7.40, 7.32 and 7.12 in their study which were not similar to the present study. Flavor was found higher in stall feeding lambs than grazing lambs which was statistically significant (p<0.05). When the meat is in a normal freezer, there is a scope to grow large extracellular ice crystals. These ice crystals break the myofibrils apart and make the meat tender. Vieira et al. (2009) reported that small intracellular ice crystal can release the protease enzyme which causes proteolysis and tenders the meat. Previously water is bound to the protein in the intrafibrillar spaces and remains in an immobilized condition. The released water changes its position and accumulates to the sarcoplasmic and extracellular spaces (Anon and Cavelo, 1980).

Table 4. Effect of feeding system of the performance on sensory analysis of Jamuna basin lambs

Parameters	Treatments (Mean±SE)		Level of significance
	T_1	T_2	
Color	$4.62^a \pm 0.05$	$4.69^a \pm 0.04$	0.17
Flavor	$4.63^a \pm 0.05$	$4.76^a \pm 0.04$	0.08
Tenderness	$4.68^a \pm 0.04$	$4.68^a \pm 0.04$	0.07
Juiciness	$4.72^a \pm 0.03$	$4.77^a \pm 0.03$	0.25
Overall acceptability	$4.66^a \pm 0.01$	$4.73^a \pm 0.02$	0.34

Mean in each row having different superscripts varies significantly at values p<0.05, T_1= Grazing, T_2= Stall feeding.

Effect of feeding system of the performance on instrumental color values of Jamuna basin lambs

Color values are an important criterion of meat quality evaluation. Color values of lambs were found to vary according to age, sex, breed, geographical location and management condition of lambs. The L* value was found non-significantly (p>0.05) higher in grazing lambs than stall feeding lambs (Table 5). The a* and b* values were found significantly (p<0.001) higher in grazing lambs than stall feeding lambs. The enzyme is in the active state in fresh meat, the metmyoglobin was earlier reduced to form deoxymyoglobin and it can also be oxygenated back to oxymyoglobin. Thus, the color of the meat was found pleasant. This activity was explained by Livingston and Brown (1981) which is termed as Metmyoglobin Reducing Activity (MRA). The meat color is the qualitative trait that most influences the choice of the consumers' interest in purchasing or rejecting the products finally (Ramos et al., 2012). Cetin et al. (2012) showed that CIE L*, a* and b* values were 51.78, 14.14 and 13.03, respectively in their study. These results were not in accordance with the result found in the present study. Ali et al. (2008) stated that the stress condition before slaughtering reduced the pH and increased the redness of meat. The stress factors were long distance transport, direct sun light, jerking of vehicle and without rest before slaughtering the lambs. The hue angle from stall feeding lambs had non-significant (p>0.05) higher than grazing lambs and saturation index from grazing lambs had significantly (p<0.001) higher. Emami et al. (2015) stated that the function of CIE a* and b* values and the hue angle value might be provided more realistic information regarding meat browning than single color values. In their work, the conventional meat had higher hue angle and therefore, meat was lighter. The present study was in agreement with the findings of Emami et al. (2015) and Guzman et al. (2019).

Table 5. Effect of feeding system of the performance on color values of lamb meat

Parameters	Treatments (Mean ± SE)		Level of significance
	T_1	T_2	
L*	$43.56^a \pm 1.80$	$41.48^{a \pm}$ 0.55	NS
a*	$22.63^a \pm 0.23$	$14.83^b \pm 0.47$	<0.0001
b*	$16.62^a \pm 0.90$	$11.52^b \pm 0.23$	<0.0001
Hue angle	$28.59^a \pm 0.84$	$32.16^a \pm 1.67$	0.07
Saturation index	$27.64^a \pm 0.44$	$21.23^b \pm 1.12$	<0.0001

Mean in each row having different superscripts varies significantly differed at values (p<0.05), T_1= Grazing, T_2= Stall feeding, NS=Non-significant (p>0.05)

Conclusions

It is revealed from the study that grazing lambs shows better productive performance, carcass traits, proximate components, physicochemical, sensory and instrumental color value attributes than stall feeding lambs. Rearing system significantly changed the major meat quality traits. The Jamuna basin lambs had good quality meat with a higher pH, lighter color and higher WHC % in grazing. Therefore, grazing system was better for productive and meat quality traits than stall feeding for Jamuna basin lamb.

Conflicts of Interest

The authors declare that there are no potential conflicts of interests.

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