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# Carcass Quality and Proximate Composition of Meat of Indigenous Sheep of Assam Raised on Different Rearing Systems

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**ABSTRACT**

The study was conducted to investigate the effect of rearing systems, grazing, grazing with supplement and stall feeding with supplement on the carcass traits and mutton quality of the non-descript indigenous sheep of Assam. Eighteen weaner male lambs of similar and non-significant (P>0.05) body weight (5.38±0.26 kg) were divided in 3 groups (6 in each) in completely randomized block design (CRD) and reared for 112 days. $T_1$ group was grazed, $T_2$ group was grazed and fed concentrate supplement and $T_3$ group was fed both green grass and concentrate supplement in the stall. At the end of rearing period, the lambs were slaughtered. The values for the different carcass traits of pre-slaughter weight (12.57±0.13 kg), slaughter weight (11.53± 0.12 kg), carcass weight (6.33± 0.06 kg), dressing percentage (50.36±0.26%), carcass length (52.30±0.29 cm), back fat thickness (1.56±0.06 mm), loin eye area (7.09±0.13 $cm^2$), wholesale cuts (6.31±0.06 kg) and by products (5.11±0.06 kg) as well as for the proximate compositions of protein (19.57±0.06%), fat (6.31±0.08%) and total ash (1.01±0.00%) were higher (P<0.05) in the stall fed group. It was concluded that the stall fed lambs yielded more mutton with less moisture, higher protein, fat and total ash content in meat.

**HIGHLIGHTS**

- Concentrate and green grass showed better carcass traits and mutton yield than the lambs with or without concentrate supplement.
- The nutritive value of the meat obtained from stall fed animals was also better than animals with grazing.

**Keywords:** Sheep, rearing system, supplement, carcass traits, proximate composition

Sheep rearing is a popular farming practice in Assam and contributes significantly to its agrarian economy. It is an important source of subsidiary income through production of meat, wool, skin and manure of the sheep rearing farmers of the state. Sheep being a good grazer requires less production input and remains to be a remunerative livestock farming option. Sheep husbandry has the advantage of its high hardiness and quick adaptability to local agro-climatic conditions (Ali *et al.,* 2015). The sheep population in Assam is around 3.321 lakhs contributing 1.84% of the total meat produced in the state and is showing positive growth over the years (20th Livestock Census, 2019). Sheep husbandry has immense scope for increasing the meat production in meat deficient state of Assam to meet the requirement of more than 90% of its 3.12 crore population (Census, 2011) and increasing farmers' income. Sheep rearing in Assam is still largely traditional in nature where most poor rural farmers raise

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their sheep flocks entirely on grazing in natural pasture. In contrast, a section of the farmers allow their sheep for grazing with supplemental feeding of home produced grains or balanced concentrate feed. However, because of the market demand of meat and meat products and acute shortage of grazing land (0.77 hectare available/ACU against 3 hectare/ACU as per CSWRI, Avikanagar), the intensive production system by rearing and feeding in the stalls with minimal inputs is one of such promising options (Singh and Kumar, 2007) to improve meat supply and carcass quality.

Carcass yields, wholesale cuts and meat composition are indicators of growth, weight gain, tissue composition, consumer preference and overall economics of production of meat animals. However, information of carcass yield and meat composition of indigenous sheep of Assam raised on different rearing systems is lacking. Hence, this research work was conducted with the objective to evaluate carcass traits and proximate composition of meat of sheep raised under rearing systems of grazing, grazing with concentrate supplementation and stall feeding of green grass and concentrate supplementation.

## MATERIALS AND METHODS

The study was conducted as per Institutional Animal Ethics Committee approved experimental protocol of College of Veterinary Science, Assam Agricultural University, Guwahati, Assam. The experimental lambs were reared in Rajakhat-Banekuchi village. After 112 days of rearing, the lambs were slaughtered and meat sample were analyzed in the laboratory of the Department of Livestock Products Technology, College of Veterinary Science, Khanapara for study of carcass traits and proximate composition of meat.

### Animals, experimental design and rearing systems

Eighteen lambs with an average body weight of 5.38±0.26 kg were divided randomly into three equal treatment groups each having six lambs in a completely randomized block design(CRD) as below:

$\mathbf{T_1}$ : Reared under grazing only

$\mathbf{T_2}$ : Grazing with supplementation of concentrate feed

$\mathbf{T_3}$ : Stall feeding of green grass with supplementation of concentrate feed

The lambs were reared for 112 days. Ten days of conditioning and adaptation to rearing systems was allowed prior to actual experiment. The lambs of $T_1$ and $T_2$ groups were allowed grazing for 7 hours daily on natural pasture while $T_3$ group was fed green grass collected from the pasture in the stall. Additionally, $T_2$ and $T_3$ lambs were fed concentrate daily @ 1% of their body weight containing 16% CP and 75% TDN (Table 1). Drinking water was fed two times daily to all the groups. All the lambs were dewormed as per standard protocol before start of the experiment. The lambs were housed in elevated floor shed. Proper hygiene and sanitation were maintained in all respects of management.

### Slaughter, carcass traits and meat sample analysis

At the end of rearing period, the lambs were starved of solid feed for 12 hours, recorded the pre-slaughter weight and then slaughtered. At slaughter, the lambs were stunned by cerebral concussion and then bled completely by severing the jugular veins and carotid arteries. The blood of the individual lamb was collected and measured in litre (lt). After complete bleeding, the lambs were weighed to record slaughter weight. After that, head, tail, fore and hind cannons, skin and all the viscera, namely gastrointestinal tract (GIT), heart, liver, kidneys, pancreas, spleen, lungs & trachea and testes were removed following appropriate procedures and weighed in kilogram (kg) to record the carcass weight of the lambs. The dressing percentage of the lambs were calculated out as the percentage value of hot carcass weight to pre-slaughter weight. All the offal including the emptied GIT were measured and recorded their weight (kg). The carcass length was measured in centimeter (cm) as per Agnihotri *et al*. (2006) as the distance from the point of shoulder to point of hock. Back fat thickness in millimeter (mm) as per Sen *et al.* (2004) was measured on the $12^{th}$ rib. Loin eye area in square centimeter ($cm^2$) was measured on the cut surface of the *longissimus dorsi* muscle between $12^{th}$ and $13^{th}$ rib taken on either side of the carcass as per Agnihotri *et al*. (2006). The five wholesale cuts of neck and shoulder, breast and fore shank, rack, loin & flank and legs were made as per specifications of Indian Standard Institution as reported by Prasad (1981) and weighed in kg. One hundred gram (gm) of representative meat sample from each group was analyzed as per the standard procedures of AOAC (2005)

to estimate percentage (%) of moisture, protein, fat and total ash.

## STATISTICAL ANALYSIS

Result data obtained were subjected to analysis of variance (ANOVA) and critical difference tests to examine significance of treatment effect and pair wise comparison of treatment means as per Snedecor and Cochran (2004).

## RESULTS AND DISCUSSION

### Carcass traits

Analysis of variance revealed a highly significant ($P<0.01$) effect of treatment on the carcass traits (Table 2). Pre-slaughter weight, slaughter weight, carcass weight, dressing percentage, carcass length, back fat thickness and loin eye area were significantly ($P<0.01$) or apparently higher in $T_3$ than $T_2$ and $T_1$ groups. The

**Table 1:** Chemical composition of concentrate feed

| Ingredients | Parts / 100 kg | CP and TDN content |
|---|---|---|
| Maize crush | 49 | |
| Wheat bran | 25 | |
| Soya DOC | 24 | 16% DCP and 75% TDN |
| Mineral mixture | 1.5 | |
| Common salt | 0.5 | |

**Table 2:** Carcass traits in different treatment groups*

| Traits | | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| Pre-slaughter weight (kg) | | 8.87±0.28 [a] | 10.92±0.3 1 [b] | 12.57±0.13 [c] |
| Slaughter weight (kg) | | 8.19±0.25 [a] | 10.08±0.28 [b] | 11.53±0.12 [c] |
| Carcass weight (kg) | | 4.14±0.1 [a] | 5.30±0.15 [b] | 6.33±0.06 [c] |
| Dressing percentage (%) | | 46.67±0.19 [a] | 48.53±0.25 [b] | 50.36±0.26 [c] |
| Carcass length (cm) | | 49.32±0.29 [a] | 50.98±0.33 [b] | 52.30±0.29 [c] |
| Back fat thickness (mm) | | 1.25±0.03 [a] | 1.38±0.04 [b] | 1.56±0.06 [c] |
| Loin-eye area ($cm^2$) | | 5.09±0.175 [a] | 6.08±0.21 [b] | 7.09±0.13 [c] |
| Wholesale cuts | Neck and shoulder (kg) | 0.91±0.12[a] | 1.31±0.04[b] | 1.54±0.01[c] |
| | Breast and fore shank (kg) | 0.63±0.02[a] | 0.81±0.02 [b] | 0.97±0.01 [c] |
| | Rack (kg) | 0.61±0.02[a] | 0.77±0.02 [b] | 0.9±30.01 [c] |
| | Loin and flank (kg) | 0.55±0.02 [a] | 0.70±0.02 [b] | 0.84±0.01 [c] |
| | Legs (kg) | 1.33±0.04 [a] | 1.70±0.05 [b] | 2.03±0.02 [c] |
| | Total (kg) | 4.13±0.14 [a] (46.56%) | 5.29±0.15 [b] (48.44%) | 6.31±0.06 [c] (50.20%) |
| Byproducts | Blood (lit) | 0.68±0.03 [a] | 0.85±0.02 [b] | 1.04±0.01 [c] |
| | Head (kg) | 0.57±0.02 [a] | 0.70±0.02 [b] | 0.81±0.01 [c] |
| | Skin (kg) | 0.82±0.03 [a] | 1.02±0.03 [b] | 1.29±0.02 [c] |
| | Empty GIT (kg) | 0.74±0.02 [a] | 0.92±0.03 [b] | 1.06±0.01 [c] |
| | Lungs and Trachea (kg) | 0.19±0.00 [a] | 0.23±0.01[b] | 0.27±0.01 [c] |
| | Pancreas (kg) | 0.02±0.00 [a] | 0.03±0.00 [b] | 0.03±0.00 [c] |
| | Spleen (kg) | 0.03±0.00 [a] | 0.04±0.00 [b] | 0.04±0.00 [c] |
| | Kidneys(kg) | 0.05±0.00 [a] | 0.06±0.00 [b] | 0.07±0.00 [c] |
| | Liver (kg) | 0.18±0.00 [a] | 0.23±0.00 [b] | 0.27±0.00 [c] |
| | Heart (kg) | 0.09±0.00 [a] | 0.00±0.00 [b] | 0.13±0.00 [c] |
| | Testis (kg) | 0.08±0.00[a] | 0.09±0.00 [b] | 0.17±0.00 [c] |
| | Total byproducts (kg) | 3.44±0.11[a] (38.78%) | 4.26±0.12 [b] (39.01%) | 5.11±0.06 [c] (40.65%) |

[abc] Means with different superscripts within a row differ significantly ($P>0.05$); ***$T_1$**: Reared under grazing only **$T_2$** : Grazing with supplementation of concentrate feed **$T_3$**: Stall feeding of green grass with supplementation of concentrate feed.

**Table 3:** Proximate composition of meat in different treatment groups

| Proximate composition | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|
| Moisture (%) | 76.41±0.08[a] | 75.44±0.09[b] | 73.34±0.08[c] |
| Protein (%) | 17.44±0.08[a] | 18.37±0.08[b] | 19.57±0.06[c] |
| Fat (%) | 3.83±0.15[a] | 4.41±0.09[b] | 6.31±0.08[c] |
| Total Ash (%) | 0.90±0.05[a] | 1.00±0.00[b] | 1.01±0.00[b] |

[abc] Means with different superscripts within a row differ significantly (P>0.05); ***$T_1$**: Reared under grazing only **$T_2$**: Grazing with supplementation of concentrate feed **$T_3$**: Stall feeding of green grass with supplementation of concentrate feed.

total yield of wholesale cuts in $T_3$ and $T_2$ groups were significantly higher (P<0.01) than the $T_1$ group. Total by-products yield were significantly higher (P<0.01) in $T_3$ than $T_2$ and $T_1$ groups. The carcass traits revealed a positive relationship with their respective pre-slaughter weight in the three treatment groups. The present findings well corroborated with findings of other workers. Das *et al.* (2008) found higher slaughter weight, carcass weight, dressing percentage, back fat thickness and loin eye area under intensive system than semi-intensive system of management in Muzzaffarnagari lambs at 6 months of age. Carrasco *et al*. (2009) also obtained significantly higher (P<0.01) slaughter weight and carcass weight of stall fed Churra Tensina male lambs than reared under grazing with supplementation of concentrate and only grazing. Hoque (2017) found significantly higher (P<0.01) carcass weight, dressing percentage, wholesale cuts and non carcass components in the stall fed goat with fodder and concentrate feed than raised on grazing only. Kochewad *et al.* (2018) observed higher pre-slaughter weight, hot carcass weight, meat percentage, fat percentage and meat: bone ratio in Deccani lambs reared under intensive system than semi-intensive system of management.

### Proximate composition of meat

Results revealed that protein, fat and total ash percentages were highest in stall fed group ($T_3$) followed by grazing with concentrate supplement ($T_2$) and grazing ($T_1$) groups while moisture content was in reverse order. Respective proximate composition values were, 76.410.08,75.440.09 and 73.340.08 percent moisture, 17.440.08, 18.370.08 and 19.570.06 percent protein, 3.830.16, 4.410.09 and 6.310.08 percent fat as well as 0.900.05, 1.000.00 and 1.010.00 percent total ash in meat of $T_1$, $T_2$ and $T_3$ groups respectively. Treatment had highly significant (P<0.01) effect in respect of moisture, protein and fat and significant (P<0.05) effect for total ash. Restricted movement along with feeding supplemental concentrate was responsible for higher values of protein, fat and total ash in $T_3$ groups followed by $T_2$ and $T_1$ groups. Workers like Essary *et al*. (1966) and Twining *et al*. (1979) found higher meat protein in broiler birds fed higher protein in diet. Similarly Enfalt *et al.* (1997) and Bee *et al.* (2004) found higher muscle lipid contents in pig reared in indoor conventional than the outdoor free range system.

## CONCLUSION

It was concluded that stall feeding with green grass and concentrate supplement was more economic and promising option of lamb rearing for higher and quality meat production followed by grazing with concentrate supplement and only grazing respectively

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