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Carcass characteristics of Patanwadi ram lambs maintained under intensive feeding system

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ABSTRACT

The present study was aimed to evaluate the carcass traits of Patanwadi ram lambs at 6.9 months (207 days; Gr-1) and 9.6 months (288 days; Gr-2) maintained under an intensive feeding system. The study involved 10 Patanwadi ram lambs maintained on *Cenchrus ciliaris* grass and supplemented 300 g concentrate daily. The lambs were slaughtered after fasting for 18 h to assess the carcass traits. The body length and live weights were significantly higher in Gr-2 lambs. Empty body weights, hot carcass weights, and dressing yields were significantly higher in Gr-2 than Gr-1. Loin eye area was significantly lower in Gr-1. In primal cuts, weights of the leg, loin, rack, neck and shoulder and breast, and foreshank were significantly different between the groups. The chilling losses were comparable among the groups. The lean yields did not differ significantly for Gr-1 and Gr-2. The subcutaneous fat was significantly higher in loin cut in Gr-2. The intermuscular fat contents were significantly lower for Gr-1. The dissected bone yields were comparable for Gr-1 and Gr-2. Lean: fat and meat: bone ratios were comparable. The present study indicated that Patanwadi ram lambs produce a desirable carcass with lean, fat and bone contents at 6–7 months of age with 30 kg body weight. Though carcass yield was higher at 9–10 months of age it's not economical to rear ram lambs after 6 months because of poor growth rate and feed efficiency.

Keywords: Carcass traits, Meat quality, Patanwadi ram lambs

Patanwadi (Desi, Kutchi, Vadhiyari, and Charotari) is a large-sized sheep breed of Gujarat reared for meat, wool, and milk. As per the 19th Livestock census (2012) there are 7.63 lakh Patanwadi sheep, representing 1.25% of the sheep population of the country. They attained bodyweight of 27.81 and 36.68 kg at 6 and 12 months of age in an organised farm with a daily milk yield of 950 g (Annual Report ICAR-CSWRI 2018). Farmers prefer Patanwadi sheep, as lambs attain market weight at an early age compared to other native breeds like Malpura (Gowane *et al.* 2015). Carcass traits of different sheep breeds have been documented earlier by several authors, but no scientific data pertaining to carcass traits of Patanwadi ram lambs is available in the literature. Hence, the present study was undertaken to evaluate the carcass traits of Patanwadi ram lambs.

MATERIALS AND METHODS

The present study was carried at the ICAR-Central Sheep and Wool Research Institute, Avikanagar. The Patanwadi ram lambs were maintained on *Cenchrus ciliaris* grass and supplemented 300 g concentrate daily. The carcass traits of ram lambs were evaluated at 6.9 (207 days; Gr-1) and 9.6 months (288 days; Gr-2) of age with each group containing five animals. Prior to slaughter, the ram lambs were fasted for 18 h with access to water. Live weights of ram lambs were recorded while pre-slaughter measurements were recorded as below:

1. *Body length*: The distance between the points of the shoulder to the tuberischii (cm).
2. *Height*: The vertical distance from the top of the scapula to the ground (cm).
3. *Heart girth*: The body circumference immediately posterior to the front leg (cm).
4. *Paunch girth*: Circumference of the body just before the hind legs (cm).

The animals were slaughtered in the experimental abattoir of the institute according to the Halal method ensuring animal welfare. Afterwards bleeding, skinning and evisceration was done. The carcass measurements (cm) were recorded. The carcass compactness was calculated as a ratio of hot carcass weight to carcass length. Then each carcass was split into fore and hind quarters at the juncture of the 12th and 13th thoracic vertebrae. Loin eye area (cm^2) was measured at the cut surface of *Longissimus dorsi* muscle at the interface of the twelfth and thirteenth rib on both sides of the carcass. Thereafter, the carcass was halved along the midline and the left half was fragmented into standard cuts, viz. leg, loin, rack, neck and shoulder, breast and foreshank as per the ISI (1963) specification. Further, all the five cuts were chilled overnight at 4°C in a refrigerator.

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Next day the chilled cuts were manually dissected into lean, bone, subcutaneous fat and intermuscular fat. The data obtained for carcass traits were subjected to analysis of variance (Snedecor and Cochran 1995).

RESULTS AND DISCUSSION

Carcass traits: The pre-slaughter body measurements indicated that body length of ram lambs was significantly (P<0.05) higher in Gr-2 while other body measurements, viz. height, heart girth, and paunch girth were comparable between the groups (Table 1). The live weights, carcass measurements like carcass width and the carcass compactness of ram lambs were significantly (P<0.05) higher in Gr-2. The difference in body measurements and weights are attributed to the age-dependent growth and development of lambs. As animal age increases its body weight and body size also increases (Warris, 2000). Similar to our findings, age-dependent differences in body measurements and live weights have been reported in Malpura and Kendrapara sheep (Shinde *et al.* 2018, Gadekar *et al.* 2018). The leg circumference was numerically higher in Gr-2 and was comparable. The empty body weights, hot carcass weights, and dressing yields were significantly (P<0.01) higher in Gr-2. Higher dressing yields in Gr-2 were due to higher live weight, empty body weights, and hot carcass weights. Sen and Karim (2010) reported that dressing yield in Malpura lambs at 10 months of age was 37.71 and 47.44% on live weight and empty body weight basis respectively. A positive correlation of dressing percentage with pre-slaughter weight, empty body weights, and hot carcass weight have been reported (Awet and Solomon 2009, Hailu *et al.* 2011).

Table 1. Carcass characteristics (mean±SE) of Patanwadi ram lambs

Parameter	Gr-1	Gr-2
Body measurements (*cm*)		
Length	61.20±1.20^{b}	65.40±0.93^{a}
Height	67.00±1.48	69.20±1.50
Heart girth	77.00±1.73	76.6±1.44
Paunch girth	88.80±2.20	85.6±2.11
Live weight (kg)	29.58±1.01^{b}	35.04±1.90^{a}
Carcass measurements (*cm*)		
Length	72.00±0.95	75.20±1.56
Width	62.40±0.93^{b}	67.6±1.63^{a}
Depth	71.20±1.43	74.00±1.67
Carcass compactness	0.17±0.01^{b}	0.23±0.01^{a}
Leg circumference (cm)	28.25±0.64	30.35±0.78
Empty body weight (EBW; kg)	24.40±0.95^{b}	31.26±1.62^{a}
Hot carcass weight (kg)	12.45±0.55^{b}	17.15±1.13^{a}
Dressing yield (%) (live wt. basis)	42.04±0.44^{b}	48.84±0.94^{a}
Dressing yield (%) (EBW basis)	51.00±0.5^{b}	54.71±0.98 ^{a}
Fore canon and hooves (kg)	0.42±0.02^{b}	0.49±0.02^{b}
Hind canon and hooves (kg)	0.35±0.02	0.38±0.01
Forequarter wt. (kg)	6.71±0.30^{b}	9.25±0.65^{a}
Hindquarter wt. (kg)	5.53±0.26^{b}	7.51±0.45^{a}
Loin eye area (cm^2)	15.60±0.84^{b}	18.50±1.04^{a}
Backfat thickness (mm)	1.90±0.17	2.12±0.17
Breast fat thickness (mm)	22.44±1.85	27.10±0.75
Inedible offal wt. (kg)	7.46±0.25^{b}	8.40±0.29^{a}
Edible offal wt. (kg)	1.81±0.08^{b}	2.91±0.21^{a}
Yield on a pre-slaughter weight basis (%)		
Inedible offal	25.25±0.52	24.10±0.69
Blood	4.53±0.19^{b}	5.03±0.10^{a}
Head	5.83±0.11	5.93±0.18
Skin	12.02±0.59	10.42±0.43
Edible offal	6.11±0.15^{b}	8.30±0.35^{a}
Spleen	0.16±0.02	0.18±0.03
Pancreas	0.12±0.01	0.12±0.01
Caul fat	0.72±0.12^{b}	1.61±0.26^{a}
Kidney fat	0.48±0.04^{b}	0.85±0.11^{a}
Kidney	0.25±0.01	0.25±0.01
Heart	0.42±0.01	0.42±0.01
Liver	1.43±0.03	1.69±0.13
Lungs with trachea	1.92±0.09	1.79±0.06
Pluck	3.76±0.09	3.90±0.16

n=5 in each group; Gr-1: 6.9 months; Gr-2: 9.6 months; Means bearing different superscripts between columns differ significantly (P<0.05).

The fore canon and hooves weight differed significantly (P<0.05) while hind canon and hooves weights were comparable among the groups. The forequarter and hind quarter weights were significantly (P<0.01) higher in Gr-2. The loin eye area, an indicator of tissue accretion, differed significantly (P<0.05) among the groups. Higher values in Gr-2 were attributed to the higher body weight and a proportionate increase in the eye muscle area. The backfat thickness and breast fat thickness were numerically comparable. A similar increase in backfat thickness in Muzaffarnagari lambs reared in a semi-intensive system from 6 to 9 months of age have been reported (Das *et al.* 2008). The yields of edible and inedible offals also differed significantly (P<0.05) with higher yields in Gr-2. The yields of blood, head, caul fat, kidney, kidney fat, heart, liver, and lungs along with the trachea on pre-slaughter weight basis were significantly higher in Gr-2 than Gr-1. The pluck yield was comparable. The higher values in Gr-2 were attributed due to the more age of lambs which affected slaughter body weights, hot carcass weights. Age-dependent differences in carcass composition and non-carcass components have been reported earlier also by Shinde *et al.* (2018).

Carcass composition: The yields of primal cuts: leg, loin, rack, neck and shoulder, and breast and foreshank were significantly (P<0.05) higher in ram lambs of Gr-2 (Table 2). Similarly, half carcass weight increased significantly (P<0.05) as the age of animals increases. The percent yield (on a half carcass weight basis) of cut-up parts and chilling losses in different primal cuts were comparable among the groups. The lean yield, although numerically higher in Gr-1 but it was comparable in both the groups. Lean yield decreases with an increase in the age of the animal and this could be attributed to increase in the fat content of the carcass as evident from increased back fat, breast fat thickness and separable fat in lamb carcasses of Gr-2. A decrease in lean yield with an increase in slaughter weight from 26 to 30 kg in Kimis lambs have been reported

Table 2. Primal cut yield and carcass composition (mean±SE) of Patanwadi ram lambs

Parameter	Gr-1	Gr-2
Primal cut weight (*kg*)		
Leg	1.98±0.10^{b}	2.66±0.19^{a}
Loin	0.71±0.04^{b}	0.98±0.07^{a}
Rack	0.83±0.03^{b}	1.18±0.09^{a}
Neck and shoulder	1.52±0.09^{b}	2.04±0.16^{a}
Breast and foreshank	1.04±0.05^{b}	1.48±0.10^{a}
Half carcass weight (kg)	6.09±0.28^{b}	8.33±0.58^{a}
Chilling losses (%)		
Leg	2.8±0.44	2.4±0.29
Loin	1.6±0.33	2.5±0.84
Rack	4.2±0.46	4.6±0.62
Neck and shoulder	4.1±0.43	5.3±1.48
Breast and foreshank	3.7±1.40	4.6±0.48
Average chilling losses	3.28±0.45	3.88±0.47
Lean yield (%)		
Leg	68.33±0.88	69.3±1.16
Loin	62.32±2.10	57.47±1.48
Rack	55.15±1.07	52.67±2.16
Neck and shoulder	56.04±2.02	56.58±1.44
Breast and foreshank	55.19±1.81	55.24±2.19
Average lean yield	59.41±1.16	58.25±1.29
Subcutaneous fat (%)		
Leg	2.65±1.04	2.77±0.53
Loin	7.08±1.82^{b}	12.90±1.23^{a}
Rack	4.59±2.22	6.29±0.71
Neck and shoulder	6.70±1.64	7.62±0.93
Breast and foreshank	5.20±0.55	7.72±1.01
Average subcutaneous yield	5.24±1.27	7.46±0.74
Intermuscular fat (%)		
Leg	1.89±0.44	3.12±0.61
Loin	5.81±1.02^{b}	11.5±0.83^{a}
Rack	2.90±0.56^{b}	5.87±0.76^{a}
Neck and shoulder	3.97±0.56	4.82±0.54
Breast and foreshank	4.20±0.64	5.10±0.46
Average intermuscular fat	3.76±0.46^{b}	6.08±0.50^{a}
Separable fat (%)	9.00±1.71	13.55±1.18
Dissected bone (%)		
Leg	25.59±1.28	23.83±0.87
Loin	21.81±1.76	15.63±1.62
Rack	32.01±1.58	30.99±1.46
Neck and shoulder	29.59±1.11	28.63±1.28
Breast and foreshank	30.72±0.74	29.59±1.93
Average dissected bone	27.94±0.97	25.73±1.22
Lean: fat ratio	7.51±1.26	4.46±0.49
Meat: bone ratio	2.14±0.08	2.29±0.13

n=5 in each group; Gr-1: 6.9 months; Gr-2: 9.6 months; Means bearing different superscripts between columns differ significantly (P<0.05).

(Papadopoulos *et al.* 1993).

The subcutaneous fat content was comparable among the groups. The intermuscular fat in loin and rack cut and average intermuscular fat was significantly (P<0.05) higher in Gr-2. Separable fat content increased from 9 to 13.55% as the age of lambs increased from 207 to 288 days. Results are in agreement with Skapetas *et al.* (2006) who reported that as slaughter age of mountain Greek lambs increased from 30 to 90 days; total fat also increased (20.84 to 23.59%). Sen and Karim (2010) reported a separable fat content of 6.55% in Malpura lams at 10 months of age.

Dissected bone content, meat: bone ratio, and lean: fat ratio were comparable among the groups. With maturity and body weight increase, the quantity of fat in the carcasses increases and the proportion of muscles and bones decreases. The meat: bone ratio is an important attribute and it is always desirable to have a higher lean yield. In concurrence with our findings, Sabbioni *et al.* (2016) reported comparable meat: bone and lean: fat in Cornigliese sheep at 6–12 months and more than one year of age.

The findings of the present study indicated that age had a significant effect on the pre-slaughter weight, dressing yield and carcass composition. A desirable carcass with lean, fat and bone contents could be obtained at 6–7 months of age with 30 kg body weight in Patanwadi ram lambs. Though more carcass yield could be obtained at 9–10 months of age it is not profitable to rear ram lambs after 6 months of age because of their lower growth rate and feed efficiency.

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