Evaluation of Black Bengal goats and their cross with the Jamunapari breed for carcass characteristics

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Abstract

Carcass quality of Jamunapari × Black Bengal (JBB), Black Bengal selected for growth (SBB) and random-bred (RBB) wethers of 1 year of age was studied. There was no significant difference between JBB and SBB in pre-slaughter traits and carcass characteristics, except height at wither and dressing percentage which were significantly higher in JBB than in SBB, and muscle fiber diameter which was significantly smaller in JBB than in SBB. Performance of RBB was significantly lower than JBB and SBB. When hot carcass, non-carcass, variety meat, prime cuts, fat deposition and total saleable portion were expressed as % of empty live weight and compared among genetic groups, JBB ranked first. Selection for rapid growth rate within Black Bengal goat increased its live weight and improved meat production. Increased live weight showed a positive relationship with increased fat deposition. Relationships between 'eye muscle’ area and hot carcass yield, empty live weight and gut fat and perinephric fat and gut fat were positive and significant. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

Goats are regarded as an intimate and integral part of rural farming systems in Bangladesh. Goat population has increased at a rate of 10% per annum with a simultaneous reduction (0.21% per annum) of cattle numbers from 1970 to 1997 (FAO, 1970, 1997). Annual meat supply is 0.51 million mt against the national requirement of 5.77 million mt (Government of Bangladesh, 1988). In Asia, Bangladesh has the third highest population of goats which accounts for about 34 million heads representing 57% of total ruminant livestock. Goats of Bangladesh accounted for 116,000 mt of meat representing 25% of total red meat (FAO, 1997). Goat meat is more expensive as compared to other livestock and poultry meats. Black Bengal, the only recognized goat breed of Bangladesh, is known for its excellence in reproductive capabilities and production of quality meat. Recently, Jamunapari has been introduced for cross-breeding with indigenous goats. Husain et al. (1996) and Husain et al. (1998) recommended that genetic improvement of the Black Bengal goat could be achieved by selection. However, utilization of hybrid vigor for commercial meat production is possible by cross-breeding of Black Bengal goat with the Jamunapari breed. This experiment was undertaken to examine relative merits of the Black Bengal goats and their cross with Jamunapari in terms of pre-slaughter traits and carcass characteristics.
2. Materials and methods

2.1. General

It was a field-based program conducted at villages in the vicinity of Bangladesh Agricultural University, Mymensingh. Goats were owned by the farmers, except stud bucks, and the breeding schedule was monitored by the researchers. Three separate breeding lines were maintained to produce progenies. JBB goats were produced by crossing Jamunapari (male) with random-bred Black Bengal (female) goats. SBB and RBB were the progenies of selected and random-bred Black Bengal goats, respectively.

Either parent of the selected group were phenotypically selected on the basis of their live weight at maturity for one generation. A significant (18%) improvement resulted from selection in 6-months live weight of SBB compared to RBB (control).

All animals were reared under grazing-based semi-intensive husbandry system that exists in the rural areas of Bangladesh.

2.2. Pre-slaughter weights and measurements

Live weight (LW) at 1 year of age, empty stomach live weight (body wt. taken after 12 h fasting, ELW), height at wither, heart girth and body length (pin bone to point of shoulder) were recorded for each of the wethers just before slaughter.

Eight male goats (castrated before 1 month of age, wether) from each of the three different genetic groups at 1 year of age taken at random were slaughtered by severing the carotid arteries and veins in both sides with a sharp knife.

After complete bleeding the slaughtered animals were skinned. The head was detached at the atlanto-occipital joint and the fore and hind cannons were removed at the knee and hock joint respectively. All abdominal and thoracic organs were removed and weighed. Internal fat deposited on the top of the kidneys (perinephric fat) and around gastro-intestinal tract (gut fat) were separated and weighed. The tail was cut off at its articulation. Tail, genitalia and cannons were excluded.

The hot carcass (HCY) and the alimentary tract (gut) without its content were weighed. For measuring the area of muscle longissimus dorsi or “eye muscle” (EMA) the hot carcass was split between the 13th and 14th ribs. From the cross section the area was traced five times onto an acetate paper and from the weight–area relationship of the acetate paper the average area of each single ‘eye’ was estimated. Single hind and fore limbs (separated from cannons) were separated from the carcass and weighed.

The carcass was chilled for 24 h at 0°C and weighed. Muscle fiber diameters in the thigh and neck muscle were measured. It was accomplished by making permanent slides by histological procedure. Fibers were measured with the help of a micrometer under microscope. Total saleable portion was found by summing weights of hot carcass, liver, spleen, kidneys, respiratory organs, heart and empty gastro-intestinal tract. For effective comparison, distribution of different cuts/organs/tissues were calculated as a percentage of ELW for each individual. Dressing percentage (DP) was calculated as a ratio of fasting weight and chilled carcass weight.

2.3. Statistical analyses

Data were analyzed using the general linear model (GLM) procedure of Harvey mixed model least squares and maximum likelihood computer package (Harvey, 1990). The following statistical model was used for the analyses of each measurement

\[ Y_{ij} = \mu + g_i + e_{ij} \]

where \( Y_{ij} \) is an individual observation, \( \mu \) the general mean, \( g_i \) the effect of \( i \)th genetic group \((i=1,2,3)\), \( e_{ij} \) the residual error normally distributed with mean 0 and variance \( \sigma^2_e \).

The model includes only genetic group as a fixed effect. Least significant difference (LSD) test was performed for difference of least squares means (LSM) where \( F \)-values were significant. Correlation and regression estimates were carried out between EMA and HCY, ELW and gut fat and perinephric fat and gut fat.

3. Results and discussion

3.1. Pre-slaughter body measurements and carcass characteristics

Least squares means of pre-slaughter body measurements and carcass characteristics are presented in
Table 1. Among body measurements, JBB did not differ significantly from SBB except in height at wither where the former was higher than the latter. RBB showed significantly lower body measurements. Longer legs in JBB caused significantly higher height at wither. Singh et al. (1990) noticed that body length and height at wither both were higher in JBB crosses than those of Black Bengal goats. Slaughter weight, empty live weight and all body measurements were lower in RBB compared to JBB and SBB wethers. Significant positive correlations between body weight and body measurements (body length and heart girth) were obtained by Singh et al. (1987) in Black Bengal goats at 1 year and by Varade et al. (1997) in Indian local goats at 1.5 year of age.

Hot carcass yield (HCY) and chilled carcass yield (CCY) both differed significantly between genetic groups as JBB=SBB>RBB. Significantly higher dressing percent (DP) was obtained in JBB followed by SBB and RBB respectively. Eye muscle area varied significantly between groups in a similar way as JBB=SBB>RBB. This, in turn, reflects the positive association between EMA and carcass yield or LW/ELW. DP in Black Bengal wethers at 1 year of age in this experiment appeared to be lower in comparison to the value (44.6) cited by Acharya (1988) and Bhattacharyya (1989). Rao et al. (1988) observed DP to be affected by breed type among Jamunapari, Barbari and their crosses which is in agreement with current findings. Muscle fiber diameter varied among groups at thigh and neck. They ranked in order as SBB>JBB=RBB. Gaili and Ali (1985) and Devendra (1988) explained the variation of muscle fiber diameter as the positive response of individual muscles to differences in nutritional regime or species or some other genetic background.

3.2. Proportionate distribution of weights of some prime cuts/organs/tissues as percent of ELW

Table 2 represents the weight of HCY, non-carcass composition, variety meats, prime cuts, major fats and total saleable portion as percent of ELW. JBB showed highest efficiency in producing HCY, fore limb and total saleable portion and relatively lesser percentages of depot fat. Skin weight as a percentage of ELW was lowest in JBB. RBB was poor in performance reflecting the lower proportion HCY, total saleable portion, prime cuts, heaviest head and empty gut. Percentage of total saleable portion for wethers in this investigation exceeded the values reported by Singh and Sahu (1997) in Sirohi (43–48), Kutchi (42–47) and Marwari (41–48) breeds of goats. It might be because they calculated the percentage based on live weight instead
of ELW. Of the variety meats, proportionate weights of kidneys, respiratory organs and heart were highest in RBB and they were inconsistent in the other two groups. According to Pal et al. (1997), weights of variety meats and cavity fat vary significantly between breeds and ages in sheep. Wahid et al. (1985) reported that breed type affected weight of heart, lungs, liver and testis in goats. Partial similarities of these results can be seen in the present findings.

Significant positive correlations were observed between EMA and HCY (0.94±0.14 for JBB, 0.79±0.25 for SBB and 0.90±0.17 for RBB), between ELW and gut fat (0.94±0.14 for JBB, 0.79±0.25 for SBB and 0.96±0.11 for RBB) and between perinephric fat and gut fat (0.93±0.15 for JBB, 0.76±0.26 for SBB and 0.95±0.13 for RBB) in wethers of three genetic groups. Significantly positive correlations between EMA and weight at slaughter and between EMA and DP were observed in goats by Manfredini et al. (1988). Gamallo et al. (1988) found a strong positive relationship of kidney fat with total carcass fat in Criollo goats. Both results support the finding of the present study.

### 4. Conclusion

JBB and SBB were similar in live weight and carcass weight and both were significantly heavier than RBB. Yet, JBB was superior to SBB in terms of dressing percentage, proportionately heavier total saleable portion, for limb cut and lower depot fat. Selection within Black Bengal goat not only increased live weight, but also improved carcass value.

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