Polymorphism analysis at FecB locus in Kajali sheep of India


Received: 29-04-2016 Accepted: 29-06-2016 DOI: 10.18805/ijar.v0i0f.3796

ABSTRACT

The present study reports the polymorphism study of bone morphogenetic protein receptor (BMPR-1B) FecB mutation in Kajali sheep of India. Blood samples were collected from native tract i.e. Sangrur, Barnala, Ludhiana and Moga districts of Punjab, India. Screening of 40 DNA samples revealed absence of FecB carriers in this population. The results thus indicate that either other genetic mutations or simple management practices (mostly the feeding), could be responsible for high fecundity in Kajali population, thus these animal deserve further investigation.

Key words: FecB gene, Kajali sheep, Polymorphism.

Sheep is considered most important source of wool, meat and to some extent milk also throughout the world. It is one of the most prolific species as far as litter size is concerned. Major mutations resulting in increase of ovulation rate have been discovered in the BMPR-1B, BMP15 and GDF9 genes (Davis, 2004). An extensively studied mutation responsible for increased ovulation rate and litter size in sheep is an autosomal mutation FecB.

FecB was identified on the bone morphogenetic protein receptor (BMPR1B) gene (Montgomery et al. 2003). Expression of this gene is observed in oocytes and granulose cells and the first report on association of FecB mutation with high prolificacy was documented in Booroola sheep of Australia (Wilson et al. 2001). Since then, many other sheep breeds around the globe have been shown to harbor this fascinating mutation resulting in high economic gains to the farmers. FecB mutation has also been identified in Garole sheep (Davis et al., 2002), Kendrapada (Kumar et al. 2009) and Nilagiri (Sudhakar et al. 2013) sheep of India; Hu and Han of China (Davis et al. 2006) and Javanese of Indonesia (Davis et al. 2002). Recently, 5 to 10% of the Kajali sheep were reported to give births to twins (Anonymous 2015) making it an interesting genetic material to explore for the FecB mutation as the reason for twinning. Kajali is a mutton type sheep, distributed in Sangur, Barnala, Ludhiana, Moga and adjoining districts of Punjab (India). The breeding tract of Kajali lies in the Northern India between 30°38' and 30°82' of North latitude and 75°17' & 75°55' east longitude. The climate of the area may be classified as tropical steppe, hot and semi-arid which is mainly dry with very hot and coldwinter, except during monsoon when moist air penetrates into the area. The soil of the zone has developed under semi-arid condition and is sandy loam to clay with normal reaction (pH from 7.8 to 8.5). Multiple births/twining in this population can greatly enhance the overall productivity and hence economic returns to poor farmers, rearing these animals. Therefore, the present study was carried out to screen the Kajali sheep for FecB mutation, as a reason for its good reproductive performance.

The blood samples of 40 Kajali sheep were collected randomly from their breeding tract in Punjab, that included 10 samples each from Sangur, Barnala, Ludhiana and Moga districts. Approximately 5 ml of blood was collected from all individuals aseptically from jugular vein in Na/K EDTA containing vacutainers. DNA was extracted from white blood cells using standard phenol-chloroform extraction method (Sambrook and Russell, 2001). DNA isolated was PCR amplified and PCR-RFLP technique was used to screen the samples for FecB mutation. The BMPR1B gene locus having FecB mutation was PCR amplified using primers CCAGGACAATAGCAAAGCAA (Forward) and CAAGATGTTTTCATGCCTCATCAACCACCGTC (Reverse) and digested with AvaII restriction enzyme as described by Ahlawat et al. (2015).

The PCR products with FecB carrier sheep have an AvaII restriction site, whereas products from non-carriers lack this site, which could be easily differentiated on agarose gel. Several workers have reported introgression of FecB resulting in multiple births in singleton producing ewes by crossing with FecB carrier rams (Kumar et al. 2006; Hua and Yang, 2009). In this study, all the individuals of Kajali sheep were found to be homozygous non-carrier (FecB ++ ) for Booroola mutation, because they showed only single band at 190 bp position indicating absence of FecB mutation at the gene locus (Fig. 1). DNA samples of Garole sheep were included as positive controls, which showed homozygous...
GG or heterozygous AG genotype on agarose gels. Since, all the samples were monomorphic for FecB gene in Kajali sheep, the frequency of non-carrier genotype FecB++ (AA) was observed to be 100%. Our results are in agreement with the findings of Nimbkar et al. (2003), Kumar et al. (2006) and Sudhakar et al. (2014), who reported that FecB mutation to be absent in sheep breeds such as Deccani, Bannur, Malpura and Mecheri. Amre et al. (2009) also reported that the digestion of 190 bp PCR product (FecB gene) with Avall restriction enzyme resulted in non-carrier 190 bp band in five Egyptian breeds. In a recent study by Yatoo et al. (2015), Dorper sheep from Jammu were also reported to lack this mutation. Hence, it can be postulated that high prolificacy in Kajali sheep could be due to environmental factors or mutations in other candidate genes for fertility and is not due to FecB mutation.

This report thus negates the FecB mutation as the cause of twining in Kajali sheep and other mutations responsible for high fecundity in sheep need to be explored.

ACKNOWLEDGEMENT

The authors are thankful to the Director, ICAR-National Bureau of Animal Genetic Resources, Karnal for providing facilities and express sincere gratitude to all sheep keepers to allow recording of data on their animals and blood sample collection. We also sincerely thank the Director, Animal Husbandry, Govt. of Punjab (India) and Deputy Directors of Sangrur, Barnala, Ludhiana and Moga districts and all Veterinary Officers of breeding tract of Kajali sheep of Punjab.

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