Association of Copy Number Variation of the CHKB, KLF6, GPC1, and CHRM3 Genes with Growth Traits of Datong Yak (Bos grunniens)

Authors : Habtamu Abera Goshu, Ping Yan

Abstract : Copy number variation (CNV) is a significant marker of the genetic and phenotypic diversity among individuals that accounts for complex quantitative traits of phenotype and diseases via modulating gene dosage, position effects, alteration of downstream pathways, modification of chromosome structure, and position within the nucleus and disrupting coding regions in the genome. Associating copy number variations (CNVs) with growth and gene expression are a powerful approach for identifying genomic characteristics that contribute to phenotypic and genotypic variation. A previous study using next-generation sequencing illustrated that the choline kinase beta (CHKB), Krüpple-like factor 6 (KLF6), glypican 1(GPC1), and cholinergic receptor muscarinic 3 (CHRM3) genes reside within copy number variable regions (CNVRs) of yak populations that overlap with quantitative trait loci (QTLs) of meat quality and growth. As a result, this research aimed to determine the association of CNVs of the KLF6, CHKB, GPC1, and CHRM3 genes with growth traits in the Datong yak breed. The association between the CNV types of the KLF6, CHKB, GPC1, and CHRM3 genes and the growth traits in the Datong yak breed was determined by one-way analysis of variance (ANOVA) using SPSS software. The CNV types were classified as a loss (a copy number of 0 or 1), gain (a copy number >2), and normal (a copy number of 2) relative to the reference gene, BTF3 in the 387 individuals of Datong yak. These results indicated that the normal CNV types of the CHKB and GPC1 genes were significantly ($P<0.05$) associated with high body length, height and weight, and chest girth in six-month-old and five-year-old Datong yaks. On the other hand, the loss CNV types of the KLF6 gene is significantly ($P<0.05$) associated with body weight and length and chest girth at six-month-old and five-year-old Datong yaks. In the contrary, the gain CNV type of the CHRM3 gene is highly ($P<0.05$) associated with body weight, length, height, and chest girth in six-month-old and five-year-old. This work provides the first observation of the biological role of CNVs of the CHKB, KLF6, GPC1, and CHRM3 genes in the Datong yak breed and might, therefore, provide a novel opportunity to utilize data on CNVs in designing molecular markers for the selection of animal breeding programs for larger populations of various yak breeds. Therefore, we hypothesized that this study provided inclusive information on the application of CNVs of the CHKB, KLF6, GPC1, and CHRM3 genes in growth traits in Datong yaks and its possible function in bovine species.

Keywords : Copy number variation, growth traits, yak, genes
Conference Title : ICAHD 2022 : International Conference on Animal Husbandry and Dairying
Conference Location : Rome, Italy
Conference Dates : July 21-22, 2022