

Marija Špehar^{1*}, Zdenko Ivkić¹, Dora Ceranac¹, Jelena Ramljak², Ante Kasap²

¹Croatian Agency for Agriculture and Food, Svetošimunska cesta 25, 10000 Zagreb, Croatia

²University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia

*marija.spehar@hapih.hr

Povezanost polimorfizma kapa kazeina s genomskim uzgojnim vrijednostima svojstava mliječnosti holstein pasmine goveda

Sažetak

Genomska selekcija temelji se na korištenju informacija velikog broja genetskih markera (SNP-ova) raspoređenih preko čitavoga genoma pri procjeni uzgojnih vrijednosti (GUV) i rangiranju selekcijskih kandidata. Genotipizacijom se također dobiva i informacija o genotipovima za monogena svojstva kao što je kapa kazein (CSN), koji igra važnu ulogu u učinkovitosti proizvodnje sireva. Cilj ovog istraživanja bio je utvrditi frekvenciju CSN genotipova i alela u populaciji holstein (HOL) goveda u Hrvatskoj te utvrditi njihovu povezanost s GUV svojstava mliječnosti (količina mlijeka - KM, količina i sadržaj masti - KM i SM, te količina i sadržaj proteina - KP i SP). Genotipizirane su ukupno 334 životinje, i to korištenjem Illumina Bovine 50KSNP BeadChip. Program R (paket 'genetics') korišten je za izračun frekvencije alela i genotipova, a inferencijalna statistička analiza povezanosti genotipova CSN-a i GUV (One-Way ANOVA) provedena je pomoću SAS (procedura 'glm'). Učestalost genotipova AA, AB, AE, BB, BE i EE bila je 15 %, 42 %, 13 %, 23 %, 7 % i 0,01 %. Frekvencija alela B (poželjni alel u proizvodnji sireva), A i E iznosila je 0,47, 0,43 i 0,10. Genotip BB imao je veću GUV za SP u odnosu na ostale genotipove ($p < 0,05$), ali i manju GUV za KM ($P < 0,05$). Nije bilo statistički značajnih razlika između polimorfizama CSN i GUV za ostala istraživana svojstva mliječnosti. Rezultati su pokazali da bi uzgoj za povoljan BB genotip poboljšao SP u mlijeku ali na trošak KM, tako da je u budućnosti potrebno optimizirati selekcijske strategije ako se žele iskoristiti poželjne karakteristike BB genotipa (uskладiti ga s politikama plaćanja mlijeka u mljekarama i siranama).

Ključne riječi: kapa kazein, holstein, svojstva mliječnosti, genomska selekcija

Association of kappa casein polymorphism with genomic breeding values for dairy traits in Croatian Holstein cattle population

Abstract

Genomic selection is a method that uses information from many single nucleotide polymorphisms (SNPs) obtained by genotyping to estimate genomically estimated breeding values (GEBV) and rank selection candidates. The results of genotypes also provide information on genotypes for monogenic traits such as kappa casein (CSN) which plays an important role in the efficiency of cheese production. The aim of the study was to determine the frequency of CSN genotypes and alleles in the Croatian Holstein (HOL) cattle population and to determine their association with GEBVs for milk production traits (milk yield - MY, fat yield and fat content - FY and FC, and protein yield and protein content - PY and PC). A total of 334 animals were genotyped using the Illumina Bovine 50KSNP BeadChip. Program R (package 'genetics') was used for calculation of allele and genotype frequencies, and inferential statistical analysis on relationship between CSN genotypes and GEBVs (One-Way ANOVA) was performed with SAS ('glm' procedure). The frequency of the AA, AB, AE, BB, BE, and EE genotypes was 15 %, 42 %, 13 %, 23 %, 7 %, and 0.01 %, respectively. The frequency of allele B (which is favourable for the processing properties of milk), A, and E was 0.47, 0.43, and 0.10. The BB genotype was positively related to GEBVs for PC ($p < 0.05$), but negatively related to GEBVs for MY ($p < 0.05$). There were no statistically significant differences between polymorphisms of CSN and GEBVs for other examined dairy traits. The results showed that breeding for a favourable BB genotype would improve the overall PC in milk, but on the cost of MY, so more emphasis needs to be put on optimising future selection strategy if beneficial properties of BB genotype is to be exploited (harmonize it with the milk payment policy of dairies and cheese plants).

Keywords: kappa casein, Holstein, dairy traits, genomic selection