

Effects of the α -lactalbumin +15 polymorphism on milk protein composition

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Background

α -lactalbumin has an essential role in synthesis of lactose. Lactose is the major osmotic constituent in milk, consequently, important for milk yield.

The α -lactalbumin promoter +15G>A polymorphism has been associated with lactose content of milk (1).

Research question

Is the α -lactalbumin +15G>A polymorphism associated with milk production traits or with milk protein composition?

Method

α -lactalbumin +15G>A polymorphism genotyped in 1857 Dutch Holstein Friesian cows.

Milk protein composition determined by capillary zone electrophoresis.

Association analysed with an animal model, comprising systematic environmental effects and genetic relationships.

Association with α -lactalbumin content

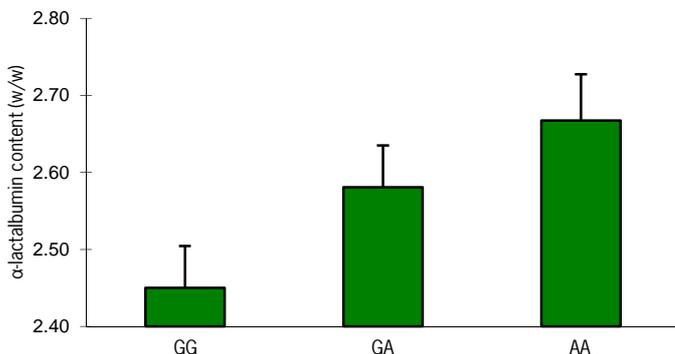


Figure 1: Association of α -lactalbumin content with α -lactalbumin +15G>A polymorphism. Error bars represent standard errors. The additive effect corresponds to 0.35 phenotypic standard deviation.

Selection for α -lactalbumin +15A (current frequency 0.25) can increase α -lactalbumin content from 2.51% to 2.67% (w/w), which is 0.49 phenotypic standard deviation.



Results

α -lactalbumin +15G>A polymorphism

- is not significantly associated with milk production traits, including lactose content and milk yield.
- is significantly associated with α -lactalbumin content ($p < 0.001$) and relative amount of casein ($p = 0.012$).
- is not significantly associated with α_{s1} -casein, α_{s2} -casein, β -casein, κ -casein or β -lactoglobulin content.

Conclusion

The α -lactalbumin +15G>A polymorphism can be used to select for higher α -lactalbumin content or higher relative amount of casein.

Association with relative amount of casein

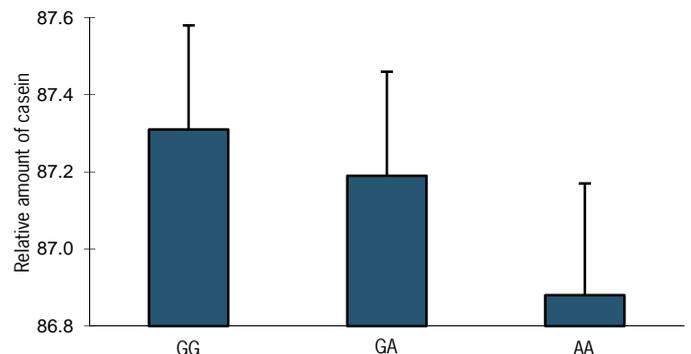


Figure 2: Association of relative amount of casein with α -lactalbumin +15G>A polymorphism. Error bars represent standard errors. The additive effect corresponds to 0.15 phenotypic standard deviation.

Selection for α -lactalbumin +15G (current frequency 0.75) can increase relative amount of casein from 87.24% to 87.31%, which is 0.05 phenotypic standard deviation.

(1) Lundén & Lindersson (1998) Proceedings '6th World Congress on Genetics Applied to Livestock Production', Armidale, Australia, Volume 25: 47-50.