Analysis of the effects of a cow's genetic predisposition on the composition of its milk

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The genetic predisposition of cows has an effect on the fat and protein content of their milk. Researchers at Wageningen University have spent the past few years examining the scope and significance of genetic variation between cows for the differences in quality characteristics of milk. They have discovered a number of genes that contribute to this genetic variation.

The research was carried out as part of the large-scale Milk Genomics project that Wageningen University (The Netherlands) launched in 2004 in association with the cattle breeding and dairy sector. On the basis of this knowledge, it is possible to devise an innovative breeding programme for cows and bulls to increase the proportion of unsaturated fatty acids in the milk and to improve cheese production.

Researchers found enormous variation in the composition of the milk fat in cows' milk. A significant proportion of these differences can be put down to genetic predisposition. DNA was analysed to find out which genes contribute to genetic differences between the animals. Researchers in Wageningen demonstrated that a mutation in a gene with a large influence on the *amount* of fat in milk, also affects the *composition* of that milk fat. Moreover, the Wageningen researchers were able to make use of available cattle genome data in their research; late last week more than 300 scientists published on this subject in the prominent scientific journal *Science*.

The information on the cattle genome was used to identify new genes

that affect the quality characteristics of milk. They identified six areas on the genome, where genes contributing to the genetic variation in milk fat composition are found.

According to the researchers, these findings provide an opportunity to devise an innovative breeding programme that exploits the natural variation within the dairy cattle population to make a targeted selection of cattle that produce milk with a modified fat composition. They predicted that the proportion of unsaturated fatty acids in milk could increase by ten percent in ten years by selection of bulls, in addition to the influence that animal nutrition could have on this proportion.

The researchers at Wageningen University also discovered substantial variation in the composition of milk proteins, which mainly comprise caseins. Here too, the differences can largely be put down to genetic variation. DNA analysis revealed three areas on the cow genome affecting the protein composition. Unlike the composition of milk fat, the effect of feed on the differences in the composition of milk protein is relatively small. A higher proportion of caseins results in increased cheese production, which at a rough estimate represents an extra 25 million Euros for the Dutch dairy sector.

Source: Wageningen University and Research Centre