

The pig as a Model for Nutrigenomic Studies

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Nutrigenomics is the study of the effects of nutrients on the expression of genes in various tissues of the organism. Nutrigenetics, in turn, deals with the genetic differences between people, which translate into the fact that each of us reacts differently to the same dietary components. It turns out that most chronic diseases are not caused by monogenic mutations or individual food ingredients, but by complex interactions between a very large number of different gene variants and different dietary components. Most nutrigenomic experiments are carried out on rodents (mice, rats). However, recently it has been increasingly said that the pig is a better model animal for humans due to its similar physiology, body size and omnivorousness. At our institute, we have been conducting nutrigenomic experiments on pigs for about a decade, because we see a number of advantages of this approach. Firstly, it makes it possible to obtain information from two different areas: by using various feed additives, we evaluate their impact on the characteristics of the fattening performance (gains, length of fattening), slaughter performance (carcass weight, percentage of meat in the carcass) or meat quality. On the other hand, by testing additives also used in the human diet, we can assess their impact on the molecular processes taking place in the body and thus assess their potential impact on health. Moreover, after the experiment is over, most often pig meat can be used for consumption, which gives the whole experiment a different ethical meaning than in the case of experiments on rodents. The first nutrigenomic experiment conducted at our institute concerned the analysis of the effect of feeding pigs with various types of fat (rapeseed oil, coconut oil, beef tallow) on gene expression in the liver, muscle and fat by RNA-seq (RNA- Next Generation Sequencing). We have observed that the addition of beef tallow to pigs' diets causes changes in the expression level of genes related to cholesterol biosynthesis and has a pro-inflammatory effect in the liver. At the same time, we observed that the fatty acid composition of the pigs' diet had a very strong influence on the fatty acid composition of the back fat of pigs. We are currently working on assessing the effect of supplementation with vitamin D3 in pigs' diet on gene expression in the liver, fat and muscles, as well as on growth characteristics and blood parameters. We are also testing the possibilities of enriching pork with vitamin D through dietary supplementation. So far our research has been carried out on commercial breeds of pigs; however, the fatty indigenous breeds seem to be an even better model in terms of examining the impact of nutrition on the prevention of civilization diseases such as diabetes or cardiovascular diseases.