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Prion Protein gene *(PRNP)* Polymorphism in Latvian Local Breed Goats

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Introduction. Latvian local breed goats (LVK) was developed in the 19th century by crossbreeding local goats with Russian and Megrel breed bucks. During the last decade the number of local goat is decreasing. The most relevant feature of LVK breed goats is the high reproduction capacity – fertility ~300% and kid rearing till the weaning age. The average live weight of a grown goat is 45 – 55 kg. The average milk yield of a LVK goat depending on feeding and keeping conditions varies from 450 – 650 kg with fat content 3.80 – 5.00%, and protein content 3.00 – 3.50%. Goats are disease resistant and have a longevity.

Scrapie is a lethal, neurodegenerative disease that is affecting sheep and goats. It is a disease that belongs to the group of transmissible spongiform encephalopathies (TSEs). This disease cause economic loss to herds, where animals are affected by it. The classical scrapie in sheep and goats has been affected by prion protein (*PRNP*) gene polymorphisms (Goldmann et al., 2011). The disease is hereditary and can be limited or eliminated by a thoughtful animal breeding by the selection of scrapie-resistant animals.

The aim of the study was to explain the polymorphism of the Latvian local goat breed population according to codons 146 and 222 of the *PRNP* gene.

Material and methods. In September and October 2019, farms with LVK goats (in total 7 farms) were selected and a total of 397 samples of goat biological material were collected, including 391 females and 6 male goats. The goats were 1 to 7 years old. Genetic analyzes were performed in Germany, in the laboratory Eurofins Medigenomix GmbH.

Results

In the Latvian local breed goat population analyze two codons of *PRNP* gene, were found low resistant allele frequency (Fig.1.).

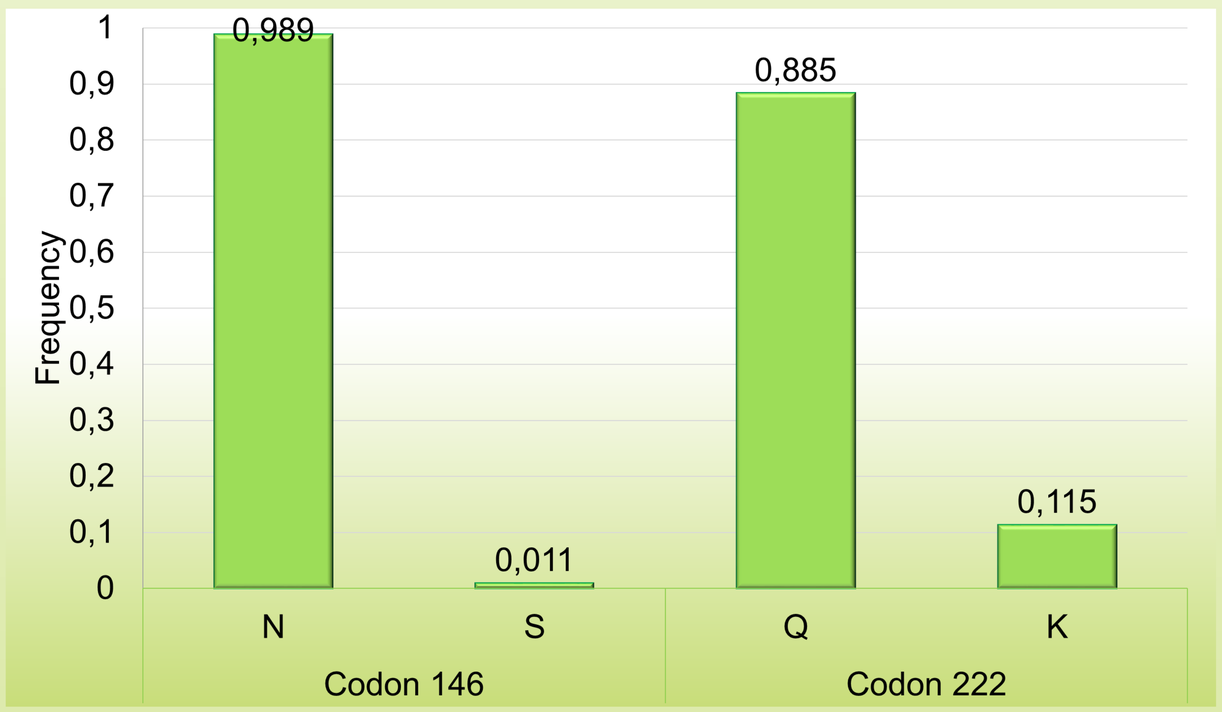

Fig. 1. The allelic frequencies of *PRNP* gene of Latvian local goat breed.

Analyzing two codons of the *PRNP* gene in the LVK breed goats, it was found that codon 146 are practically monomorphic according to the N allele, the frequency of which was 0.989. Of the analyzed LVK breed goats, only 9 animals, or 1.1%, had the S allele. No males goat had a heterozygous genotype.

A higher polymorphism was observed in codon 222 of the *PRNP* gene. 88 goats, or 11.5%, had a resistant K allele. The frequency of the Q allele was 88.5%. However. Only one male goat had the K allele.

LVK genotypic frequencies at codons 146 and 222 of the *PRNP* gene locus are displayed in the table.

The results show, that 97.7% of LVK goats had homozygous genotypes NN on codon 146. Only 2.3% of goats had heterozygous genotypes NS. Within goats, that were analyzed, none of them had SS genotype. Also, within the LVK goats, in the codon 146 the second resistant allele D was not found.

The second codon 222 analysis shows, that 77.8% of the goats had homozygous QQ genotype. Heterozygous QK genotype was seen in 21.4% of the goats. Homozygous KK genotype had almost 1% of the goats. Resistant KK genotype was found only in the female goats. Within the analyzed LVK breed goats, none had boths codon resistant alleles.

Table. Genotypic frequencies at codons 146 and 222 of the *PRNP* gene locus

PRNP codon 146		*PRNP* codon 222	
Genotypes	Frequencies	Genotypes	Frequencies
NN	0.977	QQ	0.778
NS	0.023	QK	0.214
SS	0	KK	0.008

Genotype analysis shows, that a small number of goats had resistant *PRNP* gene allele, but on the other hand, it were not observed, that LVK goats had been sick with Scrapie, basically, they are resistant to diseases and to them are good longevity.

Conclusions

- Within the analyzed 397 LVK breed goats, 1.1% of the goats had codon 146 resistant S allele and 11.5% of the goats had codon 222 resistant allele K.
- Selection work to increase the frequency of the resistant alleles and genotypes in the LVK breed in the future is problematic, because only 3 goats had a homozygous KK genotype and one male of the 6 goats had a K allele.

Fig. 2. LVK goats hair have different colors (Author's photos)

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