

# The evaluation of the influence of *FMO3* gene polymorphism on the milk productivity of Ayrshire breed cows

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**INTRODUCTION:** Russian Ayrshire population of cattle is the second largest in number the world population of animals of this breed and is one of the seven most common dairy breeds of the country with a livestock of cows of about 50 thousand heads. Trimethylaminuria (TMA) is the monogenic disease manifesting in the "fish off-flavor" of the milk from the sick cows and caused by R238X mutation in the flavin-containing monooxidase 3 gene (*FMO3*).

**The aim** our investigation was the analysis of the *FMO3* gene polymorphism of Ayrshire cattle breed and its relationship with the milk productivity of cows of the first lactation.

**MATERIALS:** The analysis of *FMO3* gene polymorphism has been carried out on 352 animals of 5 herds, and associations with the figures of the milk productivity due 305 days of the first lactation have been evaluated on 20 healthy cows (RR) and 6 ones-carriers of the mutation (RX).

**METHODS:** DNA has been extracted by means of the kit "DNA-Extran" (Syntol Company, Russia). The identification of the *FMO3* genotypes has been conducted by PCR-RFLP in according to the previously developed method with using *TaqI* restriction endonuclease.

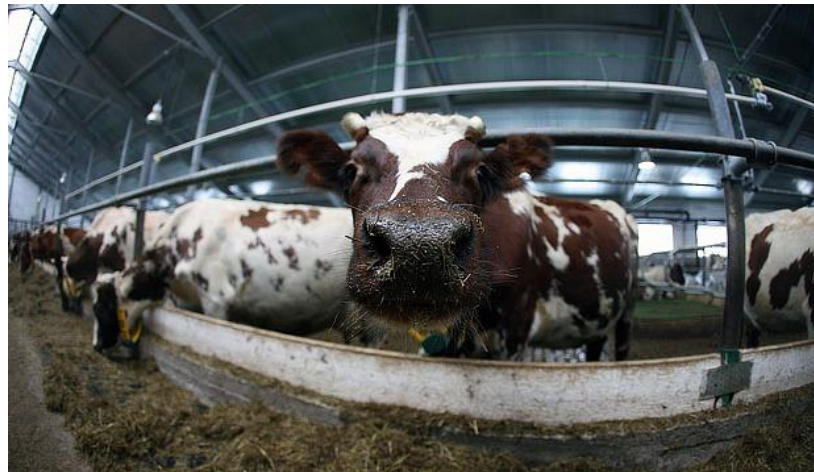


Fig 1. Ayrshire cow [https://www.bnkomi.ru/data/news/16801/?id\\_voting=268&vote\\_widget=1&yt0=%D0%93%D0%9E%D0%9B%D0%9E%D0%A1%D0%9E%D0%92%D0%90%D0%A2%D0%AC/](https://www.bnkomi.ru/data/news/16801/?id_voting=268&vote_widget=1&yt0=%D0%93%D0%9E%D0%9B%D0%9E%D0%A1%D0%9E%D0%92%D0%90%D0%A2%D0%AC/)

**RESULTS:** In the milk herds of Ayrshire cattle breed of the Central and Northern-Western districts of Russia the frequency of animals-carriers of X allele associated with the defect of "fish off-flavor" of milk was in the range 10.21-12.82%. The frequencies of R and X alleles in the position p. R238X in the studied population consisted 0.87 and 0.13 and the frequencies of RR, RX and XX genotypes - 76.9, 20.5 and 2.6 %, respectively. The study of relationship between the genotypes on *FMO3* gene and productivity traits has shown that the homozygous RR-individuals in comparing to RX-ones had significantly higher levels of the milk yield (+918.6 kg,  $p \geq 0.05$ ) and content of the milk protein (+28.8,  $p \geq 0.05$ ). A nonsignificant tendency to increase the service period in animals carrying the "fish off-flavor" defect (+190.6 days) was revealed. Adaptive abilities of cows with the RR genotype of Russian selection allowed them to surpass animals of Finnish origin with a similar genotype in milk yield  $5655.6 \pm 254.2$  against  $5105.0 \pm 238.6$  kg. The comparison of the animals of Russian genetics of different genotypes has revealed more obvious superiority of cows with RR-genotype in the milk yield and content of the milk protein against the heterozygous carriers - +1251.9 kg ( $p \geq 0.01$ ) and 58.95 kg ( $p \geq 0.05$ ), respectively.

**CONCLUSION:** The carried out investigations has shown the significant superiority the animals-non carriers of the "fish off-flavor" defect in the milk yield and content of the milk protein and also revealed the tendency to increase the service period in the heterozygous carriers of RX-genotype of *FMO3* gene cow.

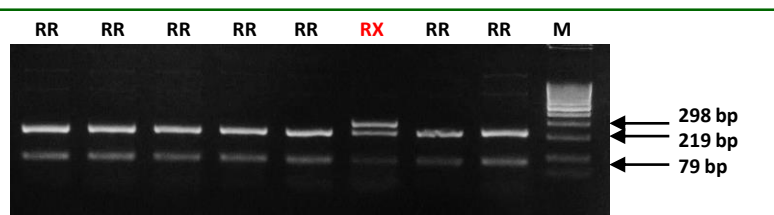


Fig 2. Identification of the *FMO3* genotypes by PCR-RFLP

Показатель	Характеристика
Gene	<i>FMO3</i> (flavin-containing monooxidase 3)
Gene ID	12466292
Chr	16
Location	NC_037343.1 (38649500...38676494)
SNP	<a href="#">16:38666821</a>
P.	p.R238*
rs	<a href="#">797790546</a>
Последовательность	TCATGGGACATGCTGTTTATCACT[C/T] GATTTGAACATTCTCAAGAACACCTT

Fig 3. OMIA 001360-9913

**ACKNOWLEDGMENTS:** This research was supported by the State task of the Ministry of Science and Higher Education AAAA-A18-118021590138-1.

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