No incidence of DUMPS carriers in Polish dairy cattle

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Abstract. DUMPS (Deficiency of Uridine Monophosphate Synthase) is a hereditary recessive disorder in Holstein cattle causing early embryo mortality during its implantation in the uterus. The only way to avoid the economic losses is early detection of DUMPS carriers. Because American Holstein semen has been intensively imported to Poland since 1970, there was a risk that DUMPS could have spread in Polish dairy cattle. In our study, 2209 dairy cattle of the Polish Holstein breed have been screened by the DNA test. The dominant group was young bulls entering the testing program (1171) and proven bulls (781). They represented all sires entering Polish breeding programs between 1999 and 2003. Also, 257 sire dams were included in the screening program. No DUMPS carrier has been found. Our results then indicate that the population of dairy cattle reared in Poland is free from DUMPS. Because of the economical significance of the DUMPS mutation and its recessive mode of inheritance, attention has to be paid to any case of a bull having in his origin any known DUMPS carrier. Such a bull should be tested and if positive eliminated from the active population. Also, young bulls (testing bulls) should be screened for DUMPS if in their progeny a high incidence of embryo mortality is observed and their genealogy cannot exclude their relatedness to any DUMPS carriers.

Key words: dairy cattle, DUMPS, genetic screening.
The primers have the following sequence:

**UMPS L** 5’ GCAAATGGCTGAAGAACATTCTG - 3’
**UMPS R** 5’ GCTTCTAACTGAACCTCCTCGAGT- 3’

To produce 108 bp fragment of the UMPS gene the following PCR mix was composed: 0.8 µL of primers UMPS L and UMPS R, each in concentrations of 100 pmol µL⁻¹, 0.8 U of Tfl polymerase (Epicentre), 12.5 µL MasterAmp 2X PCR Premix (Epicentre), ca. 150 ng of genomic DNA and H₂O ad 25 µL. Samples were amplified in an MJ Research thermocycler under the following conditions: 3 min/94°C and 35 cycles of 94°C/25 s, 62°C/25 s, 72°C/25 s.

The yield and specificity of PCR products were evaluated after electrophoresis in 1.5% agarose gel (Promega) with ethidium bromide. The results were observed, analysed and documented by the use of a Fluor-S Multimag (Bio-Rad). The PCR products were then digested by the AvaI enzyme to generate restriction fragments and electrophoresed in 3.5% agarose gel (AmpliSize, Bio-Rad).

In Figure 1 a typical result of DUMPS genotyping is shown. In the examined material no DUMPS carrier was found.

Figure 1. A typical pattern of DUMPS genotyping. PCR product of 108 bp has been digested by AvaI restrictase generating DNA fragments of 53, 36 and 19 bp (DUMPS free animals marked as TD) and fragments 89, 53, 36 and 19 bp (DUMPS carrier marked as DP – a reference DNA samples kindly provided by B. SCHWENGER). PCR – amplicon not digested (108 bp). First and last path – DNA size marker.
the females were usually provided for testing on the basis of a close relationship to a known carrier. A full list of carriers registered with the Holstein Association of America and the Red and White Dairy Cattle Association may be obtained by contact with those organisations.

Most carriers identified both in North America and Europe (438 in the USA and 314 in Europe) were offspring of Happy-Herd Beautician. He was used extensively because his production and other characteristics made him the fifth best U.S. Holstein bull in 1987. In January 1992 Happy Herd Beautician had 16000 offspring registered in the Holstein Association of America, half of which must be considered carriers. Besides, 6 DUMPS carriers were identified in North America that were descendants of other known carriers; these were black and white sires descended from Skokie Sensation Ned, but not through Beautician. The genes of Skokie Sensation Ned have certainly been imported to Poland with the imported semen of sires related to Ned. For instance, bull Constatijn, lic. No. 90200–4–9 (carrier of BLAD mutation) is his grandson. The most surprising fact, discovered lately, is the considerable burdening with the DUMPS mutation of Red and White cattle (101 carriers in North America and 84 in Europe). All were offspring of sire Needle-Lane Jon-Red, a very popular bull in the USA at the end of the nineteen eighties; his additive relationship to Skokie Sensation Ned was less than 1%. On the basis of the above mentioned program (testing of UMPS activity), the frequency of affected allele in American Holstein dairy cattle has been estimated at 1–2% (Shanks and Robinson 1990). In 1993 the cattle UMPS gene was sequenced (Schoeber et al. 1993), thus creating a possibility of conducting investigations on the DUMPS mutation using advanced DNA technologies. Although it is commonly known that Polish reproductive bulls are mostly descendants of top sires of the Holstein breed imported from different countries, especially during the last 15 years, our results indicate that the population of dairy cattle reared in Poland is free from DUMPS. However, because of the economical significance of the DUMPS mutation and its recessive mode of inheritance, attention has to be paid to any case of bull having in his origin any known DUMPS carrier. Such a bull should be tested and if positive, eliminated from the active population. Also, young bulls (testing bulls) should be screened for DUMPS if in their progeny a high incidence of embryo mortality is observed and their genealogy cannot exclude their relatedness to any DUMPS carriers.

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