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Association of *PIT-1* gene polymorphism with birth weight, milk and reproduction traits in Isfahan Holstein cows (Brief Report)

Beziehungen zwischen dem *PIT-1* Genpolymorphismus und dem Geburtsgewicht sowie Milch- und Reproduktionsmerkmalen bei Isfahan Holstein Kühen

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Background

Pit-1 (POU1F1) is a member of the POU-domain family of genes that play important regulatory roles in developmental processes (DYBUS *et al.* 2004). Pit-1, an approximate 33-kilodalton protein (291 amino acid), was first associated with a critical role in the transcriptional regulation of growth hormone (GH) and prolactin (PRL) genes (DYBUS *et al.* 2003). Molecular basis of this polymorphism was the silent mutation (G→A) located within exon 6 of the *Pit-1* gene (DIERKES *et al.* 1998). *Pit-1* gene considered as a candidate marker for milk production due to regulation of expression of bGH and the prolactin genes which are essential for mammary gland development and milk yield (DYBUS *et al.* 2004).

Material and methods

Genomic DNA samples were obtained in summer 2006 from 268 Holstein dairy cows belonging to four different herds. Animals were between 3 to 6 years of age. Genomic data along with 2588 related production and reproduction traits records (birth weight, milk yield, fat and protein percentage, pregnancy length, days in milk, open days and dry days) were used in statistical analysis. DNA samples were extracted from whole blood. PCR conditions described by EDRISS *et al.* (2008). Polymorphic variants of the *Pit-1* gene on recorded traits were analysed using SAS package (SAS 2003). The following model was employed:

$$Y_{ijk} = \mu + G_i + H_j + b(x_{ijk} - CI) + e_{ijk} \quad (1)$$

where Y_{ijk} is the analysed trait (milk and reproductive traits), μ the overall mean; G_i the fixed effect of the i-th genotype(1,…, 3); H_j the fixed effect of the j-th herd (1,…, 4); b the linear regression coefficient of analyzed trait on calving interval, x_{ijk} calving interval of cow, CI the average of calving interval and e_{ijk} the random error.

Results and discussion

As previously reported (EDRISS *et al.* 2008) the genotypic frequencies were 0.031 for AA, 0.519 for BB and 0.450 for AB as followed by 0.256 for A allele and 0.744 for B allele which were in linkage disequilibrium. Birth weight in BB genotype (41.98 kg) was significantly

Table 1
Least squares means and their standard error for birth weight, adjusted milk yield, fat and protein percentage, pregnancy length, days in milk, open days and dry days as referred to the *Pit-1* genotype

Least-Mean-Squares und ihre Standardabweichung für Geburtsgewicht, angeglichene Milchleistung, prozentualen Fett- und Eiweißgehalt, Schwangerschaftsdauer, Laktationstage, Güstzeit und Trockenstehzeit in Bezug auf den Pit-1-Genotyp

Trait		Birth weight, kg	Pregnancy length, d	Days in milk, d	Open days, d	Dry days, d	Adjusted milk yield, kg	Fat, %	Protein, %
	Overall mean	41.60±0.29	278.50±0.30	348.80±4.01	144.63±4.18	72.60±1.39	8 618±73	2.60±0.03	2.80±0.03
		(223)	(246)	(268)	(268)	(267)	(265)	(264)	(253)
Genotype	AA	40.20±1.58^{ab}	278.50±1.61^{a}	329.00±8.36^{b}	139.94±7.21^{ab}	81.92±7.21^{a}	8 433±383^{a}	2.53±0.12^{a}	2.70±0.17^{ab}
		(7)	(8)	(9)	(9)	(9)	(9)	(9)	(9)
	AB	40.80±0.44b	278.24±0.46^{a}	348.90±2.41^{a}	147.25±2.08^{a}	71.11±2.10^{a}	8 637±111^{a}	2.57±0.03^{a}	2.83±0.05^{a}
		(96)	(101)	(115)	(115)	(114)	(113)	(113)	(9)
	BB	41.98±1.58a	278.91±0.43^{a}	346.33±2.28^{a}	141.36±1.97^{b}	73.54±1.97^{a}	8 556±105^{a}	2.46±0.03^{b}	2.68±0.05^{b}
		(112)	(125)	(132)	(132)	(132)	(131)	(130)	(107)
Calving interval	b[1]	−0.004^{ns}	0.014***	0.820***	0.911***	0.117***	3.063**	−0.0008*	0.00007^{ns}

Any means in a sub-column having different superscripts (^{a,b}) are significantly different at 5% level of significance. [1] linear regression coefficient of y on x, ns not significant, *P≤0.05, **P≤0.01, ***P≤0.001

($P \leq 0.05$) higher than AB (40.80 kg) genotype. Adjusted milk yield (305d, 2×) were not significantly different among genotypes. Although numerically those individuals carrying AB genotype had produced more milk compare to the other two genotypes. Fat percentage in AB and AA genotypes was significantly ($P \leq 0.05$) higher than BB genotype. Protein percentage in AB genotype was significantly higher than BB genotype (2.83% vs. 2.68%). RENAVILLE *et al.* (1997) showed a superior effect of allele A on milk production (173.6±44.6 kg; $P \leq 0.1$) and protein yield (2.93±1.45 kg; $P \leq 0.05$), while they reported superiority of B allele over A allele for fat percentage (20.038±0.018%; $P \leq 0.1$). Pregnancy length and dry days were not affected by genotype. Days in milk in AB and BB genotypes were significantly ($P \leq 0.05$) greater than AA genotype (348, 346 vs. 329 days). Open days in AB genotype was significantly ($P \leq 0.05$) higher (+5.89 days) than BB genotype.

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