

## CONCENTRATIONS OF IGF-1 IN PLASMA OF HOLSTEIN COWS ARE NEGATIVELY ASSOCIATED WITH REPRODUCTIVE PERFORMANCE AND MILK YIELD AND POSITIVELY ASSOCIATED WITH MILK COMPOSITION

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Most breeding programs for dairy cows use indices that weight traits for yield and type more than for fertility, resulting in substantial genetic progress for yield, but associated with reduced fertility. Plasma Insulin-like Growth Factor-1 (IGF-1) has been implicated in pre and post-natal growth, lactation, reproduction, and immune function, and is produced primarily in the liver, although many other tissues produce smaller quantities (Lund *et al.* 1986). The use of plasma IGF-1 as a genetic predictor of some economically important traits has already been investigated in the beef and pig industries, where there is increasing evidence that it can be used as an indirect selection criterion for improving feed efficiency (Johnston *et al.* 2002). Plasma IGF-1 could be used in dairy cows to identify those animals most at risk of anoestrus and to select animals of differing efficiency in their productive ability on a pasture-based diet. To develop such a test, the associations between plasma IGF-1 and various important reproductive and productive factors must be understood.

Seventy-two high producing, multiparous, Holstein-Friesian cows were monitored for 12 months, from 3-4 weeks pre-partum until the end of lactation. During the dry period, they received a total mixed ration at about 1.6% of liveweight. After calving, they were fed to maintain an intake of approximately 210 MJ ME/cow/day throughout the entire lactation. This was achieved with pasture plus 6 kg DM grain concentrates. In mid-lactation, maize silage was added to the diet at 7 kg/cow/day, and progressively increased to 16 kg by late lactation. Plasma IGF-1, milk production and reproductive performance were measured, and associations were examined (Table 1).

**Table 1. Pearsons correlation coefficients between plasma IGF-1 concentrations and various production and reproduction variables.**

|                             | Plasma IGF-1, day<br>28-21 prepartum | Plasma IGF-1, day<br>70-84 postpartum | Plasma IGF-1, day<br>120 – 182 postpartum | Plasma IGF-1, day<br>210-271 postpartum |
|-----------------------------|--------------------------------------|---------------------------------------|---|---|
| Interval to first ovulation | -0.44***                             | -0.33*                                | -0.33**                                   | -0.31**                                 |
| Annual milk production      | -0.09                                | -0.52***                              | -0.34**                                   | -0.62***                                |
| Annual protein %            | 0.01                                 | 0.32*                                 | 0.17                                      | 0.33*                                   |
| Annual fat %                | 0.27                                 | 0.33*                                 | 0.23                                      | 0.32*                                   |
| Annual protein kg           | -0.11                                | -0.50***                              | -0.33*                                    | -0.60***                                |
| Annual fat kg               | 0.13                                 | -0.30*                                | -0.18                                     | -0.42**                                 |

\*\*\*=P<0.001; \*\*=P<0.01; \*=P<0.05

Plasma IGF-1 varied throughout the experimental period due to physiological, dietary and management changes. At any 1 time, there were large variations in plasma IGF-1 between cows, but an individual cow's rank position within the herd remained similar throughout. Plasma IGF-1 was correlated with reproductive performance, regardless of whether it was assessed in the dry period or during lactation, such that those cows with higher plasma IGF-1 at any time tended to have a shorter interval to first ovulation. Plasma IGF-1 correlated significantly with milk production variables throughout lactation, and particularly around mating start date and late lactation. During this time, plasma IGF-1 was negatively correlated with annual milk yield and positively correlated with milk fat and protein concentrations. These correlations provide further evidence supporting the negative relationship between production and reproduction in dairy cows, and an insight into why selection for production (low IGF-1) may have contributed to the declining fertility seen in dairy herds.

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