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*Short communication*

# Effect of a single-dose parenteral selenium supplement administered to pregnant dairy cows on selenium and iron concentrations and immune status of calves

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## Abstract

The study was performed on 21 H-F calves divided into 3 groups of 7 animals each. The first group was composed of calves whose mothers did not receive an injection of Se preparation. The second and third groups consisted of calves whose mothers were administered injections of Se and vitamin E in a single dose of 10 ml and 30 ml, 10 days before the expected parturition date. 24 hours after birth, blood samples were collected from all calves to determine Se, Fe and IgG concentrations and the activity of GSH-Px and GGT. The results of the study indicate that the administration of a single-dose Se supplement to cows in late pregnancy increases Se concentration in calves and promotes passive transfer of immunity from the mother to offspring.

**Key words:** calves, cows, selenium, IgG, GGT, passive transfer

## Introduction

The transfer of immunoglobulins from the mother to the newborn via the colostrum, known as passive transfer, plays a very important role in protecting the infant against infectious factors. The influence of selenium supplements on IgG levels has been widely debated in the literature. According to Awadeh et al. (1998), the administration of selenium supplements to pregnant cows increases IgG concentration in the colostrum and plasma, whereas other authors did not observe such correlations (Rock et al. 2001, Moeini et al. 2011b).

## Materials and Methods

The study was performed on 21 H-F calves divided into 3 groups of 7 animals each. The first group was composed of calves whose mothers did not receive an injection of selenium preparation (Se0). The second and third groups consisted of calves whose mothers were administered i.m. injections of a Se and vitamin E supplement containing 0.5 mg of sodium selenite/ml and 50 mg of tocopherol acetate/ml in a single dose of 10 ml (Se10) and 30 ml (Se30) ml, 10 days before the expected parturition date ( $10 \pm 2$  days) (Eurovet Ani-

mal Health B.V.). The mothers were characterized by similar age (4 years old, 3<sup>rd</sup> pregnancy,) and body weight (about 500 kg/bw). The animals were fed diets composed of grass haylage, maize silage and straw with the addition of a vitamin and mineral supplement for dry cows (7.5 mg Se/cow/day, sodium selenite, LactoPlus Extra Keragen Longlife®, Josera). Calves after the birth were vital (7–8) points in Mulling's Apgar score. The calves were fed 2 liters of the mother's colostrum administered by stomach tube 2 hours after birth, and another 2 liters 12 hours after birth. The colostrum collected from each cow was subjected to colostrum testing (density from 1.047 to 1.055 which corresponded to approximately 55–70 g/l Ig). 24 hours after birth, blood samples were collected from all calves. Serum Se concentration was determined by hydride generation flame atomic absorption spectrometry using a Unicam 939 Solar spectrophotometer. The activity of GSH-Px was determined using a kinetic method in an Epoll-20 biochemical analyzer with a Ransel Glutathione Peroxidase Assay Kit. Fe concentration and GGT activity in the serum were determined using an Accent 200 biochemical analyzer (Cormay) with Cormay reagent kits. Serum IgG levels were determined using a BioX ELISA Test (Bio-X Diagnostics).

The study was performed with the approval of the Local Ethics Committee for Experiments on Animals (Olsztyn, Poland, Number: 49/2014). The results of laboratory analyses were processed in the Statistica 9.0 program. The significance of differences between groups was determined with the Student's t-test for two independent samples at a significance level of  $p \leq 0.05$  and  $p \leq 0.01$ .

## Results and Discussion

In our study, the offspring of supplemented cows were characterized by significantly higher serum Se concentration than control calves, and the highest Se levels were noted in group Se30 (Table 1). Moeini et al.

(2011a, b) also reported a higher serum selenium concentration in the offspring of cows and ewes whose diets were supplemented with two doses of Se during pregnancy. A strong correlation between Se supplementation and Se concentration in newborn calves was also reported by Pavlata et al. (2003) where cows were administered one (4 weeks before parturition) or two (8 and 4 weeks before parturition) Se injections during pregnancy. In the cited study, selenium levels did not differ significantly between calves whose mothers were administered one and two Se injections. These findings suggest that a single dose of a selenium-based supplement, which was also applied in our experiment, is sufficient to restore a healthy Se balance in newborns. Selenium levels in Se0, Se10 and Se30 groups were lower than those described by Moeini et al. (2011a, b) and similar to those reported by Pavlata et al. (2003).

In our study, Se levels in the offspring of supplemented mothers were positively correlated with GSH-Px activity (Table 1). Correlations between selenium concentration and GSH-Px activity were also reported by Pavlata et al. (2003) and Rock et al. (2001).

In our study, IgG levels in 24 hour old calves were significantly higher in calves whose mothers received a single i.m. injection of Se and vitamin E than in control calves and the highest level was observed in the Se30 group calves (Table 1). In the S0 group IgG concentration was within the range 6.4–13.5 g/dl, in the S10 group 13.2–30 g/dl and in the S30 group 17.6–35.5 g/dl. These results are similar to obtained by Awadeh et al. (1998). In contrast, Hidiroglou et al. (1992) did not report significantly higher IgG levels in calves receiving vitamin E supplements in comparison with non-supplemented calves.

GGT activity in Se10 and Se30 calves was significantly higher (Table 1), which could indicate that GGT is absorbed more effectively by the offspring of cows whose diets were supplemented with Se during pregnancy. According to Wilson et al. (1999), GGT activity is correlated with serum IgG concentration in calves.

Table 1. Selenium, iron and IgG concentrations and activity of glutathione peroxidase and gamma-glutamyl transferase in control group (Se0) calves and in calves whose mothers were administered 10 ml of Se+Vit E (Se10) and 30 ml of Se+Vit E (Se30) during late pregnancy.

	Se0	Se10	Se30
Se ( $\mu\text{g/l}$ )	43.43 $\pm$ 0.86	47.77 $\pm$ 0.92*	56.64 $\pm$ 1.25**
GSH-Px (U/gHb)	49.84 $\pm$ 1.13	54.63 $\pm$ 1.13	61.00 $\pm$ 0.99**
GGTP(U/l)	421.57 $\pm$ 34.24	696.29 $\pm$ 38.73**	938.00 $\pm$ 76.89**
IgG (g/dl)	9.64 $\pm$ 1.09	18.20 $\pm$ 2.15**	26.69 $\pm$ 2.55**
Fe ( $\mu\text{mol/l}$ )	7.47 $\pm$ 0.79	9.14 $\pm$ 0.88	9.86 $\pm$ 1.06

The results are means of 7 seven determinations  $\pm$  SEM

\* significant difference between experimental and control groups at a confidence level of  $p \leq 0.05$

\*\* significant difference between experimental and control groups at a confidence level of  $p \leq 0.01$

In our study, serum iron levels were similar and within the norm in all groups (Table 1). Similarly to other authors (Moeini et al. 2011a), we did not observe significant correlations between the administration of Se and vitamin E supplements to pregnant mothers and serum Fe concentration in newborn calves.

In summary we can conclude that the results of this study indicate that a single injection of a selenium supplement administered to cows during late pregnancy increases Se levels in calves and enhances passive transfer from the mother to the offspring.

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