# SEMINAL PLASMA ZINC CONCENTRATION IN RELATION TO SPERM QUALITY PARAMETERS IN BOARS

***Lipenský J., Lustyková A., Frydrychová S., Václavková E., Rozkot M., Čeřovský J.***

*Institute of Animal Science, Prague Uhříněves, Czech Republic*

## Abstract

Zinc plays an important role in pig reproduction and is associated with boar sperm quality or quantity parameters. The aim of this study was to evaluate a relation between boar sperm quality parameters and seminal plasma zinc concentration. Thirty-eight ejaculates from thirty-eight boars from one AI centre were used in this study. The following semen quality and quantity parameters were evaluated: morphologically abnormal spermatozoa (MAS), sperm motility, semen volume, sperm concentration and total number of spermatozoa per ejaculate. Only non-significant differences were found among the groups in the MAS incidence and in the boar sperm motility parameter. The highest MAS incidence (24.3 %) was found in group with the lowest seminal plasma zinc concentration while the lowest MAS incidence (16.8 %) was noted in group with the highest seminal plasma zinc concentration. On the basis of these results we cannot conclude that there is a significant relation between boar seminal plasma zinc concentration and evaluated sperm quality parameters.

**Key Words**: Zinc, seminal plasma, boar

Seminal plasma is important for progresive motility of sperm cells (Rodriquez-Martinez et al., 1990) and might be of importance to protect membranes and maintain fertilizing capacity during storage (Harrison et al., 1978). Sperm function is highly dependent on ionic environment (Hamamah et al., 1998). Zinc is one of the most important ions in the seminal plasma. Wong et al. (2002) reported that zinc influences the process of spermatogenesis, plays a major role in sperm motility (Wroblewski et al., 2003; Henkel et al., 1999), stabilizes sperm membrane (Lewis-Jones et al., 1996), exerts protective, antioxidant-like aktivity (Gavella et al., 1998), preserves the ability of sperm nuclear chromatin to undergo decondensation and modulates sperm function (Suruki et al., 1995). Moreover, proteins binding $Zn^{2+}$ ions in boar seminal plasma can presumably protect the sperm plasma membrane against cold shock and stabilize spermatozoa acrosome (Mogielnicka-Brzozowska et al., 2011).

The aim of this study was to evaluate a relation between boar sperm quality parameters and seminal plasma zinc concentration.

## Material and Methods

Thirty-eight ejaculates from thirty-eight boars from one AI centre were used in this study. The following semen quality and quantity parameters were evaluated: morphologically abnormal spermatozoa (MAS), sperm motility, semen volume, sperm concentration and total number of spermatozoa per ejaculate. MAS incidence were evaluated microscopically under oil immersion and 1500x magnification according to the staining method of Čeřovský (1976). Sperm motility was evaluated subjectively by microscopic estimation of the number of sperm moving in a visual field of phase contrast microscopy with a heating stage (38°C) at 100x magnification. Each sample was examined at three different microscopic fields and motility was expressed as percentage of sperm showing normal forward progressive movements. Sperm concentration was estimated using a Bürker counting chamber. Sperm samples were centrifuged and seminal plasma was removed for zinc concentration analyzes. Results were divided in three groups based on zinc concentration. Group I up to 450 umol/l (n = 15). Group II between 450 to 600 umol/l (n = 12). Group III over 600 umol/l (n = 11).

Statistical characteristics of the results were calculated using the QC Expert statistical program. Statistical significance was checked by the analysis of variance ANOVA.

## Results and Discussion

Figure 1 shows differences in the MAS incidence in comparison to the seminal plasma zinc concentration. The highest MAS incidence was found in group I (24.3 %) while lower MAS incidence was noted in group II (22.5 %) and group III (16.8 %). There is a possibility to conclude that seminal plasma zinc concentration related to a certain degree to MAS incidence. However it's necessary to say that no significant differences in the MAS incidence were found among the groups. Furthermore only low non-significant correlation between zinc concentration and MAS incidence (r = -0.13) was noted.

In boars it has been shown that, when sperm cells are damaged, Zn accumulates in the sperm cells with a consequent reduction of Zn in seminal plasma (Westmoreland et al., 1967).There is a trend for a negative association between Zn concentration and the number of abnormal tails (López Rodríguez et al., 2013).

Sperm motility was the second sperm quality parameter evaluated in this experiment. There were only minimal and non-significant differences among the groups in this parameter. The highest average motility was observed in group II. (62.1 %) while the lowest average motility (56.7 %) was observed in the group with the lowest seminal plasma zinc concentration. The results for average sperm motility

values are shown in Figure 2.

The level of $Zn^{2+}$ ions in the seminal plasma was rapidly decreased in boars with a high ejaculation frequency. A zinc deficiency may result in lower fertility due to increasing sperm fragility (Strzeżek et al., 1995).

There was a significant difference between low sperm concentration in group I ($261.3 \times 10^3/mm^3$) and high sperm concentration in group II ($320.4 \times 10^3/mm^3$) ($P<0.05$) as well as between high semen volume in group I (394.3 ml) and low semen volume in group II (271.3 ml) ($P<0.05$). Comparison of average values of the semen quantity parameters is presented in Table 1.

## Conclusions

Ejaculates with low seminal plasma zinc concentration slightly tended to higher morphologically abnormal spermatozoa incidence but on the basis of these results we cannot conclude that there is a significant relation between boar seminal plasma zinc concentration and morphologically abnormal spermatozoa incidence.

***Figure 1. Average values of the MAS incidence in comparison to the seminal plasma zinc concentration***

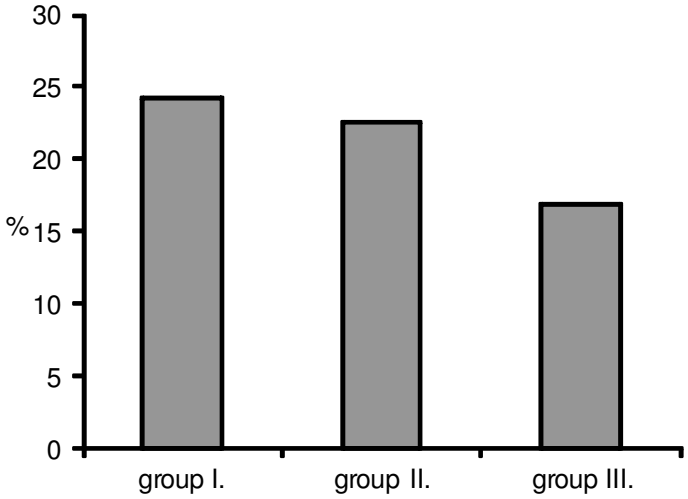


***Figure 2. Average values of the sperm motility in comparison to the seminal plasma zinc concentration***

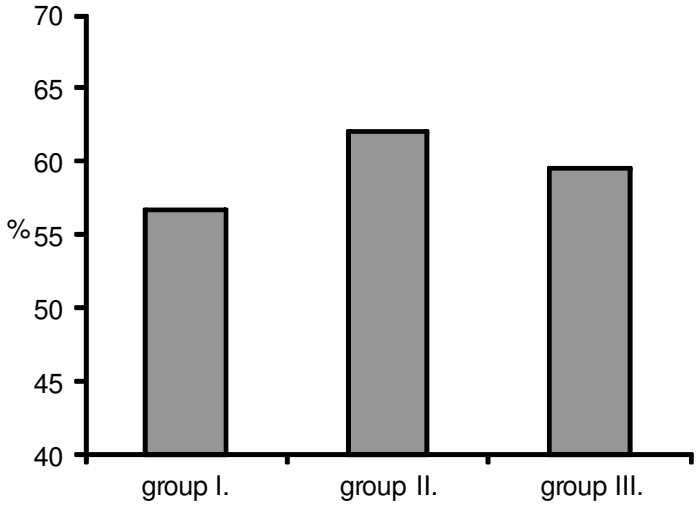

***Table 1. Comparison of average values of the semen quantity parameters based on the seminal plasma zinc concentration***

| Group | Semen volume | Sperm concentration | Spermatozoa per ejaculate |
|---|---|---|---|
| | (ml) | ($mm^3$ $x10^3$) | ($x10^9$) |
| I. | 394.3[a] | 261.3[a] | 96.6 |
| II. | 271.3[b] | 320.4[b] | 86.1 |
| III. | 342.7 | 292.7 | 94.1 |

[a,b] means within the column $P < 0.05$

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**Corresponding Address:**
Ing. Jan Lipenský
Institute of Animal Science Prague
Department of Pig Breeding
Komenského 1239, 51741 Kostelec nad Orlicí
Czech Republic
Email:lipensky.jan@vuzv.cz


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