ZINC SUPPLEMENTATION IMPROVES REPRODUCTIVE PERFORMANCE OF KARAN-FRIES CATTLE

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ABSTRACT

The pregnant Karan-Fries (KF) cattle were either fed basal ration only (0Zn, n=6), or were daily supplemented with 80 and 120 ppm Zinc (Zn), respectively (80Zn or 120Zn, n=6 each) for 45 days before and after calving to assess their producing ability, parity and body weight. The number of cattle exhibiting retained fetal membranes and metritis were 2, 1 and 0 in 0Zn, 80Zn and 120Zn group, respectively. Moreover, compared to no Zn supplemented group, in 120Zn and 80Zn supplemented group, there was reduction ($p<0.05$) in postpartum estrus interval, days to first insemination, service period, services per conception and an increase in conception rate. In brief, the supplementation of Zn improves reproductive efficiency of KF cattle.

Keywords: Conception rate, Estrus, Karan Fries Cattle, Metritis, Zinc

INTRODUCTION

Zinc (Zn) is an important element for efficient reproductive efficiency of livestock due to the role of Zn as co-factor for >200 enzymes (Abdel Monem and El-Shahat, 2011). Zinc is involved in major metabolic pathways and has anti-oxidative properties (Powell, 2000). The supplementation of Zn improves semen quality and fertility in male animals (Kumar *et al*., 2006), but its action on female reproduction remains unclear. The present study was planned to evaluate the effect of Zn supplementation on reproductive performance of KF cattle.

MATERIALS AND METHODS

The experiment was conducted on crossbred Karan-Fries (Holstein x Tharparkar) cattle expected to calve 45 days later. The control group (n=6, 0Zn) was fed basal diet, whereas the other two groups were fed 80 ppm or 120 ppm Zn (80Zn or 120Zn) as $ZnSo_4$ (food grade), respectively, along with basal diet from 45 days pre-partum to 45 days post-partum. Blood samples were collected, before offering any feed, on day -45, -30, -15, - 0, +15, +30 and +45 with respect to the expected date of calving (day 0). Plasma Zn was estimated with help of Atomic absorption spectrophotometer (Model Z-5000). After calving, the animals failing to shed the fetal membrane within 12 h of calving were considered as the cases of retained fetal membranes. The animals were observed till day 15 post-calving for lochial / abnormal discharge and postpartum metritis. The recovery from metritis was assessed by rectal examination and physical characteristics of cervico-vaginal mucus. Subsequently, the animals were observed regularly during morning and evening using a teaser bull for the signs of estrus. The day to first observed estrus, day of first insemination, service period, services per conception and conception rate was recorded. The statistical analysis of reproductive performance was carried out by one-way ANOVA using SPSS software (version 22.0).

RESULTS AND DISCUSSION

On the day of calving, compared to day 45 before calving, the plasma Zn concentrations decreased ($p<0.01$) by 34.2% in 0Zn group, whereas, the

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Table 1: Plasma Zn concentrations (ppm, Mean±SE) **in Zn supplemented and non-supplemented Karan-Fries cattle** (n=6 in each group)

Day	0 ppm Zn	80 ppm Zn	120 ppm Zn
-45	0.94 ± 0.02	0.96 ± 0.03	0.93 ± 0.01
-30	0.82^{a} ± 0.01	1.02^{ab} ± 0.12	1.19^{b} ± 0.07
-15	0.64^{a}± 0.01	0.99^{b} ± 0.06	1.12^{b}± 0.04
0 (Calving)	0.60^{a}± 0.01	0.82^{b}± 0.05	1.05^{b}± 0.06
15	0.74^{a}± 0.05	0.90^{b}± 0.02	1.31^{b} ± 0.05
30	0.86^{a}± 0.02	1.11^{b} ± 0.06	1.49^{c}± 0.08
45	0.97^{a} ± 0.07	1.21^{b} ± 0.04	1.59^{c}± 0.04

^{a,b,c}Means having different superscripts within a row differ significantly ($p<0.01$)

respective reduction in 80Zn and 120Zn groups was only 17% and 3.3% (Table 1). Subsequent to calving, plasma Zn was higher ($p<0.01$) in supplemented compared to non-supplemented KF cattle (Table 1). A previous study has also reported higher plasma Zn following supplementation of 60 ppm Zn to dairy cattle (Maurya *et al*., 2013).

About 33.3% non-supplemented cattle, 16.6% cattle following 80 ppm Zn supplementation and none of the cattle following 120 ppm Zn supplementation had retention of fetal membranes and post-partum metritis (Table 2). Moreover, the time to shed fetal membranes and days to recover from post-partum metritis was lesser in 120Zn group (Table 2). Previously, a reduction in cases of retention of fetal membranes from 37% to 25% following supplementation of 80 ppm Zinc to cattle during dry periods was reported (Phondba, 2012). In another study, the supplementation of selected minerals from day 60 prepartum to day 200 post-partum reduced the incidence of metritis in cattle (Toni *et al.*, 2007).

Zinc supplementation at 80 ppm and 120 ppm reduced ($p<0.05$) post-partum estrus interval by 11.14% and 11.98% compared to non-supplemented cattle (Table 2). Similar results were reported in an earlier study (De *et al*., 2014). Artificial insemination was done in 80 ppm and 120 ppm supplemented group about 10.8 and 17.3 days earlier ($p<0.05$) in comparison to non-supplemented cattle, respectively (Table 2). The organic mineral supplementation containing Zn can reduce the mean interval to first service in dairy cattle (Socha *et al*., 2003). The service period following Zn supplementation at 80 ppm and 120 ppm was reduced ($p<0.05$) by 20.12% and 23.14% compared to non-supplemented cattle (Table 2). The supplementation of sustained-release multi-trace element/vitamin bolus containing Zn, Co, Mn, Cu and Se to Holstein cattle reduced the service period by about 50 days (Khorsandi *et al*. 2016). Furthermore, the number of services per conception was reduced and the conception rate was increased following Zn supplementation ($p<0.05$, Table 2). Others have also reported similar results in dairy cattle (Ahola *et al*., 2004). Thus, the present study found that supplementation of Zn both at 80 ppm and 120 ppm concentration in the basal ration improved the reproductive efficiency of Karan-Fries dairy cattle.

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REFERENCES

Abdel Monem, U.M. and El-Shahat, K.H. (2011). Effect of different dietary levels of inorganic zinc oxide on ovarian activities, reproductive performance of Egyptian Baladi ewes and growth of their lambs. *Bulgarian. J. Vet. Med*., **14**(2): 116-123.

Ahola, J.K., Baker, D.S., Burns, P.D., Mortimer, R.G., Enns, R.M., Whittier, J.C. and Engle, T.E.

Table 2: Effect of Zn supplementation on reproductive performance of Karan-Fries cattle (n=6 in each group)

Parameters	0ppm Zn	80ppm Zn	120ppm Zn
Cattle with retained fetal membrane	2	1	0
Hour for fetal membrane shedding	8.25	6.46	6.12
Cattle with metritis	2	1	0
Days to recover from metritis	22	16	13
Days to 1st observed estrus	71.23±1.56[a]	57.33±1.29[b]	56.73±2.52[b]
Days to 1stinsemination	109±3.68[a]	99.16±2.83[b]	92.66±2.51[b]
Service period (days)	146.2±2.2[a]	116.7±1.7[b]	112.3±1.8[b]
Services per conception	2.3[a]	1.8[b]	1.6[b]
Conception rate (%)	42.8	54.5	60

[a, b, c] Means having different superscripts within a row differ significantly ($p<0.05$)

(2004). Effect of copper, zinc, and manganese supplementation and source on reproduction, mineral status, and performance in grazing beef cattle over a two-year period. *J. Anim. Sci.*, **82**(8): 2375-2383.

De, K., Pal, S., Prasad, S. and Dang, A.K. (2014). Effect of micronutrient supplementation on the immune function of crossbred dairy cows under semi-aridtropical environment. *Trop. Anim. Health Prod*., **46**: 203-211.

Khorsandi, S., Riasi, A., Khorvash, M., Mahyari, S. A., Mohammadpanah, F. and Ahmadi, F. (2016). Lactation and reproductive performance of high producing dairy cows given sustained-release multi-trace element/vitamin ruminal bolus under heat stress condition. *Liv. Sci.*, **187**: 146-150.

Kumar, N., Verma, R.P., Singh, L. P. Varshney, V.P. and Dass, R.S. (2006). Effect of different levels and sources of zinc supplementation on quantitative and qualitative semen attributes and serum testosterone level in crossbred cattle (*Bos indicus* x *Bos taurus*) bulls. *Repro. Nut. Dev.*, **46**(6): 663-675.

Maurya, P.K., Aggarwal, A., Chaudhari, B.K., Panday, A.K. and Maurya, P.S. (2013). Effect of α-tocopherolacetatae and zinc supplementation on immunity and reproductive health of karan fries cows during dry periods and early lactation. *Vet. Pract.,* **14**: 153-156.

Phondba, B. (2012). Influence of Zn and vitamin E supplementation to perarturient cows on immunity, incedience of mastitis and productive performance. *Doctoral dissertation submitted to NDRI Deemed University, Karnal, Haryana, India*.

Powell, S. R. (2000). The antioxidant properties of zinc. *J. Nut.,* **130**(5): 1447-1454.

Socha, M.T., Ensley, S.M., Tomlinson, D.J. and Johnson, A.B. (2003). Variability of water composition and potential impact on animal performance. In: *Proc. Intermountain Nut. Conf*. pp. 85-96.

Toni, F., Grigoletto, L., Rapp, C.J., Socha, M.T. and Tomlinson, D.J. (2007). Effect of replacing dietary inorganic forms of zinc, manganese, and copper with complexed sources on lactation and reproductive performance of dairy cows. *Pro. Anim. Sci.*, **23**(4): 409-416.