CHAPTER VI
SUMMARY AND CONCLUSION S

Among different trace minerals, Zn plays an important role in both male and female reproduction. Normal requirement of Zn in most domestic animals ranges between 40-100 ppm. Zn content in animal feeds varies widely due to various factors viz., soil type, seeds, fertilizers, irrigation and climatic conditions. Oil seed cakes, cereal brans and legumes contain higher concentration of Zn, followed by green fodders, cereal grains and cereal straws. Zn is found to be important mineral in improving the quality of semen. Organic and inorganic forms of Zn are metabolized differently in the body after absorption and organic form of Zn is better absorbed and utilized in body compared to inorganic Zn.

Zn as an important trace mineral playing critical role in metabolic activities has received attention of scientific community in improving libido, semen quality and conception rate in breeding bulls. Considering the importance of Zn on sexual behaviour and semen quality, an experiment was undertaken to investigate the “Effect of organic Zn supplementation in the ration on sexual behaviour and semen quality of Gir bulls” with following objectives.

The present investigation was formulated with the following objectives.

Objectives:
1. To assess the effect on feed and water intake in Gir bulls in view of organic Zn supplementation in the diet.
2. To evaluate pre and post thaw semen characters in Gir bulls supplemented with organic Zn.
3. To record sexual behavioural changes, if any, in Gir bulls maintained on organic Zn supplemented rations.

A total of 128 ejaculates (64 pre supplementation and 64 post supplementation) were collected from 8 adult Gir bulls. The ejaculates were so numbered that minimum of eight ejaculates for one spermatogenic cycle were collected to compare and evaluate supplementation effect of Zn propionate on sexual behavior and semen quality.

ICAR (2010) feeding standards were followed for meeting the nutrient requirements of breeding bulls. Following were part of the experimental rations:
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$T_1$

Concentrate: Commercial concentrate mixture (ISI –grade –I) and Cotton seed cake to meet protein requirement.

Green fodder: 10 kg maize/ seasonal green fodder available on the farm to meet carotene requirement.

Dry fodder: Groundnut haulms (6 kg/animal/day) and mature pasture grass hay offered *ad libitum*.

Changes were made in nutritional allowances according to changes in body weight recorded at fortnight intervals.

Experimental rations were offered for a period of one month and the observations recorded during this period were treated as control for a period of 50 days to encompass one spermatogenic cycle.

$T_2$

To the basal diet given in $T_1$, Zinc Propionate at the rate 40 ppm per animal was supplemented for a period of 50 days to complete one spermatogenic cycle. Zn content in the experimental feeds and fodder was concentrate (Amualdan) 59.30, cotton seed cake 39.65, maize 09.34, groundnut 27.10, pasture grass hay 3.00 ppm, respectively.

The parameters studied included body weight, biometry and scrotal measurements, feed intake, dry matter intake, protein intake, zinc intake and water intake. Sexual behaviour and semen quality parameter like pH, colour, consistency, physical parameter like Ejaculate volume, Individual motility, Mass motility, Sperm concentration, Live –dead and Morphological Abnormality and Post thaw seminal characteristics.

Body weight of experimental Gir bulls varied from 370 to 680 kg with an overall mean of 491.25 ± 38 and 554.67 ± 35 kg, respectively, during prior and post supplementation phases of the experiment. Experimental bulls gained 8.00 % of body weight in the second phase of the experiment, which was significant ($p<0.001$). Out of the total eight experimental bulls three bulls were farm born and five bulls were purchased animals. Four animals were in growing phase and significant body weight gain was due to growth effect.

Mean heart girth (meters) was 1.82 ± 0.05 and 2.00 ± 0.07, respectively, before and after supplementation period in experimental Gir bulls.
Summary and conclusions

Body length of Gir bulls was 1.54 ± 0.14 and 1.67 ± 0.13 meters, respectively before and after supplementation period.

Height at withers was recorded to be 1.29 ± 0.03 and 1.37 ± 0.02 meters, respectively before and after supplementation period in Gir bulls.

Significant (p<0.01) for Heart Girth, (p<0.02) for body length and (p<0.05) for Height at Withers, changes in body measurements of experimental bulls is explainable due to growth stage of four of the eight experimental bulls over a period of 100 days.

During pre supplementation phase, length of right testis, length of left testis, circumference of right and left testis and total scrotal circumference respectively were (mm) 116.98 ± 0.14, 114.23 ± 3.66, 72.68 ± 2.00, 74.47 ± 2.64, 114.25 ± 4.84. Respective values during post feeding were (mm) 127.36 ± 0.13, 124.06 ± 3.67, 81.24 ± 1.96, 89.89 ± 3.37, 132.73 ± 4.49. At the end of second phase of the experiment, there is significant (p<0.001) increase in all the scrotal measurements, mainly due to growing stage of farm borne bulls.

Overall mean values for DM intake kg/day in Gir bulls was 7.72 ± 0.70 and 8.32 ± 0.40 kg per day, before and after supplementation of Zinc Propionate, respectively, while percent DM intake kg/100kg BW and DM intake g/kg W^0.75 basis were 1.92 ± 0.21 and 2.11 ± 0.74 and 86.41 ± 1.20 and 93.14 ± 1.08, respectively. DM intake significantly (p<0.01) increased due to Zn propionate supplementation. DM intake in the present study was lower than ICAR (2010) recommended intake before supplementation. However, post supplementation of Zn propionate, percent DM intake and DM intake/100 kg BW, DM Intake/kg W^0.75, in Gir bulls were at par with ICAR (2010) recommended intakes.

Average values for water intake was 38.54 ± 0.74 Lit./day, 9.62 ± 1.12 Lit./100 kg/BW, 432.51 ± 0.33 ml/kg W^0.75 and 40.01 ± 0.87 Lit./day, 10.00 ± 1.00 Lit./100 kg BW, 450.27 ± 0.21 ml/kg W^0.75, respectively, before and after supplementation of Zn propionate. Water intake was not significantly affected due to Zn propionate supplementation.

Mean intake of CP was 512.10 ± 2.11 g/day, 128.52 ± 0.89 g/ 100 kg BW and 5.85 ± 0.23 g/kg W^0.75 and 523.10 ± 1.88 g/day, 130.78 ± 0.98 kg/100 kg BW, and 6.98 ± 0.20 g/kg W^0.75, respectively, before and after supplementation of Zn propionate. The difference in CP intake was significant (p<0.05).
**Summary and conclusions**

Mean Zn intake was $33.27 \pm 1.05$ ppm prior to supplementation and $55.59 \pm 0.96$ ppm post supplementation period, with significant difference.

Regarding sexual behaviour score, all the experimental individual bulls showed improvement in libido score, mating ability score and sexual behaviour score post Zn propionate supplementation period and overall these scores improved significantly ($p<0.01$) indicating that Gir bulls responded to Zn propionate supplementation.

Libido ranged from $34.55 \pm 4.0$ to $72.11 \pm 2.1$ per cent in Paras to Raj bulls, respectively. Average libido score was $53.23 \pm 3.8$ per cent pre supplementation. Post supplementation, libido score ranged from $50.45 \pm 4.3$ and $80.24 \pm 4.3$ per cent in bulls Pratap to Vasu, respectively. Average libido score was $64.45 \pm 3.7$ per cent post supplementation. Post supplementation, libido score significantly ($p<0.01$) improved in Gir bulls.

Mating ability varied from $30.41 \pm 4.1$ to $80.87 \pm 2.9$ in bulls Paras to Raj, respectively before supplementation and $45.47 \pm 3.3$ to $85.91 \pm 4.0$ per cent in bulls Paras to Raj, respectively post supplementation period with means $56.71 \pm 2.7$ to $71.22 \pm 3.3$ per cent; the difference being significantly ($p<0.01$).

Following the same trend to sexual behaviour varied from $32.26 \pm 1.4$ to $76.11 \pm 2.3$ per cent in bulls Paras to Raj, respectively in control group compared to $57.50 \pm 2.8$ to $77.50 \pm 2.8$ per cent in bulls Baldev to Vasu in treatment group with mean $55.97 \pm 2.8$ and $68.81 \pm 2.7$ % difference in mean sexual behaviour score being significantly ($p<0.01$).

While considering the effect on semen colour, $57.8$ % semen samples were creamy white in colour followed by $26.6$ % yellowish and $15.6$ % milky white. Post supplementation, creamy white colour dominated in $81.3$ % of the samples followed by $17.1$ % samples appearing yellowish and only one sample, $1.6$ %, was milky white in colour.

Regarding consistency thin, thick and very thick samples constituted $32.8$%, $60.9$%, $6.3$ %, respectively in control group. The values for the same during post supplementation period were $10.9$%, $45.4$ % and $43.7$ %, respectively.

Average pH values of Gir bull semen ranged from $6.6 \pm 0.0$ to $6.7 \pm 0.1$ and $6.7 \pm 0.0$ to $6.8 \pm 0.1$ during pre and post supplementation periods with an overall mean of $6.7 \pm 0.0$ and $6.7 \pm 0.1$, respectively. pH value was not affected due to supplementation of Zn propionate.
Summary and conclusions

Overall mean values for semen volume was 3.3 ± 0.6 and 4.7 ± 0.4 ml per ejaculate, before and after supplementation, respectively, the difference being significant (p<0.01). Among individual bulls Ganesh and Paras recorded significantly [(p<0.02), (p<0.05)] increased semen volume from 2.7 ± 0.4 to 4.3 ± 0.5 and 3.3 ± 0.5 to 4.7 ± 0.4 ml respectively. Twenty five per cent of the experimental bulls responded to Zn propionate supplementation with regard to increasing semen volume.

Regarding mass motility, it was increased by 11.33 per cent during post supplementation period. Though all the bulls showed improvement in mass motility. 62.5 per cent bull showed significant (p<0.05, p<0.01) increase in mass motility.

With regard to individual motility per cent all the experimental bulls (100%) responded significantly to individual sperm motility. The mean being 79.14 ± 1.96 and 86.74 ± 1.34, respectively before and after supplementation with an overall increase of 9.8 %. In bulls Vasu, Baldev, Shiv (p<0.01), Ganesh, Pratap and Raj (p<0.05), Sawan (p<0.02) and Paras (p<0.001) responded positively with enhanced individual motility per cent post supplementation.

Post thaw semen motility in present experiment (p<0.01) improved in post supplementation period compared to control. The mean post thaw motility was 55.05 ± 1.4 and 61.0 ± 1.3 % during pre and post supplementation period, respectively.

Mean values for sperm concentration was 1306 ± 71.88 and 1447± 71.84 million/ml respectively, before and after supplementation period. The difference was significant (p<0.001).

Sperm concentration improved by 10.8 % after supplementation of Zn propionate. The difference in 37.5 % of experimental Gir bulls were not significant in relation to sperm concentration. Post supplementation appeared to have increased live sperm per cent significantly (p<0.001).

Mean live sperm per cent was 81.33 ± 1.93 and 88.28 ± 1.17, respectively pre and post supplementation of Zn propionate. Except Pratap all the individual Gir bulls responded significantly with regard to live sperm count. Raj and Sawan (p<0.05), Ganesh, Paras, Baldev and Shiv (p<0.01), Vasu (p<0.02) responded significantly to Zn propionate supplementation with regard to live sperm count.

Total abnormalities in neat semen of Gir bulls reduced significantly by 27.00 %. The mean total abnormalities were 15.75 ± 0.7 and 10.57 ± 0.8 % pre and post supplementation, respectively.
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All the experimental Gir bulls (100%) responded significantly (p<0.01) in reducing tail abnormality. The reduction was significant at p<0.01 % in Vasu and Shiv, p<0.05 % in Paras, Baldev and Raj, p<0.001 in Ganesh, Pratap and Sawan.

Conclusions

From the present study following broad conclusions were drawn.

1) Body weight, biometry and scrotal measurements were improved significantly in post supplementation period as compared to pre supplementation period which might be due to growing phase of four experimental Gir bulls as well as organic Zn supplementation synergistically.

2) Sexual behaviour score and mating ability were significantly influenced by organic Zn supplementation.

3) Semen volume, sperm concentration, mass motility, individual motility and live-dead sperm count in neat and post thawed semen were significantly improved in Gir bulls on organic Zn supplementation.

4) Overall the study indicated positive influence of organic Zn supplementation (at the rate 40 ppm zinc propionate) on semen quality and its attributes.