MORPHOMETRICAL RESPONSE OF SEMINAL VESICULAR GLAND TO DIETARY ZINC SUPPLEMENTATION IN ASSAM GOATS (*Capra hircus*)*

J. Devi[1], J. Goswami[2], B.C. Sarmah[3], A. Borah[4], K. Sarma[5], K. Hussain[6]

ABSTRACT

Seminal vesicular glands secrete seminal fluid that support and maintain sperm in breeding males. There are ample evidences regarding the ameliorative effect of zinc on the functional attributes of seminal vesicular glands, but its effect on dimensional dynamics has been least studied in livestock, particularly in goats. This study depicts the morphometrical reaction of seminal vesicular gland to dietary zinc supplementation in Assam goats (*Capra hircus*), an early maturing dwarf breed of North-Eastern India. Thirty six male Assam goats, aged 4 months, were divided into three groups, with 12 goats in each group. Group I goats were maintained on standard diet, and served as the control. Group II goats were given inorganic zinc (Zinc sulphate), while group III goats were given organic zinc (Zinc propionate) along with the diet up to 7 months of age. The study revealed linear increase in all morphological characteristics (length, width, thickness, weight) of the seminal vesicular glands with advancement in age. The highest length (1.81±0.029 and 1.75±0.029 cm), width (1.28±0.009 and 1.1±0.026 cm), thickness (0.99±0.02 and 0.99±0.015 cm), and weight (0.98±0.003 and 0.93±0.015 g) in group I, the highest length (1.82 ± 0.015 and 1.90 ± 0.009 cm), width (1.36 ± 0.006 and 1.36 ± 0.023 cm), thickness (1.10 ± 0.02 and 1.10 ± 0.009 cm), and weight (1.02 ± 0.02 and 1.04 ± 0.024 g) in group II, and the highest length (1.93 ± 0.015 and 1.94 ± 0.021 cm), width (1.39 ± 0.009 and 1.41 ± 0.009 cm), thickness (1.11 ± 0.023 and 1.12 ± 0.009 cm), and weight (1.07 ± 0.003 and 1.08 ± 0.003 g) in group III goats were recorded at 7 months in right and the left seminal vesicular glands respectively. The dimensions of morphological characterstics of goats supplimented with organic zinc (group III) were significantly ($P \leq 0.05$) higher than control goats. The response was uneven in case of group II goats. Organic zinc caused significant ($P \leq 0.05$) increase in length, width, and weight of the right gland (group III) than inorganic zinc (group II) at 7 months, while the differences between the two groups were non-significant ($P \geq 0.05$) with respect to the left gland. A comparative study between the right gland and left gland revealed that the right gland accrued more weight ($P \leq 0.05$) than the left in control goats (group I) at 7 months, while the left gland gained more weight than the right gland in zinc supplemented groups at 7 months, the difference was significant ($P \leq 0.05$) in group III goats. It is inferred that zinc supplementation significantly stimulated the morphological characteristics of the seminal vesicular glands, and the glands responded more favourably mophometrically to organic than inorganic zinc supplementation. The differential response of the right gland and the left gland to zinc supplementation needed exposition, but was beyond the scope of this study.

KEY WORDS

Assam goat, Morphometry, Seminal vesicle, Zinc supplementation

Author attribution: [1]Associate Professor & Head, Division of Veterinary Physiology, [5]Associate Professor & Head, Division of Veterinary Anatomy, [6]Assistant Professor, Veterinary Medicine, Faculty of Veterinary Science and Animal Husbandry, Sher-e-Kashmir University of Agricultural Science and Technology–Jammu, Jammu, Jammu & Kashmir, India- 181102. [2]Professor & Head, [3]Retd. Professor & Head, [4]Professor, Department of Veterinary Physiology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India- 781022. [5]Corresponding author: kamalsarma73@rediffmail.com *Part of the PhD thesis (Assam Agricultural University) of the first author. Date of Receipt: 16/11/2011, Acceptance: 01/08/2012.

INTRODUCTION

Zinc partakes in the physiological processes of cells through synthesis and regulation of zinc dependent enzymes (Prasad, 1969). Zinc is crucial for sperm health (Kendall *et al*., 2000). High concentration of zinc in sex organs like testis (Bedwal and Bahuguna, 1994), accessory sex glands, and spermatozoa itself (Underwood and Somers, 1969) signifies its importance in male reproduction.

Vesicular glands, a pair of asymmetrical accessory sex glands, just posterior to the bladder (Figure-1) produce seminal fluid that support and maintain sperm (King *et al*., 1989). Breeding males of small ruminant livestock like goat, managed under range grazing are likely to suffer from zinc deficiency due to low content of this micro-mineral in forages, particularly so in breeding season, due to their sexual overindulgence under polygamous breeding system. There are sparse reports on the effect of zinc supplementation on vesicular gland in domestic animals, particularly the dimensional characteristics of the gland in goats, since there is a close relationship between the size and the function of the gland (Coloma *et al*., 2011).

The present study was undertaken to elucidate the effect of oral zinc supplementation on the dimension dynamics of the seminal vesicular gland in growing Assam male goat, which is an early maturing dwarf breed of North-Eastern India.

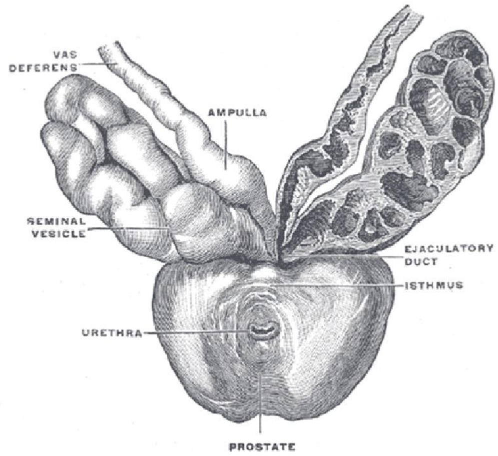

Figure-1. Seminal vesicles.

MATERIALS AND METHODS

This study was carried out on 36 male kids of Assam goat breed of 3 months of age of 3 to 4 kg body weight at the Department of Veterinary Physiology, College of Veterinary Science of the Assam Agricultural University, Khanapara, Guwahati.

The animals were reared under semi intensive system, and standard management practices were adopted in rearing the animals. The experimental goats received concentrate mixture @ 50 g / day / goat up to 5 months, and then @ 100 g / day / goat on 6th and 7th months of age, besides free range grazing.

The animals were divided into 3 groups with 12 goats in each group. Group I goats were maintained on standard diet with out zinc supplementation (control). Group II goats received inorganic zinc (Zinc sulphate) @ 120 mg/ day/goat along with the diet, while group III goats received organic form of zinc supplement (Zinc propionate) @ 40 mg/ day/goat.

Nine animals from each group were sacrificed after attaining 4, 5, 6, and 7 months of age. The right and left seminal vesicular glands were incised and their size with respect to length, width, thickness, and weight were recorded. The seminal vesicular glands retrieved after post-mortem of the cadaver were incised and were measured by Vernier Calipers. Weight was recorded with a Monopan Electronic Balance. The data were analysed by standard statistical procedures (Snedecor and Cochran, 1994).

RESULTS

The morphometrical observations of right and left vesicular glands (Figure-2) with respect to length, width, thickness, and weight of different treatment groups of goats (Group I- control, Group II- supplemented with inorganic zinc, and Group III- supplemented with organic zinc) at various ages (4m, 5m, 6m, 7m) are presented in Table-1.

Length: The length (cm) of the right and left seminal vesicular glands increased from 1.31±0.009 to 1.81±0.029, and 1.35±0.035 to 1.75±0.029 from 4 to 7 months of age, respectively in group I (control) kids. The corresponding values increased from 1.34±0.015 to 1.82±0.015, and 1.35±0.041 to 1.90±0.009 respectively in group II, and 1.36±0.023 to 1.93±0.015, and 1.37±0.029 to 1.94±0.021 respectively in group III kids.

The length of vesicular glands increased significantly ($P \leq 0.05$) with the increase in age up to 6 months in control (group I), and up to 7 months in treatment groups (group II and group III). Treatment groups (group II and group III) had significantly ($P \leq 0.05$) higher lengths than the control (group I) at 7 months, while the difference between them (group II and group III) were non-significant ($P \geq 0.05$). The length of the left gland (1.94±0.021 cm) in group III goats was higher than the length of the right gland (1.93±0.015 cm) at 7 months, but the difference was non-significant ($P \leq 0.05$).

Width: The width (cm) of the right and left seminal vesicular gland increased from 1.02 ±0.021 to 1.28±0.009 and 1.03±0.017 to 1.10 ±0.026 from 4 to 7 months of age, respectively in group I kids (control group). The corresponding values increased from 1.00±0.015 to 1.36±0.006 and 1.01±0.015 to 1.36±0.023 respectively in group II, and 1.00 ±0.015 to 1.39±0.009 and 1.00±0.022 to 1.41 ±0.009 respectively in group III kids.

The width of vesicular glands was significantly ($P \leq 0.05$) higher at 6 months in control (group I) goats, and at 5 months in treatment groups (group II and group III) over the previous ages. Treatment groups (group II and group III) had significantly ($P \leq 0.05$) higher widths than the control (group I) at 7 months, while the difference between them (group II and group III) were significant ($P \leq 0.05$) with respect to the right gland, but non-significant ($P \leq 0.05$) with respect to the left gland. There was no difference ($P \geq 0.05$) between the right gland and the left gland at 7 months, although the width of left gland (1.41±0.009 cm) was higher ($P \geq 0.05$) than the right gland in group III goats.

Thickness: The thickness (cm) of the right and left seminal vesicular glands increased from 0.60±0.006 to 0.99±0.020 and 0.66±0.015 to 0.99±0.015 from 4 to 7 months of age, respectively in group I kids (control group). The corresponding values increased from 0.64±0.017 to 1.10±0.020 and 0.65±0.006 to 1.10±0.009 in group II, and 0.61±0.015 to 1.11±0.023 and 0.64±0.015 to 1.12±0.009 respectively, in group III kids.

The thickness (cm) of the seminal vesicular glands increased significantly ($P \leq 0.05$) with increase in age up to 7 months. The thickness of the right seminal vesicular gland of group II and group III goats (treatment groups) were significantly ($P \leq 0.05$) higher than group I (control) at 7 months, while the differences between the treatment groups (group II and group III) was non-significant ($P \geq 0.05$). The differences between the right and left seminal vesicular glands were non-significant ($P \geq 0.05$) at all ages in all the groups.

Weight: The weight (g) of the right and left seminal vesicular gland increased from 0.47 ± 0.012 to 0.98 ± 0.003 and 0.52 ± 0.006 to 0.93 ± 0.015 from 4 to 7 months of age, respectively in kids of control group. The corresponding values increased from 0.49 ±0.009 to 1.02 ± 0.020 and 0.51 ± 0.012 to 1.04 ± 0.024 in inorganic and 0.52 ± 0.009 to 1.07 ± 0.003 and 0.52 ± 0.003 to 1.08 ± 0.003 in organic group of kids (Figure-3).

The weight of the seminal vesicular glands increased significantly ($P \leq 0.05$) with increase in age up to 7 months. The weight of the right gland in group III (1.07±0.003) was significantly ($P \leq 0.05$) higher than the control (group I) and group II goats at 7 months, while the difference between group I and group II was non-significant ($P \geq 0.05$). The weight of the left gland in group III goats (1.08±0.003) was significantly ($P \leq 0.05$) higher than the control (group I) goats, but did not differ from group II goats at 7 months of age. The weight of the left gland was significantly ($P \leq 0.05$) higher than the right gland in group III at 7 months. The difference was non-significant ($P \geq 0.05$) in group II goats.

Table-1. Morphometry of right and left vesicular glands at different ages under different treatments.

Character	Group I (n=9)		Group II (n=9)		Group III (n=9)	
	Right	Left	Right	Left	Right	Left
Length (cm)						
4m	1.31±0.009 (a1x)	1.35±0.035 (a1x)	1.34±0.015 (a1x)	1.35±0.04 (a1x)	1.36±0.023 (a1x)	1.37±0.029 (a1x)
5m	1.61±0.015 (b1x)	1.64±0.015 (b1x)	1.65±0.012 (b1x)	1.64±0.009 (b1x)	1.67±0.029 (b1x)	1.66±0.006 (b1x)
6m	1.78±0.015 (c1x)	1.71±0.020 (c2x)	1.76±0.012 (c1x)	1.80±0.015 (c2y)	1.82±0.009 (c1x)	1.86±0.009 (c2z)
7m	1.81±0.029 (c1x)	1.75±0.029 (c1x)	1.82±0.015 (d1x)	1.90±0.009 (d2y)	1.93±0.015 (d1y)	1.94±0.021 (d1y)
Width (cm)						
4m	1.02±0.021 (a1x)	1.03±0.017 (a1x)	1.00±0.015 (a1x)	1.01±0.015 (a1x)	1.00±0.015 (a1x)	1.00±0.022 (a1x)
5m	1.05±0.026 (a1x)	1.05±0.036 (ab1x)	1.10±0.018 (b1x)	1.12±0.009 (b1xy)	1.12±0.024 (b1x)	1.15±0.018 (b1y)
6m	1.30±0.009 (b1x)	1.10±0.023 (b2x)	1.32±0.003 (c1xy)	1.32±0.017 (c1y)	1.34±0.009 (c1y)	1.41±0.006 (c2z)
7m	1.28±0.009 (b1x)	1.10±0.026 (b2x)	1.36±0.006 (d1y)	1.36±0.023 (c1y)	1.39±0.009 (d1z)	1.41±0.009 (c1y)
Thickness (cm)						
4m	0.60±0.006 (a1x)	0.66±0.015 (a1x)	0.64±0.017 (a1y)	0.65±0.006 (a1x)	0.61±0.015 (a1xy)	0.64±0.015 (a1x)
5m	0.72±0.006 (b1x)	0.74±0.009 (b1x)	0.76±0.006 (b1y)	0.77±0.009 (b1y)	0.78±0.020 (b1y)	0.75±0.015 (b1xy)
6m	0.84±0.026 (c1x)	0.99±0.020 (c2x)	0.99±0.023 (c1y)	0.95±0.006 (c1x)	1.06±0.019 (c1z)	1.06±0.021 (c1y)
7m	0.99±0.020 (d1x)	0.99±0.015 (c1x)	1.10±0.020 (d1y)	1.10±0.009 (d1y)	1.11±0.023 (c1y)	1.12±0.009 (d1y)
Weight (g)						
4m	0.47±0.012 (a1x)	0.52±0.006 (a2x)	0.49±0.009 (a1x)	0.51±0.012 (a1x)	0.52±0.009 (a1y)	0.52±0.003 (a1x)
5m	0.80±0.017 (b1x)	0.82±0.003 (b1x)	0.84±0.006 (b1y)	0.84±0.003 (b1y)	0.85±0.006 (b1y)	0.85±0.019 (b1xy)
6m	0.94±0.018 (c1x)	0.92±0.012 (c1x)	0.97±0.003 (c1xy)	0.98±0.006 (c1y)	1.00±0.015 (c1y)	1.05±0.012 (c2z)
7m	0.98±0.003 (d1x)	0.93±0.015 (c2x)	1.02±0.020 (d1x)	1.04±0.024 (d1y)	1.07±0.003 (d1y)	1.08±0.003 (d2y)

Note: The figures are presented as Mean ± SEM. (2) The figures in parentheses depict differences between ages (a, b, c, d), between treatment groups (x, y, z), and between the left gland and the right gland (1, 2) for the morphological characters (length, width, thickness, weight) at P≤0.05. (3) Group I: Standard diet without zinc supplementation, Group II: Standard diet supplemented with inorganic zinc, and Group III: Standard diet supplemented with organic zinc.

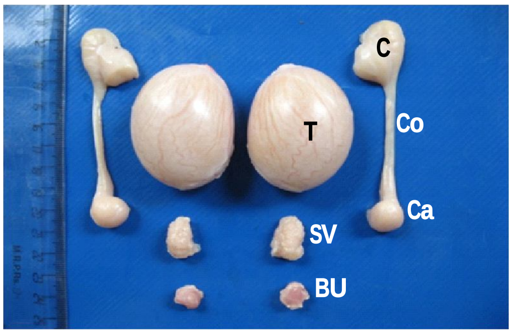

Figure-2. Photograph of a six month old goat showing dissected testis (T), caput (C), corpus (Co), cauda (Ca) of the epididymis, seminal vesicles (SV), and bulbo-urethral glands (BU).

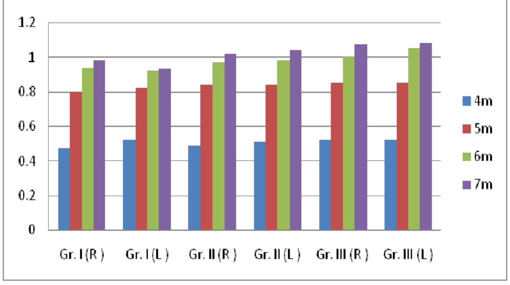

FIGURE-3. WEIGHT OF SEMINAL GLANDS AT DIFFERENT AGES IN DIFFERENT GROUPS

DISCUSSION

One of the micro-minerals crucial in male reproduction is zinc, whose relation with sperm quality has been amply proved (Kendall *et al*., 2000). This study was undertaken on the dimensional characteristics of seminal vesicular gland, since there is close relation between function and morphology (Coloma *et al*., 2011).

Scant literature restricted proper discussion of the results obtained in the present study. There was an increasing trend in the length, width, thickness and weight of seminal vesicular glands with advancing age in all the three groups. It corroborated the findings of Pathak *et al*. (2009), who reported increase in the weight and gross measurements of seminal vesicular gland as the age advanced in Gaddi goats.

There was an increasing trend in the dimension of the gland up to 7 months. The effects were visible at 6 months, as Assam goat is an early maturing breed. It is agreeable to the report of Mukerjee and Rajan (2006), who observed rapid increase in the weight of the seminal vesicle gland in sexually mature rats.

Our study revealed that the effect of organic zinc on the morphological characteristics of seminal vesicular gland was better than the inorganic zinc. It could be due to higher bioavailability of organic zinc in the organs (Cao *et al*., 2000).

The weight of the right gland was higher than the left in normal goat, agreed with Gofrit *et al*. (2009). Increase in the weight of the left gland over right in zinc supplemented groups needs further investigation.

CONCLUSION

(1) The dimensional characteristics of the glands increased with increase in age in control as well as in treatment groups up to 7 months. (2) The treatment group with organic zinc supplementation (group III) showed superiority in dimensional characteristics (length and width, and

weight) of the right gland over the treatment group with inorganic zinc supplementation (group II), while there was no difference between the two with respect to the left gland at 7 months. (3) The weight of the right gland was significantly higher in control group than the left at 7 months, while the weight of the left gland was significantly elevated in the treatment group (group III) over the right gland at 7 months indicating difference in functional dynamics of the glands in its interaction with extraneous zinc. This needs exploration.

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