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METABOLIC RATE OF EJACULATED BUCK SPERMATOZOA

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Epididymal spermatozoa are maintained at a low rate of metabolism as they are suspended in a medium of several inhibitory factors. On ejaculation, mixing with accessory gland secretions initiates a set of chemical reactions resulting in sudden increase in metabolic rate (Salisbury *et al.*, 1978). Methylene blue reduction (M.B.R) test is used as an indicator of metabolic activity of spermatozoa due to the property of Methylene blue to change the colour by the hydrogen ions liberated from anaerobic glycolysis of spermatozoa (Salisbury *et al.*, 1978; Kumaran and Kumaran, 1983). A knowledge of variation in metabolic rates of ejaculated spermatozoa will be helpful to assess quality of semen and to determine the suitable time for dilution. The present study was taken up to find out the rate of sperm metabolism immediately after ejaculation.

Materials and methods

Semen collected from six adult bucks maintained at KAU Goat Farm, Mannuthy, Thrissur formed the material for the study. Thirty six samples (six from each buck) were collected using artificial vagina regularly at weekly intervals. All the samples were subjected to preliminary evaluation to assess volume, density, mass activity, pH and initial motility. Satisfactory samples on the basis of preliminary evaluation were used for MBR test immediately after collection and thereafter at 15 minutes interval, for a period of 60 minutes.

Methylene blue solution was prepared by dissolving 50 mg of methylene blue (BDH) in 100 CC of 1.96 per cent sodium citrate dihydrate buffer. Tris diluent 0.4 ml was taken in a 5 ml test tube, then 0.1 ml of semen and 0.05 ml of methylene blue solution were added and mixed. It was layered with 1 cm liquid paraffin, and incubated immediately in a water bath maintained at 46.5° C. Time taken for decolourization of methylene blue was recorded as MBR time. The data were subjected to statistical analysis (Snedecor and Cochran, 1967).

Results and discussion

Average time taken for reduction of methylene blue using the ejaculates was 198.86, 173.19, 204.02, 238.75 and 269.16 seconds at 0, 15, 30, 45 and 60 minutes respectively after ejaculation. MBR time is inversely propotional to the metabolic rate of spermatozoa. Hence from the results, the metabolic activity of spermatozoa is seen increasing to maximum at 15 min. after ejaculation and thereafter gradually decreases (Table 1). However, there was no statistically significant difference between the average values.

In epididymis spermatozoan metabolism is suppressed by various factors such as high concentration of Co_2, low pH, hypertonicity of the medium, ionic concentration differences and lack of reducing sugars (Maule, 1962; Salisbury *et al.*, 1978 and Mann and Mann, 1981). At ejaculation, spermatozoa are moved rapidly along the vas deferens and urethra being joined enroute by the secretions of the accessory sex glands (Austin and Short, 1982). Emission initiates absorption of fructose by the spermatozoa. Concentration of fructose is directly related to metabolic rate

Table 1 Average of M.B.R. time of buck semen

Sl. No.	Volume	Density	Mass activity	pH	Initial mortality	MBR time (in sec.)				
						0 m	15 m	30 m	45 m	60 m
1	0.66	DDDD	++++	6.03	85.8	130.0	120.0	160.0	195.0	230.0
2.	1.03	DDD	+++	6.2	77.5	249.16	229.16	257.5	282.5	315.0
3.	0.70	DDDD	++++	6.08	84.16	150.0	145.0	179.16	195.0	235.0
4.	1.05	DDDD	++++	6.13	82.5	180.0	165.0	190.0	217.5	230.0
5.	0.78	DDDD	++++	6.21	78.33	235.0	202.5	237.5	297.5	330.0
6.	0.7	DDDD	++++	6.2	79.16	195.0	177.5	200.0	245.0	275.0
Av.	0.82	DDDD	++++	6.14	81.24	189.86	173.19	204.02	238.75	269.16

(Salisbury *et al.*, 1978). In bucks emission and ejaculation are completed in a very short period of time and maximum metabolic rate is attained immediately after ejaculation. Certain metabolic regulators which are inactive in the epidydimal spermatozoa are activated on mixing with seminal plasma. On ejaculation carbondioxide diffuses out and oxygen diffuses in stimulating the metabolic rate (Salisbury *et al.* 1978). This may be the reason for the increasing trend of metabolic activity of buck spermatozoa upto 15 minutes after ejaculation. Once the metabolic rate reaches its maximum there is a gradual decline which is due to substrate exhaustion and accumulation of waste production. Since there is a decline in metabolic rate from 15 minutes onwards, it is desirable to carry out semen processing and dilution within 15 minutes in order to preserve spermatozoa with better viability.

Summary

Thirty six ejaculates collected from six adult bucks were tested for MBR time immediately after collection and at 15 minutes intervals upto 60 minutes. Metabolic rate was seen increasing upto 15 minutes and then declined as shown by increasing MBR time.

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