EFFECT OF SEASONAL VARIATION ON BODY TEMPERATURE, RESPIRATION AND SEMEN CHARACTERISTICS OF DAIRY BULLS

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Morning and evening body temperatures and respiration rates of dairy bulls were the highest during summer and were the lowest during winter season. Evening body temperatures and respiration rates were consistently higher than the morning one. The average volume of semen was the highest during spring and summer and was the lowest during fall seasons. The best quality semen was produced during spring seasons.

INTRODUCTION

Pakistan, due to her location in the temperate region, faces peculiar problems as far as the health and welfare of its livestock population is concerned. The extremes of climate adversely affect the innate potential of their production and reproduction. The stress caused by extreme heat or cold results in severe testicular damage. The end results of such a situation is that either the fertility is lowered or there occurs a complete reproductive failure amongst the livestock.

It is, therefore, necessary to investigate to what extent the adverse atmospheric temperatures affect the spermatogenesis and general body condition of breeds of this country. The present investigation was undertaken to (1) study the effect of various seasons on the body temperature and respiration rate of *Nili-Ravi* buffalo and Sahiwal cow bulls; (2) study the variations which might occur in the semen characteristics of *Nili-Ravi* and *Sahiwal* cow bulls during the different months of the year and (3) correlate the seasonal effects on general body conditions to the changes produced in the semen characteristics during these periods.

REVIEW OF LITERATURE

Gaalass (1945) reported that the average body temperature and respiration rates of Jersey cattle were consistently higher in the afternoon than in the morning. Body temperature and respiration rates were decidedly higher during hot summer months than during the winter months. These results were also supported by Johnston and Branton (1953). Rees (1964) observed that an

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increase in air temperature above an apparent threshold of 85°F. overtaxed the thermostatic mechanism, resulting in an increase in respiration rate.

Patel (Maule, 1962) observed that semen volume of *Surti* buffalo bulls was the highest in summer and the lowest in winter (November to January), but Swanson and Herman (1944) observed that semen volume was greater in spring than the summer months. The difference among bulls was also highly significant. Pavlicenko (1965) observed that the semen volume increased during March to April, and was the highest during May to August and decreased in volume from September to February.

Horie and Ishikura (1964) stated that initial motility of Spermatozoa was the best in April and poorest in August and September, but Swanson and Herman (1944) revealed that the initial motility and viability were low in winter. Kushwaha *et al.* (1955) observed that in the ejaculates obtained during summer and spring months from *Murrah* buffalo bulls, there was a significant seasonal difference in initial motility of sperms which was the best in spring and appreciably lower during summer. Sayed *et al.* (1962) also reported significant seasonal variation in initial motility of Egyptian buffalo semen.

The most common types of abnormalities in buffalo bulls were coiled tailed, bent tailed, tailless and cells with protoplasmic droplets (Maule, 1962). The percentage of abnormal spermatozoa in *Surti* buffalo semen was the lowest in spring and the highest in autumn but in *Murrah* buffalo maintained at Izat Nagar, the abnormal spermatozoa were also lowest during spring (Maule, 1962). A significant seasonal variation in abnormal spermatozoa in Egyptian buffalo were also observed by Sayed *et al.* (1962).

Stoev *et al.* (1966) reported that the percentage of dead spermatozoa was high in June, August to November and January but in buffalo bulls dead spermatozoa was high in July and December and low in January to July. Significant seasonal variation in dead spermatozoa percentage was also observed in buffalo semen by Sengupta *et al.* (1963).

Erb *et al.* (1942) and Swanson and Herman (1944) reported that average period of sperm survival was the least in August, was lower in July and September and was high in March, April and November.

MATERIAL AND METHODS

Two mature buffalo bulls were selected for this experiment. These animals were regular herd sires of the West Pakistan Agricultural University, dairy herd. In order to study the seasonal effects, the period of study (from April 10, 1967 to April 6, 1968) was divided into four seasons-spring, summer, fall and winter. Morning and evening body temperature and respiration

rates of the bulls were recorded on the day of semen collection. The respiration rates were recorded by holding the palm of the hand within an inch from one nostril. Semen was collected once a week from each bull and two ejaculates were obtained by the use of artificial vagina. The following seminal attributes were studied : (1) volume ; (2) motility percentage was observed by mixing one drop of semen with phosphate buffer, under high power objective. Percentage of motile spermatozoa was estimated to the nearest 10 per cent by using the 0-10 scale (10=100 per cent motile spermatozoa); (3) dead and alive staining was done by the use of analine blue and eosin stain; (4) abnormal spermatozoa percentage was observed by staining the slides with Rose Bengal stain ; (5) spermatozoal longevity : semen samples were diluted with egg yolk citrate diluent at the rate of 1.50 and were stored for 7 days and 40°F. Small portions were withdrawn at day 1, 4 and 7 of storage and were examined for motility at 100°F.

RESULTS AND DISCUSSION

1. Effect of seasonal variation on body temperature and respiration rates

Morning body temperature was the highest during May and the lowest during January, whereas the evening body temperature was the highest during August and the lowest during December. Morning and evening respiration rates were the highest during July and the lowest during January (Table I). The differences in morning and evening body temperature and respiration rates, due to seasons, times and bulls were significant ($P<0.01$). The highest values of above-mentioned characters were seen in summer, whereas the values of above characters were the lowest during winter (Table II). The average evening body temperature and respiration rates were consistently higher than in the morning. Marked increase in body temperature and respiration rates were noticed at high atmospheric temperature with high humidity percentage. Results also suggested that high humidity (80 per cent) at low atmospheric temperature (60°F) appeared to have no such effects on body temperature, and respiration rates as were seen at high humidity (80 per cent) with high atmospheric temperature. These results were in close agreement with those of Gaalass (1945) and Johnston and Branton (1953). Increased respiration rates during summer months were also supported by Rees (1964).

2. Effect of Seasonal Variation on Semen Characteristics

Semen Volume. The monthly mean value of the volume of semen of buffalo bulls (Table 3) indicate that the average volume of the first ejaculate was the highest during March and the lowest during May and December,

whereas the average volume of second ejaculate was the highest during July and the lowest during September. The volume of semen of the first and second ejaculates of buffalo bulls showed that the differences due to seasons, ejaculates and bulls were highly significant ($P<0.01$). The volume of first and second ejaculates was the lowest during fall season. The highest volume of first and second ejaculates was in spring and summer, respectively (Table 2). The average volume of semen of second ejaculate was higher than the first ejaculate ($P<0.01$). The volume of semen produced by the buffalo bulls during different months of the study period was not related to their body temperatures. These results were in line with those of Pavlicenko (1965), who reported that the semen volume increased during March to April and was the highest during May to August and decreased in volume from September to February. The volume of semen of *Surti* buffalo bulls was the highest during summer and lowest during winter (Maule, 1962), but Swanson and Herman (1944) reported high volume of semen in spring season in dairy bulls.

Initial Motility. In buffalo bulls, the initial motility of spermatozoa was the highest during March and lowest during December (Table 1). Differences in initial motility of spermatozoa due to seasons were highly significant. This value was the highest during spring and was the lowest in winter. These results were in agreement with those of Horie and Ishikura (1964), Kushwaha *et al.* (1955) and Sayed *et al.* (1962).

TABLE 1.—*Monthly Mean values of body temperature and respiration rate of buffalo bulls.*

Month	Body temperature		Respiration rate	
	Morning	Evening	Morning	Evening
January ..	99.77	101.70	9	11
February ..	99.81	100.48	11	14
March ..	100.05	100.87	13	17
April ..	100.82	101.55	14	18
May ..	101.20	101.55	16	21
June ..	100.73	101.24	19	24
July ..	101.00	101.50	23	27
August ..	101.10	101.70	22	27
September ..	101.10	101.45	21	24
October ..	100.57	100.82	13	18
November ..	100.07	100.62	14	16
December ..	99.96	100.43	12	12

TABLE 2.—*Seasonal mean values of body temperature, respiration and semen characteristics of buffalo bulls*

Character	Spring	Summer	Fall	Winter
Morning body temperature ..	100.47	100.92	100.86	99.80
Evening body temperature ..	101.18	101.47	101.18	100.61
Morning respiration rate ..	14	21	17	11
Evening respiration rate ..	17	25	21	13
Volume of first ejaculate ..	3.00	2.89	2.81	2.90
Volume of second ejaculate ..	3.20	3.54	3.14	3.18
Initial motility percentage ..	78.1	71.6	74.8	71.1
Abnormal spermatozoa percentage	11.1	14.0	12.4	13.7
Dead spermatozoa percentage ..	18.2	21.8	19.5	23.7
Motility percentage on day 1 of storage ..	66.1	61.1	58.1	55.9
Motility percentage on day 4 of storage ..	48.3	44.1	39.1	44.9
Motility percentage on day 7 of storage ..	24.5	20.2	18.2	18.3

Abnormal Spermatozoa Percentage

Abnormal spermatozoa percentage of buffalo bulls was the highest during July and August and lowest during March (Table 1). The difference in abnormal spermatozoa percentage due to seasons was highly significant ($P<0.01$). This value was the highest during summer and was the lowest during spring (Table 2). The most common types of abnormalities observed in this study were the coil and bent tailed spermatozoa, spermatozoa with protoplasmic droplets and tailless cells. Rarely the double tailed, double headed, enlarged headed and small headed and under-developed spermatozoa were also observed. These results were supported by Bhattacharya in a review by Maule (1962) and Sayed *et al.* (1962).

Dead Spermatozoa Percentage

The dead spermatozoa percentage was the highest during August and was the lowest in March (Table 1). Different seasons significantly affected the dead spermatozoa percentage. This value was the highest during winter and the lowest during spring (Table 2). Dead spermatozoa percentage had a close relationship with body temperature and atmospheric temperature. Stoev *et al.* (1966) reported that the percentage of dead spermatozoa was the highest

in June, July, August and December and lowest from January to July. Significant seasonal variation in dead spermatozoa percentage were observed by Sengupta *et al.* (1963).

Longevity of Spermatozoa

The motility percentage of spermatozoa after 1, 4 and 7 days' storage was the highest during March. This value for day 1 and 4 was the lowest during December and for day 7 in September (Table 1). The longevity of spermatozoa varied in different seasons ($P < 0.01$). This value on day 1, 4 and 7 of storage was the highest during spring. The lowest value for day 1 was in winter and for day 4 and 7 of storage was in fall (Table 2). Similar observations were observed by Erb *et al.* (1942) and Swanson and Herman (1944). They reported that the average period of sperm survival was the least in August and was low in July and September and was high in March, April and November.

TABLE 3.—*Monthly mean values of semen characteristics of buffalo bulls*

Month	Volume		Initial motility percentage	Dead spermatozoa percentage	Abnormal spermatozoa percentage	Motility at		
	1st ejaculate	2nd ejaculate				Day 1	Day 4	Day 7
January ..	3.2	3.2	69.0	23.2	13.1	55.0	43.5	20.0
February ..	3.2	3.2	78.3	18.8	12.4	61.0	47.1	22.0
March ..	3.6	3.3	80.3	15.9	10.8	71.2	51.2	27.7
April ..	2.8	3.5	76.5	18.6	10.9	63.7	46.2	27.2
May ..	2.4	3.2	77.8	18.8	10.7	65.0	48.5	20.2
June ..	3.0	3.4	75.4	19.9	13.9	60.0	43.7	16.2
July ..	2.6	3.7	76.8	24.7	15.5	60.0	42.5	21.0
August ..	2.9	3.6	69.0	24.8	15.5	58.7	42.2	21.0
September ..	2.6	2.6	72.8	20.4	13.5	58.7	37.5	15.0
October ..	3.1	3.2	79.0	16.8	11.4	60.5	45.7	19.0
November ..	2.7	3.2	74.0	23.4	11.7	60.0	42.5	17.7
December ..	2.4	2.8	66.9	24.3	14.3	50.0	37.6	16.6

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