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Interaction of Season and Nutrition on Buffalo Semen
III-Fructose Content and Fructolysis Index

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Semen was collected from twelve sexually mature buffalo bulls kept under three systems of feeding for a full calender year.The fructose concentration(mg/100m semen)and thefructolysis index were estimated during the last week of each season on four semen samples from each bull. The overall mean of fructose coneentration was 500.4 +10.0 100 ml semen and the fructolysis index was 1.5 + 0.1 mg /10^9 spermatozoa at 37 C. The fructose content of the whole semen was significantly different among the different groups of feeding and seasons. Highly significant ($P<0.01$) differences were observed in fructose utilization / - 10^9 sperms among the different seasons, while the differences among groups under different systems of feeding were not apparent. Since the interactions of nutrition and season on the fructolysis were not appaeciable the significant differences in the fructolytic activity between the experimetnal groups can mainly be attributed to the changes in climatic conditios.

Fructose has been identifid as the prenciple source of energy for spermatozoa (Mann, 1945.). The rate of fructose utilization by the sperm cells as expressed in terms of fructolysis index (Mann, 1948) or fructolytic coeffiicient (Mixner, Mather& Freund, 1957) has been used as a prameter for the estimation of the metabolic activity of spermatozoa. The fructose concentration and the rate of fructose utilization seem to vary under the effects of some influencing factors. It was found that underfeeding tended to reduce the fructose concentration in the semen when compared to that in the normally fed bulls (Rzeznik, 1974). Rams kept on a constant diet under a natural or a reversed annual light cycle maintained a constant concentration of seminal fructose, but when the energy intake was reduced the fructose per ejaculate declined (Moule, Braden and Mattner, 1966). Seasonal fluctuations in fructose concentration had been attributed to variations in the hormonal activity (Dimitriev, 1965). However, these factors influencing the fructose concentration and the fructolytic activity of buffalo spermatozoa have not been well established. The present study was to make clear the changes in fructose content of the semen and the fructolytic activity of spermatozoa in relation to the changes in nutritional levels and seasons.

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Material and Methods

Throughout the coruse of a study on the effect of nutrition and season on the physical characteristics of buffalo semen (El-Azab, Rakha & Aboul - Fadle, 1982), semen was collected from twelve sexually mature buffalo bulls kept under thrree systems of feeding for a full calender year (Table 1). The initial fructose concentration of buffalo semen and the fructolytic activitiy of buffalo spermatozoa were estimated on four semen samples from each bull during the last week of each season, Following the technique adopted by Mann (1948) semen specimens were handled, diluted, incubated and prepared for determi nation of the fructose concentration (ml/100 ml) and the fructose utilization after 60, 120 and 180 minutes. Fructolysis index was expressed as the amount of fructose consumed by 10^9 spermatozoa per hour at 37 °C of incubation. Data were subjected for statistical analysis according to Victor (1976).

TABLE 1. **The feeding requirements per bull kept under the different systems of feeding in the different seasons.**

System offeeding	Seasons			
	Winter	Spring	Summer	Autumn
Constant	Barseem 30kg Concentrate 5kg Wheat straw 15kg	Barseem 30kg Concentrate 5kg Wheat straw 15kg Drease 10kg Concentrate 5kg Wheat straw 10kg	Darawa 20kg Concentrate 5kg Wheat straw 15kg	Darawa 20kg Concentrate 5kg Wheat straw 15kg Drease 10kg Concentrate 5kg Wheat straw 10kg
Proposed	Barseem, ad librum	Elephant grass, ad librum	Elephant grass, ad librum	Elephant grass, ad librum
Available	Barseem 60kg	Barseem 60kg Drease, ad librum	Darawa 75kg	Darawa 75kg Drease, ad librum

Results

The fructose content of semen and the fructose utilization of spermatozoa in relation to the changes in feeding system and seasons of semen collection are shown in table (2). The overall mean of frucotse concentrations was 500.4 ± 17.0 mg per 100 ml semen and the amounts of fructose utilized were

1 8 ± 0·1, 3·0 ± 0·1 and 3·9 ± 0·2 mg/10^9 sprm incubated at 37° C for 60, 120 and 180 minutes respectively. The fructolysis index was 1·48 ± 0·09 (Table 2).

TABLE 2: **Interaction of feeding and season on fructose content (mg/100 ml semen) and fructose utilization in mg/10^9 sperm at 37 °C (Fructolysis index).**

System of feeding/Season	content (mg/100ml)	Fructose utilization after			Fructolysis index
		60minutes (mg)	120minutes (mg)	180minutes(mg)	(mg / 10^9 sperm/hr)
Constant feeding:-					
Winter	309.8±40.7	1 6±0.3	2.6±0 4	3.2±0.5	1.31±0.20
Spring	562.8±55.4	2.5±0.5	3.8±0.6	4.7±0.6	1.79±0.22
Summer	426.3±30.0	1.7±0.3	2.8±0.4	3.6±0.3	1.54±0.16
Autumn	390.0±38.0	2.4±0.3	4.6±0.5	5.9±0.6	2.03±0.20
Mean	414.4±22.7	2.1±0.2	3.4±0.2	4.3±0.3	1.67±0.10
proposed peeding					
Winter	676.1±37.3	1.8±0.3	3.0±0.4	3.6±0.4	1.39±0.15
Spring	558.8±92.3	1.8±0.5	3.1±0.7	4.4±1.3	1.56±0.36
Summer	653.8±53.6	1.4±0.3	2.2±0.4	3.0±0.6	1.12±0.22
Autumn	402 4±36.9	2.2±0.6	3.3±0.7	2.2±0.6	1.57±0.26
Mean	574.5±29.1	1.8±0.2	2.9±0.3	3.9±0.4	1.39±0.12
Available feeding :-					
Winter	320.4±34.3	1.2±0.2	2.0±0.4	2.3±0.5	0.98±0.18
Spring	595.4±64.9	2.0±0.2	3.5±0.3	4.5±0.3	1.73±0.13
Summer	650.1±60.1	1.3±0 2	2.3±0.4	3.1±0.4	1.19±0.15
Autumn	523.1±62.4	1 8±0.3	3.2±0.4	4.4±0.5	1.61±0.18
Mean	517.6±33.3	1.5±0.1	2.7±0.2	3.5±0.2	1.36±0.09
Seasonal effect :-					
Winter	449.1±34.5	1.5±0.2	2.6±0.2	3.1±0.3	1.25±0.10
Spring	572.8±38.8	2.1±0.2	3.5±0.3	4.5±0.4	1.71±0.13
Summer	571.6±31.9	1.5±0.1	2.5±0.2	3.3±0.3	1.28±0.11
Autumn	426.4±25.8	2.2±0.3	3.8±0.3	5.1±0.5	1.76±0.14
Overall mean	500.4±17.0	1.8±0.1	3.0±0.1	3.9±0.2	1.48±0.09

It was observed that the fructose contents of the whole semen were significantly($P<0.01$) different among three different groups of feeding and among four seasons. A synergestic effect of feeding and season was indicated from the highly singificant($P<0.01$)interaction of both factors on the fructose content (Table 3).

Highly significant ($P<0.01$) differences were observed in fructose utilization /10^9 sperms among four different seasons, while the differences among three groups under different systems of feeding were not apparent (Table 3).

TABLE 3. **Analysis of variance showing the effects of feeding levels and seasonal changes on fructose concentration and fructose utilization**

Source of variation	D.F.	Fructose Concentration	Fructose utilization after			Fructolysis index
			60 min.	120 min.	180 min.	
Feeding (F)	2	377574.45^{++}	3.246	7.311	8.853	1.529
Season (S)	3	241314.52^{++}	5.222^{+}	17.720^{++}	38.245^{++}	2.925^{++}
ExS interaction	6	197423.35^{++}	0.567	2.393	2.539	0.328
Residual	147	31292.06	1.733	2.990	5.212	0.581

Values are expressed in Mean Square.

+ : $P<0.05$

++ : $P<0.01$

Discussion

In the present study, differences in frustose concentration were apparent throughout the year among the different three groups of feeding conditions. these result confirmed earlier reports (Mann and Walton, 1953) where it was shown that the secretory function of the accessory sexual glands could be influenced by the changes in nutritional levels. It was also reported that changes in fructose concentrations were related to changes in protein level (Shirley, Meacham, Warnick, Heniges and Cunha, 1963) or the energy intake (Moule *et al.*, 1966) of the diet. In tropical bulls, Igboeli and Rakha(1971)suggested that the poor nutrition prevalent during the hot season contains the seasonal effects. However, Oloufa, Sayed and Badreldin (1959), Sayed, Oloufa & Badreldin (962) and Sengupta, Misra & Roy (1963) did not show significant changes among seasons in the initial fructose content of buffalo semen. The present study showed that the type of feeding did not seem to have any apparent effect on the fructolytic activity of buffalo spermatozoa as indicated by the fructolysis index. However, highly significant differences were observed among seasons. Sengupta *et al* (1963) showed a significant difference in the fructolytic rate of buffalo spermaozoa amony seasons. The rates of fructose utilization by spermatozoa collected from Europian bulls (Nakabayashi and Salisbury, 1956) or tropical bulls (Igboeli and Rakha, 1971) were significantly less in the summer of the hot season. On the other hand, Freund, Mixner & Mather (1957) demonstrated that the

the fructolytic coefficient was independent of both sperm concentration and initial fructose level since the addition of frucose to the diluent caused an increase in the rate of fructolysis even in these samples with relatively low sperm concentration and high initial fructose level. Since nutritional level seemed to have no apparent effect on fructolysis and since the interaction of nutritional level and season were not appreciable, the singificant differences in the fructolytic activity among the experimental groups can mainly be attributed to the changes in climatic conditions.

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التأثير المشترك لعامل الموسم والتغذية على السائل المنوى للجاموس

٣ ـ تركيز ودليل استهلاك الفركتوز

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أجريت هذه الدراسة باستخدام اثنتا عشرة طلوقة جاموس بالغين جنسيا وموضوعين فى ثلاثة أنظمة من التغذية لمدة عام ، وبالتحليل الاحصائى لنتائج العينات التى أمكن جمعها على مرتين خلال الأسبوع الأخير لكل موسم تبين ما يلى :

المتوسط الكلى لتركيز الفركتوز كان ٤ر٥٠٠٠ + ٤٠٠ر١٠ ملليجرام/ ١٠٠٠ سم٣ من السائل المنوى وأن دليل استهلاك الفركتوز كان ٤٨٤ر١+ ٠٩ر٠ ملليجرام /١٠ حيوان منوى عند درجة حرارة ٣٧م° ، أن محتوى الفركتوز للسائل المنوى يختلف اختلافا معنويا بين المجموعات المختلفة بالنسبة للموسم ، التغذية ، تلاحظ أن معدل استهلاك الفركتوز يختلف اختلافا معنويا بين المواسم المختلفة بينما لا يتضح ذلك بين نظم التغذية المعمول به ولما كان التأثير المشترك لعامل الموسم فى استهلاك الفركتوز بين المجموعات المختلفة قد يعزى أساسا الى التغيير فى الظروف الموسمية ٠

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