GROWTH HORMONE CONCENTRATIONS IN LACTATING CROSSBRED COWS AND BUFFALOES

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Summary

The studies were conducted on 12 lactating animals comprising of six Karan Swiss (KS) cows and six Murrah buffaloes in second and third lactation. At the start of experiment the cows had completed on an average 51 days in lactation and were yielding an average of 15.1 kg milk a day. The buffaloes had completed 53 days in lactation and were yielding an average of 11.6 kg milk a day. At fortnightly intervals jugular blood samples were drawn at morning, noon, evening and night hours.

Plasma growth hormone concentrations were highest during morning and thereafter decreased. In both the species there was a definite trend in the change of growth hormone concentrations during the day. In general growth hormone concentrations decreased as the stage of lactation advanced. The overall average values of plasma growth hormone in cows and buffaloes were 2.95 and 2.48 ng/ml which were not statistically different. With the advancing lactation, the decline in milk yields in both the species was positively correlated with the growth hormone concentrations.
(Key Words: Growth Hormone, Crossbred Cows, Buffaloes, Milk Yield, Relationship)

Introduction

Earlier studies indicated that growth hormone is probably involved in controlling the functioning of the mammary gland (Asimov and Krouze, 1937; Cotes et al., 1949; Chi-Wu Chung, 1958; Greep, 1974). Very few attempts have been made to establish relationship between hormone levels and milk yield (Hart et al., 1978; Koprowski and Tucker, 1973). The objective of the present communication was to study the growth hormone (GH) concentrations at different stages of lactation and at different sampling intervals and to establish correlations with milk yield in lactating crossbred cattle and Murrah buffaloes.

Materials and Methods

Twelve lactating animals comprising of 6 Karan Swiss (KS) (crosses between Brown Swiss bulls and indigenous cows having 50:50 blood level) cows and 6 Murrah buffaloes in second and third lactation were selected from the institute herd. At the start of experiment the cows had completed on an average of 51 days in lactation and were yielding an average of 15.1 kg milk a day. The buffaloes had completed 53 days in lactation and were yielding an average of 11.6 kg milk a day. The experiments were started during the month of November, 1986 and continued upto 90 days.

Out of a total of six animals of each species, at the end of experiment one cow and one buffalo were 117 and 106 days pregnant, respectively. All the animals were housed in Dutch Barn type shed with sides open. They were stall fed on a balanced ration of concentrate mixture and green maize (*Zea mays*) fodder. During the course of experiment daily account of feed consumption and milk production of individual animals was maintained. The cows were hand milked three times a day, whereas, buffaloes at two time only.

At fortnightly intervals jugular blood samples from individual animals were drawn at morning (8 AM), noon (2 PM), evening (8 PM) and night (2 AM) hours and the plasma was separated and stored at $-20^{\circ}C$. Frozen samples of plasma were used for the estimation of growth hormone.

Radioiodination of b GH

Bovine GH was labelled with carrier free $Na^{125}I$ at room temperature adopting the method of Peake et al. (1979). Labelled sodium iodide used

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for iodination was supplied by Radiopharmaceuticals Division, Bhabha Atomic Research Centre, Bombay. Bovine grown hormone (b GH) and its antiserum was obtained from National Institute of Arthritis, Diabetes and Digestive and Kidney Diseases, USA and were created by Dr. A.F. Parlow, USA. Second antibody (GAARG – Goat antibody to rabbit gamma globulin) was a product of Behring Diagnostics, La Jolla, California, USA.

Assay protocol followed was similar to the one suggested by Peake et al. (1979). The sensitivity of the assay for GH was 100 pg per tube. Cross-reactivity data indicated that the antiserum used was highly specific for growth hormone.

Results

Average daily milk yields of cows and buffaloes during different fortnights have been presented in table 1. Plasma GH concentrations (table 2) in buffaloes were highest during morning sampling thereafter decreasing during the subsequent sampling intervals being lowest during the night. The respective values during morning, noon, evening and night sampling intervals were 2.95, 2.51, 2.37 and 2.09 ng/ml. The differences between morning and night concentrations of GH were statistically significant ($p < 0.05$). In cows, there was no significant difference in the concentrations of GH at different sampling intervals but the values were highest during morning sampling and then decreased during following sampling intervals. The values being 3.36, 2.98, 2.72 and 2.75 ng/ml during morning, noon, evening and night samplings, respectively.

In both the species there was a definite trend (figure 1) in the change of GH concentrations during the day. However, in cows due to high animal to animal variation the night values were slightly higher than the evening values. Fortnight x sampling interval interaction indicates differential behaviour of buffaloes during different sampling times and at various fortnights. Such interaction was not observed in cows. The pattern of change in GH levels during different fortnights of the study has been presented in figure 2. With the exception of second fortnight in cows and fourth fortnight in buffaloes, the value of GH decreased as the lactation advanced. The overall average values of GH (2.95 and 2.48 ng/ml in cows and buffaloes) in both the species were not statistically significant. With the advancing lactation, the decline in milk yields in both the species was positively correlated with the GH concentrations ($r = 0.74^*$ in case of cows and 0.94^* in case of buffaloes).

TABLE 1. AVERAGE DAILY MILK YIELD (KG/DAY) DURING DIFFERENT FORTNIGHTS

Attributes	Species	
	Cow	Buffalo
Fortnight		
1	14.07±0.78	11.47±0.38
2	13.40±1.02	11.09±0.47
3	13.52±0.78	10.52±0.56
4	12.87±0.97	10.00±0.56
5	11.45±0.77	9.72±0.66
6	11.46±0.60	8.96±0.66
Average	12.80±0.39	10.30±0.27
C.D.	0.78	0.75

TABLE 2. CONCENTRATION OF GH (NG/ML PLASMA) DURING DIFFERENT SAMPLING INTERVALS AND FORTNIGHTS

Attributes	Species	
	Cow	Buffalo
Sampling intervals		
Morn.	3.36±0.32(36)	2.95±0.33(36)
Noon	2.98±0.30(36)	2.51±0.21(36)
Even.	2.72±0.28(36)	2.37±0.29(36)
Night	2.75±0.39(36)	2.09±0.22(36)
C.D.	–	0.59
Fortnights		
1	3.77±0.25(24)	3.30±0.25(24)
2	4.27±0.57(24)	3.16±0.25(24)
3	2.76±0.28(24)	2.52±0.37(24)
4	2.60±0.42(24)	2.79±0.45(24)
5	2.56±0.34(24)	1.90±0.27(24)
6	1.75±0.15(24)	1.20±0.08(24)
Average	2.95±0.16	2.48±0.14
C.D.	0.98	0.73

Figures in parenthesis indicate the number of observations.

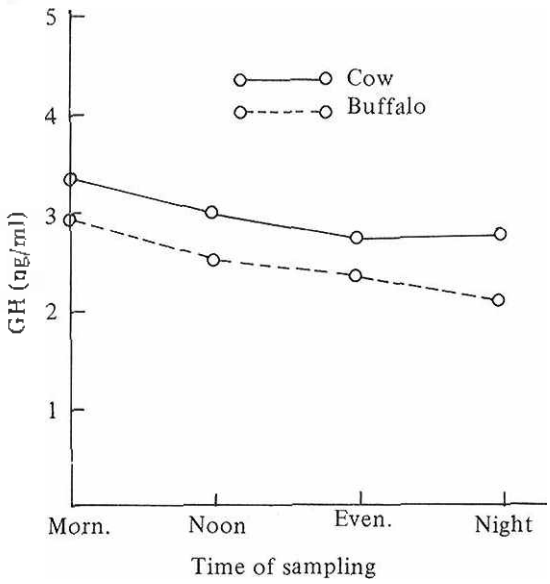

Figure 1. Concentration of GH in plasma of cows and buffaloes at different sampling intervals.

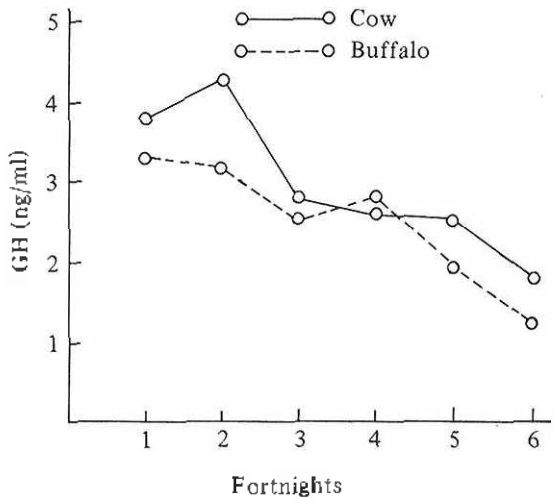

Figure 2. Concentration of GH in plasma of cows and buffaloes during different fortnights.

Discussion

High concentrations of GH in the morning and thereafter a declining trend in both the species indicates that GH levels in the circulating blood show a diurnal variation. In cows the variation was not significant. In buffaloes, compared to the morning values the night values were significantly lower. Hove and Blom (1973) observed a post-prandial reduction in GH concentrations in under-fed cows but not in cows given an adequate diet. In these experiments the cows and buffaloes were given an adequate diet and the morning, noon and evening samples were collected two hours after the concentrate feeding whereas the green fodder was available ad lib. The results in cows confirm the earlier reports (Bassett, 1974; Bines et al., 1983; Koprowski et al., 1972; Vasilatos and Wangsness, 1981). The results in buffaloes need further investigations regarding the diurnal pattern in GH secretion.

In both the species the levels of GH in the circulating blood were almost similar. No previously reported values of plasma GH levels in lactating buffaloes and zebu crosses are available for comparison. However, in cows the values are comparable to those obtained by Sartin et al. (1988) but are lower than those reported earlier (Hart et al., 1978; Vasilatos and Wangsness, 1981; Bines et al., 1983) in high yielding dairy cows.

Decreasing trend in plasma GH concentration in relation to advancing lactation observed in these experiments is in agreement with the previous reports (Koprowski and Tucker, 1973; Smith et al., 1976; Vasilatos and Wangsness, 1981; Sartin et al., 1988). With the advancing lactation, the decline in milk yields in both the species was positively correlated with the GH concentration ($r = 0.74^*$ in case of cow and 0.94^* in case of buffaloes). The significant 'r' values between GH and milk yield suggest the role of GH in the regulation of milk secretion in both the species. Such significant 'r' values were also obtained by some earlier workers (Johnson and Vanjonack, 1976; Hart et al., 1979). Because daily injections of exogenous GH increased milk production in cows and buffaloes (Bauman et al., 1985; Ludri et al., 1988) a correlation between GH and milk production is anticipated. However, in normal lactating animals the relationship is more complex than a direct cause and effect relationship as changes in GH are accompanied by changes in other hormones and metabolites at the same time (Jindal, 1988). Growth hormone is known to decrease lipogenesis and favour lipolysis and gluconeogenesis. Since receptors for GH are not known to be present in mammary tissue of rumin-

ants, it has been speculated that GH related effects on milk yield might be mediated through somatomedin C and its receptors (Ronge et al., 1988). However, it is suggested that more work relating the levels of GH with somatomedin C may also be carried out in future studies designed to correlated milk yield with hormone levels.

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