EFFECT OF INCLUDING VARYING LEVELS OF UREA IN THE DIET ON THE POSTPARTUM REPRODUCTIVE PERFORMANCE IN FRIESIAN COWS

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SUMMARY

Twenty six friesian cows were used in this study to investigate the effect of adding urea to the diet on the postpartum reproductive performance. Towards the end of their pregnancy they were divided into three groups. Group 1 was given no urea (control) while in groups 2 and 3 urea was added to the diet to replace 25 or 50% ,respectively,of the total digestible crude protein.

The intervals from calving to complete uterine involution,first ovulation,first detected oestrus and conception were significantly ($P < 0.01$) shorter and the number of services per conception was significantly ($P < 0.01$) smaller in the control group than in the other two groups which did not differ significantly from each other.

High incidence of metritis resulted from the inclusion of urea in the diet in both groups 2 & 3.

INTRODUCTION

With the increasing demand for oilseed and grains for human consumption, the shortage of feed resources for ruminants has become more apparent. In recent years, this has boosted the use of unconventional feeds with the inclusion of non-protein nitrogen (NPN) to replace part of the plant proteins given to dairy cattle (Huber and Kung ,

1981). Contraversy has developed over the level at which urea can be included in the diet. Although cattle were reported in some studies to lactate and reproduce moderately on purified diets containing urea as a sole source of nitrogen (Huber,1978;Huber and King,1981), others have indicated adverse effects of urea on dairy cattle productivity and health (Erb et al.,1976; Bond and Oltjen,1973a).

Evidence on the effect of long term feeding on diets containing urea on reproductive performance is inconclusive,with the limited number of trials reported in the literature.

The present study aims at investigating the effect of including varying levels of urea in the diet of friesian cows on their reproductive performance during the postpartum period.

MATERIALS AND METHODS

This study was carried out at Sakha Animal Research Station, Ministry of Agriculture,in November 1983. Twenty six friesian cows in their 7th - 8th month of pregnancy with either one or two previous lactation seasons were chosen in this study. They were divided into three similar groups according to their parity, body weight and previous milk yield. Cows in group 1(n=9) were fed a control diet which contained no urea,while diets given to cows in groups 2 (n=9) and 3(n=8) included urea to replace 25 and 50%, respectively, of the total digestible protein. All three diets were composed of rice straw and concentrate mixture. The concentrate mixture of the control group was the co-op concentrates (65% undecorticated cottom seed meal, 20% rice polish, 9% wheat bran, 3% molasses, 2% limestone and 1% salt), with a starch value of 55% and digestible crude protein of 16%. The concentrate mixture given to cows in group 2 consisted of 59% co-op concentrates,30% yellow maize, 10% molasses, 1.04% urea and 0.05% sulpher. In group 3, the concentrate mixture consisted of 32.7% co-op concentrates

,24% yellow maize,23% molasses,2.2% urea and 0.1% sulpher. Starch value of feed mixtures given to groups 2 and 3 was 60.7 and 61.6%,respectively, while the respective digestible crude protein was 12.0 and 12.8%. In the three groups,the concentrate mixture was given in quantities to cover about 76% of the total requirements of individual animals while the rest was covered by rice straw.
Throughout most of the gestation period prior to the start of this study all cows were fed the control diet. The last month of gestation was considered as a preliminary period during which cows in groups 2 and 3 were adapted to concentrate mixture containing urea. This was applied by giving urea in small quantities which were increased gradually from 0.5 to 0.8% and from 0.66 to 1.0% of the concentrate mixture in groups 2 and 3, respectively. The experimental rations were given starting on the day of parturition and continued for the whole lactation period. Requirements of individual animals were calculated according to the recommendations of Ghoneim (1964).
All cows were housed in open yards. They were machine milked twice daily at 0700 and 1500 h and were given their concentrates allowances at milking times, while rice straw was given to individual animals in stalls.
The cows were checked for standing oestrus,using a teaser bull, twice daily at 0800 and 1600 h for 40 minutes on each occasion. Starting from day 40 postpartum,cows were inseminated when seen in oestrus using locally produced frozen semen.
Rectal palpation was performed once every four days starting from the second week after calving. Examination procedures were as described by Zemjanis (1962). Uterine involution was judged to be complete according to the criteria described by Buch et al. (1955). Date of first postpartum ovulation was calculated by subtracting two days from the date at which first palpable corpus luteum

was detected. Pregnancy diagnosis was performed through rectal palpation on day 45 after the last insemination.
The following criteria were recorded : intervals from parturition to complete uterine involution (UI) ,first ovulation (POV) ,first detected oestrus (POE) ,conception service, days open (DO); number of services per conception (S/C) and incidence of endometritis diagnosed as described by Lotthammer and Farries (1975).
The data obtained were subjected to standard analysis of variance according to Steel and Torrie (1980).

RESULTS

The interval from parturition to complete uterine involution (UI) was shorter in cows fed the control diet (group 1) than in those fed rations containing urea (groups 2&3), (Table 1). The differences between group 1 and each of group 2 (10.8 days) and group 3 (14.9 days) were statistically significant ($P < 0.01$). The length of UI increased slightly, but insignificantly,with the increase in urea level in the diet from 25 to 50% of the digestible crude protein.

First ovulation occurred 14.0 and 20.2 days earlier in group 1 compared with groups 2 and 3, respectively. These differences were statistically significant ($P < 0.01$). The difference in POV between the two urea-fed groups was statistically insignificant. The inclusion of urea in the diet resulted in significant ($P < 0.01$) delay of about 25.1 and 27.7 days in the timing of first postpartum oestrus in groups 2 and 3,respectively,as compared with the control group (Table 1).

By day 120 postpartum, about 67% of the cows in the control group conceived, compared to 22 and 38% in groups 2 and 3, respectively. All cows in the control group got in calf by day 150 postpartum. On the other hand, there were three cows in group 2

which took more than 230 days before they conceived. In group 3, there were three cows which took more than 480 days before they got in calf. This has resulted in significantly ($P<0.01$) more number of days open in groups 2 and 3 compared to that of the control group. The within group variation was also higher in groups 2 and 3 (C.V. =86.2 and 83.6%, respectively) compared to that in group 1 (C.V. = 28.6%).

The number of services per conception in the cows fed urea-contained diets (groups 2 and 3) was more than twice that in the control group and the differences were highly significant ($P<0.01$).

The inclusion of urea in the diet resulted in large increases in the incidence of endometritis as compared to the control group (Table 1).

DISCUSSION

The values obtained for different traits in the control group are comparable with those reported on a herd of friesian cows raised on the same farm (El-Keraby and Aboul-Ela,1982). The inclusion of urea to replace 25 or 50% of the digestible crude protein in the diet produced marked and significant effects on all the studied postpartum traits. The delay in the completion of uterine involution in the urea fed groups (groups 2 & 3) was mainly associated with the higher incidence of endometritis in these groups. Significant increase in the incidence of metritis was reported (Erb et al.,1976) as a result of feeding urea to replace 36% of the total nitrogen in the diet of holstein cows compared to a control group fed no urea (37 v. 29%).

The delay in the onset of first ovulation and first detected oestrus after calving observed in groups 2 and 3 indicates that urea inclusion in the diet may affect the resumption of normal cycling activity after parturition. Bond and Oltjen (1973a) reported a delay of about 97 days in the onset of first oestrus after calving in Angus cows.

In another trial the same authors found such delay to be 59 days only. On the other hand,Erb et al. (1976) reported that the effect of feeding urea on POE was small and insignificant.

The differences in UI,POV and POE between the cows fed 25% or 50% of the digestible crude protein in the form of urea (groups 2 and 3) were small and insignificant. However, the differences were more pronounced in DO and S/C. Detailed examination of the data obtained revealed long periods (>30 days) between successive inseminations in most of the urea fed cows which had DO of more than 120 days. This may indicate incidence of embryonic mortality or silent heat in these cows. Feeding urea has been reported to result in increased rate of abortion and prolongation of calving interval (Bond and Oltjen, 1973a; Erb et al.,1976). Calving to conception interval was delayed by about 67 days in Angus cows fed urea as a sole source of nitrogen (Bond and Oltjen, 1973a). In another study (Bond and Oltjen, 1973b) the authors found the delay to be less (17 days) and insignificant.

The adverse effects of feeding urea on reproductive functions have been attributed in some studies to lowered energy intake (Bond and Oltjen, 1973a). This does not apply,however,to the present study in which the three diets were isocaloric. Other authors have attributed these effects to reduced protein intake by animals fed urea-contained diets (Bond and Oltjen,1973a; Erb et al.,1976).

It is well established that the resumption of postpartum cycling activity is determined by changes in the hypothalamus-hypophysial-ovarian relationships. Increased responsiveness of the pituitary to cirulating levels of GnRH and increased frequency of pulsatile LH release during the postpartum period are thought to be major factors determining the resumption of cycling activity after parturition. The adverse effects of urea may be mediated through either supressing the release from the pituitary or

or lowering the ovarian responses to gonadotrophins. Bond and Oltjen (1973a) suggested that the lowered crude protein intake when urea is used to replace part or all of the dietary plant protein, one or several nitrogenous compounds required for the synthesis of hormones and amino acids required for fertility would be limited. There is evidence that luteal growth and capacity to synthesize progesterone *in vitro* were lowest when 50% of the dietary nitrogen was given as urea (Garverick *et al.*,1971). The effects of feeding urea found in the present study are relatively larger than those encountered in other studies where similar levels of urea intake were recorded (Ryder *et al.*,1972; Bond and Oltjen, 1973b). The differences in the response obtained in different studies may be related partially to the duration of the feeding period. Further studies are needed to elucidate more the mechanism(s) of urea effects on ovarian function in the postpartum period, and the optimal level for urea inclusion in the diet without adversely affecting the cow's reproductive efficiency.

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Table 1. Postpartum reproductive performance of friesian cows fed rations containing different levels of urea.

Trait	Urea level(% of total N)			Significance of differences
	group 1 (0 %) ($\bar{x}$±SE)	Group 2 (25%) ($\bar{x}$±SE)	Group 3 (50%) ($\bar{x}$±SE)	
No. of cows	9	9	8	
Interval(day)from parturition to:				
-complete uterine involution (UI)	22.6±3.07	33.4±3.03[a]	37.5±1.89[a]	**
-first ovulation(POV)	26.9±3.48	40.9±2.04[a]	47.1±5.60[a]	**
-first oestrus (POE)	31.7±1.21	56.8±4.50[a]	59.4±5.66[a]	**
-conception (DO)	82.5±9.65[a]	195.4±75.3[b]	338.2±115.1[c]	**
No. of services per conception (S/C)	1.33±0.21	2.68±0.76[a]	2.20±0.11[a]	**
Incidence of endometritis (%)	11.1	66.7	87.5	

Group means which are denoted by the same superscript do not differ significantly

** = Significant ($P < 0.01$)

تأثير استخدام مستويات مختلفه من اليوريا فى العليقة على الاداء التناسلى فى فترة ما بعد الولادة فى أبقار الفريزيان

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استخدم فى هذه الدراسة ٢٦ بقره فريزيان لدراسة تأثير اضافة مستويات مختلفه من اليوريا فى العليقة على الاداء التناسلى فى فترة ما بعد الولاده . تم تقسيم الحيوانات الى ثلاثة مجموعات وذلك قرب نهاية فترة الحمل . المجموعة الاولى أعطيت عليقه خاليه من اليوريا بينما تم اضافة اليوريا فى عليقة المجموعتين الثانية والثالثة لتحل محل ٢٥ ٪ أو ٥٠ ٪ على الترتيب من البروتين المهضوم الخام الكلى .

كانت الفترات من الولاده حتى اكتمال عوده الرحم الى حجمه الطبيعى والى التبويض الأول والشبق الأول وكذا حتى التلقيح المخصب أقصر بدرجه معنوية فى المجموعة الأولى عن المجموعتين الثانية والثالثة المغذاه على عليقة بها يوريا . كذلك فقد كان عدد التلقيحات اللازمة للحمل أقل بدرجة معنوية فى المجموعة الأولى عنه فى المجموعتين الثانية والثالثه . هذا وكانت الاختلافات بين المجموعتين الثانية والثالثة فى كل الصفات المدروسه غير معنوية .

كما تلاحظ أن اضافه اليوريا للعليقه فى كل من المجموعتين الثانية والثالثة نتج عنه زياده كبيرة فى نسبه حدوث الالتهابات الرحميه وذلك بالمقارنه بالمجموعة الأولى .