Studies on Some Serum Constituents
of Dairy Cows in Saudi Arabia

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Abstract:

Blood samples from 40 dairy cows were tested for their urea, albumin, total protein and glucose concentrations. Half of the animals, were pregnant and were tested 1 and 4 weeks before and after calving. Glucose was observed to increase in the first week before parturition and returned to the normal level in the fourth week after pregnancy. Albumin was low in the first week before parturition and returned to the normal level at the end of the fourth week after parturition. Urea concentration was at normal ranges in the first week before parturition and the fourth week after parturition. This study demonstrates the importance of mini metabolic profile test in dairy reproduction farm for early diagnosis of metabolic disease and nutritional deficiency.

Introduction:

A practically orientated "Mini Metabolic Profile", aimed directly at the veterinary surgeon in practice has been described (Blowey *et al*. 1973; Blowey 1975). The test requires fewer cows and parameters to be sampled and examined respectively. It involved looking at blood glucose, urea and albumin in cows at peak lactation in the herds and monitoring them at four-weekly intervals, enabling trends to be spotted, as well as variation which brought values outside the normal range. Furtheremore, a mini-profile test has been recommended as being sufficient to assess the adequacy of energy and protein intakes (Blowey,1975; Collins,1979; Radostits *et al*, 2000). More recently Kida,(2002),(2003) and vonTavel *et al* (2005) have developed an integrated herd health and productivity system which regularly assess disease occurance, health status and adequacy of nutrition and manegment in relation to productivity and economic performance. In addition they concluded that the metabolic profile test is a useful tool for assessing feeding management and periparturient diseases of dairy cows. In the present work, preliminary study was conducted to detect the status of glucose, albumin, urea, total protein and globulin at different stages of pregnancy and in dry cows with different dietary in take.

Materials and Methods
Animals:
The number of animals used in this study was 20 pregnant Freizian cows, the age of animals ranged from 4-8 years. 17 dry cows (heifers) were also included in this investigation. All animals were kept in a large dairy farm in the Eastern province of Saudi Arabia.

Management:
The animals in this dairy farm were kept in fences which were partially shaded. Water spray was used for cooling, and group of feeding system was adopted.

Feeding
Feeding of animals consisted mainly of barley (29%), silages (19%) and concentrate (52%). Different types of feed used at different stages of pregnancy and after parturition are shown in table (1). Dry cows were fed twice a day early morning and evening, milking cows were fed 3 times a day, early morning, at noon and evening.

Table (1)
feed used at different stage of late pregnancy and at postpartum

Diet (%)	Last 4 weeks pre-calving	Last week pre- calving	One week post parturition	4 weeks post parturition	Dry cow
Barley	14.2	13.3	35	25.4	29
Rodas	71.4	60	---	---	---
Concentrates	---	26.7	35	52.7	52
Silages	---	---	30	21.9	19
Concentrated protein	14.4	---	---	---	---

Sampling:
Blood for serum preparation was collected from jugular vein using vaccutainers. The collected sera were kept at -20 c͗until used.

Biochemical analysis:

Biochemical analysis included determination of glucose concentration, total protein, urea and albumin. Glucose was determined by UDI system, protein and albumin were determent by using UDI system. However globulin values been measured from substract albumin from total protein. Data concerning the examined animals were recorded during the whole period of the experiment.

Statistical analysis:

One way of variance (ANOVA) was used for statistical analysis by Duncan test SPSS – version 10.

Results

The results of the study are shown in table 2 and Fig 1 and 2. The value of glucose in cows sampled at 1 week before calving were found significantly higher than the dry cow and in the two groups of cows sampled at 1 week and at 4 weeks after calving. Both serum total protein and albumin behaved similarly in all examined groups of cattle. It both showed significantly higher values 4 weeks before calving and 4 weeks after calving when compared with the dry cows and cows sampled at 1 week before calving. The value of serum urea was found significantly lower in one week before calving as compared with the other groups sampled at different periods.

Table (2)

Duncan multiple range test for plasma total protein, albumin, urea, globulin and glucose values in different stages of reproduction.

Groups	Plsma total protein (g/L)	albumin (g/L)	Urea (mmol/L)	Glucose (mmol/L)	Globulin (g/L)
Dry cows	49.08 ± 8.16^{a}	15.13 ± 6.33^{a}	6.26 ± 1.03^{d}	$2.61 \pm .811^{a}$	33.98 ± 2.6^{a}
4 wk pre-calving	62.76 ± 10.02^{c}	36.60 ± 1.93^{b}	$6.90 \pm .59^{e}$	$3.34 \pm .16^{b}$	26.6 ± 1.8^{b}
1wk pre-calving	51.34 ± 8.39^{a}	18.9 ± 2.299^{a}	$2.44 \pm .44^{a}$	$4.05 \pm .85^{c}$	32.44 ± 2.45^{a}
1 wk post calving	60.37 ± 9.57^{b}	34.267 ± 3.16^{b}	$3.90 \pm .61^{b}$	$2.80 \pm .40^{a}$	26.10 ± 2.98^{b}
4 wk post calving	58.22 ± 9.23^{a}	39.46 ± 9.30^{c}	$4.58 \pm .43^{c}$	$2.66 \pm .45^{a}$	18.76 ± 3.2^{c}

All means ($\pm$ Sem) having the same superscript are not significantly different from each other
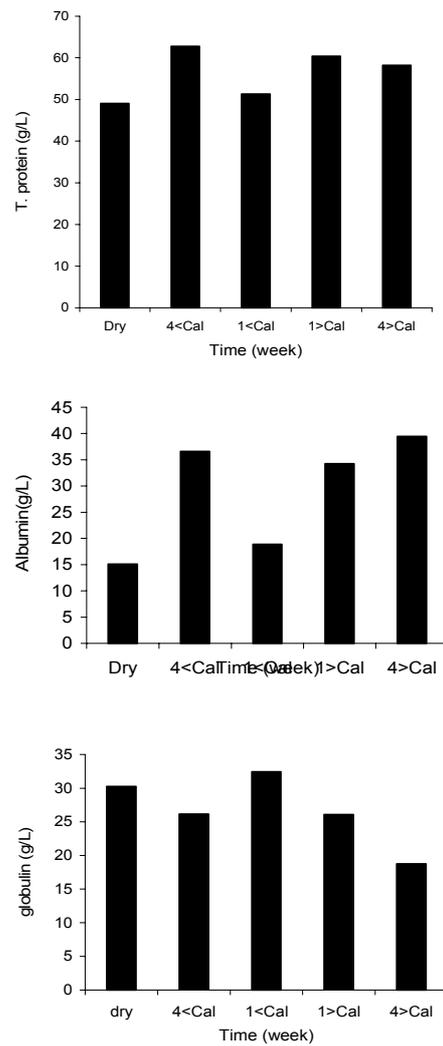
Figure 1. Serum total protein, albumin and globulin values during different
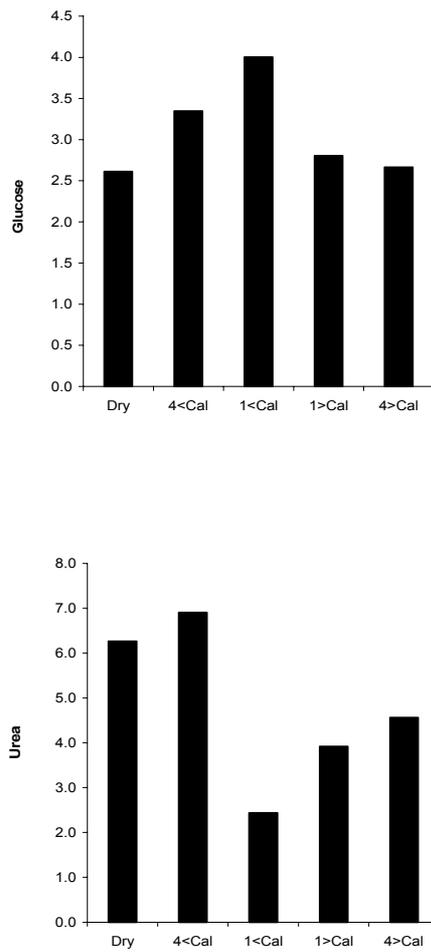reproductive periods and in dry cows

Figure 2. Serum glucose and urea values during different reproductive

periods and in dry cows

Discussion :

The mean glucose concentration were found to be 3.34±.16, 4.05±.85, 2.80±.40 and 2.66±.45 mmol/l at 4 and1 weeks before calving, 1 and 4 weeks after calving respectively. Comparing these values with standard glucose concentration in dairy cows (2.5 mmol/l) (Radostits *et al*, 2000) it is quite evident that glucose concentration was higher than normal at 4 week before calving, the concentration reached its maximum level at one week before calving and then returned to normal range. It is worth to mention that most previous work showed that there was a decrease between 8 and 18% in concentration of glucose between the last month of pregnancy and the first month of lactation (Furtmayer,1975, Hartmann *et al*, 1965). The level in dry cows (Heifers) was more or less similar to the standard level in dairy cows (2.5 mmol/l) (Radostits *et al*, 2000), The different diets which was given at different stages of pregnancy and parturition might have their benficial effect on glucose concentration. It was known that low glucose level resulted in ketosis, poor production and infertility, (Payne *et al* 1970,1987 and Manston *et al*. 1977).More recently Van Knegsel *et al* (2005) have reported that low plasmas glucose levels are associated with decreased reproductive performance

In the present work the mean albumin concentration at 4 weeks before calving was comparable to the normal standard concentration in dairy cows(36.60±1.93) (Radostits *et al*,2000) . At 1 week before calving the value decreased by 57%, then the value returned to normal level at 1 week after calving (34.267±3.16g/l) with slight increase at 4 week after calving (39.46±9.30g/l).Several authors (Little,1974 and Manston *et al*, 1975) had noted average decrease in serum albumin concentration in dairy cows of about 10% at or close to calving.

The mean total protein concentration in present work ranged between 62.76±10.02 g/l, 51.34±8.39 g/l, 60.37±9.57g/l and 58.22±9.23 g/l at 4 and 1 weeks before calving , 1and 4 week after calving, respectively. The mean globulin concentration was nearly within normal range at 4 weeks before calving and 1 week before calving 26.6±1.8g/l)and (32.44±2.45), while at 1 week after calving and 4 weeks after calving the value were 26.10±2.98g/l, 18.76±3.2 g/l respectively. The mean urea concentrations ranged between 6.90±.59 mmol/l 2.44±.44 mmol/l, 3.90±.61 mmol/l and 4.58±.43 mmol/l at 4 and 1 weeks before calving, , 1 and 4 weeks after calving, respectively. The total protein concentration was less than normal values (75 g/l) as described by Payne *et al* (1987). These values may reflect the good nutritive diet given to the dairy cows examined during the present work. Slight decrease in total protein during last week of pregnancy was also observed by

Benysek *et al* (1971). The decrease in globulin serum at late pregnancy obtained during present investigation was also reported by Rowlands *et al* , (1975). The concentration of urea was within normal value (5.3 mmol/l) obtain in dairy cows, (Payne *et al* 1987). The present results show that dry cows (heifers) samples showed that urea values (6.26±1.03mmol/l). was nearly within normal range reported by (Payne *et al* 1987). Furthermore, Mann *et al* (2005) provided further evidence that impaired reproductive function during the post partum period in dairy cows is caused by poor energy status and not elevated urea values,

It is important to remember that the metabolic profile is a herd test and not applicable to the individual cow. However, if one is only sampling a small number of cows (five or six), then it is important to remember that one atypical cow will have a fairly drastic effect on the mean values.

References

1. Benysek, V. and Kudlac, E. (1971).: The red blood picture in cows in the last month of pregnancy , during parturition and the period of puerperium. Acta vet., Brno *40*: 177-185 .

2. Blowey, R.W., Wood. D.W, and Davis J.R. (1973) A nutritional monitoring system for dairy herds based on blood glucose, urea and albumin levels. Vet. Rec, *92* :691-696 .

3. Blowey RW (1975) A practical application of metabolic profiles Vet Rec. *97*: 324-327.

4. Collins, J.D.(1979) the metabolic profile test in sheep. Irish vet. J., 33, 26.

5. Furtmayer, L.: (1975). Untersuchungen uber Metabolitkonzentrationen und Enzymaktivitaten im Blutserum von Hochleistungsrindern ; inaugural diss. Munchen..

6. Hartmann, P.E. and Lascelles, A.K. (1975).: Variation in the concentration of lipids and some other constituent in the blood plasma of cows at various stages of lactation. Aust. J. boil. Sci. *18* :114-123

7. Kida K (2002) The metabolic profile test: its practicability in assessing feeding manamement and periparturient in high yielding commercial dairy herds. J Vet Med Sci. 64:557-63.

8. Kida K (2003) Relationship of metabolic profiles to milk production and feeding in dairy cows. J Vet Med Sci. 65:671-7.

9. Little, W (1974)..: An effect of the stage of lactation on the concentration of albumin in the serum of dairy cows. Res. vet. Sci. *17*: 193-199

10. Mann GE, Mann SJ, Blache D, Webb R. (2005) Metabolic variables and plasma leptin concentrations in dairy cows exhibiting reproductive cycle abnormalities identified through milk progesterone monitoring during the post partum period. Anim Reprod Sci.:88:191-202.

11. Manston, R.; Russell, A.M.; Dew, S.M., and Payne, (1975). J.M.: The influence of dietary protein upon blood composition in dairy cows. Vet. Rec. *96*: 497-502 .

12. Manston,R:Kitchenham,B,A.and Baldry,A,F, (1977).: The influence of system of husbandry upon the blood compostion of bulls and steers reared for beef production.Br.vet.j.133;; 37-45.

13. Payne, G.M., Payne, (1987) The. metabolic profile Test. Oxford Science Publications,Oxford, England.

14. 41-Payne, J.M.; Dew, S.M.; Manston, R., and Faulks, M(1970).: The use of a metabolic profile test in dairy herds. Vet. Rec. *87*: 150-158 .

15. Rowlands, G.J. and Manston, R.; Pocock, R.M., and Dew, S.M.: (1975).

16. relationships between stage of lactation and pregnancy and blood composition in a herd of dairy cows and the influences of seasonal changes in management on these relationships. J. Dairy Res. *42*: 349.

17. von Tavel L, Kirchhofer M, Doherr MG, Kaufmann T, Kuepfer U, Eicher. (2005): Comparison of methods to evaluate the energy supply in diary herds. Dtsch Tierarztl Wochenschr. 112:443-4.

18. von Knegsel AT, van den Brand H, Dijkstra J, Tamminga S, Kemp B. Effect of dietary energy source on energy balanc, production, metabolic disorders and reproduction in lactating dairy cattle. Reprod Nutr Dev. 2005:45:665-88.

دراسات على تركيزات بعض محتويات مصل أبقار الحليب في المملكة العربية السعودية

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الملخص:

لقد تم تحليل مصل الدم لتحديد تركيز بعض العناصر مثل اليوريا، زلال البروتين الكلي والجلوكوز في الأبقار الحلابة . تم إجراء هذه التحاليل لمتابعة الحالة الصحية للأبقار وكذلك لتشخيص الأمراض الناتجة عن اضطرابات الايض الغذائي وكذلك تحديد احتمالية حدوث مثل هذه الحالات في الأبقار.

تم استخدام عشرين بقرة في مراحل مختلفة من الحمل على النحو التالي: أربعة أسابيع قبل الولادة، أسبوع قبل الولادة، أسبوع بعد الولادة ثم أربعة أسابيع بعد الولادة.

كما شملت هذه الدراسة عشرين عجلة غير حامل. أوضحت هذه الدراسة زيادة ملحوظة في تركيز سكر الدم (الجلوكوز) في الأسبوع الأخير قبل الولادة ثم عاد إلى مستواه الطبيعي أربعة أسابيع بعد الولادة. في حين نقص مستوى الزلال في الأسبوع الأخير قبل الولادة ثم عاود الارتفاع والعودة إلى المستوى الطبيعي في الأسبوع الرابع بعد الولادة.

أما بالنسبة لمستوى اليوريا في الدم فقد لوحظ عدم تغير في المستوى خلال الأسبوع الأخير قبل الولادة وكذلك في نهاية الأسبوع الرابع بعد الولادة مع حدوث نقص في مستوى اليوريا خلال الأسبوع الأول بعد الولادة.

لقد أوضحت هذه الدراسة أهمية إجراء التحاليل الكيميائية للدم للتشخيص المبكر واكتشاف الحالات المرضية الناتجة عن النقص الغذائي واضطرابات الايض الغذائي في الأبقار.