Evaluation of the pH in subacute ruminal acidosis (SARA) as diagnostic tool in crossbreed dairy cows in Al-Diwaniyah

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Abstract

The objective of this study was to find the relationship of acidity (pH) among following constituents: ruminal fluid, blood, milk, and feces, and evaluating it as an indicator and diagnostic tool for this disease in crossbreed dairy cows in Al-Diwaniyah province. A randomized selection of crossbreed dairy cows in Al-Diwaniyah province in two seasons Winter and Autumn (Sep 2013 – Feb 2014), about 427 total heads, 90 as SARA group and 50 as control. Our results of mean values of pH in the subacute ruminal acidosis (SARA) group in the ruminal fluid, milk, blood, and fecal samples were (5.22), (6.70), (7.0), and (5.56) respectively, which were different and lowest from the control group. The data obtained were processed statistically and compared together to detect the presence of significance revealed that pH of ruminal fluids and pH of fecal samples took the significant differences between groups ($p \leq 0.05$). While there were no significant difference in the milk and blood pH between the control and SARA sets ($p \geq 0.05$). Moreover, the study revealed that pH levels were in both rumenocentesis and stomach tubation sets did not have any significant difference ($P \geq 0.05$). According to the results, which were confident, can be considering the pH is an important diagnostic tool to identify the SARA in dairy cows.

Key words: Subacute ruminal acidosis (SARA), dairy cows, pH.

تقييم الدالة الحامضية (pH) في حموضة الكرش تحت الحادة كوسيلة تشخيصية في الابقار الحلوب المضربة في الديوانية

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الخلاصة

أن الهدف من هذه الدراسة هو لإيجاد العلاقة للدالة الحامضية (pH) في كل من عينات سائل الكرش والحليب والدم والبراز، وتقيم هذه الدالة كمؤشر ووسيلة تشخيصية مهمة لمرض حموضة الكرش تحت الحادة في الابقار الحلوب المضربة في محافظة الديوانية. تم اختيار حيوانات الدراسة بشكل عشوائي في محافظة الديوانية وخلال فصلي الخريف والشتاء (من أيلول 2013 ولغاية شباط 2014) وكان المجموع الكلي للأبقار 427 رأسا تضمنت 50 رأسا كمجموعة سيطرة و90 رأسا هي المجموعة التي أصيبت بالحموضة تحت الحادة. أظهرت النتائج ان قيم المتوسط الحسابي للدالة الحامضية في مجموعة الدراسة في سائل الكرش والحليب والدم والبراز هي كالاتي: 5.22, 6.70, 7, 5.56 على التوالي والتي كانت مختلفة واقل مما هو عليه في مجموعة السيطرة. تم تحليل البيانات احصائيا لتكشف ان هنالك فرقا معنويا في الدالة الحامضية لسائل الكرش والبراز مقارنة مع مجموعة السيطرة ($p \leq 0.05$) في حين ان عينات الحليب والدم لم تبدي أي فرقا معنويا ($p \geq 0.05$). أضف الى ذلك ، ان هذه الدراسة لم تجد اي فرقا معنويا في الدالة الحامضية بين طريقة جمع سائل الكرش من خلال الانبوب المعدي او من خلال عملية بزل الكرش ($p \geq 0.05$). إذا طبقا لهذه النتائج المطمئنة والدراسات السابقة يمكن ان نعتبر قياس الدالة الحامضية وخصوصا في الكرش وسيلة تشخيصية مهمة للتعرف على حموضة الكرش تحت الحادة في الابقار الحلوب.

الكلمات المفتاحية: الدالة الحامضية ، حموضة الكرش تحت الحادة ، الابقار الحلوب.

Introduction

Sub-acute ruminal acidosis (SARA) is a common health and production problem in dairy herds, and is characterize by repeated occurrences of low ruminal pH (1). (2) Showed that (SARA) is characterized by daily episodes of low ruminal pH between 5.5 and 5.0, this digestive disorder is the consequence of feeding high grain diets to dairy cows, which are adapted to digest predominantly forage diets. Rumen content acidity increase caused by large amounts of easily digestible carbohydrates and decreased of buffer capacity that originates, beside other, from forages, lead to rumen acidosis. Some investigations conducted in USA point that subacute ruminal acidosis might be the key problem in herd health (3).The control of the SARA condition can been accomplished by evaluating the pH of ruminal content, assessment of hematobiochemical and hematological profile and most significant clinical signs that warn or guide for the presence of SARA in dairy farms (4, 5). Dairy cattle and beef feedlot cattle are at similar risk to develop ruminal acidosis. Although dairy cattle are typically fed diets that are higher in forage and fiber compared to beef feedlot cattle, this is offset by their much higher dry matter intakes. Total consumption of non-fiber carbohydrates is similar between these two classes of livestock (6). Economic losses that were attributing to SARA include decreased milk yield, reduced milk fat, a general loss in efficiency of milk production, and increased culling due to lameness (7, 8).

Materials and methods

Animals and study area

A randomized selection of crossbreed dairy cows in Al-Qadisiyah province in two seasons winter and autumn and continued from Sep 2013 – Feb 2014. Herds were greater than 427 cows in size and in early lactation periods mostly, 50 cows as control group and 90 cows were study group (SARA).

Animal diet

Most of diets that were provided into dairy cows in this areas involved green foods as alfalfa, clover, etc. and others as barley, dry breads, alzahdy date, and bran or miller's bran especially in the winter and autumn, and anything provided in farms.

Samples and tests

Ruminal fluid

Samples of the ruminal fluid were obtained either by rumenocentesis (n=37) or by oro-stomach tube (n=103) were measured for pH immediately using a portable pH-meter (Hanna Instruments Inc. Romania). The pH-meter was calibrated before each use according to the manufacturer's instruction the pH-values were recorded. The two ways of samples collection as follow:

a) Rumenocentesis procedure

A 10-cm square area located 12 to 15 cm caudoventral to the costochondral junction of the last rib on a line parallel with the top of the stifle was identified. The area was clipped, scrubbed with a povidine-iodine scrub, and wiped with 70% isopropyl alcohol.Cows were sedated with xylazine (0.016 – 0.024 mg/kg.B.W.) administered intravenously in the jugular vein and were restrained in their stalls by tying their hocks together and the animal in standing position.

A 1.6-mm (o.d.) × 130-mm stainless steel needle was inserted into the ventral rumen, and a 20 ml syringe was used to aspirate a minimum of 10 ml of fluid. The pH of the fluid was measured with a portable pH meter (Henna instruments co.) immediately after it was aspirated from the rumen (5).

b) Stomach tube procedure

The samples of ruminal fluid were obtained by using a stomach tubes via Geishauser oral probe method with some of modification by using of plastic (ppr) tube 7 cm in diameter and 35 cm in long then introduce in mouth of the animal then introduced stomach tube within the plastic tube to reach to esophagus of animal and prevent irritation of the mouth and pharynx mucosa, and the first 200 mL of collected fluid was discarded to avoid saliva contamination (9). After that, we were measured it for pH immediately using a portable pH-meter.

Blood samples

Blood samples were taken from all the 140 cows from the jugular vein by vacationer tube or by 20 ml medical syringe and sterile

20 ml tube then measured for pH immediately using a portable pH-meter.

Milk samples

In this test we were wash and disinfectant application on the udder and use 250 ml container to collect the milk sample in the mid and end of milking then and measured for pH immediately using a portable pH-meter by introduced the probe of the pH meter (Hanna Instruments Inc. Romania).

Fecal samples

Samples were collected manually from the rectum (about 10 g. in 100ml size container), then these samples were mixed thoroughly and measured for pH immediately using a portable pH-meter by introduced the probe of the pH meter (Hanna Instruments Inc. Romania).

Data Analysis

Data were analyzed by digital interactive Chi-square test program (10) in addition some of results were presented as mean values and SD.

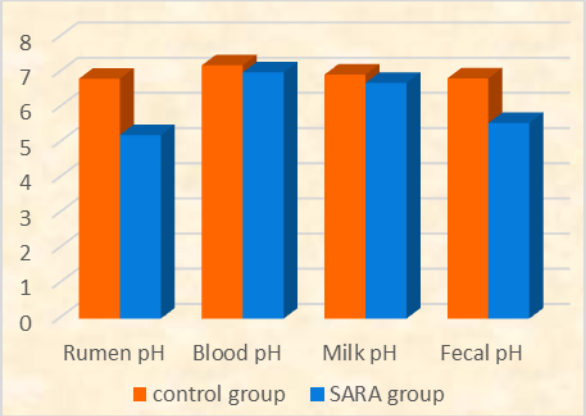
Results

The mean values of the pH for ruminal fluid, milk, blood, and fecal samples were (6.82), (6.94), (7.2), and (6.83) respectively in control group. Whereas all results of mean values in the SARA group were (5.22), (6.70), (7.0), and (5.56) respectively which were different (Table 1, fig. 1). The data obtained were processed statistically and compared together to detect the presence of significance revealed that pH of ruminal fluids and pH of fecal samples took the significant differences between groups ($p \leq 0.05$). While there were no significant difference in the milk and blood pH between the control and subacute ruminal acidosis sets ($p \geq 0.05$).

Table (1): The values of pH in ruminal fluid, blood, milk, and feces.

Samples		Control group	SARA group
Ruminal fluid	Mean ± SD	6.82 ± 0.07	5.22 ± 0.06
	Max	7.20	5.50
	Min	6.40	5.00
Blood	Mean ± SD	7.2 ± 0.07	7.0 ± 0.08
	Max	7.40	7.10
	Min	6.90	6.90
Milk	Mean ± SD	6.94 ± 0.07	6.70 ± 0.06
	Max	7.40	7.30
	Min	6.50	6.30
Feces	Mean ± SD	6.83 ± 0.09	5.56 ± 0.06
	Max	7.01	6.01
	Min	6.30	5.04

Fig. (1): The pH of the Ruminal fluid, milk, blood, and fecal samples for both groups.



The results show that the samples obtained either with rumenocentesis (n=27) or by oro-stomach tube (n=63) in study group, and in control group (n=10) via rumenocentesis and (n=40) by stomach tube which measured for pH immediately using a portable pH-meter, revealed that pH levels were in both rumenocentesis and stomach tubation sets did not have any significant difference ($P \geq 0.05$) (Table 2).

Table (2): The numbers and percentage of both groups that tested for pH by two approaches.

Approach	Control group		Study group		*P*
Rumenocentesis	N=10	20%	N=27	30%	0.235
Stomach tube	N=40	80%	N=63	70%	0.102
Total	50		90		

Discussion

In our opinion the positive relationship between the subacute ruminal acidosis in dairy cows and the acidity of rumen (minimum pH= 5.0) and feces (minimum pH= 5.04) according to our results was confident and can be consider the pH is an important diagnostic tool to identify the subacute ruminal acidosis in dairy cows. These results agree with several researchers who firm the low ruminal pH during subacute ruminal acidosis as (4, 6, and 11). Moreover, according to (4), the complex etiology of subacute ruminal acidosis necessitates its routine monitoring evidence of the sequel associated with subacute ruminal acidosis are often varied and subtle and can be easily overlooked, which prevents a definitive diagnosis of subacute ruminal acidosis in a dairy herd based only on clinical signs, thus our study is attempt to diagnosis of subacute ruminal acidosis in addition clinical signs if present. Although lactic acid is produce during subacute acidosis, it does not accumulate because lactate-fermenting bacteria remain active and rapidly metabolize it to VFA (5, 9) that confirm these studies and our study and pH ranged (5.0-5.5). Additionally, the physiological response to subacute ruminal acidosis may differ from that observed with acute acidosis because the decrease in rumen pH is not as severe as acute acidosis (1). Nearly similar results were detected by pH of rumen and feces and consider significant statistically (2, 6). Lactic acid does not consistently accumulate in the ruminal fluid of dairy cattle affected with sub-acute ruminal acidosis (12).

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