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Evaluation the effect of metoclopramide on abomasal emptying rate in healthy non-pregnant mixed breed cattle by ultrasound

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A B S T R A C T

This study was planned to evaluate the prokinetic effect of metoclopramide. For this purpose, 20 non-pregnant cattle were used and abomasal volume was assessed by ultrasonography. The abomasal volume was assessed 4 times every 2 hours and the first one was after feeding by 1hr. Two groups of cattle was used (10 of each), the first was as control and the second was received metoclopramide by intramuscular injection. The abomasal emptying rate/minute was estimated by dividing the degree of reduction of abomasal emptying volume every 2 hours(120 minute). The results revealed significant difference between control and that received metoclopramide . we could conclude that metoclopramide has prokinetic effect in cattle and could reflect good results on treatment of abomasal atony or other diseases causing abomasal emptying defect AED in cattle.

Key words: Abomasum, Emptying rate, Metoclopramide, AED, Prokinetics

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1. INTRODUCTION

Abomasum of adult dairy cow is a sac-like elongated organ lying on the lower right quadrant of the abdominal cavity extending from its abomasal attachment to the area of the eleventh or tenth rib where it is continued by the ascending duodenum (Murray et al., 1991). The rate of abomasal emptying influences the rate at which ingesta is delivered to the small intestine, Where the small intestine is the major site of fluid absorption (Marshall et al., 2008).The are many methods used for assessment of abomasal emptying rate in cattle as Electromyography, Radiography, Ultrasonography, Nuclear scintigraphy, D-xylose test and acetaminophen absorption test (Constable et al., 2006). Ultrasonography is a valuable technique for the assessment of the size, position and contents of the abomasum. The abomasum can be visualized approximately 10 cm caudal to the xyphoid process from the left and right paramedian regions and from the ventral midline, The bulk of the abomasum is situated to the right of the ventral midline(Braun et al., 1997). The wall of the abomasum appears at the most as a thin echogenic line. However, the abomasum is easily differentiated from

neighboring organs by the ultrasonographic appearance of its contents, which are seen as a heterogeneous moderately echogenic mass with echogenic stippling, Parts of the abomasal folds can occasionally be seen as echogenic structures within the content of the abomasum (Braun, 2003) . Ultrasonographic measurement of abomasal dimensions provides an accurate method of determining abomasal volume and location in suckling calves (Wittek et al., 2005a). Constable et al., (2006) revealed that evaluation of the change in calculated abomasal volume after ingestion of a standardized meal provides an accurate method for determining the abomasal emptying rate. Braun et al. (1997) showed that for the ultrasonographic measurement of abomasal emptying rate, the hair on the ventral aspect of the abdomen of each animal is clipped, the animal is then gently restrained in a standing position and a 3.5 MHz ultrasound sector probe applied to the ventral aspect of the abdomen in transverse and sagittal planes to determine the maximal ultrasonographically visible abomasal dimensions (length, width, and height). Metoclopramide has gastrointestinal and central nervous system effects. In the upper GI tract, metoclopramide increases acetylcholine release from neurons and increases cholinergic receptor sensitivity to acetylcholine. Inadequate cholinergic stimulation is incriminated in many GI motility disorders, explaining why metoclopramide is most useful in diseases in which normal motility is diminished or impaired. Metoclopramide is also a dopamine antagonist. This is a beneficial effect in the GI tract, where dopamine inhibits motility (Dowling, 1995) .

Metoclopramide has been used to treat vagal indigestion of cattle (Braun et al., 1990) and abomasal emptying defect of sheep (Ruegg et al., 1988). Therefore, the aim of this study was, evaluation of prokinetic effect of metoclopramide on abomasal emptying rate in healthy non-pregnant cattle by ultrasound.

2. MATERIALS AND METHODS

2.1. Animals

Twenty adult female dairy non-pregnant mixed breed cattle weighting 400-450 kg and aged from 3 to 5 years were obtained from private farm at Salhia area, Sharkia provenance . cattle were housed together in the farm in large in-door stalls and fed fresh barseem and mixture of corn and silage with free access to water .

2.2. Drugs

Metoclopramide (Primperan®, Sanofi-Aventis company, Cairo-Egypt) was obtained as a ready to use, sterile, aqueous, colorless solution in 2ml ampoules . Each 2ml ampoule from primperan contain 10 mg metoclopramide hydrochloride .

2.3. Experimental design

Twenty non-pregnant mixed breed cattle were divided into 2 group, 1st was control and 2nd group was IM injected with primperan, Cattle in this study were designed to evaluate the abomasal emptying rate in the control group by ultrasonography determination to abomasal volume (abomasum dimensions) at different time and to evaluate the effect of primperan as prokinetic drug to increase the emptying rate .

2.4. Method of ultrasound examination

Sonographic examination was performed by the method described by Braun et al. (1997) using a 3.5 MHZ convex transducer briefly, the examined region included the area at approximately 10 cm caudal to the xiphoid process. The cow was examined along the ventral midline and in the left and right paramedian regions, the dimensions of the abomasum were taken to calculate the abomasum volume using measuring tape , The positions of the cranial and caudal margins of the abomasum will be determined by measuring their distances from the caudal end of the xiphoid process with a measuring tape.

The length of the abomasum was calculated as the difference between these two measurements (Braun et al., 1997) .The width of the abomasum will be determined by measuring the distances from the ventral midline to its left and right margins with a measuring tape. The largest measurements were recorded on both sides in the cranial and caudal regions of the abomasum, The dorsoventral dimension (depth) of the abomasum was determined by measuring the distance from the ventral midline to the dorsal margin of the abomasum (Wittek et al., 2005a; Wittek et al., 2005b), the volume calculated by length × width × depth × π/6) where the constant π is an irrational number (approx. 3.142) as described by Wittek et al. (2005c). The volume calculated firstly in the control animals without metoclopramide administration at different time range (0 time – 2 hrs - 4 hrs – 6 hrs) 0 time mean directly after animal feeding by 1 hour (El Badawy et al., 2014). The emptying rate was simply measured by dividing the mean of abomasal volume reduction on the time of every examination (2 hours = 120 minute in this study).

The second group (10 cattle) were administrated with metoclopramide as prokinetic agent(Primperan ampoules) in the recommended dose (0.1 mg/kg IM), Roussel et al. (1994) after feeding by 1hour and the measurements and the emptying rate calculated as in the first control group.

2.4. Statistical analysis

Data were expressed as mean ± SD and a value of $P < 0.01$ was considered significant.

Repeated measures ANOVA, with repeated measures on treatment and time, was used to determine the main effects of treatment with metoclopramide.

3. RESULTS

Intramuscular injection (IM) of metoclopramide increased the rate of abomasal emptying when compared to control (Tables 1-3 and Fig. 1), as indicated by a shorter time to decrease the volume of the abomasum. Table 4 showed significant increase in abomasum volume reduction and the emptying rate/min in cattle injected with metoclopramide than cattle which not injected with metoclopramide.

4. DISCUSION

Ultrasonography can be helpful in the diagnosis of several disorders of the abomasum, including displacements, impactions, ulceration and adhesions, lymphosarcoma, and ostertagiasis,

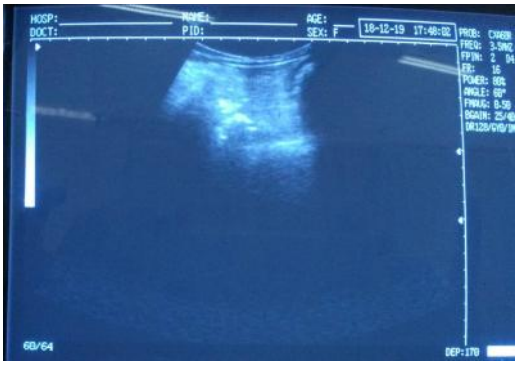

Fig. 1 Picture showed the normal content of the abomasum

Tab1e (1) Abomasum dimension in control cattle

Abomasum dimensions	Time range			
	0 time	2 hour	4 hours	6 hours
Cranial margin(cm)	10 ± 0.28	9 ± 0.29	9 ±0.28	9 ± 0.58
Caudal margin(cm)	33 ± 1.5	30 ± 0.58	30 ± 0.56	29 ± 0.29
Length (cm)	21 ± 1.6	21 ± 0.58	20.5 ± 0.5	20 ± 0.29
Left lateral extension at cranial margin(cm)	1 ± 1.5	11.5 ± 1.3	11 ± 0.86	10.5 ± 1.04
Right lateral extension at cranial margin(cm)	20 ± 0.76	20 ± 1	19.5 ± 0.76	19 ± 0.29
Left lateral extension at caudal margin(cm)	11 ± 0.74	11 ± 0.72	10.5 ± 0.58	10 ± 0.76
Right lateral extension at caudal margin	27.5 ± 1.04	25 ± 0.58	24 ± 1	23 ± 0.58
Abomasum volume (ml)	2278.47 ± 9.04	2066.80[a] ± 7.86	1898.72[a] ± 10.70	1833.25[a] ± 11.11

Tab (2) Abomasum dimension in cattle injected with metoclopramide

Abomasum dimensions	Time range			
	0 time	2 hour	4 hours	6 hours
Cranial margin(cm)	10 ± 0.5	9 ± 0.29	8.5 ±0.29	8.5 ± 0.5
Caudal margin(cm)	32 ± 1.53	30 ± 0.57	29 ± 1	29 ± 0
Length (cm)	21 ± 1	20.5 ± 0.58	20 ± 0.29	20 ± 0.58
Left lateral extension at cranial margin(cm)	12 ± 1.53	11.5 ± 1.3	11 ± 0.89	10. ± 1.15
Right lateral extension at cranial margin (cm)	21 ± 1.15	20 ± 0.89	19 ± 0.76	18.5 ± 0.29
Left lateral extension at caudal margin(cm)	11 ± 0.76	11 ± 0.76	10 ± 0.58	9 ± 0.58
Right lateral extension at caudal margin	25.5 ± 1.04	24 ± 0.29	23 ± 1	20.5 ± 0.5
Abomasum volume (ml)	2305.30 ± 17.59	1868.85^{b} ± 4.55	1618.70^{b} ± 10.35	1287.44^{b} ± 5.85

Table (3) The mean values of abomasum volume at different time range in control animals and metoclopramide injection group

Items	0 min	2 hours	4 hours	6 hours
Control group	2278.47 ± 9.04	2066.80^{a} ± 7.86	1898.72^{a} ± 10.70	1833.25^{a} ± 11.11
Injected group	2305.30 ± 17.59	1868.85^{b} ± 4.55	1618.70^{b} ± 10.35	1287.44^{b} ± 5.85
P-value	0.192	< 0.01	< 0.01	< 0.01

Date presented (means ± S.E) with different superscript letters are significantly different at (P < 0.01)

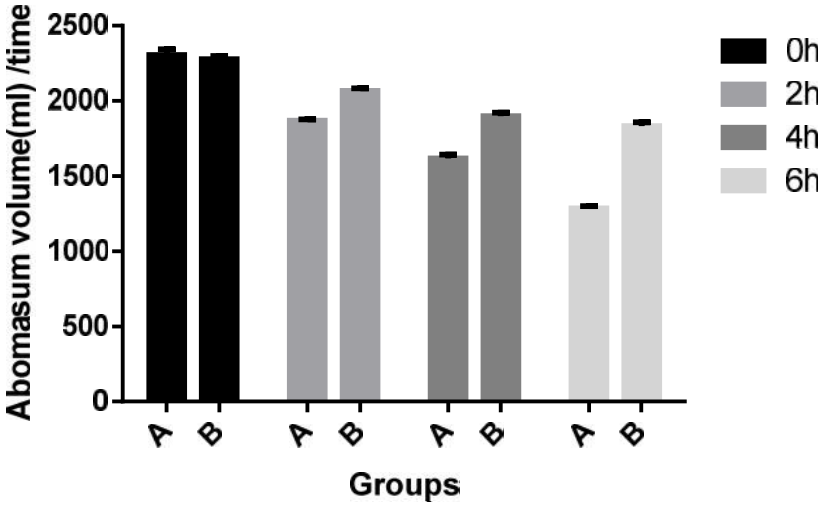

Fig. (2) The mean values of abomasum volume at different time range in control animals and metoclopramide injected animals. A: Treated. B: Control.

The abomasum is imaged along the ventral abdominal wall, beginning immediately behind the xiphoid cartilage (Streeter and Step, 2007). From our study the abomasum emptying easily evaluated by the ultrasound through calculation the abomasal volume and the abomasal dimensions and recording the time which required for the volume to decrease and our finding were agreement with Constable et al. (2006).In agreement with Braun et al. (1997), who mentioned that the abomasum is easily accessible to ultrasonography, because it is situated immediately adjacent to the ventral

abdominal wall. The abomasum could be imaged from the left and right paramedian areas and from the ventral midline.

Metoclopramide stimulates and coordinates esophageal, gastric, pyloric, and duodenal motor activity. It increases lower esophageal sphincter tone and stimulates gastric contractions, while relaxing the pylorus and duodenum. These results revealed accelerated gastric emptying and reduced esophageal reflux, Dowling (1995) .

From our study intramuscular injection of metoclopramide (primperan) in recommended dosage 0.1 mg/kg has marked and strong prokinetic effect to increase the emptying rate of the abomasum and these findings agreement with Braun et al. (1990) who said metoclopramide is strong prokinetic so used to treat vagal indigestion in cattle in addition Ruegg et al. (1988), who concluded metoclopramide used for abomasal emptying defect in sheep. Moreover Roussel et al. (1994) explained that metoclopramide is good prokinetic drug so used in yearling cattle with abomasum disorder. In contrast (Wittek and Constable, 2005) reported that the metoclopramide don't exert prokinetic effect of abomasum and duodenum and has minor changes on electromyography of abomasum so don't increase emptying rate

6. CONCULOSIONS

From our study we can concluded that metoclopramide play an important role to increase the emptying rate in the cattle due to its strong prokinetic effect so can used in treatment of abomasum disorders.

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