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**EFFECT OF RUMINAL DISTENSION ON
 CASTRO-INTESTINAL MOTILITY IN GOATS**
 (With One Figure)

By

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تأثير نفاخ الكرش على حركة المعدة والأمعاء في الماعز
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أجرى هذا البحث على عدد ست من الماعز البالغة وسجل النشاط الكهربائي لحركة عضلات جدار الكرش والغليسة والأنفحة والاشني عشر قبل وبعد نفاخ الكرش بواسطة استعمال بالونة مطاطية مليئة بالهواء أدخلت في تجويفه من خلال فتحة صناعية. وسجلت النتائج باستخدام الكمبيوتر عن طريق ثمانية مجاميع من أسلاك حديد لاتصدأ ومغلقة بسادة التيفلون، تم زراعتها في جدار تلك الأعضاء. واتضح من النتائج أن نفاخ الكرش له تأثير مباشر وتثبيطي على نشاط حركة عضلات جدار الكرش والشبكية وتصل درجته الى توقف تام لحركة جدار الجزء القاعي والبوابي للانتفحة.

SUMMARY

In the present work, six adult goats were used for experimental study. The motility pattern of the rumen, reticulum, abomasum (fundus - antrum) and duodenum was recorded before and after ruminal distension by means of electromyography using IBM Computer and volt Amplifier.

It was found that the fundus and pyloric antrum of the abomasum in goats is the first organ of the gastro-intestinal tract to be affected by ruminal distension. This effect may cause total absence of the fundus motility as evidenced by lack of any mechanical and myo-electrical activity.

INTRODUCTION

Although the goat is frequently used in experimental work on ruminant digestion, the information could trace on mechanical and myo-electrical activity of gastro-intestinal tract (RUCKEBUSCH, 1970).

Regarding the influence of ruminal distension on gastro-intestinal motility in goats, the limited data refer mainly to the abomasum (fundus and antrum) and there has been nothing reported about forestomach. The mechanical movements of the forestomach of goats have been investigated recently by recording the potential changes associated with muscular contractions of the reticulo - rumen or of the stomach (RUCKEBUSCH, 1970).

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Much of the present knowledge of the movement of the ruminant stomach has been obtained by balloons or open tipped catheters placed in the various compartments to record pressure changes. The development of methods for partial exteriorization of the reticulum helped investigation of the activity of the ruminant stomach a great deal. More recently the problem of transmitted pressure which occurs in voluminous organs such as the reticulo-rumen has been avoided by implantation of polyethylene balloons or strain gauges (RUCHEBUSCH, 1970).

GRUNDY and SCRATCHERD (1982) stated activation of intestino-gastric reflexes by distension of loops of duodenum and colon with relatively small intraluminal pressures. Also, JANSON (1969) recorded that distension of the intestine has powerful inhibitory influences on gastro-intestinal motility and tone.

OOMS and OYAERT (1978) found that the lowest frequency was usually found at end just after segmentary activity in the proximal duodenum. However the frequency of slow (rhythmic contraction) on the abomasum usually significantly decreased, not only during the period of segmentary activity of the duodenum but also for a few minutes after this period. Sometimes there were no slow waves at all. They also mentioned that the starting point of peristaltic contractions was mostly found on the pyloric antrum.

MATERIAL and METHODS

Six clinically healthy adult female goats, weighing 86-135 lbs were used in our experimental study. Care was taken to select goat that remained placid in the experimental work. These goats were fed only on hay and water.

In each animal ten groups of electrodes were chronically implanted in the sero-muscular layers of the forestomach wall (RUCKEBUSCH, 1970 and RUCKEBUSCH & BRADY, 1982) except omasum. Two groups placed on diaphragmatic reticular wall, two groups on the ventral ruminal sac, two groups on the fundus and other two groups on the antrum of the abomasum and the last two groups placed on proximal part of the duodenum. Each two groups of electrodes were implanted at 2 inches apart.

Pre-operative techniques were done in a routine manner specially fasting the goat overnight before surgery. Aseptic surgical procedures were always carried out to the animal under the effect of inhalation anaesthesia (Halothane)* with endotracheal intubation preceded by intravenous injection of Surital** in a dose of 6 mg/1b body weight. The experimental animal was fixed on dorsal recumbency.

Laparotomy was done by longitudinal incision at the ventral midline, started from the umbilicus and extended cranially for about 6-8 inches. The implanted electrodes in the wall of gastro-intestinal tract, contain three electrodes, 2 mm apart (RUCKEBUSCH and BUENO, 1973).

*: Halothane = (U.S.R.) Manufactured in USA by Holocarbon laboratories, IM.

** : Surital (Thiamylal sodium) Parke - Davis, Div of Warner-Lambert Co., Morris Plain, NJ 07950 USA.

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Migrating myoelectrical complex (MMC) was recorded using three monopolar stranded stainless steel wire coated in Tiflon (Biomed wire) 28 gauge, 120 μ diameter and 25 inch in length. The electrodes were exteriorised through a stab wound in the left dorsal region just caudal to the last rib. The free ends of electrodes were surrounded by adhesive, were fixed to the skin and also by string to a belt around the chest of the operated animal. From the belt, the electrodes were surrounded by adhesives and fixed to elastic wires and directed to the electrical amplifier and IBM computer.

Recordings were not used until at least one week had been elapsed from the time of surgery. During the recordings continuous notes were done in order to facilitate the calculations afterwards. Myoelectrical activity was recorded by using eight channels chart recorder with universal amplifiers.

The abdominal wall was sutured by Dexon2/0 with simple continuous pattern. The skin wound was closed with simple interrupted sutures using Nylon or silk No. 0. Post operative care was completed by injection of Phenylebutazone (20%) as analgesic for each operated goat in a dose of 2 mg/1b body weight.

Ruminal Cannulation :

Permanent ruminal cannulae -fistulae were fitted in all goats by method of Phillips Innes (1939) for about few days before experimental studies. The use of a delicate balloon, placed in the dorsal ruminal sac of goat, it is properly distended with air and correctly adjusted to a delicate manometer - recording apparatus. The pressure was about 15 Oz/in².

Migrating myo-electrical complex were recorded in each operated animal in eight channels including (Rumen, Reticulum, abomasum "Fundus and Antrum" and Duodenum). Recordings of MMC in the first 30 minutes refer to normal contraction (control). At the beginning of the second 30 minutes, the delicate balloon was inflated by air, while it is in the dorsal ruminal sac of the operated goat. Time elapsed of artificial ruminal distension with balloon took about 3-5 minutes under pressure of 15/in². After that deflation was done and the balloon was removed from ruminal fistula. Recordings of MMC were continued and completed for about one hour.

After the experiments had been done, the operated goats recovered completely and they were eventually euthanized by euthanasia solution (T - 16)***.

RESULTS

In the present study, recordings of the myo-electrical activity of the gastrointestinal tract (Rumen, Reticulum, Abomasum "Fundus & Antrum" and duodenum) were obtained before and after ruminal distension by introducing of the delicate rubber balloon

①: Biomed wire = Cooner wire company, Chatsworth, CA, USA.

②②: Phenylebutazone (20%) = Dist. by Burns Vet. Supply, Oakland CA 94621 USA.

***: (Euthanasia solution); manufactured by Taylor Pharmacal Co., Decatur, Illinois 62525, Dist. by Hoechst-Roussel Agri-Vet Co., Somerville, NJ 08876 W - h.

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(inflated by air) into the rumen of the goats, as shown in Fig. (1).

Normally the myo-electrical contractions of the fundus and pyloric antrum (Abomasum) are more stronger than that of the rumen and reticulum. The electromyographic records taken from the stomach and duodenum in goats after artificial distension of the rumen show that it produced its effect on all gastric compartments in few minutes (1-2 min.).

Abomasal and duodenal motility nearly ceased for about 11-15 minutes, then gradually returned to normal but remained significantly reduced after ruminal deflation.

The spikes of the myo-electrical contractions (MMC) were suddenly and sharply reduced in the regions of Fundus and pyloric antrum of the abomasum just moments after ruminal distension by inflation of the introduced rubber balloon.

The normal myo-electrical contractions (MMC) were retained within 30 minutes, after deflation of the rubber balloon. Thus the motility of the Fundus and pyloric Antrum of the abomasum reappeared after deflation of the rubber balloon. During ruminal distension the affected goat suffered from irritability and restlessness, accompanied with hard respiration and passive recumbency.

In this experimental work, it was found that a predominant effect of the ruminal distension was inhibition of gastric motility and tone specially Fundus, where it was totally absent as evidenced by the lack of any mechanical and myo-electrical activity. It was concluded that the Fundus of the Abomasum is the first organ of the gastrointestinal tract to be affected by ruminal distension in goats.

In general, the results in the present experiments demonstrate the need for additional studies on changes in gastro-intestinal tract and the possible role of these changes on the pathogenesis of abomasal distension or impaction in small ruminants.

DISCUSSION

The results of the present experiments suggest the effect of the ruminal distension on the electrical and mechanical activities of the stomach and intestine in adult goats. By using stainless steel electrodes connected with IBM computer and volt amplifier, usually ruminal distension has mainly an effect on abomasum and somewhat on the other organs like duodenum (ELIZABETH, 1956). The present method is easy to use in recognizing the effect of drugs on gastro-intestinal activity in ruminants (JONES, 1974).

The effect of the ruminal distension on gastro-intestinal motility is somewhat like the effect of the rumen digestion from grain on abomasal motility (SEVENDSEN, 1979).

Normally the myo-electrical activity at the wall of the pyloric antrum in goats was very active. These results are in agreement with that obtained by (RUCKEBUSCH, 1970), who mentioned that the group of discharges recorded from the abomasum show that the muscular contractions are restricted almost exclusively to the pyloric antrum

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is which very active. The lesser curvature of the fundus does, however show some contractility.

Electrical discharge from muscle layers of the stomach and intestine has been recorded. ALVAREZ and MAHONEY (1922) have applied the term electroenterogram to the group of potentials obtained from the intestinal wall.

Normally the major movements of the reticulum and rumen in small ruminants are accompanied by synchronous electrical activity of the muscle demonstrable as major cyclic group discharge (RUCKEBUSCH, 1970). The same author also decided that the motility of the abomasum increases not only after ingestion of food but is also activated by the sight of food as in man and dog. Feeding grain like distension reduce the peristaltic activity of the gut although the segmental activity may increase in the duodenum.

From the present study, we concluded that the abomasum (specially fundus) is the first organ of the gastro-intestinal tract to be affected by ruminal distension in small ruminants. Migrating myo-electrical contractions (MMC) disappeared as evidenced by lack of any mechanical and electrical activity from the muscle layers of the abomasum just after ruminal distension.

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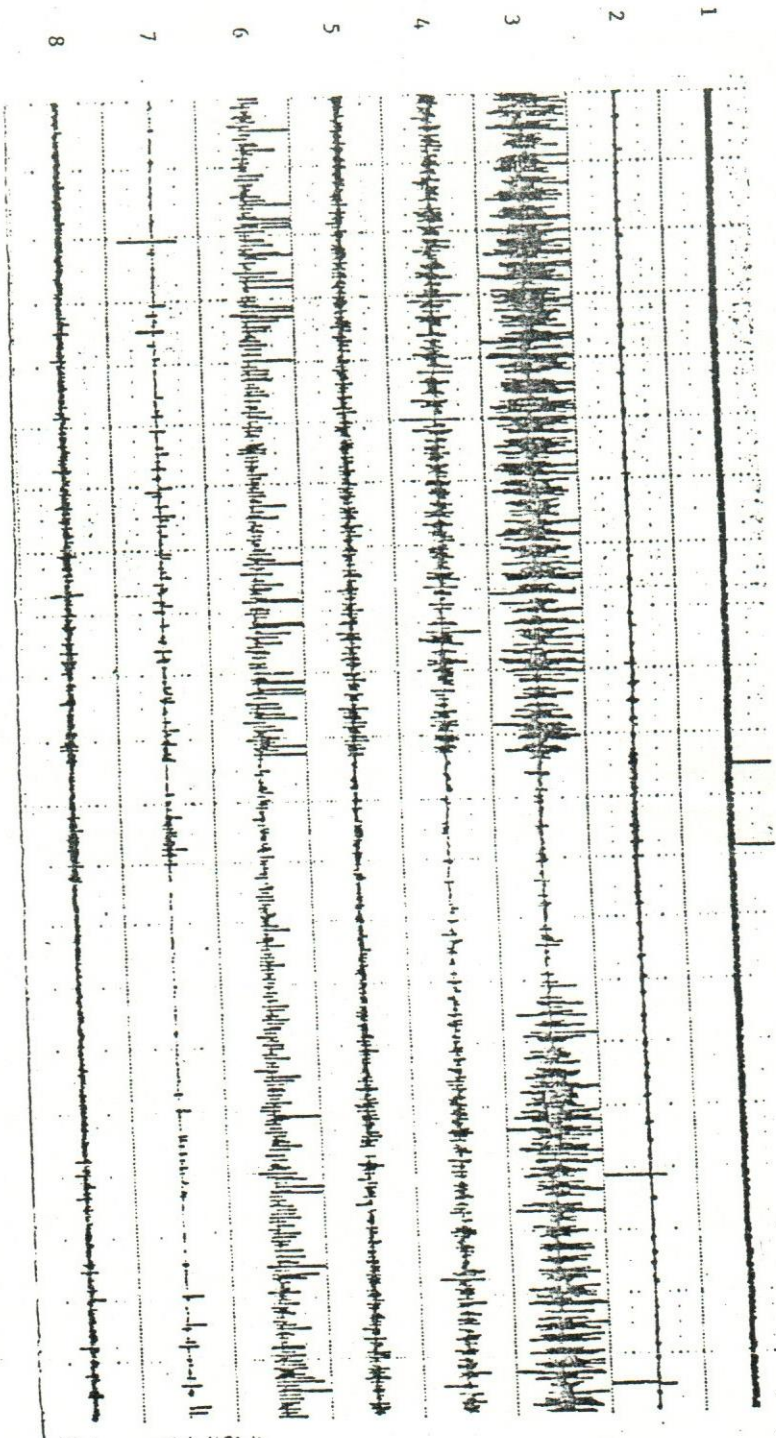


Fig. (1) : Shows NMC before and after ruminal distension in goats. (1: rumen, 2: reticulum, 3,4: fundus (abomasum), 5,6: antrum (abomasum), 7,8: duodenum.