EFFECT OF MUSCULAR WORK ON THE MOTOR FUNCTION OF THE STOMACH AND DUODENUM

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Despite the considerable theoretical and practical significance of studies directed to the clarification of the effect exerted by muscle work upon the activities of various organs and systems in the healthy organism, the changes in the digestive tract due to muscle work have been studied but inadequately. The overwhelming majority of the studies have dealt with changes in the secretory glands under the influence of the most varied kinds of muscle work. In regard to gastrointestinal movements the studies have been few and have dealt principally with the function of stomach emptying.

Observations on the influence of static effort upon motor (peristaltic) activity of the digestive tract [2, 5] are very scant and deal only with stomach movements, particularly under conditions of physiological hunger.

The present study is devoted to an examination of the influence static muscular effort exerts upon three different types of gastric motor activity: periodic, "hunger" contractions, "acid" movements [6] and the peristaltic movements occurring when a stomach has been filled with food. It was interesting to compare simultaneously motor activity of the duodenum with changes in the motor activity of the stomach.

The results we obtained enabled us to compare the influence of static motor effort upon gastric and duodenal motility with results obtained when making analogous studies upon the influence of dynamic motor effort (running in a treadmill) in the same animals [4].

EXPERIMENTAL METHODS

The experiments were conducted using 6 dogs, each one having a fistula in the fundic portion of the stomach. Besides this, three of them had duodenal openings to the outside. The animals were used in these experiments after they had fasted 18-20 hours. The experiments were begun in the absence of a pronounced acid secretion (of the stomach contents). The usual balloons recorded gastric movements. In order to record duodenal activity, a modification of this method was used, as worked out in our laboratory by V. F. Mostun [3].

"Acid" movements of the stomach were initiated by sham feeding (feeding with the gastric fistula open); within 5-7 minutes, 150 grams of raw meat were given. Experiments made to observe gastric peristalsis during digestion were conducted in an identical manner except that the sham feeding was replaced by the real.

The static muscular effort consisted in having the dog support a large weight (sand bag) which was laid across the shoulder girdle of the animal. The intensity and duration of the load was varied in two ways: 1) relatively short but very intense effort; in this instance, the dog being made to support a weight equal to its own (sometimes more) for 10 minutes; 2) prolonged but less intense effort; the weight being in this instance about half the body weight and being supported for about an hour.
Before commencing experiments pertaining to the effect of muscular loading, "background" studies were made and the influence of the new type of environment, associated with the loading studies, was extinguished.

The influence of high intensity, short duration static effort upon "hunger" contractions of the stomach was observed in two dogs - Kashtan and Tsirkach. In these experiments, the "background" period of "hunger" contractions was recorded first, after which the next period of contractions was preceded by the placing of the static load. Figure 1 represents a typical experiment (dog Kashtan).

**EXPERIMENTAL RESULTS**

It is evident that a static load, placed at the very beginning of a period of "hunger" contractions, depresses them in a very short interval of time. Removal of the static load allows the "hunger" contractions to resume. The same relationships were observed in analogously conducted experiments with a second dog - Tsirkach, although a somewhat larger load was required.

The influence exerted by prolonged but less intense static loads upon "hunger" contractions occurring periodically in the stomach and duodenum was studied experimentally on two dogs - Reke and Peggy. The experiments were conducted in two variations. In the first variation, after having recorded the "hunger" contractions and in the quiet interval, the static load was placed and kept to the end of the next period of contractions. When this maneuver was employed, it was evident that these latter contractions began and ended (at the termination) of an hour of static effort. The majority of these experiments indicated that the contractions of the "hunger" type in the stomach occurring during static effort were of shorter duration; the analogous duodenal motor changes were also less pronounced.

In the second variation, work of the same intensity and duration, was stopped just before an anticipated period of gastric "hunger" contractions. When this was done, the gastric and duodenal contractions were not depressed in regard to the length of time, number or intensity of the effort.

The influence of static loading was studied upon the digestive and "acid" gastric contractions of dogs Kashtan, Tsirkach, Peggy and Aster; the amount of load and length of time it was kept on was the same as in the preceding experiments.

Figure 2 is a typical sample. It can be seen that "acid" (Fig. 2,a) and digestive movements of the stomach (Fig. 2,b) are not markedly depressed by a short and intensive period of static loading. There was no depression of digestive movements of the stomach under the influence of the second type (prolonged) of static loading. However, when the load was increased in the same animals, it could be seen that a very intense static load did produce some depression of gastric motility (Fig. 2,c).

In order to compare the motor changes in the stomach with those in the duodenum, experiments were conducted on three dogs - Aster, Dik, and Peggy - intensive static loading being observed for its effects upon the periodic "hunger" contractions of both bowel segments. Figure 3 represents such an experiment on dog Aster. It can be seen that the braking effect of the static loading is clearly reflected in gastric movements but not in...