

A COMPARATIVE STUDY OF SERUM AND LYMPH FERMENTS AFTER FEEDING.

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In a preceding paper Jobling and his associates¹ have discussed the ferment changes that are observed in the serum of dogs after feeding. During the course of that work certain abrupt alterations in the titer of the ferments were occasionally encountered, changes that seemed to us to appear more rapidly than would be anticipated from gradual absorption following the stimulation of the ferment-producing organs.

In order to study these relations more fully we have undertaken a comparison of the lymph and serum alterations following feeding, collecting the lymph from a thoracic duct fistula and taking samples of the blood at varying time intervals.

The technique used was the same as described in the previous paper¹ except that the action of the proteolytic ferments has been accelerated by incubating at from 47° to 50°C., which represents more nearly the optimum temperature than 37°C., heretofore used. The peptidase (ereptase) has been estimated by the dilution method with the digestion of a peptone solution and subsequent production of the tryptophane reaction with bromine water.

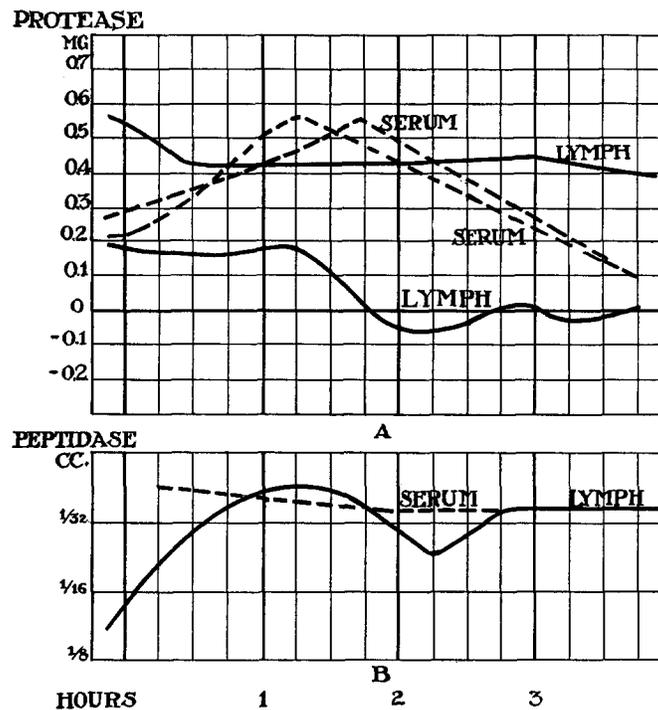
EXPERIMENTAL.

Normal dogs of from 15 to 20 kilos were operated on as a rule in the morning, a lymph fistula was established, and recovery from the operation permitted. A liter of fresh milk was then fed. The lymph was completely collected in half hour periods; the blood was taken at various time intervals.

¹ Jobling, J. W., Petersen, W., and Eggstein, A. A., *J. Exp. Med.*, 1915, xxii, 129.

Protease (Text-Fig. 1).—The serum protease was found to increase uniformly until a maximum was reached between the 1st and 2nd hours after feeding, following which a progressive decrease occurred until in some animals no protease action could be determined in the serum.

The lymph protease decreased progressively following the feeding, in some experiments quite rapidly, so that the negative phase of the

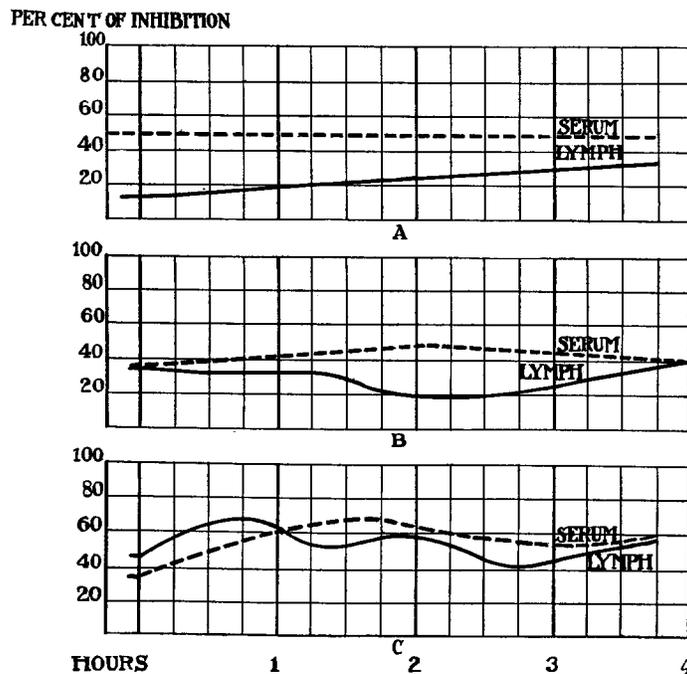


TEXT-FIG. 1. Effect of feeding on serum and lymph protease and ereptase (peptidase).

ferment action (proteosynthesis?) appeared within 2 to 3 hours after the feeding.

Peptidase.—The peptidase of the lymph is increased rapidly as a rule after the feeding, reaching a maximum at about the time that the maximum flow of lymph is observed. The peptidase of the serum, on the contrary, gave no evidence of an increase after the feeding (Text-fig. 1).

Antiferment.—In the previous experiments wide fluctuations were noted in the antiferment titer, which are readily understood when the fact that the antiferment titers of the serum and lymph are not necessarily equal is taken into consideration, so that the volume of the lymph flow entering the circulation appreciably modifies the antiferment titer of the serum.

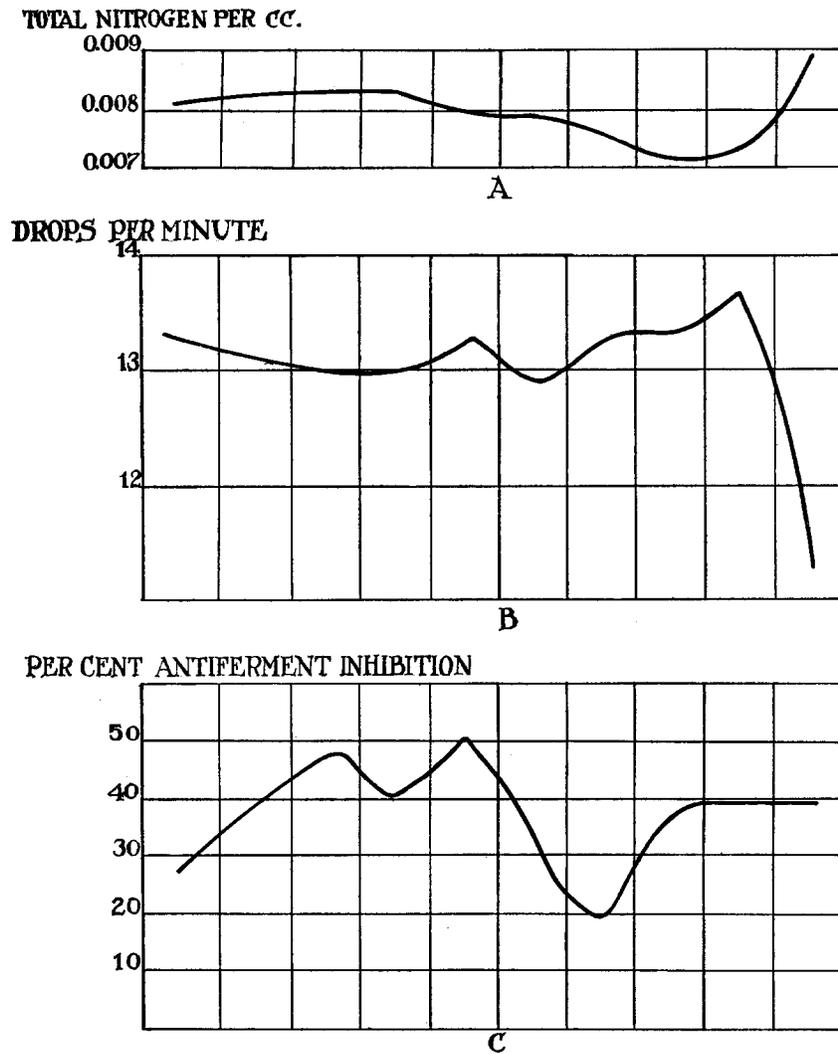


TEXT-FIG. 2. Effect of feeding on the antiferment titer of the lymph and serum.

The milk feedings used in these experiments caused a gradual increase in the antiferment titer of the lymph, but did not influence the titer of the blood serum (Text-fig. 2, A).

In the next experiment the milk fats were removed and 75 cc. of olive oil added to the milk in their place. It will be observed that in this case the antiferment titer of the lymph actually decreased, the serum showing a very slight increase (Text-fig. 2, B).

In Text-fig. 2, C is illustrated the effect of feeding 5 gm. of sodium



TEXT-FIG. 3. Relation of the antiferment to the lymph concentration and stalagmometric determination.

oleate, preceded by neutralization of the gastric acidity. In this case the antiferment both of the lymph and of the serum increased considerably.

Relation of the Antiferment to the Lymph Concentration and Stalagmometric Determinations.—Coincident with these experiments we have studied the relation of the antiferment to the concentration of the lymph as determined by the total amount of proteins contained, and also to the rate of flow through the stalagmometer. As will be observed in Text-fig. 3, the stalagmometric rate is influenced markedly by the concentration of the lymph. The antiferment on the other hand bears no relation to these two curves and its titer is obviously independent of the concentration of the proteins.

DISCUSSION AND SUMMARY.

In these experiments in which the lymph and serum ferments and antiferment have been studied separately, the changes that are found to occur are uniform and consistent. Possibly as a result of increased blood flow through the ferment-producing organs a moderate amount of protease is directly absorbed into the blood stream, but when intestinal digestion is actively under way this rapidly diminishes in extent. If any protease is absorbed during digestion from the gastrointestinal tract it is probably removed when it reaches the liver. The ereptase, or peptidase, is evidently absorbed directly from the intestinal tract and enters the circulation through the lymphatic channels.

The influence of the diet on the antiferment of the lymph is striking and accounts for the fluctuations observed in previous experiments. Following the milk meal the increase occurs gradually in the lymph in an amount that, when diluted in the blood stream, would be only nominal. When the fats of the milk were replaced by olive oil in large amounts it is surprising to find a decrease in the antiferment instead of an increase in titer, as might be expected in view of the nature of the antiferment. This result, however, is probably due to the fact that the antiferment lipoids of the serum and lymph may exist in both water and fat dispersion phases, but are active as antiferments only when in the former. If the amount of the fats of the

serum is increased, as it is after the olive oil feeding, more of the antiferment will enter the fat phase and will as a result be rendered inactive. When the feeding included the sodium oleate, the antiferment was in consequence increased in both the serum and the lymph, some of the soap being apparently absorbed directly into the blood stream. It is possible that the titer of the antiferment may be altered, therefore, by means of selective feeding.