

THE EFFECT OF SHAM FEEDING ON THE FEEDING BEHAVIOR OF ESOPHAGOTOMIZED DOGS

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There is a close relationship between the drinking and feeding behavior of animals. I. V. Malkiman [8] pointed out that dogs kept short of food drank very little water. On the other hand, A. I. Lakomkin [7] showed that when drinking time is increasingly restricted, the amount of food consumed falls until finally none is accepted. I. N. Zhuravlev [6] found that when the dogs are sham-fed, water is drunk when the amount in the ration does not exceed the daily requirement. However, the daily requirement itself depends on many conditions, including the quality and quantity of the food consumed.

The receptors of the upper part of the digestive tract are well known to play an important part in the development of both positive and negative feeding and drinking responses. I. N. Zhuravlev showed that in dogs, the actual act of sham drinking of up to 10 liters of fluid may abolish the stimulus to drink. Even a very strong urge to drink may be eliminated by introducing large amounts of water in a balloon placed in the stomach, or by repeatedly pouring water directly into the stomach. A. I. Baranov [1] and I. P. Bel'skaya [2] inflated a rubber balloon introduced into the stomach of an esophagotomized dog through a gastric fistula. They found that the positive feeding response was obliterated, but that it was renewed when the balloon was withdrawn.

There is therefore a resemblance between the feeding and drinking responses under sham conditions.

We set out to observe the simultaneous drinking and feeding responses, under conditions of fractional true and fractional sham feeding, in order to determine the part played by the receptors on the upper portion of the digestive tract during the interaction of the feeding and drinking reactions.

METHOD

We carried out 40 experiments on fractional true and fractional sham feeding, under conditions where drink was given freely. The food stimulus consisted of crusts of white bread given in 10 g portions, or of boiled liver or spleen given in 30 g portions. The crusts and meat were finely chopped. A portion of the food was offered at intervals of five minutes. Water was placed on the stand, and the dog could drink it at will. Three experiments in which fractional feeding was given were performed while water was withheld. The experiments in fractional true feeding were carried out on three dogs, and those on fractional sham feeding on a single dog (Mal'chik) after esophagotomy; in this dog, a gastric fistula was established. All the experiments were carried out after a 16-24 hour period of fasting. Before the experiments, a diet for each dog was worked out which ensured that the weight (9-10 kg) remained unchanged. There was no restriction on fluid intake.

During the experiment, a determination was made of the time for which the animal continued to eat "until refusal", i. e., of the time for which the positive feeding reaction was maintained, and the amount of food and water consumed was noted. A record was also made of the behavior of the animal during the experiment.

RESULTS

With fractional true feeding with crusts, the amount of water drunk was greater, the greater the amount eaten. In three experiments, the dog Zhuchka ate 370 g of crusts and drank 750-850 ml of water. The greatest amount of water drunk was 1,000 ml, when it consumed the greatest amount of crusts (410 g) (Table 1).

Two experiments were carried out on the dog Mal'chik in such a way that the same amount of crusts (300 and 310 g) was consumed in different times, because in experiment No. 1, the portions weighed 5 g, whereas in experiment No. 3 they weighed 10 g. It was found that more water was drunk in experiment No. 1, which lasted consider-

TABLE 1. Drinking Reaction in Dogs during Fractional True and Sham Feeding (Crusts and Bread)

Number of Experiment	Name of dog	Amount of food consumed (in g)	Time of eating until refusal of food (in minutes)	Feeding reaction	Drinking reaction
Fractional true feeding with crusts, while drink is given freely					
11	Zhuchka	370	185	Food refused	Drank 850 ml
13	"	370	185	" "	" 750 "
16	"	410	200	" "	" 1000 "
17	"	390	195	" "	" 900 "
20	"	370	185	" "	" 800 "
1*	Mal'chik	300	300	No refusal	" 1000 "
3	"	310	170	" "	" 750 "
2	Belyi	150	105	Food refused	" 250 "
Fractional true feeding with crusts without fluid					
4	Zhuchka	110	50	Food refused	
14	"	270	150	" "	
Fractional sham feeding with crusts					
6	Mal'chik	270	165	Food refused	Drinks a little
7	"	410	210	No refusal	Does not drink
8	"	80	40	Food refused	" "
9	"	100	50	" "	" "
10	"	100	50	" "	" "
11	"	60	30	" "	" "
12	"	70	35	" "	" "
13	"	80	35	" "	" "
20	"	Not recorded	45	" "	" "
Fractional sham feeding with bread					
18	Mal'chik	490	85	Food refused	50 ml drunk

* Portion of crusts weighed 5 g, not 10 g.

ably longer (see Table 1). The same effect occurred in all the experiments with Zhuchka.

In the experiments with fractional true feeding with meat, we found no definite relationship between the amount of food consumed and the amount of water drunk (Table 2).

The essential point is that, with meat eating, less water was required than with crusts. With fractional true feeding, when no water was given, less crusts were eaten than when water was supplied. Thus, Zhuchka ate 110 g in experiment No. 4, and 270 g in experiment No. 14. The average amount of crusts consumed in the nine experiments in which drink was supplied exceeded 320 g.

The absence of drink did not affect the amount of meat consumed: in experiment No. 12, when no fluid was given, Zhuchka consumed 1,240 g of meat, and the mean amount of meat eaten in seven experiments in which fluid was given was slightly greater than 1,100 g.

TABLE 2. Drinking Reaction in Dogs in Fractional True and Sham Feeding (Meat)

Number of Experiment	Name of dog	Amount of food consumed (in g)	Time of feeding until refusal of food (in minutes)	Feeding reaction	Drinking reaction
Fractional true feeding with drink freely offered					
7	Zhuchka	960	155	No refusal	Drank 650 ml
9	"	1170	190	" "	" 650 "
10	"	960	175	Refusal	" 400 "
12*	"	900	145	No refusal	" 250 "
18	"	1200	195	" "	" 450 "
19	"	1320	215	Refusal	" 200 "
4	Mal'chik	1170	200	"	" 1000 "
1	Belyi	1140	185	"	" 200 "
3	"	960	105	"	" 350 "
Fractional true feeding without drink					
15	Zhuchka	1240	195	No refusal	
Fractional sham feeding while drink freely available					
5**	Mal'chik	1140	185	No refusal	Drank (amount not recorded)
14	"	1110	180	" "	Did not drink
15	"	1140	185	" "	" "
16	"	1650	275	" "	" "
17	"	1140	180	" "	" "
19	"	2150	360	" "	" "

* Portion of meat weighed 50 g and not 30 g.

** The experiment was performed before esophagotomy, and there was an open gastric fistula.

Interesting results were obtained in experiments with fractional sham feeding. It was only in the first experiments with crusts (No. 6) and with meat (No. 5, performed before esophagotomy and with an open gastric fistula), and in the single experiment (No. 18) with bread, that Mal'chik showed a weakly positive drinking reaction. In all the other experiments with bread and meat, not only did the dog drink none of the water which was on the stand, but actually turned away from it when it was brought up to its mouth.

Thus, with fractional sham feeding with either crusts or meat, no positive drinking reaction occurred, although it is well shown with fractional true feeding. It may therefore be concluded that the latter effect is due to the action of food on the gastric receptors.

When giving fractional sham feeds to an esophagotomized dog, when the food does not act on the gastric receptors, the animal is not stimulated to drink. In experiment No. 5 on the dog Mal'chik, in whom a gastric fistula was established before esophagotomy, when the dog was supplied with meat, i. e., when the food exerted some action on the gastric receptors, a positive drinking reaction was induced. In this experiment, the feeding was only partially sham, because the food was not returned through the gastric fistula until 40 minutes after the animal had begun to eat. During this time the gastric receptors were exposed to the meat, so that a positive drinking reaction was induced.

The significance of the reflex excitation of the drinking center through the action of the food on the gastric receptors is probably that it regulates water balance after it has been disturbed through the abundant secretion of digestive juices during the digestion of the food.

The gastric receptors concerned are probably osmoreceptors. Borshchevskaya [3] showed that osmoreceptors are present in the digestive tract, and I. N. Zhuravlev [4,5] has studied the effect on drinking behavior of different concentrations of salt introduced into the stomach.

SUMMARY

A study was made of drinking behavior in dogs during fractional true and fractional sham feeding with dried crusts or cooked meat. When the food was consumed normally, they drank shortly after swallowing the first portions of food, and continued to drink during the whole time that they were eating. When sham-fed, they did not drink. The stimulus to drink is therefore evoked by the action of food on the gastric receptors.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. Some or all of this periodical literature may well be available in English translation. A complete list of the cover-to-cover English translations appears at the back of this issue.
