10254

Food Intake and Gastro-Intestinal Motility in the Albino Rat During Chronic CO Asphyxia.

CHARLES A. PATTERSON, ERMA SMITH* AND H. B. HALE.
From the Department of Zoology, Iowa State College, Ames, Iowa.

Rats treated daily with carbon monoxide for increasing intervals of time become adapted to the gas and will withstand 0.34% for one hour after about 10 days. One hour in this percent CO causes the blood to become 70-80% saturated; it contains about 5% CO 24 hours after exposure; thus a state of chronic CO asphyxia is induced.[1] Illuminating gas containing CO, or pure CO may be used, the effects of illuminating gas being somewhat more pronounced.

Food Intake [Illuminating gas (I.G.)]. The following experiment was designed to measure the effects of chronic CO asphyxia on food intake. Thirty female albino rats were selected from 6 litters; litter mates of approximately equal weight were distributed in 2 groups. Fifteen animals were subjected to CO as described above and 15 were maintained as controls. The rats were caged individually and the food intake of all measured for periods ranging from 57-87 days. An adequate ration was fed *ad libitum*.[2] The results are shown in Table I.

TABLE I.
Food Intake During Chronic CO Asphyxia.

	No. of animals	Body wt, g		Food intake, mean g per day	
		Initial	Final		
Control	15	173	240	8.28 ± .752	Mean difference 1.98
Gassed	15	175	233	6.30 ± .253	$t = 2.4959$*

*Significant difference.

About 23% decrease in food intake is shown by the table. Diminished muscular activity and depressed oxidation probably account for the maintenance of body weight by the gassed rats.

Gastro-Intestinal Motility. (1) Effective peristalsis. In order to obtain a quantitative picture of the effects of CO on peristalsis a modification of Macht's technic was used.[3]

* Aided by a grant from the Committee on Scientific Research of the American Medical Association.

1 Williams, I. R., and Smith, Erma, *Am. J. Physiol.*, 1935, **110**, 611.

2 Lee, Milton O., *Am. J. Physiol.*, 1926, **78**, 246.

3 Macht, D. I., PROC. SOC. EXP. BIOL. AND MED., 1933, **30**, 1272.

Forty rats were selected from the stock colony and comparable animals paired for the tests, 2 being killed at each test. All were allowed to eat 3 g of the following mixture: bread, 25%; milk, 25%; hamburger, 48%; pure Fe_2O_3, 2%. Five minutes after eating, 20 of the rats were subjected to 0.34% CO in 1.43% I.G.-air mixture for 30 minutes. Forty-five minutes after eating the rats were decapitated and the distance of the dyed food from the stomach measured.

TABLE II.
Action of CO on Effective Peristalsis.

	No. of animals	Distance traversed in cm mean	
Control	20	35.0417 ± 2.374	Mean difference 11.9167
Gassed	20	23.1250 ± 1.721	t = 4.0637*

*Highly significant difference.

It may be seen from the table that food is propelled about 33% more slowly in animals subjected to CO immediately after eating. This technic measures the inhibition during maximum saturation of the blood with CO.

(2). Egestion time. The time required for the first appearance of red fecal pellets following the test meal is a measure of the total time of passage through the alimentary canal. This interval we have termed the "Egestion time." For measurement of egestion time we have designed and constructed an excrementometer. (Fig. 1.)

A table, (T) with holes accommodates 6 twelve-inch funnels (F), on which rest cages (C), of ½-inch hardware cloth. Food, water and the test animals are maintained thus above a receiving disc (D), consisting of 6 concentric lanes divided into 64 compartments. The receiving disc is revolved by a kymograph (K), which makes one revolution in 16 hours. Hence the disc constitutes a timing unit, in which the maximum error is ±15 minutes.

Rats of similar age, weight and genetic history were arranged in 2 groups; the time elapsing between eating a test meal and the appearance of red fecal pellets was determined, using the excrementometer. Group I consisted of 40 rats; 20 were treated for one hour with 0.34% CO in 1.43% I.G.-air, immediately after eating the test meal described in (1). Group II consisted of 12 rats. Six were treated with 0.37% pure CO-air mixture immediately after eating 3 to 5 g of a test meal made up of 2% Fe_2O_3 in moistened, pulverized dog chow.

From Table III it may be seen that the egestion time is prolonged about 22% by treatment for one hour with 0.34%-0.37% CO.

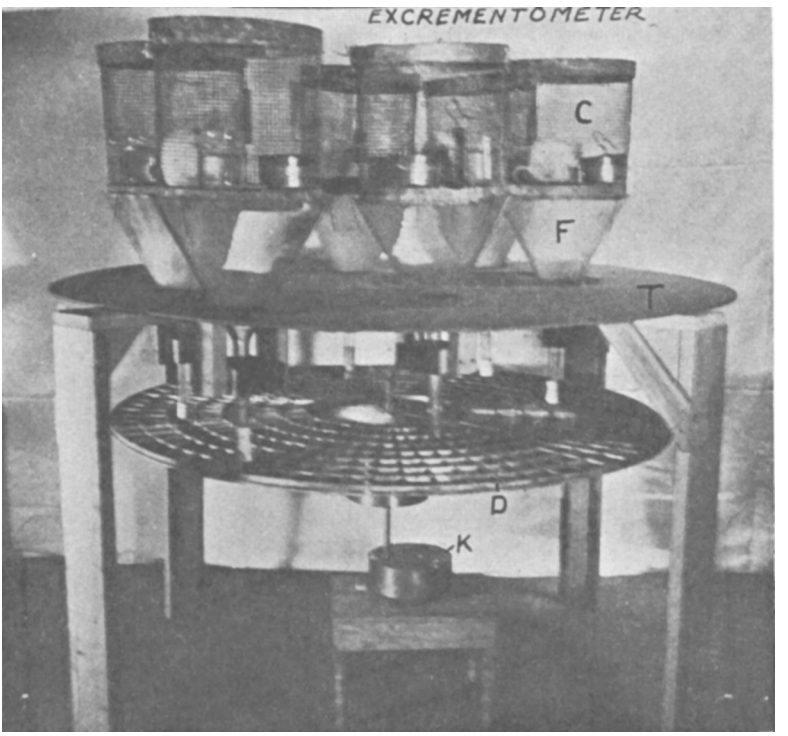

FIG. 1.

TABLE III.
Action of CO on Egestion Time.

Group		No. of animals	No. of determinations	Mean egestion time	Mean difference and t value
I	Control	20	27	8.79 ± .505	Mean difference 2.27
	Gassed	20	27	11.07 ± .655	t = 2.1410*
II	Control	6	27	6.89 ± .269	Mean difference 1.49
	Gassed	6	27	8.38 ± .428	t = 2.7510*

*Highly significant difference.

Repeated tests using 6 animals (Group II) gave less variable results than single tests using 20 animals (Group I). Pure CO prolonged the egestion time less than I.G. containing an equal percentage of CO.

Conclusions. Chronic carbon monoxide asphyxia decreases food intake and inhibits gastro-intestinal peristalsis significantly.