

THE PHARMACOLOGICAL ACTION OF GINGER.*

BY HERBERT M. EMIG.¹

Due to the numerous cases of "Jake" paralysis reported within the last year, considerable work has been done to ascertain the cause. While many theories have been advanced to explain the paralysis, the cause is still somewhat uncertain; Fluidextract of Ginger contains 83% alcohol. In preparations not conforming to U. S. P. X standards, adulterations may be found. In the collecting of ginger, foreign roots may be gathered, while in the alcohol, government denaturants such as diethylphthalate and cresols may be present. Though "jake" paralysis has been attributed to these adulterants, ginger itself has not been seriously considered.

The effect of ginger as a stomachic is well known, yet its action on other organs has not been established. Therefore, we thought it worth while to investigate its action when given orally or intravenously in large doses.

A perusal of modern textbooks on Pharmacology and Therapeutics (1) failed to reveal any action of ginger other than a local one such as is exerted in the stomach and intestines to relieve flatulence. No statement regarding its action after absorption or the effect of larger doses was found. An experimental study, therefore, seemed advisable.

EXPERIMENTS.

I.

Three rabbits were weighed and given various amounts of ginger. The drug was emulsified with acacia and fed to the animals with the aid of a stomach tube, during a ten-day period as follows:

Day.	Rabbit no. 1 2055 Gm.	Rabbit no. 2 2180 Gm.	Rabbit no. 3 2220 Gm.
1st	2 Gm.	3 Gm.	4 Gm.
2nd	3 Gm.	4 Gm.	5 Gm.
3rd	8 Gm.	9 Gm.	10 Gm.
4th	No drug given	
5th	12 Gm.	13 Gm.	14 Gm.
6th	14 Gm.	15 Gm.	16 Gm.
7th	16 Gm.	17 Gm.	Died
8th	No drug given	
9th	18 Gm.	18 Gm.
10th	18 Gm.	18 Gm.

Rabbits Nos. 1 and 2 showed no ill effects, appearing just as healthy as when the experiment started. The third animal died the eighth day, a post-mortem revealing a bright red liver and a ginger odor from the lungs. It seems probable that death in this case was not due to the ginger.

II.

A concentrated extract of ginger was made by evaporating an alcoholic extract in a vacuum until 1 cc. of the finished preparation was equivalent to 5 Gm. of drug.

* Read before Chicago Branch, A. P. H. A., December 1, 1930.

¹ University of Illinois, School of Pharmacy, from the Laboratory of Pharmacology, College of Medicine, Chicago.

At the rate of 1 cc. per minute, various doses of this product were injected into the marginal ear vein of each of three rabbits as follows:

Rabbits.	Wt. in Gm.	Cc. injected.
1	2470	1.0
2	2350	1.5
3	2310	2.0

Rabbit No. 1 showed a slight reaction of the drug. Rabbit No. 2 immediately became spastic, assuming the position of opisthotonos, legs extended, stiff and immobile. The entire nervous system appeared to be stimulated. The pupils at first were contracted, afterward dilated. Respiration was very rapid, the count being over 180 per minute. The test for sugar in the urine was negative. At the end of a forty-minute period, the spastic condition disappeared and the respiration rate dropped to 144 per minute. The following day this animal appeared perfectly normal. The third rabbit died immediately after receiving the injection.

III.

A dog was given 20 Gm. of ginger through a stomach tube. Two minutes later the animal vomited practically all of the drug as would be expected from the introduction of an irritating substance into the stomach of an animal that can vomit.

Into a normal dog 3 cc. of the concentrated extract (1 cc. = 5 Gm.) were injected intravenously. This resulted in a rapid panting respiration.

A third dog was anesthetized with morphine and nembutal and prepared for the recording of the blood pressure. Five cc. of the concentrated extract were injected slowly, 1 cc. per minute, into the femoral vein. The results showed a very marked increase in respiration, also a vagus inhibition of rather transient character followed by an increase in blood pressure and heart rate. After section of vagi there was no evidence of vagal inhibition but the respiration, blood pressure and heart rate continued to show a marked increase.

Before and after section of vagi, 50 cc. of 95% alcohol were injected very slowly, 1 cc. per minute, intravenously, displaying no demonstrable effect in respiration, heart rate or pressure.

Five cc. of the concentrated extract were then evaporated on the water-bath and suspended in 2 cc. of ethylene glycol which has very little physiological action when injected intravenously in this amount (2). This preparation of ginger was then injected intravenously. The results indicate a primary transient cessation and a secondary acceleration with a decreased amplitude in respiration. The inhibition of the heart was not as marked as in the case of the concentrated extract, but was definite. The probable reason for this change is attributed to the loss of some active volatile substance during heating. After section of the vagi the only effect was a rise in blood pressure, there being no change in heart rate or respiration.

DISCUSSION.

Since the large doses of ginger that were given to rabbits showed no appreciable effects, it is evident that the drug when taken by mouth exerts very little toxic action. This is probably due to the fact that the amount of active ingredient ab-

sorbed from the gastro-intestinal tract is negligible, or if absorbed, is rapidly rendered innocuous in the body.

From the experiments in which the drug was given intravenously no definite conclusion as to the toxic effect may be drawn because the amount injected into the vein is so much greater than that which would be absorbed by the gastro-intestinal tract. Secondly, if absorption did take place to such an extent it is most probable that the individual constituents would be considerably altered from the original state. Nevertheless these experiments show that ginger does have a decided stimulating effect upon the central nervous system evidently due to some volatile constituent, since in the experiment where evaporation was accomplished by heating, the action was decidedly lessened.

The change in respiration was effected probably by the stimulation of the respiratory center. The cardiac inhibition is not peripheral in origin since it did not occur after section of the vagi nerves. Although our experiment does not rule out a reflex inhibition, it is our opinion that the slowing of the heart is due to direct stimulation of the vagus inhibitory center. This conclusion is based upon the fact that ginger produces symptoms which may be attributed to a widespread stimulation of the entire central nervous system. Also upon this same basis we assume that the increase in blood pressure is due to a stimulation of the vaso-constrictor center, although a local irritating action on the arterioles must be considered.

CONCLUSIONS.

1. Ginger may be administered in very large doses to rabbits by mouth, without producing any significant action.
2. Ginger contains an active ingredient which definitely stimulates the central nervous system as shown by action in rabbits; and
3. Accelerates respiration and causes vagal inhibition in rabbits and dogs.
4. It also effects a secondary acceleration of pulse rate and rise in blood pressure.

BIBLIOGRAPHY.

- (1) Hugh McGuigan, "A Text-book of Pharmacology," W. B. Saunders Co. (1928). Torald Sollman, "Manual of Pharmacology," W. B. Saunders Co. (1926). Cushny, "Pharmacology and Therapeutics," Lea & Febiger (1928).
- (2) I. H. Page, *J. Pharmacol.*, 30 (1927), 313.

VETERINARY PRODUCTS, BRAZIL.

The Brazilian Ministry of Agriculture has furnished information to the effect that there is a fairly large demand for veterinary products in Brazil. Although no statistics are available, it is believed that more than 60 per cent of the total demand is satisfied by Federal and State Government departments. Veterinary products, which are distributed by Government institutions, are manufactured in Governmental Laboratories, and up to a short while ago they were distributed free of charge to stock raisers. Medical attendance is extended without charge, and both Federal and State Governments maintain a staff of veterinary doctors who travel throughout the state visiting the many stock-raising ranches. At present medicines are sold to ranch owners at a nominal price, which is less than the cost price to the Government. The most important laboratories are located in Rio de Janeiro, São Paulo and Porto Alegre.

A list of the principal druggists who are known to handle veterinary products in the Porto Alegre District may be obtained. (Vice-Consul A. Whidden Magnitzky, Porto Alegre.)