FOOD INTAKE AND CROP EMPTYING RATE OF CHICKENS TREATED WITH GUANETHIDINE

M. Furuse[1], Y. H. Choi, R. T. Mabayo, K. Sugahara[2] and J. Okumura

Laboratory of Animal Nutrition, School of Agricultural Sciences, Nagoya University, Nagoya 464-01, Japan

Summary

The effect of guanethidine on feeding behavior was investigated in the chicken. Graded levels of chronically administered guanethidine, an adrenergic neurone blocker, at 0, 25, 50 and 100 mg/kg body weight, decreased body weight gain and food intake in a dose dependent manner. The effect of acute guanethidine administration on crop emptying rate of the chicken was also investigated. The highest level (10 mg i.v./kg body weight) of guanethidine significantly delayed crop emptying compared with the control. These results suggest that the sympathetic nervous system in the chicken is an important factor for the regulation of feeding behavior associated with food passage from the crop.
(**Key Words** : Food Intake, Crop Emptying Rate, Guanethidine, Chicken)

Introduction

Leibowitz (1978) reported that the paraventricular nucleus of the hypothalamus (PVN) was the sensitive site to norepinephrine (NE)-stimulated feeding in the rat. This response is mediated by α_2-receptors (Schlemmer et al., 1981), since if clonidine (a specific α_2-agonist) is infused centrally feeding behavior is stimulated. Sawchenko et al. (1981) found that animals showed a reduced intake of food when they supplied NE in the PVN after the branch of the vagus nerve that serve the pancreas was cut. Guanethidine decreases the amount of NE released in response to sympathetic-nerve stimulation and is known as an adrenergic neurone blocker. Body weight gain and food intake were decreased by subcutaneous injection of guanethidine in the back of the neck in the rat (Tordoff et al., 1984).

In chickens, Denbow et al. (1981) also demonstrated that cerebroventricular injection of NE increased food intake. This effect was also mediated by adrenergic α_2-receptors (Choi et al., 1995). So far, however, whether or not peripheral adrenergic neurone controls feeding behavior in the chicken has not been reported. With regard to β-adrenergic action, the response was different in species. For instance, capsaicin, the active substance responsible for the irritating and pungent effect of various species of hot pepper, enhanced the energy metabolism of rats through β-adrenergic action of capsaicin itself (Kawada et al., 1986b). Capsaicin decreased consequently adipose tissue weight in the rat (Kawada et al., 1986a), though not in the laying hen (Furuse et al., 1994).

The present study, therefore, was done to clarify the effect of guanethidine on feeding behavior of the chicken. Moreover, crop emptying rate of the chicken after guanethidine treatment was also studied.

Materials and Methods

Feeding behavior

Day-old single Comb White Leghorn male chicks were purchased from a local supplier (Hattori hatchery Co. Ltd., Nagoya, Japan) and were kept in individual cages. They were exposed to continuous lighting in a temperature-controlled (28℃) room. Single subcutaneous injections of graded levels of guanethidine (0, 25, 50 and 100 mg/kg body weight) were daily given for 13 days. Control group was injected with 0.85% NaCl solution. Animals were given a commercial chick mash (crude protein 215 g/kg diet, metabolizable energy 12.1 MJ/kg diet, Marubeni Shiryo Ltd., Tokyo, Japan) *ad lib.* Guanethidine, purchased from Sigma Chemical Co., St

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[1] Address reprint requests to Dr. M. Furuse, Laboratory of Animal Nutrition, School of Agricultural Sciences, Nagoya University, Nagoya 464-01, Japan.

[2] Department of Animal Science, Faculty of Agriculture, Utsunomiya University, Utsunomiya 321, Japan.

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Louis, MO, U.S.A., was dissolved in 0.85% NaCl solution. Body weight and food intake were monitored daily for 13 days. The number of birds used was 7 per treatment.

Crop emptying rate

The chicks were given *ad lib.* the chick mash diet described above for 19 days and then were fasted overnight (about 14 h) with free access to water. The birds were selected and distributed into 4 experimental groups of 7 birds each so that average body weight during the experiment (about 192 g) among the experimental groups was made as uniform as possible. The birds received a single meal of a semipurified diet. Composition (g/kg) of the semipurified diet was as follows: isolated soybean protein, 226; mineral mixture (Mabayo et al., 1995) 58.8; vitamin mixture (Mabayo et al., 1995) 2; choline chloride 1.5; inositol 1; L-methionine 2.9; L-threonine 1.2; glycine 4.2; glyceryl tricaprylate 180; corn oil 20; cellulose 100; and corn starch 402.4 Graded levels of guanethidine (0, 2.5, 5 and 10 mg/kg body weight) were given intravenously just before diet intubation. The test meal was blended with water (wt : wt = 4 : 7) and the birds were tube-fed with 7 ml slurry through the esophagus into the crop. Crop emptying was examined 3 h after intubation of animals fasted for about 14 h. The animals were treated according to "Guide for the care and use of laboratory animals (1985). Crop emptying was examined by incision of the skin of crop and clamping the lower and upper crop junctions under light anesthesia with diethyl ether. The crop was then cut distal to the clamps, and crop content was removed and dried at 55℃ for 24 h and weighed. Animals were sacrificed thereafter. Crop emptying rate was assessed by measuring the dry weight of a meal remaining in the crop and expressed as the relative weight of the crop content to the amount of food intubated.

Statistical analysis

Data for body weight gain and cumulative food intake were analyzed by one-way analysis of variance at each day basis. One-way analysis of variance was also used to determine the significance of the data for crop emptying rate and comparison of means were performed by Duncan's new multiple range test (Duncan, 1955).

Results

Figures 1 and 2 show the effect of guanethidine on body weight gain and cumulative food intake of the chicken. Body weight gain was significantly decreased ($p < 0.001$) by the increasing level of guanethidine from 1 day of age. The difference between the control and the guanethedine treated groups increased as the feeding period continued. Food intake was also significantly decreased ($p < 0.001$) by guanethidine from 2 days of age.

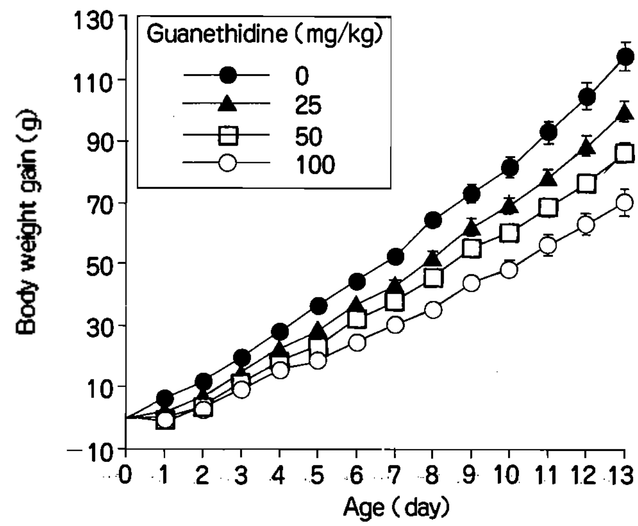

Figure 1. Effects of chronically administered daily graded levels (0, 25, 50 and 100 mg/kg body weight) of guanethidine on body weight gain of the chicken. Values are means with SEM of 7 birds.

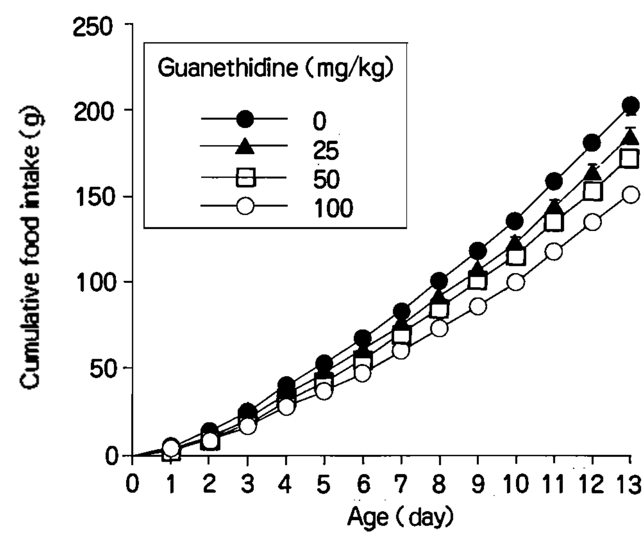

Figure 2. Effects of chronically administered daily graded levels (0, 25, 50 and 100 mg/kg body weight) of guanethidine on cumulative food intake of the chicken. Values are means with SEM of 7 birds.

Figure 3 demonstrates the effect of guanethidine on crop emptying rate of the chicken. The birds treated with the highest level of guanethidine (10 mg/kg BW) showed only significantly delayed crop emptying rate compared with other treatments ($p < 0.001$). No significant difference was observed among 0, 2.5 and 5 mg/kg BW.

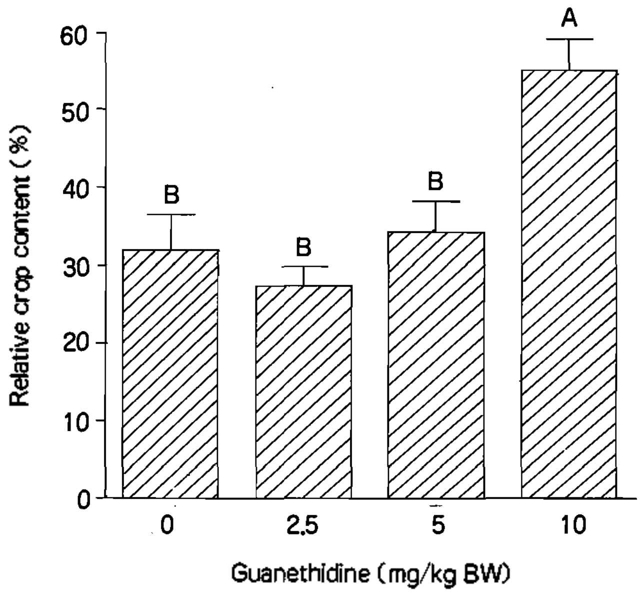

Figure 3. Effects of acute intravenous injection of graded levels (0, 2.5, 5 and 10 mg/kg body weight) of guanethidine just before diet intubation on crop emptying rate of the chicken. Crop emptying rate was determined 3 h after diet intubation. Different letters indicated significant differences at $p < 0.05$.

Discussion

The response obtained here on the effect of guanethidine on feeding behavior of the chicken was similar to the observation reported in the rat (Tordoff et al., 1984). The decreased body weight gain due to guanethidine treatments in the present study might be mostly explained by the reduction in food intake.

One of the factors regulating feeding behavior is the rate of food passage in the gastrointestinal tract. Forster et al. (1991) reported that acutely administered guanethidine (5 mg/kg body weight) did not change gastric emptying of liquid meal in the rat. Until the level of 5 mg guanethidine/kg body weight, no significant difference in the crop emptying rate was observed when compared with the control (0 mg/kg), which was in accordance with the finding of Forster et al. (1991). However, crop emptying rate was significantly delayed by the highest level (10 mg/kg body weight) of guanethidine treatment. This result suggests that sympathetic-nerve is important for food passage from the crop in the chicken and that the decreased food intake due to guanethidine treatment might be partly explained by delayed crop emptying.

In conclusion, adrenergic neurone blockages decreased food intake and delayed crop emptying, consequently depressing body weight gain of the chicken.

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