《Research Note》

The Role of Gustation in Oil Preference in the Chicken

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Involvement of gustation on the preference of diets containing 20% medium chain (MCT) or long chain triacylglycerol (LCT) was investigated in the chicken. Oxethazaine, a local anesthesia, was applied to paralyse the sense of the tongue. Oxethazaine (2 mg/l) was dissolved in 0.01% hydrochloric acid solution. Just before choice feeding trial, oxethazaine or vehicle was applied on the tongue of birds by using the swab. In the vehicle treatment group, birds significantly preferred LCT diet over MCT diet. On the contrary, preference for oil was eliminated by the oxethazaine treatment. Data suggest that oil preference in the chicken might be partly controlled by gustation.

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Key words : gustation ; chickens ; oil preference ; medium chain triacylglycerol

Introduction

Medium chain triacylglycerol (MCT) decreased food intake of chickens compared to dietary long chain triacylglycerol (LCT) (FURUSE *et al.*, 1992 b ; MABAYO *et al.*, 1994). Under self-choice feeding conditions, chickens preferred LCT diet over MCT diet (FURUSE *et al.*, 1993) while the same preference was not shown by rats (FURUSE *et al.*, 1992 a). The species difference is also important factors in varying results obtained from efforts to regulate food preferences. Most hypothalamic and amygdaloid lesions affect the manifestations or acquisition of preferences (Le MAGNEN, 1992) but the results of lesion-experiments in mammals offer little to suggest that the hypothalamus plays a similar role in the control of food intake in fowls as it does in mammals (SYKES, 1983).

Color, taste and smell and other physical properties of food can influence food intake especially in situations where a choice can be made (GENTLE, 1979). Recent study indicated that the olfactory-bulbectomized chicks and ones whose bilateral olfactory nerves were cut, lost the strong preference for LCT and tended to peck on MCT as intensively as on LCT (MABAYO *et al.*, 1996). Furthermore, dietary flavor modifies the oil preference between MCT and LCT diets in the chicken (MABAYO *et al.*, unpublished data), implying that taste aversion may be induced by the flavor aside from olfaction. Accordingly, the involvement of gustation in the oil preference was investigated in the present study.

Materials and Methods

Day-old Single Comb White Leghorn male chicks (Hattori Hatchery, Ltd., Nagoya, Japan) were housed in a windowless house with a controlled temperature kept constantly at 30°C. Lighting was provided continuously. The birds were reared in

stainless steel metabolism cages ($25 \times 21 \times 19$ cm) and were given a commercial chick mash (Marubeni Shiryō Co., Tokyo, Japan). Two or 3 days before the start of each experiment, the chickens were fasted overnight (about 14 h) with free access to water and were selected so that mean body weights were as uniform as possible. All the chickens were individually housed in stainless steel metabolism cages and were offered semipurified pre-feeding diet in uniform feeders ($70 \times 115 \times 150$ (depth) mm). The pre-feeding diet contained isolated soybean protein, 238 g/kg; sucrose, 200; corn oil, 30; cellulose, 30; mineral mixture, 58.5; vitamin mixture, 2; choline chloride, 1.5; DL-methionine, 5; glycine, 2.5 and corn starch, 432.5.

The fasted birds (18-d-old, mean body weight 169 g) were again selected and distributed into groups and all chickens in each group were allocated at random to individual metabolism cages. Each bird was given the experimental diets in 2 feeding troughs ($70 \times 58 \times 50$ (depth) mm) and a waterer and was offered a self-choice feeding. Choices were made between MCT and LCT diets. The composition of experimental diets is shown in Table 1. Corn oil (Wako Pure Chemical Industries, Osaka) was used as LCT source and glyceryl tricaprylate was used as MCT source. The MCT source in this study was donated by Kao Corporation (Wakayama, Japan). The 20 g corn oil/kg diet in the MCT diet was supplemented to meet the requirement for essential fatty acids. Oxethazaine, a local anesthesia purchased from Wako Pure Chemical Industries, was applied to paralyse the sense of the tongue. Oxethazaine (2 mg/l) was dissolved in

Table 1. Composition of experimental diets (g/kg)

Ingredient	MCT ^a	LCT ^a
Isolated soybean protein	226	
Mineral mixture ^b	58.8	
Vitamin mixture ^c	2	
Choline chloride	1.5	
Inositol	1	
L-Methionine	2.9	
L-Threonine	1.2	
Glycine	4.2	
Cellulose	100	
Corn starch	402.4	
Con oil	20	200
Coconado RK ^{®d}	180	0

^a MCT, medium chain triacylglycerol; LCT, long chain triacylglycerol.

^b Contained 20.7 g $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$, 14.8 g CaCO_3 , 10 g K_2HPO_4 , 3 g KCl, 6 g NaCl, 3 g MgSO_4 , 0.5 g $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, 0.35 g $\text{MnSO}_4 \cdot 5\text{H}_2\text{O}$, 2.6 mg KI, 40 mg $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, 62 mg ZnO, 1.7 mg $\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$, 0.4 mg Na_2SeO_3 , 0.93 mg CoCl_2 .

^c Contained 15 mg calcium pantothenate, 6 mg riboflavin, 4 mg pridoxine hydrochloride, 40 mg nicotinic acid, 1.5 mg folic acid, 0.2 mg biotin, 0.02 mg cyanocobalamin, 3 mg thiamin hydrochloride, 200 ICU vitamin D₃, 0.5 mg vitamin K₃, and 1.93 g glucose. The DL- α -tocopheryl acetate (10 IU) and retinyl acetate (1700 IU) were dissolved in corn oil.

^d Coconado RK[®], glyceryl tricaprylate (donated by Kao Corp., Wakayama, Japan).

0.01% hydrochloric acid solution. Just before choice feeding trial, oxethazaine or vehicle was applied on the tongue of birds by using the swab. During the experiment, the birds were offered a self-choice feeding between MCT and LCT diets. Food intake was measured at time 30, 60, 120, 180 or 360 min after feeding. The position of the feeders was changed after every food intake measurement to prevent the birds from pecking at one position. A paper pad was placed under the cage to collect spillage of food and the collected food was returned to each feeder whenever food intake was measured.

Data on food intake were analyzed by split-plot design by taking bird as a main plot and time as a subplot, by using a commercially available statistical package (SAS, 1985).

Fig. 1. Cumulative food intake of birds offered a self-choice feeding between medium chain triacylglycerol (MCT) and long chain triacylglycerol (LCT) diets after vehicle (A) or oxethazaine (B) treatment on the tongue of birds. Values are means of 5 birds $\pm$ SEM.

Results and Discussion

Fig. 1 shows cumulative food intake of chickens offered a self-choice feeding between MCT and LCT in both vehicle (A) and oxethazaine (B) treatments. In vehicle group, the intake for LCT diet was significantly higher than that for MCT diet. On the contrary, the oxethazaine group tended to prefer MCT diet than LCT diet, but no significant effect in food intake between two diets was detected.

Chickens reduced their food intake of MCT diet (FURUSE *et al.*, 1992 b ; MABAYO *et al.*, 1994) and one factor influencing this effect is the delayed forward movement of the crop contents (MABAYO *et al.*, 1992). The mechanism of this effect is not yet understood. Under self-choice feeding conditions, the chicken showed preference for LCT over MCT diet (FURUSE *et al.*, 1993). Recently, the role of olfaction in oil preference in rats was identified; olfactory bulbectomy reduced preference for oil emulsions (RAMIREZ, 1993). Our recent data showed that the intact and sham groups had a strong preference for LCT over MCT. MCT has a rancid odour that influences avoidance in chickens. The olfactory-bulbectomized chicks and ones whose bilateral olfactory nerves were cut, however, lost the strong preference for LCT and tended to peck on MCT as intensively as on LCT. The application of flavor also altered preference for oil (MABAYO *et al.*, unpublished data), but one problem in the use of flavor is that flavor is associated with both olfaction and gustation. The present study clearly showed that after paralysing the surface of tongue chicken did not select LCT diet. Data suggest that not only olfaction but gustation is an important regulator for oil preference in the chicken. However, other effects such as the inhibitions of the tongue movement and the laryngeal opening might be induced by the application of oxethazaine. Further studies are needed to identify the contribution of gustation in oil preference in the chicken.

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ニワトリの油脂選択性における味覚の役割

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ニワトリに中鎖脂肪を含む飼料と長鎖脂肪を含む飼料を同時に与えると後者の飼料を好んで摂取することが知られていた。そこでその選択摂取において味覚がどのように関与しているかについて調査した。

ニワトリヒナの舌に局所麻酔剤である oxethazaine を塗布した後に両飼料を選択摂取させた。対照区には vehicle を塗布した。その結果、対照区においては長鎖

脂肪に対する嗜好性が強いものの、試験区においては逆に中鎖脂肪を含む飼料の摂取量がわずかに高まり、油脂選択性が消失した。これらの結果より、ニワトリの油脂選択性には味覚が関与していることが示唆された。

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