

Studies on the Food Habits of Rats II. Relation Between Food Consumption and Caloric Intake in the Food Preferences of Norway Rats. Kiyohisa NAGANUMA* and Yasunosuke IKEDA** (Department of Medical Zoology, Osaka City University, Medical School* and Sankyo Co., Ltd Tokyo**) Received April 30, 1974. *Botyu-Kagaku*, 39, 85, 1974.

17. ネズミの食性に関する研究 II. ドブネズミの食物嗜好性における食物消費と栄養摂取の関係 永沼清久*, 池田安之助** (大阪市立大学医学部医動物学教室*, 三共株式会社**) 49. 4. 30 受理

ドブネズミの食物嗜好性における食物消費と栄養摂取の関係をj知るため、同種の動物群を用いて単一食物に対する摂取試験をおこなった。

供試食物間の消費量には著しい差異が見られたが、栄養摂取の総量にはほとんど差異が認められなかった。本試験においては、栄養価の最も低い甘藷がすべてのネズミに好まれた。これらの結果から、各種の食物のあるところではドブネズミはかならずしも栄養価の高い食物を摂取しないものと結論した。甘藷への嗜好性はその栄養価よりも風味によるものと考える。

In the previous paper⁹⁾, the authors reported that the preferences of Norway rats for a particular bait may depend upon its flavor more than its nutrient content or the previous food experience.

This paper deals with further investigation conducted in order to ascertain the relation between consumption and caloric intake of the test bait. The results show that rats may not always choose the most nutrient bait. The authors wish to express their appreciation to Prof. S. Takada, Dept. of Med. Zool., Osaka City Univ. for his kind guidance during the present work. The authors also indebted to Mr. T. Sakurai and Mr. S. Azuma for their assistance in the experimental work.

Materials and Methods

The animals used were a laboratory colony of Norway rats, *Rattus norvegicus*, which had been reared and maintained since 1967. In the present test, the infant animals from the same litter were separated from their mother at 25 day after birth and confined in a stainless cage, 36 cm × 42 cm × 17 cm. Then five groups of ten infant animals reared with a particular simple bait in every group. The rearing baits used were commercially available wheat flour (356 calories per 100g), ground peanut (553 cal), fish meal=dried small sardines (322 cal) crushed sweet potato (120 cal) and powdered rat food = bait for breeding experimental animals (360 cal).

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An individual test: The rats used were 150 days old after birth. A test rat was confined in a cage individually and allowed to choose the baits for 24 hours. The test bait used were the same kinds which had been used as a simple bait for rearing test animals. The test cage is consisted of stainless wire-netting, 26 cm long 30 cm broad, and 17 cm in height, with a netted door in the ceiling. A container for the test bait is consisted of glass dish, 7 cm in diameter and 4.5 cm in height.

Five dishes with the greater amount of test baits were placed parallel to either inside wall of the cage at the same time. After the exposure for 24 hours the baits were removed and weighed. The baits were renewed and their positions were changed every day to eliminate prejudice due to place preference.

The criterion of preference was based on comparing the amount of consumption of different kinds of test baits set at the same time.

A group test: In this test, each test group consisted of five or less caged rats of separate sexes in order to prevent the copulation during the test period.

The test cage is consisted of stainless wire-netting 36 cm × 42 cm × 17 cm, with a netted door in the ceiling. Water was provided in the center of the cage, and dishes with the test baits were placed around a water supply. Details of the test

conditions were the same to those in the individual test mentioned above.

Results and Discussion

The results are given in Tables 1 and 2. Average daily consumption of the baits was calculated and indicated per 100 body weight of rat. As shown in the results, there were significant differences in the amount of consumption among the test baits.

It has been definitely shown by many investigators that the food preferences of Norway rats may depend upon the initial environmental exposure¹⁾, learning or adapting behavior to experience²⁾, or nutritional requirements^{3,4,5)}, especially the choice of food may closely related with the nutritional content or the previous food experience.

In the present tests, a sweet potato was highly preferred by all rats in spite of they had no experience in eating it. Since the rats had been reared with a simple bait from childhood to just before to the test, they had no experience in the test bait except they had learned as a rearing

bait.

A small quantity of a nourishing bait such as peanuts of rich in protein and fat, fish meal of rich in protein, or a rat food of elements balanced was enough to maintain rat's health. Even though a sweet potato, rich in carbohydrate and poor in protein, was consumed in large quantities, the rats reared with this bait were so poor healthy that they were checked the normal growth and a few animals could hardly survive.

To confirm the relation between food consumption and caloric intake, feeding test with a simple bait was carried out by using the other groups of animals from the same litter. In advance of the test, the rats were adapted to a test bait for a few days, because they had been reared with a conventional rat food.

The result are given in Table 3. As the results observed in rearing investigation, so heavy consumption of a sweet potato and small consumption of a nourishing bait were observed. There was a small difference in the total caloric intake in spite of a great difference in the amount of consumption among the baits.

Table 1. The relative consumption of test baits and the caloric intake of Norway rats in an individual test during three day periods.

Rearing bait	Test bait Consumption/100g body wt./day					A/B*	C/D**
	Flour	Peanut	Fish meal	Sweet potato	Diet		
Flour	g	0.0	3.4	1.2	9.5	1.4	15.5
	%	0.2	22.0	7.8	61.0	9.0	100.0
	cal	0.0	18.8	3.9	11.4	5.0	39.1
Peanut	g	0.5	1.2	1.6	11.4	1.3	16.0
	%	3.2	7.4	9.9	71.5	8.0	100.0
	cal	1.8	6.6	5.2	13.7	4.7	32.0
Fish meal	g	0.9	4.6	0.1	7.7	1.8	15.1
	%	6.1	30.4	0.9	50.9	11.7	100.0
	cal	3.2	25.4	0.3	9.2	6.5	44.6
Sweet potato	g	1.4	4.5	0.9	12.5	1.3	20.6
	%	6.6	21.8	4.4	60.7	6.5	100.0
	cal	5.0	24.9	2.9	15.0	4.7	52.5
Diet***	g	0.3	3.0	0.3	14.0	0.1	17.7
	%	1.6	16.9	1.8	79.1	0.6	100.0
	cal	1.1	16.6	1.0	16.8	0.4	35.9

* Total intake/100g body weight/day.

** Average body weight/number of rats tested.

*** Bait for rearing experimental animals.

Table 2. The relative consumption of test baits and the caloric intake of Norway rats in a group test during three day periods.

Rearing bait		Test bait Consumption/100g body wt./day					A/B*	C/D**
		Flour	Peanut	Fish meal	Sweet potato	Diet		
Flour	g	0.3	2.6	1.4	13.4	1.7	19.4	136.6 (8)
	%	1.3	13.6	7.1	69.2	8.8	100.0	
	cal	1.1	14.4	4.5	16.1	6.1	42.2	
Peanut	g	1.0	0.9	1.8	9.7	2.7	16.1	192.7 (10)
	%	6.1	5.5	11.2	60.4	16.8	100.0	
	cal	3.6	5.0	5.8	11.6	9.7	35.7	
Fish meal	g	0.6	4.3	0.7	9.0	1.8	16.4	163.4 (10)
	%	3.7	26.2	4.5	54.7	10.9	100.0	
	cal	2.1	23.8	2.3	10.8	6.5	45.5	
Sweet potato	g	0.8	5.9	2.6	6.3	3.1	18.7	112 (7)
	%	4.2	31.5	13.8	33.7	16.8	100.0	
	cal	2.8	32.6	8.4	7.6	11.2	62.6	
Diet***	g	0.3	1.6	0.5	12.7	0.2	15.3	215.4 (10)
	%	1.9	10.7	3.2	83.0	1.2	100.0	
	cal	1.1	8.8	1.6	15.2	0.7	27.4	

* Total intake/100g body weight/day.

** Average body weight/number of rats tested.

*** Bait for rearing experimental animals.

Table 3. Daily bait consumption and the caloric intake of Norway rats when an individual bait was provided for seven days.

Rearing simple bait	Consumption/100g body wt./day			Average of body weight (No. of rats tested)
	Bait consumed (g)	Water required (ml)	Caloric intake (cal)	
Flour	9.1	7.0	32.4	276.8 (♀3 ♂1)
Peanut	4.5	8.1	24.9	365.2 (♂4)
Fish meal	10.2	32.8	32.8	215.8 (♀4)
Sweet potato	32.5	3.4	39.0	324.8 (♂4)
Diet*	7.2	10.6	25.9	393.0 (♂4)

* Bait for rearing experimental animals.

In so far as the food preferences of Norway rats are concerned, it may be concluded that in the presence of various baits, rat does not always choose the most nutrient bait. The less nutrient baits are accepted by rats if the flavour is sufficient to induce appetite of the rats. The preference for sweet potato may depend not so much upon nutrient content as its texture, sweet taste, water content, or certain odorous component.

Summary

To ascertain the relation between food consumption and caloric intake in the food preferences of Norway rats, feeding tests with a simple bait were carried out by using the groups of animals from the same litter.

There was a small difference in the total caloric intake in spite of a great difference in the amount of consumption among the baits. In the present tests, a sweet potato was highly preferred by all

rats even though the caloric value was very low. From the results so far obtained, it may be concluded that in the presence of various baits, rats do not always choose the most nutrient bait. The preference for sweet potato may be due to its flavour more than its nutrient content.

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The Resistant Level of the Houseflies to Several Synthetic Insecticides in Indonesia. Akifumi HAYASHI¹⁾, Masayoshi HATSUKADE²⁾, Satoshi SHINONAGA¹⁾, Rokuro KANO¹⁾, J. Sulianti Saroso³⁾ and Iskak Koiman⁴⁾ (Department of Medical Zoology, Faculty of Medicine, Tokyo Medical & Dental University¹⁾, Tokyo, Japan, Laboratory of Applied Entomology, Taisho Pharmac. Co., Ltd. Tokyo, Japan, Communicable Diseases Control³⁾, Jakarta, Indonesia and National Institute of Medical Research⁴⁾, Jakarta, Indonesia) Received May 10, 1974. *Botyu-Kagaku*, 39, 88, 1974. (with English Summary 91)

18. インドネシア産イエバエの数種殺虫剤に対する感受性について* 林 晃史¹⁾, 廿日出正美²⁾, 篠永 哲¹⁾, 加納六郎¹⁾, J. S. Saroso³⁾, Iskak Koiman⁴⁾ (東京医科歯科大学医学部医動物学教室¹⁾, 大正製薬(株)会社防虫科学研究室²⁾, CDC³⁾, NIMR⁴⁾) 49. 5. 10 受理

インドネシアの8島, 16カ所からイエバエを採集飼育し, 9種類の主要殺虫剤に対する感受性について調査した。インドネシア産イエバエは日本産イエバエに比較してこれら殺虫剤に対し高い感受性をしめした。しかし, sumithion に対して耐性を持つものが認められた。また, malathion についても同様の傾向であった。なお, γ -BHC, DDT に対しては日本産のイエバエよりきわめて高い感受性をしめした。

全般的にみて, Ambon, Flores, Bali, Lombok の系統が各種の殺虫剤に対して高い感受性をしめした。

本邦におけるイエバエの殺虫剤抵抗性に関する調査, 研究報告は少なくない。本邦における最近10年間の報告が林 (1973)¹⁾ によりとりまとめられている。また, 独立した広い地域での調査研究報告では林, 長谷川 (1974)²⁾ が北海道全土での研究をとりまとめ, 同様に高知県下の調査も林, 松崎 (1973)³⁾ が整理した。また, 沖縄, 台湾に関しても林, 廿日出 (1974)⁴⁾ の報告がある。しかし, インドネシアに関する報告は皆無である。現在の如く, 交通機関が発達し文物の交流が頻繁な時代には, 完全なる防疫対策をたてるためにも広い視野で衛生害虫を調査研究して置く必要がある。今回, インドネシアについて調査研究を行なう機会を得て検討を行なった結果, 興味ある知見を得たので報告する。

本文に入るに際し, 種々の御指導をいただいた名古屋大学名誉教授弥富喜三博士, イエバエの搬入に際し

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実験材料および方法

供試昆虫: 実験に用いたイエバエ *Musca domestica* Linné, 1758はインドネシアの次の地域で採集し, 研究室に空輸して大量に飼育した個体群である。

採集地と採集年月日は次の如くである。

- No. 1. Java (Bogor)……郊外溪流沿いの店, 昭和48年11月10日
- No. 2. Java (Jakarta)……海岸の魚市場, 昭和48年11月11日
- No. 3. Java (Jakarta)……市内中心地の市場, 昭和48年11月11日
- No. 4. Java (Jakarta)……市内 Kebayoran Baru のホテル裏, 昭和48年11月11日