調 査

小学生の食品嗜好性に関する研究 (第 2 報)

野菜類の嗜好と健康状態および尿 pH との関連

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Studies on the Preference of Food of Primary School Girls (Part II)

Relationships among the preference of Vegetables, the Status of
Mental and Physical Health and Urine pH

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食品の嗜好性への影響因子は多様であるが、心理学的、生理学的側面より検討を行なった。精神のおよび身体的健康状態に関しては両者とも不健康群が野菜嫌いの傾向を示した。尿 pH に関してはⅢ群 ($\text{pH} \geq 6.22$) がⅠ群 ($\text{pH} \leq 5.87$)、Ⅱ群 ($5.88 \leq \text{pH} \leq 6.21$) に比べて野菜類の一部を好む傾向を示した。また精神のおよび身体的健康両面とも野菜類の嗜好との間に相関関係がみられたが、特に身体的健康と野菜の嗜好は強く結びついていると考えられた。他方尿 pH と野菜類の嗜好の間では明確な関連性はみられなかった。精神的、身体的健康の間には高い相関性を見出したが、尿 pH と両者間には何ら関係性はなかった。加えて食品の嗜好性の研究が児童の健全な心身発達のための基礎研究の一助となると考える。

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1. INTRODUCTION

In order to support life, various nutritive elements are taken from food. Food acceptance is a complex reaction determined by physiologic, psychologic, biochemical, social, educational aspects and sensory reaction of individuals in a framework of race, religion, tradition, economic status and environmental condition.¹⁾ The same thing might be possible to be said about food preference. As mentioned above, it has been shown that various factors cause food preference. The determinate factors for food preference may be roughly classified into environmental, psychological, physiological and social factors.²⁾

The idiosyncrasy of preference seems to appear in a rather early period of childhood and is said to appear already in babyhood. In the course of nursing a child the problem of food preference is disputable with reference to the influence of unbalanced food preference on the child and its influence on character formation. It was suggested that the correlation between food preference and character is especially remarkable in kindergarten and primary school children while on the other hand not remarkable in junior college students. That is to say the emotionally unbalanced child is inclined to dislike vegetables and so on.^{3) 4) 5)}

The interdisciplinary field between dietetics and psychology is gradually starting to gather investigators' attention. Concerning food preference, the approach based only on the psychological point of view is insufficient. From the physiological point of view, it was shown that comparing healthy children with unhealthy children the latter had an inclination of disliking vegetables.⁽⁶⁾⁷⁾ It might be notable that test results have been especially remarkable in preference of vegetables. In the present report an examination of mental and physical status of health, and a test based on urine pH (hydrogen ion exponent) value which is influenced by food was conducted.

2. METHOD

Subjects

Food preference investigation, FAT (The Factors's Diagnosis Test of Achievement-Advancement) and examination of urine pH on 102 Osaka Shin-ai primary school girls was conducted during June 8 to 16 in 1976.

For the investigation of food preference, the authors used the Hedonic scale (Table 1) translated into Japanese by the authors which shows relative and absolute degree of food preference for a certain food. This scale was developed by Peryam et al.⁽⁸⁾⁹⁾ in 1952, and it is broadly accepted that the Hedonic scale and Fact scale which are generally used to measure food acceptance have correlation with each other.⁽¹⁰⁾ The foods to be investigated were raw material for avoiding considerable risk; that is to say one of the causes of children's unbalanced diet depends on the food material chosen to be cooked. There were many kinds of vegetables that were eaten in the raw state and in spite of the fact that food preference was greatly affected by the way of cooking, vegetables in this sense were the least affected food.

Table 1 Hedonic scale

Scale value	Hedonic scale	(in Japanese)
1	Like very much	(dai-suki)
2	Like moderately	(suki)
3	Neither like nor dislike	(suki-demo-kirai-demonai)
4	Dislike moderately	(kirai)
5	Dislike very much	(dai-kirai)

Table 2 Food and food group

No.	Food group	Food
1	Milk & eggs	Milk, Eggs
2	Fish & shellfish	Horse-mackerel, Cuttle fish, Shellfish, Fish paste products
3	Meat & meat products	Pork, Beef, Chicken, Ham-sausage
4	Bean products	Bean-curd, Fried bean-curd
5	Vegetables	{Cabbage, Chinese cabbage, Cucumber, Onion, Tomato, Japanese radish, carrot, White potato, Eggplant, Spinach
6	Fruits	Orange, Apple, Banana
7	Cereals	Rice, Bread, Noodles

Twenty eight food items (Table 2) were chosen from the Annual Report on Family Income and Expenditure Survey.¹¹⁾ These items were those which were thought to have been taken by children some times before the test was conducted. Food preference for the 28 items was investigated by employing the Hedonic scale the questionnaire papers of which were all signed by the children testees.

For the testing of physical and mental health, CMI (Cornell Medical Index) was widely used in medical colleges, hospitals and health centers.¹²⁾ This method of testing however, was limited to only persons over 14 years old.

On the other hand, not a few contents of the questionnaire of FAT¹³⁾ were common with those of CMI and were usable on the testees in spite of their age. Therefore FAT was considered to be adoptable for the testees below 14 years old. FAT includes 160 questions, 40 of which are aimed to test both mental and physical status of health.

For the examination of urine, urine urinated just after getting up was required to be sealed up into a receptacle, kept under 5°C for three or four hours, and immediately after being restored to indoor temperature, examined by a Beckmann Expandomatic SS-2 pH meter according to the method proposed by Kanai.¹⁴⁾ In examining urine, glucose and protein contents were checked to ascertain nothing was wrong. G.P.-Pretest (Wako med. co.) was used for the test.

Statistical Analysis

With reference to their mental health, children were divided into three groups : healthy (n=29), average (n=49), unhealthy (n=24) according to the guide prescribed in FAT. Children were also divided according to their physical health : healthy (n=35), average (n=35), unhealthy (n=32).

With reference to urine pH values, the result was divided into three groups statistically : group II ($5.88 \leq \text{pH} \leq 6.21$, n=38) the limit within $\text{mean} \pm 1/2$ standard deviation, group I ($\text{pH} \leq 5.87$, n=32) below the group II limit, group III ($\text{pH} \geq 6.22$, n=32) over the group II limit.

Correlation coefficient and regression line between the Hedonic scale value and FAT value on mental health and physical health were computed by an electronic computer, WANG 600 and the T-test was used for the significant test.

3. RESULTS

There was no consistency among the results of any other kind of food except vegetables.

The result of the Hedonic scale and standard deviation of vegetables regarding status of health is presented in Table 3 and urine pH is given in Table 4. In reference to mental health, the mean value of the Hedonic scale of 10 vegetable items was as follows; healthy group : 2.1, average group : 2.5, unhealthy group : 2.7. In regard to physical health, the mean value of the Hedonic scale of the same items was : healthy group : 2.1, average group : 2.4, unhealthy group : 2.7. It is shown that the healthy group mostly preferred those items while on the other hand the unhealthy group showed the least preference for them. Regarding urine pH, the mean value of the Hedonic scale was : group

Table 3 Result of the Hedonic scale value on the status of health

Vegetables	Mental			Physical		
	Healthy	Average	Unhealthy	Healthy	Average	Unhealthy
Cabbage	1.6±0.8	2.2±1.0	2.5±1.1	1.8±0.8	2.1±1.9	2.4±1.1 ^{a)}
Chinese cabbage	2.0±1.0	2.4±1.0	2.6±1.1	2.0±1.0	2.4±0.9	2.6±1.2
Cucumber	1.8±1.0	2.1±1.0	2.6±1.3	1.6±0.8	2.2±1.0	2.7±1.3
Onion	2.5±1.2	3.0±1.1	3.1±1.3	2.6±1.2	3.0±1.2	3.1±1.2
Tomato	1.8±1.1	2.1±1.4	2.2±1.5	1.8±1.1	1.9±1.3	2.4±1.6
Japanese radish	2.3±1.0	2.8±1.2	3.1±1.1	2.4±1.2	2.7±1.0	3.1±1.1
Carrot	2.9±1.4	3.1±1.1	3.0±1.3	2.5±1.1	3.2±1.2	3.4±1.2
White potato	1.8±0.8	2.1±1.0	2.3±1.1	1.7±0.9	2.2±0.8	2.4±1.0
Spinach	2.0±1.1	2.0±1.0	2.3±1.1	1.8±0.8	2.1±1.1	2.3±1.2
Eggplant	2.1±1.1	2.7±1.3	3.1±1.5	2.3±1.3	2.5±1.2	3.0±1.5
(Total mean)	2.1±1.1	2.5±1.1	2.7±1.2	2.1±1.0	2.4±1.1	2.7±1.2

a) Mean±standard deviation

Table 4 Result of Hedonic scale value on urine pH

Vegetables	I	II	III
Cabbage	2.1±1.1	2.3±1.0	1.9±0.9 ^{a)}
Chinese cabbage	2.4±1.2	2.5±1.0	2.0±0.9
Cucumber	2.3±1.4	2.2±0.9	1.9±1.0
Onion	3.0±1.3	2.9±1.2	2.8±1.1
Tomatoes	2.1±1.5	1.8±1.1	2.2±1.4
Japanese radish	2.8±1.3	2.9±1.0	2.5±1.2
Carrots	3.0±1.3	3.2±1.2	2.9±1.2
White potatoes	2.0±1.1	2.0±0.9	2.1±0.9
Spinach	2.1±1.2	2.2±1.0	1.9±1.0
Eggplant	2.7±1.5	2.8±1.3	2.4±1.3
(Total mean)	2.5±1.3	2.5±1.1	2.3±1.1

a) Mean±standard deviation

Table 5 Result of the T-test : preference of vegetables of other groups in contrast to the mental healthy group

Vegetables	Average	Unhealthy
Cabbage	* * *	* * *
Chinese cabbage	—	*
Cucumber	—	* *
Onion	*	—
Tomatoes	—	—
Japanese radish	—	* * *
Carrots	—	—
White potatoes	—	—
Spinach	—	—
Eggplant	—	* * *

* p < 0.05, ** p < 0.02, *** p < 0.01

I : 2.5, group II : 2.5, group III : 2.3. T-hat is to say group III showed the highest preference value.

Table 5 shows the result of the T-test. It was found that at the mental healthy group showed the higer preference value of the following six items, cabbage, Chinese cabbage, cucumber, onion, Japanese radish, eggplant, as compared with the unhealthy or average group. It was also found that the physical healthy group showed the higher preference value of the following eight items, cabbage, Chinese cabbage, cucumber, tomatoes, the Japanese radish, carrots, potatoes, eggplant as compared with unheathy group.⁷⁾ Regarding urine pH, group III showed higher preference value on Chinese cabbage as compared with group II. The same process with the rest of the foods was carried out but a remarkable result was not obtained.

The correlations between the value of the Hedonic scale and value of mental health, the mental

Fig. 1 Relationship between preference of vegetables and mental health

Fig. 2 Relationship between physical health and mental health

health and physical health were investigated, and the result of the correlation coefficient and regression line is presented in Fig. 1, and Fig. 2. From the significant test according to the T-test it was significant at the level of significance of 5% so that there was a correlation between food preference and mental health. The correlation between mental and physical health was significant at the level of 0.1%. Although the same process was carried out to investigate correlations between the Hedonic scale value of vegetables and urine pH, FAT value on mental health and urine pH, FAT value on physical health and urine pH, no remarkable correlation was found between them.

4. DISCUSSION

Very few investigations have been previously made about food preference concerning primary school children from both psychological and physiological points view.

The present investigation on mental and physical status of health and food preference of vegetables was found interesting. A correlation ($p < 0.05$) was found between mental health and preference of vegetables. Especially, there was a high degree of correlation between physical health and preference of vegetables ($p < 0.001$) so that it was shown that they were directly related with each other.⁷⁾ On the other hand, a high degree of correlation between mental health and physical health ($p < 0.001$) indicated that the preference for vegetables was necessarily related with mental health. Thus, it was clear that food preference showed strong correlation with both physiological and psychological factors.

On the other hand, regarding urine pH, the pH value is said to change according to the kind of food taken: generally, it tends to be alkaline when vegetables are taken.¹⁴⁾ Acid urine results when excessive acidity is produced in the living body.¹⁵⁾ The present investigation concerning the mean value of the Hedonic scale on vegetables resulted to show that group III which was the group nearest to the alkali side prefers vegetables most. At the same time, no correlation was shown between urine pH and preference of vegetables. To explain this fact, it was considered that urine

pH was influenced not by the vegetables to be taken but by the foods taken.

From the above-stated results it might be concluded that food preference showed the possibility of becoming a basic study for development children's physical and mental health.

In U.S.A. teaching of nutritional facts and activities, on which health and well-being depend, appears to be low in priority as far as school authorities are concerned. Primary school teachers do not have the background to teach nutrition. Nutrition teaching should begin during the preschool years and should continue through elementary grades, since they are important growth periods when food habits are formed.¹⁹⁾ It is possible to say all the same thing on nutritional education and the present primary school systems in Japan.

That Osaka Shin-ai primary school on whose school girls the tests were conducted, adopts no provision of school lunch might be worth noted.

5. SUMMARY

An examination and inquiry about the preference of vegetables, FAT, and urine pH test were conducted on one hundred and two 10 to 12-year-old school girls and the relationship between them made clear. Adopting FAT for testing, questions concerning mental and physical health were picked up out of the whole inquiry items. The results were discussed after dividing the testees' status of health into healthy, average, unhealthy. In regard to urine pH, the testees' urine pH value was divided into group I $\text{pH} \leq 5.87$, group II $5.88 \leq \text{pH} \leq 6.21$, and group III $\text{pH} \geq 6.22$.

1. Regarding mental and physical status of health, the unhealthy group as compared with the healthy group showed an inclination to dislike vegetables. From the urine pH test, group III as compared with groups I and II showed an inclination to prefer certain kinds of vegetables.
2. There was a correlation between the prefer of vegetables and mental and physical health, especially between preference of vegetables and physical health.
3. There was no relationship between urine pH and preference of vegetables.
4. A high degree of correlation was observed between mental health and physical health but no correlation was found between mental and physical health and urine pH.

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REFERENCES

- 1) Schuh, D.D., Moore, A.N. and Tuthill, B.H. : *J. Am. Diet. Ass.*, **51**, 340~344 (1967)

- 2) Research Group of Nutrition Guidance in Japan : *Jap. J. Nutr.*, **33**, 169~193 (1975)
- 3) Kakimoto, M. : *Bulletin of Osaka Private Junior College Ass.*, **12**, 19~25 (1976)
- 4) Kakimoto, M. : *Memoirs of Osaka Shin-ai Jogakuin Junior College*, **10**, 53~60 (1976)
- 5) Nagasawa, K. et al. : *Kyoiku Shinri*, **24**, 354~357 (1976)
- 6) Kakimoto, M. : *Abstract of the 23rd Conference of Japan Dietetic Society* (1976)
- 7) Kakimoto, M. and Mito, H. : *Jap. J. Nutr.*, **34**, 199~205 (1976)
- 8) Peryam, D.R. and Girardot, N.F. : *Food Eng.*, **24**, II, 58~61 (1952)
- 9) Johnes, L.V., Peryam, D.R. and Thurstone, L.L. : *Food Res.*, **20**, 512~520 (1955)
- 10) Shultz, H.G. : *J. Food Sci.*, **30**, 365~374 (1965)
- 11) Bureau of Statistics Office of the Prime Minister Japan : *Annual report on the family income and expenditure survey*, 242~285 (1974)
- 12) Brodman, K. et al. : *J. Clin. Psychol.*, **8**, 289~293 (1952)
- 13) Matsubara, T. : *The Factor's Diagnosis Test of Achievement-advancement (FAT)*. (1967)
Nipponbunka-kagaku-sha
- 14) Kanai, I. and Kanai, M. : *Rinshokensaho-teiyo*, II p.1~5, (1975) Kanaharashuppan
- 15) Fujimoto, M. : *J. Physiol. Soc. Jap.*, **23**, 293~306 (1961)
- 16) Anderson, M.A. and Standal, B.R. : *J. Amer. Diet. Ass.*, **67**, 116~121 (1975)

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