

《Original Article》

The relationship between accurate conditions of taste and diet for the School of Nutritional Sciences' students**Chiaki Kojima^{*}, Hisashi Susaki^{*}, Shizuno Ishida^{*}
Yuuki Ito^{*} and Katsumi Yamanaka^{*}****Abstract**

Purpose: To reveal the accurate conditions of young people with taste disorder and the factors which influence taste disorder.

Method: For subjects, we used students from our University School of Nutritional Sciences and carried out a taste examination in which we used taste discs (Sanwa Kagaku Kenkyusho Co.Ltd). We also considered the association between taste examination and a food intake frequency investigation.

Result: In the abnormal taste group (hereafter the abnormal group) there were 30 (58.9%) males, 121 (42.6%) females. The relationship between taste and the quantity of food intake for males was as follows; there were more subjects in the normal taste group (hereafter the normal group) than the abnormal group when their meal intake was significantly higher for seafood, egg products, other vegetables, fruits, sugar products and confectionery. Among females, for all the food groups there was no significant difference, however, for most of the food groups there was a tendency for the subjects to have a higher intake in the normal group than in the abnormal group. Regarding the relationship of the quantity of nutrient intake for males (these included vitamins B₁, B₂, C, D and E, saturated fatty acids, mono-saturated fatty acids, poly-unsaturated fatty acids, cholesterol, and sodium chloride equivalent) the normal group had a significantly higher intake than the abnormal group. Among females there was no significant difference in each of the nutrient groups, however for most of the nutrient groups there was a tendency that the subjects have a higher intake in the normal group than the abnormal group.

Conclusion: Our university students suggest there is a correlation between the quantity of intake for food groups and nutritional intake and taste disorder, especially among males, it was considered that their living circumstances may have an impact on taste disorder.

Purpose

In recent years, the number of patients with taste disorders has been increasing and has therefore become a problem. In a survey by the JAPAN SOCIETY OF STOMATO-PHARYNOGOGY 2003, the number of patients with taste disorder who had consulted an otolaryngologist was 240,000 per

year and it is surmised that this has increased by 1.8 times from the 1990's survey¹⁾. However this is just the number of patients and there is a concern that there are latent patients who do not consult with a doctor even if they have taste disorder, or the ones who are not aware of their symptoms. Actually it is anticipated that there are more people with taste disorder than the given survey number.

^{*} School of Nutritional Sciences, Nagoya University of Arts and Science

There is a tendency to disregard taste disorders as illnesses which do not lead to death; however it ought to be considered that this disorder may elevate risks leading to various diseases, so it is crucial to detect and treat the problem early.

So far it has been said that taste disorder is prevalent among elderly people, but with an increasing number of those with taste disorders and changes in dietary habits, this problem has been noted in young people. However, in Japan, there have only been a few surveys related to taste disorder in young people, so there are many unknown points for accurate conditions and causes. Hence, in this study the subjects were from our University School of Nutritional Sciences and our purpose was to investigate the correlation between the accurate conditions of young people with taste disorder and meal intake.

Subjects and Method

1. Subjects

The subjects were from our University School of Nutritional Sciences. The number of second year students was 177 (28 males, 149 females) and third year students was 172 (25 males, 147 females).

2. Taste examination

Taste examinations took place at the following times: —the period September 2008 to December 2008, January 2009, September 2009 to December 2009 and January 2010, the taste examination was part of a laboratory experiment. For examination purposes, we used taste discs (Sanwa Kagaku Kenkyusho Co.Ltd.) We took the results of these taste examinations for our research. As a method of examination we put filter papers, which were soaked in taste solutions, into the subjects' mouths for three seconds and we asked the subjects to show the taste they felt on the taste indication chart. The reagent density was from 1 to 5 and we examined the low density values increasing in intensity, then we ruled the density they judged correctly as the recognized threshold value. The taste solutions were sweet, salty,

sour and bitter (four kinds) and the measurements were taken on the innervation regions of the following parts of the tongue left/right chorda tympani nerve (anterior 2/3 part of tongue), glossopharyngeal nerve (posterior 1/3 part of the tongue) and the greater petrosal nerve (soft palate). We tested on 6 parts of the tongue overall. The method of evaluation was to take the average of all recognized threshold numbers. If the total average value was below 3.0, this was deemed as normal, over 3.0 and below 3.5 was borderline, over 3.5 and below 4.5 was mild disorder, over 4.5 and below 5.5 was a minor disorder, over 5.5 was seen as a severe case²⁾. We followed details of other methods of practice according to reference books³⁾⁴⁾.

3. Meal intake frequency investigation

We used a 'congregational type' method as our form of investigation using survey forms which the respondents completed themselves. We carried out this investigation using Food Frequency Questionnaire: FFQ (System Supply Corporation Ltd Ver. 1.21)⁵⁾.

4. Method of analysis

We used SPSS (Ver.15.0). Within the results we received for the taste experiments, if the total average value is within normal range we designated that as the normal taste group (hereafter the normal group). Values designated as borderline, mild, minor and severe were grouped as abnormal taste group (hereafter abnormal group). In between these groups we conducted a T test for the quantity of food group and nutrient intake and we carried out a χ^2 test as a correlation for each group and their living circumstances. Yet, we ruled that under $P < 0.05$ had significant differences.

Results

1. Taste evaluation distribution

From the results of the taste examination, the number of males with normal taste was 21 (41.1%),

Table 1 Food intake in normal and abnormal taste group (male n=46)

	Normal taste group (n=21)	Abnormal taste group (n=25)	p ²⁾
	Mean±SD ¹⁾	Mean±SD	
Staple diet (g)	742.7±234.0	746.9±266.9	0.956
Fat (g)	18.9±8.7	14.2±7.2	0.055
Beans (g)	28.9±18.9	24.3±26.4	0.505
Seafood (g)	38.6±27.0	22.7±21.5	0.032*
Meat (g)	62.8±32.0	49.9±28.0	0.153
Egg products (g)	48.9±47.1	25.9±17.8	0.044*
Dairy products (g)	340.2±310.0	243.0±295.1	0.285
Green/Yellow vegetables (g)	107.0±180.0	58.2±63.3	0.212
Other vegetables (g)	84.7±40.8	58.5±37.1	0.027*
Fruits (g)	100.9±105.5	43.8±43.4	0.028*
Sugar products (g)	4.2±1.9	2.7±2.0	0.018*
Confectionary (g)	146.4±129.9	84.4±53.3	0.034*
Alcohol (g)	5.4±16.9	9.0±22.8	0.558

1) SD standard deviation

2) T test

and the number of people with taste disorder was 30 (58.9%). Within these groups of people with taste disorder, the number of borderline cases was 13 (43.3%), mild was 12 (40.0%), for minor disorders there were 4 (13.3%), and there was 1 severe case (3.3%).

The number of females with normal taste was 163 (57.4%), people with taste disorder was 121 (42.6%). Within the people with taste disorder group the number of borderline cases was 45 (37.2%), mild was 60 (49.6%), for minor disorders there were 13 (10.7%) and there were 3 in the severe group (2.5%).

2. Relationship between the quantity of food intake according to food group

For males we report as follows; there were more subjects in the normal group than the abnormal group when their meal intake was statistically significantly higher for seafood, egg products, other vegetables, fruits, sugar products, confectionery. There was also a tendency for the subjects in the normal group to have a higher intake of fat, soy beans, meat, dairy products, and green/yellow vegetable than those in the abnormal group. Conversely for the alcohol group we could see a tendency that subjects in the

abnormal group had a higher intake of alcohol than the normal group (Table 1).

Among females, we were not able to determine a significant difference between the normal group and the abnormal group for all food groups. However, there was a tendency for more subjects to be in the normal group than the abnormal group when their meal intake was higher for seafood, meat, green/yellow vegetables, other vegetables, sugar products, confectionery and alcohol (Table 2).

3. Relationship with quantity of nutrient intake

For the relationship for the quantity of nutritional intake for males (these included protein, fat, iron, potassium, magnesium, vitamin A, retinol, carotene, vitamins B₁, B₂, C, D and E, saturated fatty acids, mono-saturated fatty acids, poly-unsaturated fatty acids, cholesterol, and sodium chloride equivalent) the normal group had a statistically significantly higher intake than the abnormal group. Also for energy, glucides, calcium, and dietary fibers, there was a tendency that those in the normal group had a higher intake than the abnormal group (Table 3).

For females, we could not see any significant difference for the normal and abnormal groups in

Table 2 Food intake in normal and abnormal taste group (female n=274)

	Normal taste group (n=157)	Abnormal taste group (n=117)	p
	Mean±SD	Mean±SD	
Staple diet (g)	571.7±161.6	551.6±170.0	0.319
Fat (g)	17.2±8.1	17.2±8.1	0.984
Beans (g)	31.9±29.8	38.0±96.4	0.451
Seafood (g)	31.8±20.3	29.4±19.8	0.324
Meat (g)	48.9±25.0	47.7±26.6	0.708
Egg products (g)	41.6±30.0	44.2±35.2	0.505
Dairy products (g)	142.6±299.4	143.2±187.7	0.983
Green/Yellow vegetables (g)	74.6±87.9	74.0±80.4	0.949
Other vegetables (g)	74.1±45.7	70.1±51.0	0.494
Fruits (g)	77.5±90.9	87.0±116.7	0.452
Sugar products (g)	4.4±3.3	4.4±3.2	0.421
Confectionary (g)	99.0±81.8	90.0±104.4	0.423
Alcohol (g)	1.0±4.4	0.5±2.4	0.296

Table 3 Nutrient intake in normal and abnormal taste group (male n=46)

	Normal taste group (n=21)	Abnormal taste group (n=25)	p
	Mean±SD	Mean±SD	
Energy (kcal)	2247±680.5	1942±588.5	0.11
Protein (g)	73.7±24.7	59.6±22.5	0.050*
Fat (g)	64.8±23.1	49.2±23.1	0.028*
Glucide (g)	330.6±105.0	302.4±91.0	0.334
Calcium (mg)	682±382.6	493±369.4	0.097
Iron (mg)	7±2.9	6±2.3	0.042*
Potassium (mg)	2417±1044.3	1686±826.9	0.011*
Magnesium (mg)	244±87.6	192±78.7	0.041*
Zinc (mg)	9.9±3.1	8.3±2.7	0.062
Vitamin A (µg)	588.3±264.4	372.5±223.2	0.004**
Retinol (µg)	377±197.4	250±185.6	0.029*
Carotene(µg)	2493±1634.9	1457±950.5	0.010*
Vitamin B ₁ (mg)	0.81±0.3	0.59±0.3	0.013*
Vitamin B ₂ (mg)	1.34±0.6	0.92±0.6	0.029*
Vitamin C (mg)	71±42.8	40±28.1	0.005**
Vitamin D (µg)	7.3±5.9	4.2±2.9	0.024*
Vitamin E (mg)	6.8±3.0	4.7±2.3	0.011*
Dietary fibers (g)	10.5±4.2	8.4±3.9	0.097
Saturated fatty acid (g)	21.5±9.7	15.9±9.0	0.048
Monounsaturated fatty acid (g)	21.63±7.7	15.92±7.4	0.014
Polyunsaturated fatty acid (g)	12.24±4.2	9.29±4.4	0.026
Cholesterol (mg)	388±240.6	234±126.7	0.013
Sodium chloride equivalent (g)	7.6±3.0	5.8±2.3	0.022
Ethanol (g)	0.5±1.6	0.9±2.3	0.505

*: p<0.05 **: p<0.01

Table 4 Nutrient intake in normal and abnormal taste group (Female n=274)

	Normal Taste group (n=157)	Abnormal Taste group (n=117)	p
	Mean±SD	Mean±SD	
Energy (kcal)	1708±509.9	1651±480.8	0.344
Protein (g)	56.8±21.5	55.0±18.7	0.471
Fat (g)	49.8±21.3	48.2±19.2	0.514
Glucide (g)	250.1±65.5	241.6±66.6	0.296
Calcium (mg)	431±387.7	419±254.7	0.767
Iron (mg)	6±2.4	6±2.5	0.694
Potassium (mg)	1725±908.4	1679±724.0	0.651
Magnesium (mg)	185±77.8	180±67.3	0.597
Zinc (mg)	7.3±2.5	7.0±2.3	0.42
Vitamin A (µg)	412.7±248.4	393.4±199.0	0.491
Retinol (µg)	228±151.9	222±128.1	0.738
Carotene (µg)	2174±1797.4	2009±1473.3	0.419
Vitamin B ₁ (mg)	0.60±0.3	0.58±0.2	0.597
Vitamin B ₂ (mg)	0.88±0.6	0.86±0.4	0.692
Vitamin C (mg)	57±40.4	57±40.9	0.939
Vitamin D (µg)	4.9±2.9	4.8±3.8	0.851
Vitamin E (mg)	5.8±2.7	5.7±2.9	0.791
Dietary fibers (g)	9.1±4.1	8.6±3.4	0.32
Saturated fatty acid (g)	14.8±8.6	14.3±7.0	0.617
Monounsaturated fatty acid (g)	16.92±6.8	16.44±6.6	0.555
Polyunsaturated fatty acid (g)	10.32±3.9	10.07±4.1	0.614
Cholesterol (mg)	306±161.7	308±178.8	0.935
Sodium chloride equivalent (g)	6.3±2.7	6.1±2.2	0.368
Ethanol (g)	0.1±0.4	0.1±0.3	0.436

any of the nutrient groups. However, the quantity of intake of the following-energy, protein, fat, glucides, calcium, iron, potassium, magnesium, zinc, vitamin A, retinol, carotene, vitamins B₁, B₂, C, D and E, saturated fatty acids, mono-saturated fatty acids, poly unsaturated fatty acids, dietary fibers, sodium chloride equivalent and ethanol, there was a tendency for the normal group to have a higher intake for these than the abnormal group. Conversely there was a tendency that subjects in the abnormal group had a higher intake of cholesterol than the normal taste group (Table 4).

4. The relationship with living circumstances

For males, in the normal group the percentage of students in lodging was significantly lower compared to the abnormal group. For females, we could not see

any significant difference between the normal and abnormal groups; however, there was a tendency that the percentage of students in lodging was lower in the normal group than the abnormal group.

Also for males, in the normal group the percentage of people missing breakfast was significantly lower compared to the abnormal group (Table 5 and 6).

Discussion

In this investigation, for both males and females we could see that taste disorder was slightly lower than 50% of students. However most were borderline or mild.

The principle causes of taste disorder includes zinc deficiency, drug induced problems, diseases of the oral cavity, e.g. xerostomia etc, peripheral problems

Table 5 The relationship between taste and life style (Male n=47)

		Normal Taste group		Abnormal Taste group		P
		No. of people	%	No. of people	%	
Styles of living	Live alone	6	28.6	17	56.7	0.047*
	Other	15	71.4	13	43.3	
Without breakfast	Not	18	85.7	15	57.7	0.037*
	Twice or more a week	3	14.3	11	42.3	

*: p<0.05

Table 6 The relationship between taste and life style (Female n=284)

		Normal Taste group		Abnormal Taste group		P
		No. of people	%	No. of people	%	
Styles of living	Live alone	39	23.9	37	30.6	0.225
	Other	124	76.1	84	69.4	
Without breakfast	Not	132	83.5	100	84.7	0.869
	Twice or more a week	26	16.5	18	15.3	

caused by nerve disorders, systemic illnesses like diabetes etc, psychogenesis, radioactivity, endocrine problems etc⁶⁾. However these causes are strongly correlated with elderly people, we are unable to see the relationship with young people with taste disorder and it has been reported and suggested that the main causes of taste disorder in young people is a diet imbalance⁴⁾. In this investigation, the correlation between the quantity of intake for food groups and nutrient intake and taste was particularly strong in males. For food groups such as seafood, egg products, other vegetables, fruits, as well as for nutrient purposes the intake of minerals and vitamins which are included in the afore-mentioned foods was significantly higher for those in the normal group than those in the abnormal group. Our results showed there was no contradiction between past studies and this investigation's result⁴⁾. For this investigation it is unclear how this is related to taste disorder, however, it is indicated that for these university students there is a correlation between quantity of intake and taste disorder.

In addition, in this investigation, for males, we could see a correlation between the students in lodging and with those students who missed breakfast more than twice a week and taste disorder.

Previous research showed the rate of missing breakfast—students in lodging as significantly higher than those when attending school from their family homes. Also relating to the quantity of intake for food groups and nutrient intake, students in lodging had a lower intake than those living with their families⁵⁾. From this, it would appear that there is a possibility that living circumstances especially for males who live in lodgings influences taste.

For young people, the method to prevent a reduction in taste sensation is a well balanced diet. Students in lodging are more prone to have an imbalanced diet; there is therefore a higher risk of taste disorder. Students need to have a better diet to prevent a reduction in taste.

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管理栄養学部生の味覚の実態と食生活との関連

小島 千明* 須崎 尚* 石田 静乃*
伊藤 勇貴* 山中 克己*

要旨

- 目的：若年者における味覚異常者の実態と、味覚異常へ影響する因子を明らかにする。
- 方法：本学管理栄養学部生を対象とし、テーストディスク（三和科学研究所㈱）を使用した味覚検査を行った。また味覚検査と食事摂取頻度調査との関連性を検討した。味覚検査では、舌6箇所測定部位に4種類の味溶液をそれぞれ置き、認知閾値を測定し、この閾値結果の総平均値が3.0以下のものを味覚正常群（以下正常群とする）、3.0超のものを味覚異常群（以下異常群とする）とした。
- 結果：味覚異常群が男性で58.9%（30名）、女性で42.6%（121名）であった。味覚と食事摂取量との関連では、男性においては魚貝類、卵類、その他の野菜、果物、砂糖類、菓子類の間で味覚正常群の方が味覚異常群より有意に多く摂取していた。女性においては、どの食品群間にも有意な差は見られなかったが、ほとんどの食品群で正常群の方が異常群より多く摂取している傾向が見られた。栄養素摂取量との関連では、男性においてはビタミンB₁、ビタミンB₂、ビタミンC、ビタミンD、ビタミンE、飽和脂肪酸、一価不飽和脂肪酸、多価不飽和脂肪酸、コレステロール、食塩の間で正常群の方が異常群より有意に多く摂取していた。女性においては、どの栄養素間にも有意な差は見られなかったが、ほとんどの栄養素で正常群の方が異常群より多く摂取している傾向が見られた。ライフスタイルとの関連については、住居状況（自宅か下宿か）において男性では味覚異常群の割合は下宿生の方が有意に高かった。朝食欠食状況において男性では欠食をほとんどしない群より、週2回以上欠食する群の方が味覚異常の割合が有意に高かった。
- 結語：本学学生においては食品群および栄養素摂取量と味覚異常の関連が示唆された。また、特に男性においてはライフスタイルが味覚異常に影響を及ぼす可能性が考えられた。