Odour and Salt Taste Identification in Older Adults: Evidence from the Yakumo Study

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Abstract: This study examined the relationship between olfactory function and taste function. A personal function test was calculated from the Yakumo study database, and the odour stick identification test and salt taste identification test were administered to healthy elderly people. The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed everyday life by themselves. We performed a questionnaire survey for each participant to evaluate the salivation condition, the sense of smell recognition, and favourite taste in their daily life. We compared the answers of female participants with that of male participants and found that recognition of salivation, smell recognition, and favourite taste in their daily life were better in female participants than in male participants. The results showed that the performance score on odour identification test was better in female participants than male participants. The results of the salt taste identification test showed that the recognition of salt density was lower in female participants than in male participants. Because taste and olfactory cognitive abilities decline with age, the development of meals for the elderly requires a new approach. Meals for the elderly should be healthy, with a strong fragrance and a light taste of salt.
Keywords: Olfactory function; taste function; healthy elderly people; Yakumo study

1. Introduction

Japan is an ageing society. The proportion of elderly population in Japan will become the highest among the total population in the next ten years. It is thought that many elderly people enter the welfare institution. In addition, it is predicted that many elderly people will receive care at home. Although, meals are consumed everyday, the elderly have a low appetite, and the quantity of the meal may decrease as well. Therefore, the body composition state worsens. It is necessary to think about preparing meals that an elderly person will enjoy eating; hence, we need to check the salt taste and olfactory recognition of the elderly.

Dining out and replacements for home meals (pre-prepared meals) are increasingly a part of the modern dietary habits. In many cases, dietary varieties for consumers are limited and the opportunity for them to prepare and consume a variety of ingredients using different cooking methods is reduced. This change contributes to fewer opportunities for the consumers to come into contact with a diversity of unique food ingredient smells and odours. There is a concern that with increasing age, individuals would soon be unable to identify through the sense of smell. Furthermore, nasal congestion and olfactory disorders occurring after inflammation that are caused by allergic rhinitis, modern-day hay fever, and common colds also inhibit the sense of smell [1], [2], [3].

The odour and taste of food are intimately related, where our appreciating palate is formed by a combination of olfaction (olfactory sense) and gustation (gustatory sense). Such a combination of smell and taste is referred to as 'flavour' and is an important element in the appreciation of food. Functioning in close coordination, taste buds on the tongue distinguish tastes and nerves in the nose distinguish odours. This sensory information sent to the brain is combined to form a single cognition and enjoyment of 'flavour'. While basic taste components of gustation, such as sweet, sour, salty, and bitter, can be detected without the need for olfaction, the recognition of both gustation and olfaction is required for the enjoyment of more

complex flavours (such as fruits, which contain a mixture of tastes and smells).

Present in a narrow region of the mucosa that covers the inside of the nose (olfactory epithelium) are the olfactory receptor neurons. The dendritic ends (olfactory cilia) of these neurons detect odour molecules that enter the nose via currents of air, which produces an electrical signal. This signal travels up through the bone that forms the ceiling of the nasal cavity (the cribriform plate) via nerve fibres that converge on the olfactory bulb, an enlarged area of nerve cells of the brain that also form olfactory nerves. Signals passing through the olfactory bulb travel to the brain along these olfactory nerves, where the signals are interpreted, and the smell is recognized [4]. The medial aspect of the temporal lobe that remembers smells is also stimulated at this point, and the brain can identify the odour based on a memory of previously experienced smells. In other words, smell identification requires an already-accumulated set of experienced smells [5], [6].

Both olfaction and gustation start to decline in humans around the age of 50-59 years, with 40% of the elderly experiencing a noticeable decline [7]. A person's first awareness of decline in olfaction as our primary dependence for identification of flavour occurs when one is unable to distinguish foods by taste alone.

Olfaction also performs an important and essential role in our ability to detect dangers, including the smell of leaking gas, the burning odour of fire, and the putrid smell of rotten food. Olfaction is also responsible for enrichment and psychological stimulation in our everyday lives, such as with the scents and smells of foods and flowers [8]. In an already aged society, healthy olfaction is a necessary part of creating a safe and fertile living environment and for improving an individual's quality of life.

Considering these circumstances, this study aims to understand the age-related decline in olfactory and taste function in participants aged 40-49 years, 50-59 years, 60-69 years, 70-79 years, and 80-89 years. We identified the odours and taste particularly difficult to distinguish for individuals of these age groups. This might help draw attention to issues faced by individuals in their daily lives and facilitate improvement in their quality of life.

2. Material and methods

2.1 Participants

The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed their everyday life themselves. The Yakumo Study has been conducted since 1981 as a joint project between the town of Yakumo in Hokkaido and the Nagoya University Graduate School of Medicine. Professionals in the fields of epidemiology, internal medicine, orthopedics, neuropsychology, ophthalmology, otolaryngology, and urology have joined to the Yakumo Study. The analysed data here were based upon the database from 2015 from the neuropsychology and otolaryngology teams. The participants had been engaged in a variety of jobs, not only white collar but also in agriculture, fishery, and forestry. Therefore, this town can be regarded as representative of today's Japanese society. From the database, 412 participants (213 women and 199 men) were selected.

Table 1 Yakumo study inhabitants examination participant (n=412)

Participant	40 generations	50generations	60 generations	70 generations	80 generations	90 generations
Total	**42 (10.2%)**	**94 (22.8%)**	**176 (42.7%)**	**80 (19.4%)**	**19 (4.6%)**	**1 (0.2%)**
Male	**16 (3.9%)**	**38 (9.2%)**	**94 (22.8%)**	**39 (9.5%)**	**11 (2.7%)**	**1 (0.2%)**
Female	**26 (6.3%)**	**56 (13.6%)**	**82 (19.9%)**	**41 (10.0%)**	**8 (1.9%)**	**0 (0%)**

2.2 Assessment of daily life

Before we conducted our examination of odour and taste, we performed the questionnaire survey. The questionnaire included the questions based on taste recognition, salivation, and favourite taste of daily life. Participant completed the questionnaire themselves. The participant also provided their height, weight, and blood pressure level for a questionnaire.

2.3 Assessment of odour identification

The Odour Stick Identification Test (OSIT-J) was used to assess odour perception. This test possesses high reliability and validity [9]. The OSIT-J includes 12 different odorants to be identified. As odour perception is not necessarily culture-free, the Japanese version was employed [10], [11]. The basic procedure resembles that of the San Diego Odour Identification Test [12]. The aromas used in the OSIT-J includes curry, perfume, Japanese cypress, India ink, menthol, rose, wood, nattou/sweat socks, roasted garlic, condensed milk, gas for cooking, and Japanese mandarin aromas. Each fragrance was enclosed in microcapsules made of melamine resin. These microcapsules were mixed with an odourless solid cream and then shaped to look like a lipstick. During the inspection test, the examiner applied each odorant to a piece of paraffin paper. After

application, the examiner handed the paper to the participant, who would then sniff the paper and identify the odour. Participants selected each answer from a set of cards, each of which listed the name of an odorant, including the correct answer. Each correct answer was scored as one point, with the total performance score ranging from 0 to 12 points. We defined it as follows: normal range as more than 6 points, borderline as 3 - 5 points, and abnormal as less than 2 points.

2.4 Assessment of salt taste identification

The gustatory test was performed using test paper SALSAVE (ADVANTEC Co. Ltd.), which include 7 different densities of NaCl on a test paper, as follows: 0.0 mg/cm^2, 0.6 mg/cm^2, 0.8 mg/cm^2, 1.0 mg/cm^2, 1.2 mg/cm^2, 1.4 mg/cm^2, and 1.6 mg/cm^2. The participant placed a test paper on the tongue and closed the mouth to feel the taste. We inspect it from the light taste. When the participant understood that there is taste is detection. When participant might be said that it is saltiness is the recognition. Firstly, the participant rides 0.0% of test papers on the tongue and checks taste. The participant learns the taste of the test paper. Participant checks taste on a tongue from a test paper having a low density of NaCl sequentially afterward. There is the report that detection of salt taste is more important than recognition to salt taste [13]. We defined it as follows: normal range as 0.6% - 1.0%, border as 1.2% - 1.4%, and abnormal as 1.6% - more than 1.6%.

2.5 Ethical Review Board

This study was conducted with the approval of the Ethical Review Board (Nagoya women's university 'hito wo mochiita kennkyuu ni kansuru iinnkai'). The approval number is 27-11.

3. Results

3.1 Assessment of daily life

We obtained the height, weight, and blood pressure data by a questionnaire from each participant (Cf. Table 2). The blood pressure was at a normal level; systolic blood pressure should be less than 140 mmHg, and diastolic blood pressure should be less than 90 mmHg.

Table 2 Body composition of the inhabitants examination participant （Yakumo study n=409)

SEX	Age	Height	Weight	BMI	Systolic blood pressure	Diastolic blood pressure
		cm	Kg	kg/m/m	mmHg	mmHg
Buth (n=409)	63±10	159±9	60±11	24±3	129±19	76±13
Male (n=194)	65±10	165±7	66±9	24±3	133±18	80±12
Female (n=215)	62±10	153±6	55±9	23±3	126±19	73±13

Furthermore, we investigated this in detail according to the age range (Cf. Tables 3, 4, and 5). In female participants, an upward trend in blood pressure with age was observed. The blood pressure in male participants was approximately constant regardless of age.

We obtained data on the conscious sense of smell, saliva distribution, and favourite salty taste by a questionnaire from each participant (Cf. Tables 6, 7, and 8). Female participants thought that their sense of smell was in a good state than male participants. Similarly, female participants thought that their salivation was in a good state than male participants. Regarding saltiness, female participants answered that their favourite salty taste is right taste than male participants

Table 3 Body composition of the inhabitants examination participant: generetion distinction （Yakumo study n=409)

Generation distinction	Age	Height	Weight	BMI	Systolic blood pressure	Diastolic blood pressure
		cm	Kg	kg/m/m	mmHg	mmHg
The 40 years old level (Both n=41)	44±3	163±9	66±14	25±4	123±23	75±19
The 50 years old level (Both n=92)	55±3	160±8	61±10	24±4	128±20	77±13
The 60 years old level (Both n=176)	65±3	159±8	60±10	24±3	129±18	76±12
The 70 years old level (Both n=79)	74±3	156±9	57±10	24±3	134±17	76±11
The 80 years old level (Both n=20)	84±2	160±5	62±6	24±2	136±20	77±17
The 90 years old level (Both n=1)	91	150	59	26	130	78

Table 4 Body composition of the inhabitants examination participant: generetion distinction of Male （Yakumo study n=194)

Generation distinction	Age	Height	Weight	BMI	Systolic blood pressure	Diastolic blood pressure
		cm	Kg	kg/m/m	mmHg	mmHg
The 40 years old level (Male n=15)	45±2	171±8	74±12	25±3	133±27	86±22
The 50 years old level (Male n=36)	55±3	167±5	68±9	24±3	127±18	79±11
The 60 years old level (Male n=92)	65±3	165±6	65±8	24±3	133±15	80±11
The 70 years old level (Male n=38)	74±3	162±6	63±9	24±3	139±17	79±11
The 80 years old level (Male n=12)	84±2	160±5	62±6	24±2	136±20	77±17
The 90 years old level (Male n=1)	91	150	59	26	130	78

Table 5 Body composition of the inhabitants examination participant: generetion distinction of Female （Yakumo study n=215)

Generation distinction	Age	Height	Weight	BMI	Systolic blood pressure	Diastolic blood pressure
		cm	Kg	kg/m/m	mmHg	mmHg
The 40 years old level (Female n=26)	44±3	159±6	61±13	24±5	117±19	69±14
The 50 years old level (Female n=56)	55±3	155±6	56±8	24±3	128±21	76±13
The 60 years old level (Female n=84)	65±2	153±5	54±8	23±3	124±19	72±13
The 70 years old level (Female n=41)	74±3	150±6	52±8	23±3	130±16	74±11
The 80 years old level (Female n=8)	84±3	150±4	47±9	21±3	136±14	70±10

Table 6 The conscious sense of smell recognition situation (questionnaire answer)

	The olfactory cognitive situation				
	Good	Slightly good	Slightly bad	Bad	No answer
Both (n=409)	186 (45.5%)	142 (34.7%)	22 (5.4%)	8 (2.0%)	16 (3.9%)
Male (n=194)	74 (38.1%)	73 (37.6%)	15 (7.7%)	5 (2.6%)	8 (4.1%)
Female (n=215)	112 (52.1%)	69 (32.1%)	7 (3.3%)	3 (1.4%)	8 (3.7%)

Table 7 The conscious mark saliva distribution situation (questionnaire answer)

	The secretion situation of saliva				
	Good	Slightly good	Slightly bad	Bad	No answe
Both (n=409)	124 (30.3%)	201 (49.1%)	27 (6.6%)	5 (1.2%)	18 (4.4%9
Male (n=194)	53 (27.3%)	100 (61.0%)	12 (6.2%)	2 (1.0%)	9 (4.6%)
Female (n=215)	71 (33.0%)	101 (47.0%)	15 (7.0%)	3 (1.4%)	9 (4.2%)

Table 8 The conscious sense of favorite salty taste (questionnaire answer)

	Favorite taste in daily liffe				
	Light	Slightly Light	Slightly strong	Strong	No answe
Both (n=409)	52 (12.7%)	166 (40.6%)	32.3%)	6 (1.5%)	9 (4.4%)
Male (n=194)	20 (10.3%)	79 (40.7%)	63 (32.5%)	3 (1.5%)	10 (5.2%)
Female (n=215)	32 (14.9%)	87 (40.5%)	69 (32.1%)	3 (1.4%)	8 (3.7%)

We evaluated the conscious sense of smell recognition according to the age the 40s, the 50s, the 60s, the 70s, the 80s, and the 90s. Moreover, we compared this in male and female participants. The result in female participants was better than in male participants in each age range (Cf. Figure 1, 2, 3, and 4).

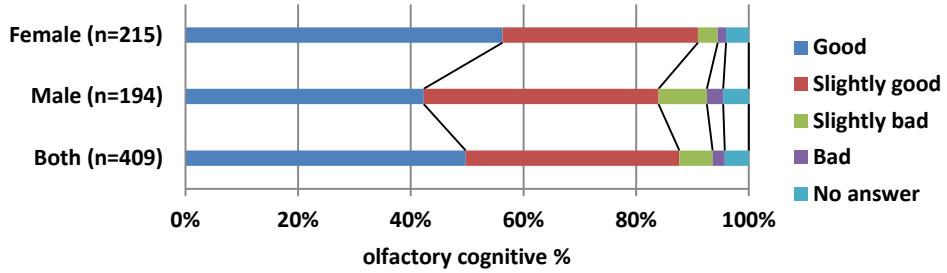

Fig. 1 The olfactory cognitive situation

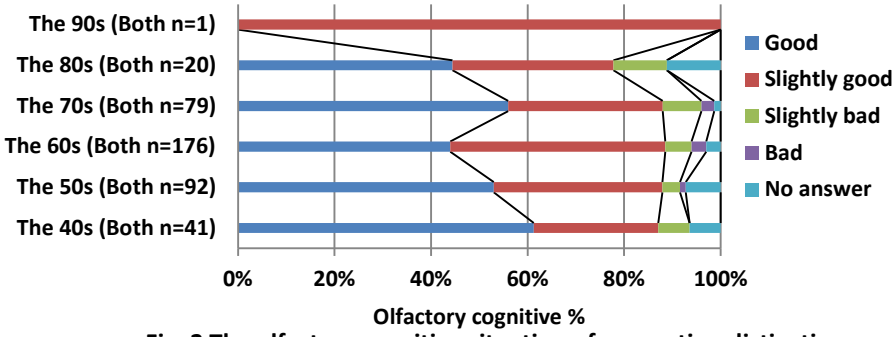

Fig. 2 The olfactory cognitive situation of generation distinction (Both n=409)

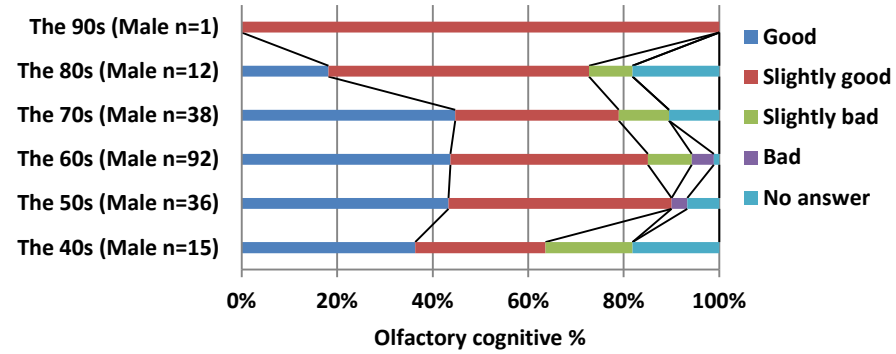

Fig. 3 The olfactory cognitive situation of generation distinction (Male n=194)

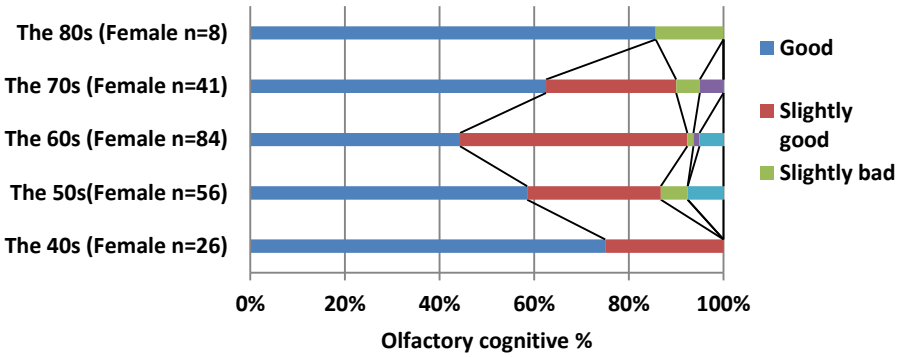

Fig. 4 The olfactory cognitive situationof generation distinction (Female n=212)

We evaluated the conscious sense of secretion salivation according to the age, comparing participants in the 40s, the 50s, the 60s, the 70s, the 80s, and the 90s. Moreover, we compared it in male and female participants. The result in female participants was better than in male participants in each age range (Cf. Figure 5, 6, 7, and 8).

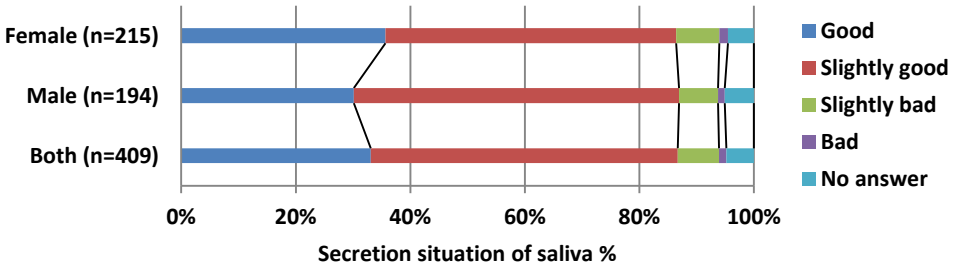

Fig.5 The secretion situation of saliva

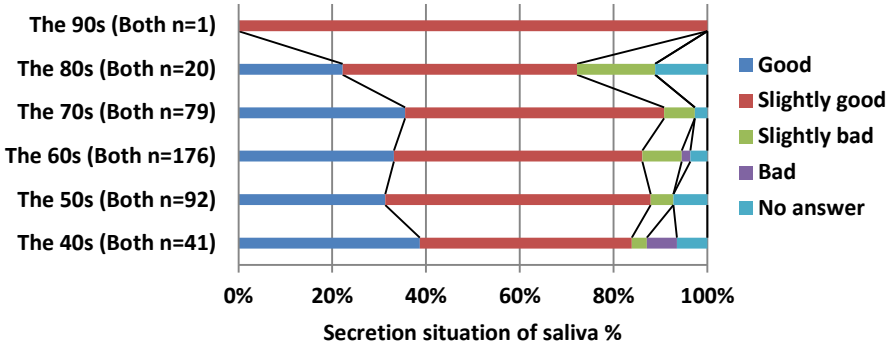

Fig.6 The secretion situation of saliva of generation distinction (Both n=409)

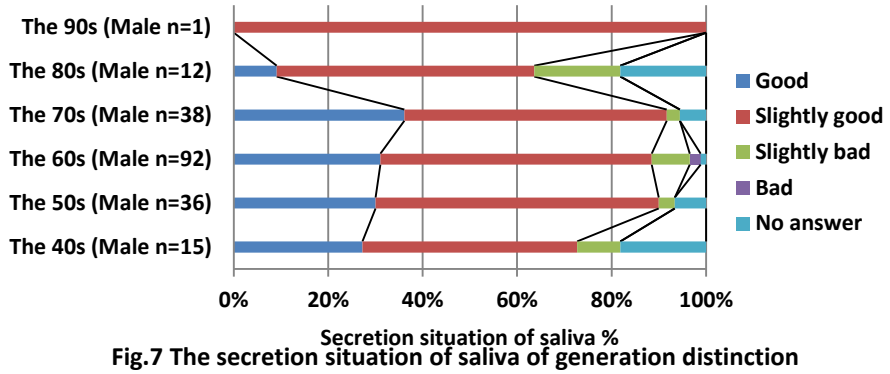

Fig.7 The secretion situation of saliva of generation distinction (Male n=174)

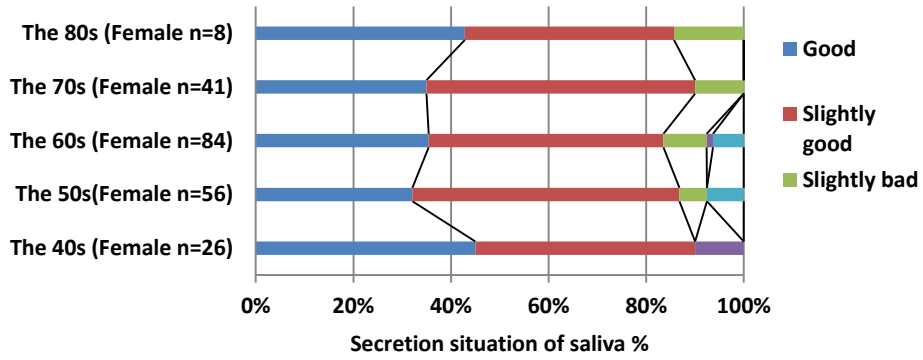

Fig.8 The secretion situation of saliva of generation distinction (Female n=212)

We evaluated the conscious sense of favourite salt taste according to the age, comparing participants in the 40s, the 50s, the 60s, the 70s, the 80s, and the 90s. Moreover, we compared this in male and female participants. We found that that female participant favourite salt taste is more right taste than male participants in each age range (Cf. Figure 9, 10, 11, and 12).

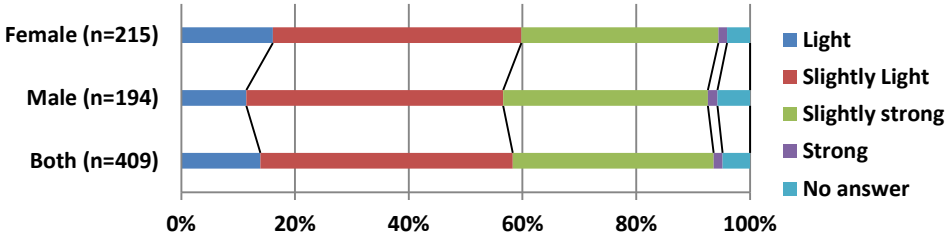

Fig. 9 Favorite taste in daily life

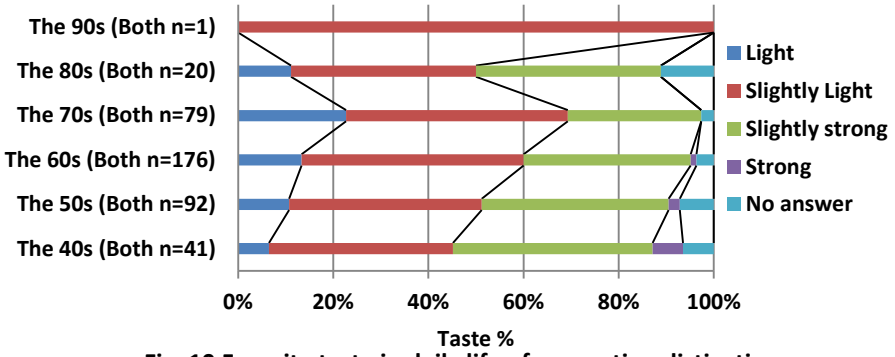

Fig. 10 Favorite taste in daily life of generation distinction (Both n=409)

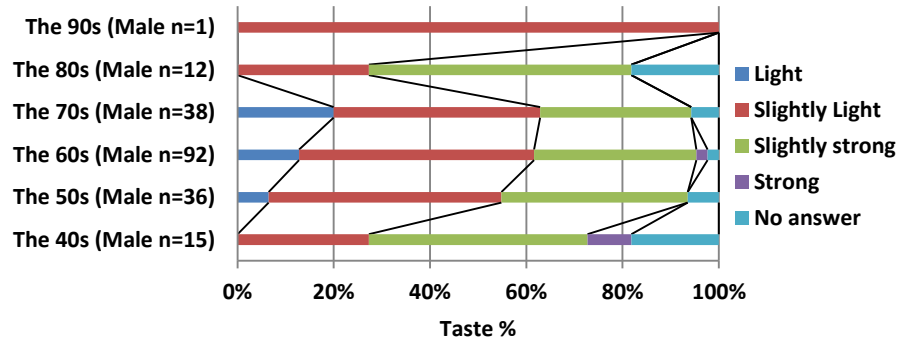

Fig. 11 Favorite taste in daily life of generation distinction (Male n=174)

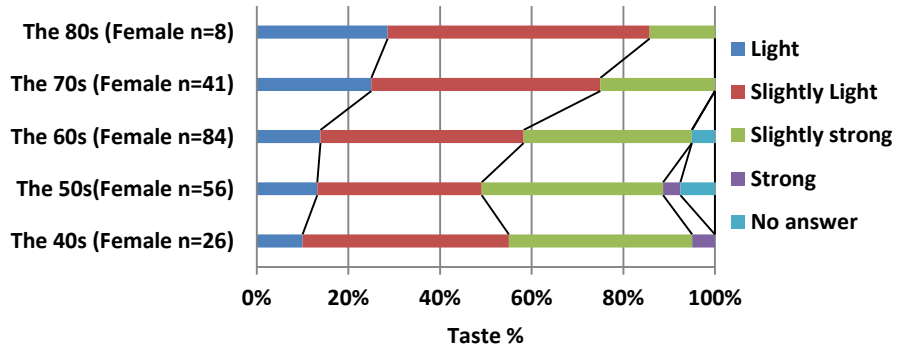

Fig. 12 Favorite taste in daily life of generation distinction (Female n=212)

3.2 Assessment of odour identification

Olfactometry was performed using odour stick (Diichi yakuhin Co. Ltd.). The results are shown in Table 9. The olfactory test result showed that approximately 80% of the participants were in the normal range. However, approximately 7% of the participants had an abnormality in the sense of smell. The sense of smell in male participants was 3 times worse than that in the female participants.

Table 9 Olfactory function tests (n=401)

Olfactory	Normal	Border	abnormal
Total	315 (78.6%)	58 (14.5%)	28 (7.0%)
Male	136 (70.8%)	35 (18.2%)	21(10.9%)
Female	179 (85.6%)	23 (11.0%)	7 (3.3%)

We investigated the olfactory function test according to the age range of the participants. The results are shown in Figure 13, 14, 15, and 16. Olfactory function was better than in female participants than in male participants. In female participants, approximately 70% of them were in the normal range in each age range, even if in the 80s. Male participants had worsened sense of odour with age. Therefore, the combined data

showed that the sense of odour becomes worse with age. The odour test results showed that there was a considerable difference between male and female participants. In male participants at 80 years of age, the odour test result suddenly worsened. We obtained results only for one 90-year-old male participant; however, this result was in the borderline range.

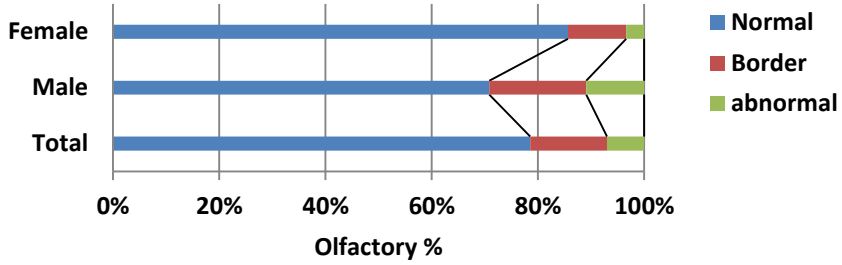

Table 13 Olfactory function tests (n=401)

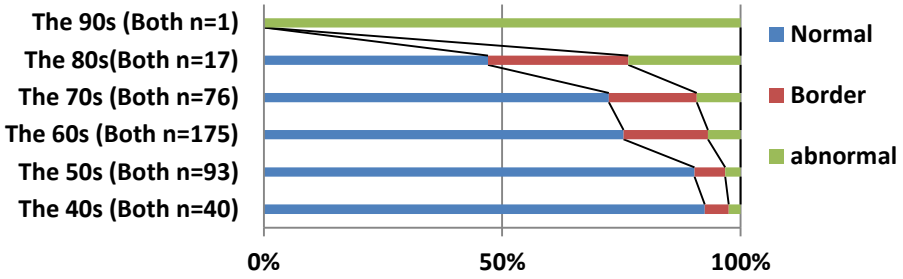

Table 14 Olfactory function tests generetion distinction (Both n=402)

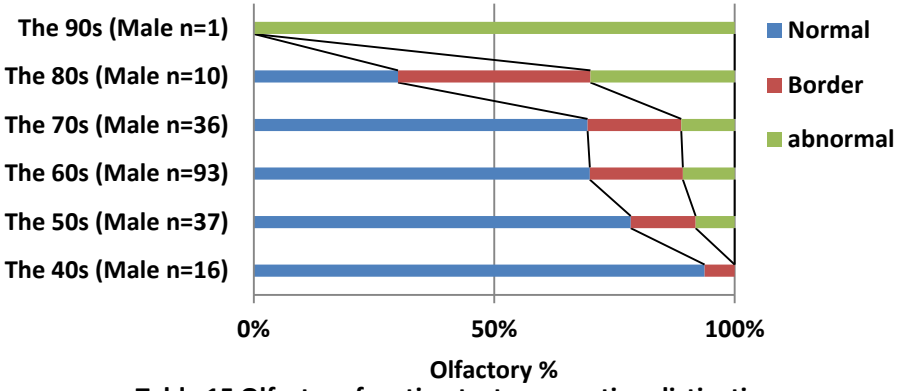

Table 15 Olfactory function tests generetion distinction (Male n=193)

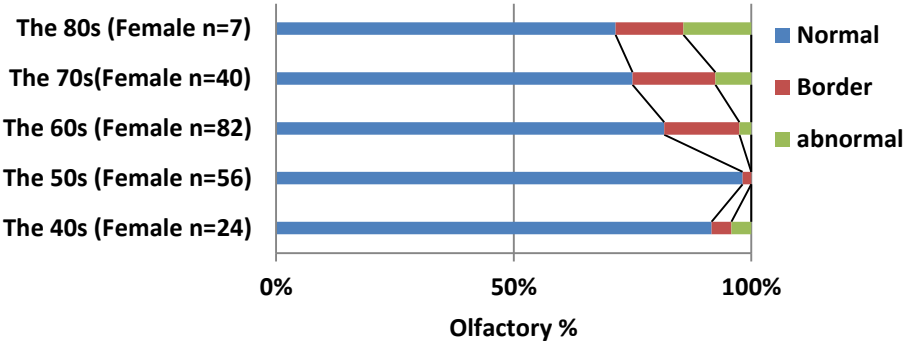

Table 16 Olfactory function tests generetion distinction (Female n=209)

3.3 Assessment of salt taste identification

Gustation was performed by using test paper SALSAVE (ADVANTEC Co. Ltd.). The results are shown in Table 10. The salt taste test result showed that approximately 90% of the participants were in the normal

range. However, approximately 4% of the participants had an abnormality in the sense of salt taste. Borderline and abnormal values were observed approximately 2 times more in male participants than female participants.

Table 10 Taste function tests (n=399)

Olfactory	Normal	Border	abnormal
Total	370 892.7%)	14 (3.5%)	15 (3.8%)
Male	174 (90.2%)	9 (4.7%)	10 (5.2%)
Female	196 (95.1%)	5 (2.4%)	5 (2.4%)

We also investigated the salt test result according to the age range of the participants. The results are shown in Figures 17, 18, 19, and 20. The salt taste results showed that female participants had better performance than male participants. Approximately 90% of female participants were in the normal range in each age range except those in the 80s. Male participants had worsened sense of odour with age.

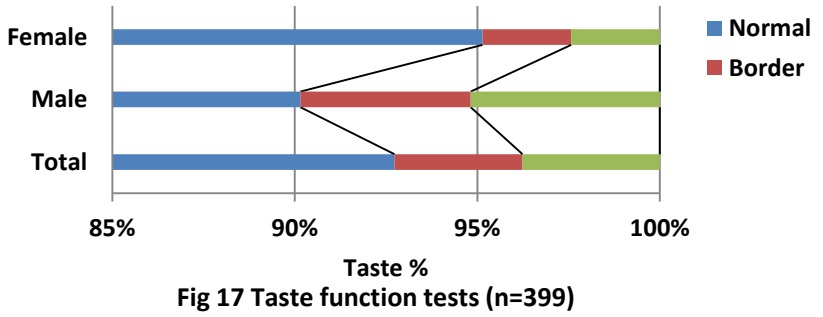

Fig 17 Taste function tests (n=399)

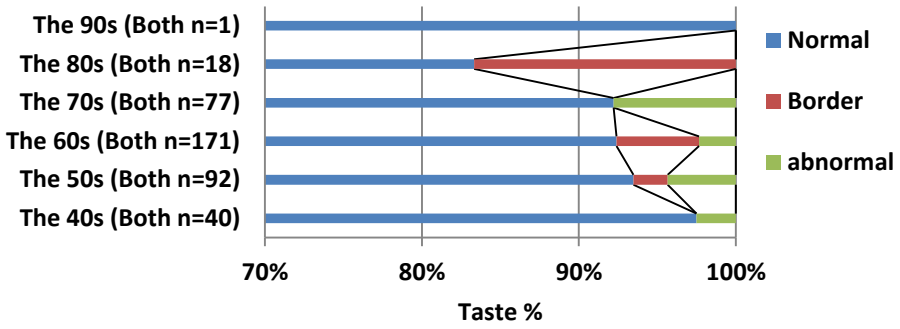

Table 18 Taste function tests genereti̇on distinction (Both n=399)

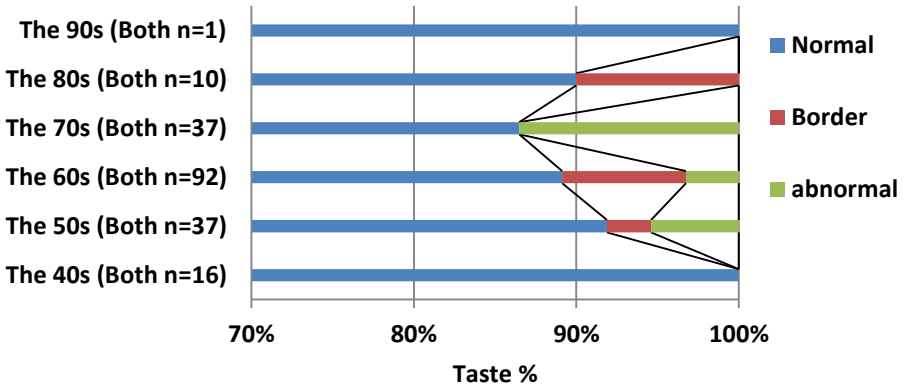

Table 19 Taste function tests genereti̇on distinction (Male n=193)

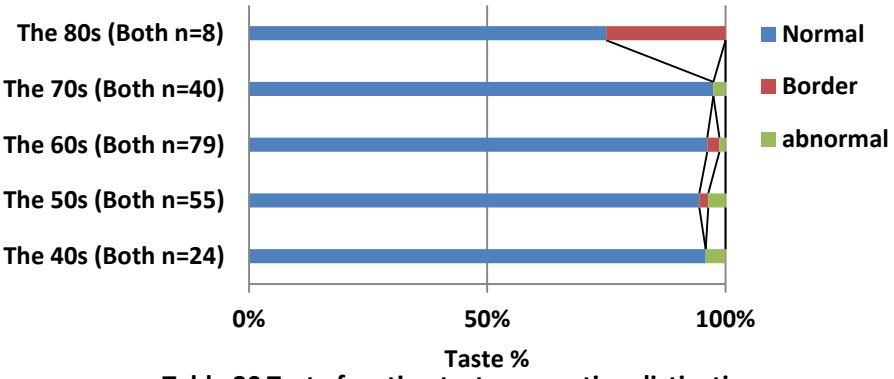

Table 20 Taste function tests generetion distinction (Female n=206)

3.4 Assessment of odour and salt taste identification

We investigated the senses of smell and taste simultaneously. We found that approximately 70% of the participants had both senses of smell and taste in the normal range. Approximately 1% of the participants had abnormal values for both taste and olfactory senses. (Cf. Tables 11,12,13)

Table11 The result of olfactometery with taste examination (n-406)

	Olfactometry Normal = 320 (78.8%)		
Total	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	298 (73.4%)	9 (2.2%)	7 (1.7%)
	Olfactometry Normal = 136 (33.5%)		
Male	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	126 (38.4%)	6 (1.5%)	4 (0.1%)
	Olfactometry Normal =174 (42.9%)		
Female	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	168 (41.4%)	3 (0.7%)	3 (0.7%)

Table12 The result of olfactometery with taste examination (n-406)

	Olfactometery Border = 58 (14.3%)		
Total	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	52 (12.8%)	4 (1.0%)	2 (0.5%)
	Olfactometery Border = 35 (8.6%)		
Male	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	30 (7.4%)	3 (0.7%)	2 (0.5%)
	Olfactometery Border = 23 (5.7%)		
Female	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	22 (5.4%)	1 (0.2%)	0 (0%)

Table13 The result of olfactometery with taste examination (n-406)

	Olfactometery Abnormal =28 (6.9%)		
Total	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	23 (5.7%)	0 (0%)	5 (1.2%)
	Olfactometery Abnormal =21 (5.2%)		
Male	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	18 (4.4%)	0 (0%)	3 (0.7 %)
	Olfactometery Abnormal =7 (1.7%)		
Female	Taste (Normal)	Taste (Border)	Taste (Abnrmal)
	5 (1.2%)	0 (0%)	2 (0.5%)

3.5 Odour identification ratio of 12 different smells

The correct answer of odour ratio according to 12 types of smells is that individually (Cf. Tables 14, 15, and 16). More than 60% correct answers were observed for the odorants perfume, curry, rose, sweaty

socks/bodily odour, and condensed milk. The incomprehensible smells were Indian ink, menthol, and Japanese cypress. A difference in the correct answer rate between male and female participants was observed in the odorants wood, perfume, mandarin orange, domestic gas, roses, Japanese cypress, and fried garlic. High correct answer ratio was observed in female participants than in male participants.

Table 14 Odor identification retio of 12 different smell （Both)

	Indian ink	wood	perfume	menthol	mandarin orenge	curry
Identification ratio	47.5%	59.9%	64.9%	42.0%	50.0%	72.8%
	domestic gas	rose	Japanese cypress	sweaty socks/bodily odour	condensed milk	fried garlic
Identification ratio	57.6%	60.9%	46.6%	66.9%	60.7%	59.2%

Table 15 Odor identification retio of 12 different smell （Male)

	Indian ink	wood	perfume	menthol	mandarin orenge	curry
Identification ratio	43.5%	52.6%	59.7%	41.0%	43.9%	70.3%
	domestic gas	rose	Japanese cypress	sweaty socks/bodily odour	condensed milk	fried garlic
Identification ratio	55.8%	53,2%	41.7%	64.7%	58.1%	51.6%

Table 16 Odor identification retio of 12 different smell （Female)

	Indian ink	wood	perfume	menthol	mandarin orenge	curry
Identification ratio	50.9%	66.1%	69.3%	42.8%	55.2%	74.9%
	domestic gas	rose	Japanese cypress	sweaty socks/bodily odour	condensed milk	fried garlic
Identification ratio	59.0%	67.3%	50.6%	68.7%	62.9%	65.7%

4. Conclusions

As expected, the correct identification rate measured using the odour identification test decreased with an increase in age, showing that olfaction declines with an increase in age. This result was similar to that obtained by Ayabe et al. (2005) [14] and shows the validity of the test method used in this study. Examining the results by individual odours also showed that common odours closely associated with everyday life, i.e., curry, sweaty socks/bodily odour, and fried garlic, were correctly identified by 60% of the participants. Furthermore, most of the subjects in all the age groups correctly identified the odours, indicating the importance of the day-to-day experience of odours. Similarly, odours such as Indian ink, a material not commonly used outside of Japanese calligraphy, had been forgotten due to lack of use. During the odour test of Indian ink, subjects would remark ‘I have smelled it somewhere before, but I do not know what it is’ during the test. From this, presumably the subject has not practised Japanese calligraphy since primary or lower secondary education. While the odour remained in a distant part of the subject’s memory, the subject was unable to identify the specific name of the odour. Identification of domestic gas also declined significantly. However, domestic gas is an odour bound closely with quality of life. Although many remarked that the odour of domestic gas was ‘a bad smell’, and ‘I do not know what the smell is’. ‘Gas’ is not an odour that individuals actively experience in their daily lives. Given the dangers posed by a gas leak, preventing explosion efforts are needed to ensure that individuals do not forget the odour, probably by periodically embellishing their experience to confirm their personal knowledge of the odour. Our level of sensory recognition of odours is created by the circumstances of our everyday lives [10].

The results showed that experiences with wood, Japanese cypress and condensed milk are on the decrease in modern life. Although such remarks as ‘it smells nice’ and ‘it smells natural’ were given for wood and Japanese cypress, subjects could not identify the specific odour. This results from the fact that people have a few opportunities to come in contact with natural wood in our modern life. The numbers of individuals who are unable to distinguish the smell of wood or Japanese cypress are now rising due to an increased presence of goods produced from chemically artificial resins and similar materials, such as bath tubs made of synthetic resins and not natural wood. Similarly, the subjects remarked the condensed milk odour ‘smells delicious,’ but were unable to identify it by name. As expected, condensed milk is a rare ingredient at the dining table. For that reason, individuals are unable to experience the odour, and they were probably unable to recall it by name from their memory alone.

The salt taste test result showed better results than the odour test results in male and female participants. The sense of smell may worsen with age earlier than the sense of taste. In either case, male participants had

worse test results than female participants. The results of odour test and salt test accorded with conscious taste.

In the future, we need to provide individuals with as many opportunities as possible to experience a variety of odours, and in particular, direction should be provided to ensure individuals accumulate the experience of odours related to quality of life, such as domestic gas and sweaty socks/bodily odour connected with food poisoning. Furthermore, since ageing is likely to be accompanied by nonspecific impairment of peripheral nerves, there exists the need to encourage active daily consumption of food containing vitamin B_{12}, a compound that contributes to preventing peripheral neuropathy. Similarly, we need to consume food that includes copper (for example seaweed or fishery products) for maintaining our sense of taste. Because both the senses of taste and smell decline with age, incense needs the meal of the elderly. It is necessary to use much spice and spicy grass to prepare a meal with the right saltiness level.

In addition, given the fundamental relationship between olfaction and gustation, a future investigation should be performed for olfactory testing and gustatory testing in tandem. This would contribute to an improvement in individuals' quality of dietary life through the enjoyment of flavour.

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