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Odor Identification in Older Adults: Evidence from the Yakumo (2019)- Results by Gender and Age

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Keywords: odor, threshold, odor stick identification test (OSIT-J), senior citizens, yakumo-study.

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Odor Identification in Older Adults: Evidence from the Yakumo (2019)- Results by Gender and Age

Naomi Katayama [α], Shoko Kondo [σ], Satofumi Sugimoto [ρ], Tadao Yoshida [ω], Masaaki Teranishi [¥], Michihiko Sone [§], Yasushi Fujimoto [χ], Hironao Otake [ν], Hirokazu Suzuki [Θ], Takafumi Nakada [ζ], Naoki Saji [£], Seiichi Nakata [€] & Tsutomu Nakashima [₣]

Abstract- An examination of taste and olfactometry in Yakumo-Cho inhabitants' examination carried out in 2005, and the result reported in Academia Journal of Medicinal Plants 2018. This study examined olfactory function. A personal function test is calculated from the Yakumo study database, and the odor stick identification tests administered to healthy older adults. The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed everyday life by themselves. The participants were engaged in a variety of jobs, not only white-collar but also agriculture, fishery, and forestry. Therefore, the city regarded as a representative of today's Japanese society. From the database, 298 participants (169 females and 129 males) were selected form data in August, 2019. The Odor Stick Identification Test (OSIT-J) was used to assess odor perception. The aromas used in the OSIT-J include curry, perfume, Japanese cypress, India ink, menthol, rose, wood, Smelly socks/ sweat, fried garlic, condensed milk, gas for cooking, and Japanese mandarin aromas. Each fragrance enclosed in microcapsules made of melamine resin. However, the olfactory test result was better for females. The reason is that 11 males out of 129 male participants (8.5%) and two females of 169 female participants (1.2%) had abnormal values in olfactory test results. Of the 12 odor, Fried garlic, Smelly socks/ sweat, and Curry recognized by more than 80%. But, of the 12 odor, Rose, Wood, India Ink, and Household gas were by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females. As olfactory decay is closely related to dementia, such as Alzheimer's disease. It is necessary to do that be increase the number of cases in the future. And it is also need to investigate the relationship between lifestyle and eating habits in the future.

Keywords: odor, threshold, odor stick identification test (OSIT-J), senior citizens, yakumo-study.

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I. Introduction

The Japanese Government uses a large amount of funds for the care of elderly individuals because of a super-aged society. The elderly individual may have a decline in the sense of smell. 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 is caused by allergic rhinitis, modern-day hay fever, and colds also inhibit the sense of smell [1,2,3].

The odor of food is intimately related where our appreciating palate formed by a combination of olfaction (olfactory sense) and gustation (gustatory sense). Such a combination of smell and taste is referred to as 'flavor' and is an element in the appreciation of food.

Signals passing through the olfactory bulb travel to the brain along these olfactory nerves, where the signals interpreted, and the smell is recognized[4]. The medial aspect of the temporal lobe that remembers smell also stimulated at this point, and the brain can identify the odor 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 to 59, with 40% of the elderly experiencing a noticeable the decline[7]. A person's first awareness of decline in olfaction as our primary dependence for identification of flavor occurs when one is unable to distinguish food 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 odor of fire, and the putrid smell of rotten food. Olfaction is also responsible for the enrichment and psychological stimulation in our everyday lives, such as with the scents and smells of foods and flavors[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.

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This study aims to understand the age-related decline in olfactory function in participants aged 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 to 89 years. We identified the odors particularly to distinguish for individuals of these age groups. This resultmight help draw attention to issues faced by individuals in their daily lives and facilitate improvement in their quality of life. Our previous paper[9] reported that: the olfactory test result was better for females. The reason is that 27 males out of 190 male participants (14.2%) and 16 females of 260 female participants (6.2%) had abnormal values in olfactory test results.

Furthermore, in this study, when 12 kinds of odors is examined individually, it was revealed that some smells were easy to recognize, and some were difficult todo.

II. Materials and Methods

a) Participants

The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed their everyday life themselves. The Yakumo Study 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 joined the Yakumo Study. The analyzed data were based on the database from 2019 to the neuropsychology and otolaryngology teams. The participants had been engaged in a variety of jobs, not only white-collar but also agriculture, fishery, and forestry. Therefore, this town can regarded as representative of today's Japanese society. From the database, 298participants (169 females and 129 males) were selected form data in August 2019 (Table 1).

Table 1: Age composition of participants in Yakumo inhabitants examination (n=298).

Participants	40's	50's	60's	70's	80's
Male (129)	**10**	**24**	**49**	**40**	**6**
Female (169)	**23**	**40**	**66**	**37**	**3**
Total (298)	**33**	**64**	**115**	**77**	**9**

b) Assessment of odour identification

The Odor Stick Identification Test (OSIT-J) was used to assess odour perception. This test possesses high reliability and validity[10]. The OSIT-J includes 12 different odorants to be identified. As odor perception is not necessarily culture-free, the Japanese version was employed [11,12]. The procedure resembles that of the San Diego Odor Identification Test[13]. The aromas used in the OSIT-J include curry, perfume, Japanese cypress, India ink, menthol, rose, wood, smelly socks / and sweat, roasted garlic, condensed milk, gas for cooking, and Japanese mandarin aromas. Each fragrance enclosed in microcapsules made of melamine resin. These microcapsules were mixed with an odorless 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 the application, the examiner handed the paper to the participant, who would then sniff the one and identify the odor. 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 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, borderline as 3 to 5, and abnormal as less than 2 points. All of these methods are the same as in the previously reported paper[9].

c) Questionnaire survey on cognitive odor perception

A direct questionnaire survey conducted on subjective odor perception. Participants chose their odor perception from three choices: well recognized, recognized, and unrecognized. The results tabulated.

d) Ethical review board

This study conducted with the approval of the Ethical Review Board (Nagoya women's university Ethics Committee: 'hitowomochiitakennkyuunikansuruiinnkai'). The approval number is 30-14.

III. Results

a) Questionnaire survey on cognitive odor perception

Tabel 2. Shows, Ten males (7.8%), and two females (1.2%) answered that they could not perceive odor well. Males do not recognized it six times as strong as females. More than 90% of males and females, subjective odor was recognizable.

b) Assessment of odor identification

Olfactometry performed using odorstick (Diichiyakuhin Co. Ltd) [14]. However, the olfactory test result was better for females. Table 3 shows, it is as a result of the fact that 11 males out of 129 male participants (8.5%) and two females of 169 female participants (1.2%) had abnormal values in olfactory test results.

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Table 2: Results of Questionnaire Survey on subjective olfaction at Yakumo Tow Resident's medical examination Age・Sex distribution (number of participants: (%)) (n=298)

	Male (n=129)			Female (n=169)		
	Well Recognized	Recognizid	Unrecognizable	Well Recognized	Recognizid	Unrecognizable
40's (M=10, F=23)	4 (40.0%)	6 (60.0%)	0 (0.0%)	8 (34.8%)	14 (60.9%)	1 (4.3%)
50's (M=24, F=40)	6 (25.0%)	16 (66.7%)	2 (8.7%)	17 (42.5%)	22 (55.0%)	1 (2.5%)
60's (M=49, F=66)	17 (34.7%)	28 (57.1%)	4 (8.2%)	14 (21.2%)	52 (78.8%)	0 (0.0%)
70's (M=40, F=37)	12 (30.0%)	25 (62.5%)	3 (7.5%)	22 (59.5%)	15 (40.5%)	0 (0.0%)
80's (M=6, F=3)	2 (33.3%)	3 (50.0%)	1 (16.7%)	1 (33.3%)	2 (66.7%)	0 (0.0%)
Total (M=129, F=169)	41 (31.8%)	78 (60.5%)	10 (7.8%)	62 (36.7%)	105 (62.1%)	2 (1.2%)

Twelve odors examined individually. The results shown in Tables 4 and 5. Of the 12 smells, Fried garlic, Smelly socks/ sweat, and Curry recognized by more than 80%. But, Rose, Wood, India Ink, and Household gas undrestood by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females.

Table 3: Cognitive number results from 12 simple olfactory tests Age/sex distribution (number of participants) (n=298)

	Recognized number of odors types Male (n=129)													
Male (n=129)	zero	one	two	three	four	five	six	seven	eight	nine	ten	eleven	twelve	Detection only
40's (n=10)	0	0	0	0	0	0	1	2	1	2	1	2	1	0
50's (n=24)	0	0	0	1	1	2	2	0	4	7	6	1	0	0
60's (n=49)	0	0	0	2	4	7	4	9	7	2	6	3	1	4
70's (n=40)	1	2	1	3	4	5	4	0	5	5	2	3	2	3
80's (n=6)	0	1	0	0	0	2	1	0	1	1	0	0	0	0
	Recognized number of odors types Female (n=169)													
Female (n=169)	zero	one	two	three	four	five	six	seven	eight	nine	ten	eleven	twelve	Detection only
40's (n=24)	0	0	0	1	0	1	0	0	7	4	5	4	2	0
50's (n=39)	0	0	0	0	0	1	1	1	6	7	7	12	4	0
60's (n=66)	0	0	1	0	4	0	6	5	10	8	9	17	6	0
70's (n=37)	0	0	1	1	1	6	4	2	8	7	6	1	0	0
80's (n=3)	0	0	0	0	1	0	0	1	1	0	0	0	0	0

Table 4: Results of 12 kinds of odor recognition test with odor stick (Number of participants) (n=298: 129 male, 169 female)

	Judgment	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
Total (n=298)	mistake	83	50	76	32	69	27	102	66	79	46	67	39
	Cognition	162	176	193	218	188	239	174	141	182	239	210	242
	ditection	45	56	24	39	39	25	22	70	29	12	19	17
	odorless	8	16	5	9	2	7	0	21	8	1	2	0
Female (N=169)	mistake	46	23	37	15	30	13	45	33	40	23	31	18
	Cognition	108	111	124	135	117	142	115	94	115	144	131	147
	ditection	13	25	7	4	21	10	9	30	12	2	6	4
	odorless	2	10	1	4	1	4	0	12	2	0	1	0
Male (N=129)	mistake	37	27	39	17	39	14	57	33	39	23	36	21
	Cognition	54	65	69	83	71	97	59	47	67	95	79	95
	ditection	32	31	17	24	18	15	13	40	17	10	13	13
	odorless	6	6	4	5	1	3	0	9	6	1	1	0

Table 5: Results of 12 kinds of odor recognition test with odor stick (%) (n=298: 129 male, 169 female)

	Judgment	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
Total (n=298)	mistake	27.9	16.8	25.5	10.7	23.2	9.1	34.2	22.1	26.5	15.4	22.5	13.1
	Cognition	54.4	59.1	64.8	73.2	63.1	80.2	58.4	47.3	61.1	80.2	70.5	81.2
	ditection	15.1	18.8	8.1	13.1	13.1	8.4	7.4	23.5	9.7	4.0	6.4	5.7
	odorless	2.7	5.4	1.7	3.0	0.7	2.3	0.0	7.0	2.7	0.3	0.7	0.0
Female (N=169)	mistake	27.2	13.6	21.9	8.9	17.8	7.7	26.6	19.5	23.7	13.6	18.3	10.7
	Cognition	63.9	65.7	73.4	79.9	69.2	84.0	68.0	55.6	68.0	85.2	77.5	87.0
	ditection	7.7	14.8	4.1	2.4	12.4	5.9	5.3	17.8	7.1	1.2	3.6	2.4
	odorless	1.2	5.9	0.6	2.4	0.6	2.4	0.0	7.1	1.2	0.0	0.6	0.0
Male (N=129)	mistake	28.7	20.9	30.2	13.2	30.2	10.9	44.2	25.6	30.2	17.8	27.9	16.3
	Cognition	41.9	50.4	53.5	64.3	55.0	75.2	45.7	36.4	51.9	73.6	61.2	73.6
	ditection	24.8	24.0	13.2	18.6	14.0	11.6	10.1	31.0	13.2	7.8	10.1	10.1
	odorless	4.7	4.7	3.1	3.9	0.8	2.3	0.0	7.0	4.7	0.8	0.8	0.0

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Next, we examined the recognition of 12 kinds of odors by age and sex for each one. The results shown in Table 6 and Table 7. In this study, there were few participants in their 40's and 80's, so we compared males, and females in their 50's, 60's and 70's. Almost all odors were poorly recognized in both males and females in their 60's than in their 50's. Especially the male fried garlic was 24.5% worse. Also, in females, it had a 35, 3% worse household gas in their 60's than in their 50's. It found that the odor suddenly became unrecognizable from the '60s.

Table 6: Individual results for 12 types of odor tests age・sex distribution (number of participants)

					Results for 12 types of odor tests	Number of correct answers	Male	(n=129)				
Male (n=129)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=10)	7	7	8	0	7	7	7	5	7	8	8	10
50's (n=24)	12	13	15	19	14	22	15	10	17	20	17	21
60's (n=49)	20	25	26	31	24	35	21	18	25	37	25	33
70's (n=40)	13	17	17	21	25	27	15	13	16	26	24	27
80's (n=6)	2	3	2	3	2	5	2	1	2	4	4	4
					Results for 12 types of odor tests	Number of correct answers	Female	(n=169)				
Female (n=169)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=24)	14	17	16	22	17	20	15	15	18	22	17	20
50's (n=39)	26	25	35	38	28	37	35	26	27	36	34	38
60's (n=66)	46	47	50	41	48	47	43	40	48	56	51	55
70's (n=37)	21	21	22	23	22	25	21	13	19	27	27	32
80's (n=3)	1	1	1	1	2	2	1	0	3	3	2	2

Table 7: Individual results for 12 types of odor tests age・sex distribution (%)

					Results for 12 types of odor tests	Correct answer rate (%)	Male	(n=129)				
Male (n=129)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=10)	70.0	70.0	80.0	0.0	70.0	70.0	70.0	50.0	70.0	80.0	80.0	100.0
50's (n=24)	50.0	54.2	62.5	79.2	58.3	91.7	62.5	41.7	70.8	83.3	70.8	87.5
60's (n=49)	40.8	51.0	53.1	63.3	49.0	71.4	42.9	36.7	51.0	75.5	51.0	67.3
70's (n=40)	32.5	42.5	42.5	52.5	62.5	67.5	37.5	32.5	40.0	65.0	60.0	67.5
80's (n=6)	33.3	50.0	33.3	50.0	33.3	83.3	33.3	16.7	33.3	66.7	66.7	66.7
					Results for 12 types of odor tests	Correct answer rate (%)	Female	(n=169)				
Female (n=169)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=24)	58.3	70.8	66.7	91.7	70.8	83.3	62.5	62.5	75.0	91.7	70.8	83.3
50's (n=39)	66.7	64.1	89.7	97.4	71.8	94.9	89.7	66.7	69.2	92.3	87.2	97.4
60's (n=66)	69.7	71.2	75.8	62.1	72.7	71.2	65.2	60.6	72.7	84.8	77.3	83.3
70's (n=37)	56.8	56.8	59.5	62.2	59.5	67.6	56.8	35.1	51.4	73.0	73.0	86.5
80's (n=3)	33.3	33.3	33.3	33.3	66.7	66.7	33.3	0.0	100.0	100.0	66.7	66.7

IV. Discussion

It showed that the number of participants who show abnormal values in the olfactory test result is more than twice that of males as compared with females. This result was almost the same as the previous paper[9]. Also, as before, it was shown that the olfactory test results worsened as the age increased. Since olfactory test results have been reported by many researchers to be related to dementia such as Alzheimer's disease[15]. It is necessary to further investigate the number of cases in the future. Especially since males have poor olfactory test results as compared with females, this showed in the previous paper; it is necessary to investigate the relationship with lifestyle and eating habits in the future. Recently, it has reported that when a person suffers from COVID-19, he/she cannot sense the smell due to olfactory disorder[16]. Research on olfaction will become more and more necessary in the future.

Twelve odors examined individually. The results are shown, of the 12 odors, Fried garlic, Smelly socks/sweat, and Curry were recognized by more than 80%. But, of the 12 smells, Rose, Wood, India Ink, and Household gas were understood by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females. It was a good result for both males and females to be familiar with curry that eats well in life, fried garlic with a burnt smell, and Smelly socks/sweat that helps prevent food poisoning. However, it is that household gas is difficult to understand. This is because the odor must be instantly applied to aboid the danger of gas poisoning and gas explosion.

Next, we examined the recognition of 12 kinds of odors by age and sex for each one. The results are shown, in this study, there were few participants in their 40's and 80's, so we compared males and females in

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their 50's, 60's, and 70's. Almost all odors were poorly recognized in both males and females in their 60's than in their 50's. Especially the male fried garlic was 24.5% worse. Also, in females, it had a 35,3% worse household gas in their 60's than in their 50's. It found that the odor suddenly became unrecognizable from the 60's. Since the perception of odors in participants in their 60's deteriorates sharply compared to those in their 50's. We believe that it is necessary to undergo a regular odor check after the '60s.

Moreover, the number of cases is small in the age of '80s in each one statistically processed at this time. Therefore, the result of this study does not go out of the range of the hypothesis. It is a future task as same as before.

V. Conclusions

In Yakumo Study, from the database, 298 participants (169 females and 129 males) were selected form data in August 2019. The aromas used in the OSIT-J include curry, perfume, Japanese cypress, India ink, menthol, rose, wood, Smelly socks/ sweat, fried garlic, condensed milk, gas for cooking, and Japanese mandarin aromas. The olfactory test result was better for females. The reason is that 11 males out of 129 male participants (8.5%) and two females of 169 female participants (1.2%) had abnormal values in olfactory test results. Of the 12 odors, Fried garlic, Smelly socks/ sweat, and Curry recognized by more than 80%. But, of the 12 smells, Rose, Wood, India Ink, and Household gas understood by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females.Almost all smells were poorly recognized in both males and females in their 60's than in their 50's. As olfactory decay is closely related to dementia such as Alzheimer's disease. It is necessary to that increase the number of cases in the future. Recently, it reported that when a person suffers from COVID-19, he/she cannot sense the smell due to olfactory disorder. We believe that regular olfaction testing is necessary to maintain the health of the elderly. And it is need to investigate the relationship between lifestyle and eating habits in the future.

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