

Original article

# Study of aromas as reminiscence triggers in community-dwelling older adults in Japan

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## Abstract

**Objective:** This study investigates the presence or absence of reminiscence experiences in older adults when using aromas. Focusing on 40 scents familiar to Japanese people, our objective was to determine points of caution for aroma selection and use in reminiscence therapy.

**Materials and Methods:** The participants were 118 community-dwelling older adults aged 65 years and older. They were asked about the experience of recalling the past in response to stimuli of 40 aromas on the Japanese version of the University of Pennsylvania Smell Identification Test (UPSIT-J). In addition, an olfactory visual analog scale (VAS) was used to evaluate olfactory function. Furthermore, a questionnaire-based survey was administered instead of asking participants to actually smell the odorants in the UPSIT-J.

**Results:** At least 70% of the participants experienced recalling the past triggered by 16 aromas including sandalwood and yuzu fruit. Furthermore, 15 of the scents demonstrated a significant association with age, gender, and olfactory function.

**Conclusion:** These results suggest the importance of considering method, age, and gender when selecting olfactory stimuli. In addition, frequently recalled aromas might evoke reminiscence in older adults.

**Key words:** reminiscence, triggers, aroma, older adults, community

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## Introduction

Population aging is progressing globally, and Japan has the highest aging rate in the world<sup>1</sup>. There is more awareness of the importance of the mental health of older adults, with the most common neuropsychiatric disturbances occurring at this age being dementia and depression<sup>2, 3</sup>. Both conditions are highly frequent disorders that can markedly reduce the quality of life (QOL) of older adults<sup>3</sup>. Under such circumstances, reminiscence therapy, which is a psychosocial approach that takes into consideration issues specific to older adults, has gained attention and been applied to community-dwelling older individuals with dementia or depression<sup>4, 5</sup>.

Reminiscence therapy, first described by Butler<sup>6</sup>, involves recollecting one's life events and connecting with this process through an empathetic and receptive attitude. In doing so, it is thought to facilitate regrouping of one's life events thus far, helping achieve greater mental and emotional stability. Since Butler's proposal, reminiscence has been utilized in various professions including occupational therapy<sup>7, 8</sup> and nursing<sup>9, 10</sup>. In general, it is recommended not only to hold a conversation but to also stimulate the five senses (sight, hearing, touch, taste, and smell) to encourage new directions through discussions when using reminiscence<sup>11</sup>. Previously, reminiscence focused on specific stimuli such as videos<sup>12</sup>, music<sup>13</sup>, crafts<sup>14</sup>, and aromas<sup>15</sup>. However, the evidence for using these senses as triggers to prompt reminiscence remains unclear.

To ascertain evidence-based triggers to be used in reminiscence therapy, we previously conducted a survey in community-dwelling older adults that assessed stimuli that trigger reminiscence in everyday life. We found that olfactory stimuli may trigger more reminiscences associated with positive feelings<sup>16</sup>. Umemoto *et al.*<sup>17</sup> conducted a survey on nostalgic aromas in community-dwelling older individuals and reported the positive effects of reminiscence that uses

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highly nostalgic scents. Both studies focused on olfaction as a trigger that prompts reminiscence. However, there are many unclear points regarding the appropriate types of aromas and the points of caution for reminiscence therapy that uses olfaction. Further investigation is, therefore, necessary in order to conduct evidence-based reminiscence therapy.

It has been reported in a recognition memory study that highly familiar aromas are better remembered than less familiar ones<sup>18)</sup>. In the present study, we focused on scents used in the Japanese version of the University of Pennsylvania Smell Identification Test (UPSIT-J), which examines aromas familiar to Japanese people<sup>19)</sup>. The purpose of this study was to investigate the presence or absence of reminiscence experiences for each type of everyday scent being used with older individuals, to determine the points of caution when selecting aromas, and to learn how to present them when using olfaction as a reminiscence trigger.

## Materials and Methods

### Study design and ethics

A cross-sectional design was used to investigate reminiscence experiences for various aromas in community-dwelling older adults and to determine associated factors.

This study was conducted after obtaining approval from the Hiroshima University Epidemiology Research Ethics Review Board (E-599).

### Participants

Participants were community-dwelling older individuals ( $\geq 65$  years old) who participated in health lectures on the prevention of long-term health problems held in City A (population  $\geq 1,000,000$ ) and City B (population approximately 500,000) in Hiroshima Prefecture, Japan. The participants were not currently receiving long-term care insurance. The author visited each venue and provided verbal and written explanations regarding the main purpose of the study to the attendees after the conclusion of the seminars. After obtaining consent from the participants, a questionnaire was distributed and completed with the responses being collected immediately.

### Measures

#### 1) Basic characteristics

Information on age, gender, and health condition (good/bad) was collected.

#### 2) Olfactory visual analog scale

To evaluate olfactory function based on participants' subjective senses, an olfactory visual analog scale (VAS), which takes into consideration the sensory impact of the test

**Table 1** Items names used in the Japanese version of the University of Pennsylvania Smell Identification Test (UPSIT-J)

Pizza	Onion	Daffodil <sup>a</sup>	Garlic <sup>a</sup>
Bubble gum	Yuzu fruit <sup>a</sup>	Turpentine	Grass
Menthol	Baby powder <sup>a</sup>	Peach	Smoke
Grapefruit <sup>a</sup>	Cheese	Rubber tyre <sup>a</sup>	Fish <sup>a</sup>
Motor oil	Cinnamon	Pickles	Grape
Mint	Gasoline	Pineapple	Coffee <sup>a</sup>
Banana	Strawberry	Popcorn <sup>a</sup>	Soap
Sandalwood <sup>a</sup>	Cedar	Orange	Natural gas
Leather	Chocolate	Wintergreen	Rose
Coconut	Apple <sup>a</sup>	Watermelon	Peanut

<sup>a</sup>Items names are not present in the UPSIT.

on participants, was used<sup>20, 21)</sup>. The olfactory VAS uses a 10 cm (100 mm) scale bar, the left end of which indicates "I do not recognize it at all (0%)" and the right "I recognize it fully (100%)". Participants were asked to mark a place on a line representing their degree of awareness of olfactory sensation, and the length (mm) from the left end of the line to the marked place was recorded as the VAS score (%). Takebayashi *et al.*<sup>21)</sup> reported that this olfactory VAS has a correlation with the T&T olfactometer threshold test and that the cutoff value for olfactory disorders with a sensitivity of 95.5% and specificity of 88.0% is 47.0%.

In the present study, participants suspected of a clear olfactory disorder (olfactory VAS score of  $< 47$ ) were excluded from analysis.

#### 3) Presence or absence of reminiscence experiences for each aroma using the UPSIT

The UPSIT is an olfaction test that is utilized worldwide. However, as the original version includes 11 scents not familiar to Japanese people, they were modified to create a Japanese version (UPSIT-J). This test is composed of 40 aromas (Table 1)<sup>19)</sup>. In this study, the questionnaire listed the Japanese names of the 40 scents on the UPSIT-J<sup>22)</sup> and the participants were asked, "Have you ever experienced recalling the past when you smelled this aroma in everyday life?" for each scent, determining the presence or absence of reminiscence experiences in everyday life when the participant smelled each one. Furthermore, in consideration of the burden on participants, instead of asking them to answer by actually smelling items, a questionnaire was distributed asking them to reflect on their daily lives.

### Data analysis

To investigate the association between the presence or absence of reminiscence experiences for each aroma in relation to age, gender, and olfactory function, a  $\chi^2$  test or t-test was performed with the presence or absence of reminis-

**Table 2** Background data of the participants (n=118)

	Mean $\pm$ SD / Number of subjects (%)
Age (years)	74.1 $\pm$ 5.8 (range, 65–89)
Aged 65–74 years old	63 (53.4)
Aged 75 years old and over	55 (46.6)
Gender	
Male	25 (21.2)
Female	93 (78.8)
Health	
Good	91 (77.1)
Bad	27 (22.9)
Self-administered olfaction test (VAS)	82.9 $\pm$ 17.9 (range, 47–100)

cence experience as the outcome and age, gender, and olfactory VAS as the predictor variables. When the expected frequency was less than 5 on the  $\chi^2$  test, Fisher's exact test was performed.

All analyses were two-tailed tests and  $p < 0.05$  was considered statistically significant. SPSS 22.0 was used for statistical analysis.

## Results

### *Participant characteristics*

The basic characteristics of the participants are shown in Table 2. A total of 118 individuals including 25 males (21.2%) and 93 females (78.8%) gave consent to participate in the study (mean age of 74.1  $\pm$  5.8 years; age range of 65–89 years). Ninety-one participants (77.1%) responded that they were in good health.

### *Reminiscence experience for each scent*

The scents are listed in Table 3 in order from the highest to lowest percentage of participants responding “yes” to having a reminiscence experience. At least 70% of the participants experienced reminiscence for these 16 aromas. There were 26 scents for which at least 60% of the participants responded “yes” to having had a reminiscence experience. There were five aromas (cedar, motor oil, pizza, pickles, and coconut) for which less than 50% of the participants experienced reminiscence.

### *Association between reminiscence experience and age, gender, and olfactory function*

For the association between age and the reminiscence experience for each aroma, significant associations were observed for orange ( $p = 0.028$ ) and bubble gum ( $p = 0.044$ ) (Table 3).

Next, the association between gender and the reminiscence experience for each odorant was assessed. Baby

powder ( $p = 0.003$ ), daffodil ( $p = 0.043$ ), gasoline ( $p < 0.001$ ), rubber tire ( $p = 0.001$ ), and motor oil ( $p < 0.001$ ) were significantly associated with gender (Table 3).

Finally, the association between the olfactory VAS and the reminiscence experience for each odorant was assessed. Baby powder ( $p = 0.049$ ), chocolate ( $p = 0.011$ ), coffee ( $p = 0.004$ ), mint ( $p = 0.009$ ), leather ( $p = 0.010$ ), popcorn ( $p = 0.005$ ), grapefruit ( $p = 0.006$ ), and pizza ( $p = 0.006$ ) were significantly associated with the olfactory VAS (Table 3).

## Discussion

### *Reminiscence experience for each aroma*

More than 90% of the participants experienced reminiscence with sandalwood, and more than 70% experienced reminiscence with 16 scents including sandalwood followed by yuzu fruit, fish, apple, and smoke. Tsuchiya *et al.*<sup>23</sup> divided participants into a young group (20–39 years old), a middle-aged group (40–59 years old), and an older group (60–89 years old) to investigate generation-based differences in everyday aromas experienced by Japanese people, and reported that five types of scents—fermented rice bran, ink, benzene, naphthalene, and sandalwood—were characteristic aromas experienced by the older group. Of these five scents, sandalwood is listed in the UPSIT-J, indicating that older individuals have experienced sandalwood aromas in daily life more frequently, leading to greater reminiscence.

In a previous study, more than 80% of the participants responded “yes” to being familiar with the names of all 40 types of aromas on the UPSIT-J<sup>19</sup>. However, in the present study, which used the same aroma names to investigate the participants' reminiscence experiences, sandalwood was the only one for which more than 80% responded “yes” to having had reminiscence experiences and there were 16 scent names for which more than 70% of the participants responded “yes”.

We postulate two reasons for why the percentage of fa-

**Table 3** Factors associated with the experience of reminiscence

	Odorant			Age (years)		Gender		Self-administered olfaction test (VAS)		
	Reminiscent experience	Number of subjects (%)	Ranking	Mean $\pm$ SD	P	Male	Female	p	p	
Sandalwood	Yes	108 (91.5)	1	74.1 $\pm$ 5.7	0.864	25	83	0.117 <sup>a</sup>	82.4 $\pm$ 18	0.48
	No	10 (8.5)		73.8 $\pm$ 6.7		0	10		86.6 $\pm$ 18.2	
Yuzu fruit	Yes	94 (79.7)	2	74.3 $\pm$ 5.4	0.42	19	75	0.608	83.8 $\pm$ 17.4	0.216
	No	24 (20.3)		73.3 $\pm$ 7		6	18		78.7 $\pm$ 19.9	
Fish	Yes	94 (79.7)	3	74.5 $\pm$ 5.7	0.109	22	72	0.243	84 $\pm$ 17.1	0.123
	No	24 (20.3)		72.4 $\pm$ 5.9		3	21		77.7 $\pm$ 20.8	
Apple	Yes	93 (78.8)	4	74.3 $\pm$ 5.5	0.472	21	72	0.475	84.6 $\pm$ 16.7	0.068
	No	25 (21.2)		73.4 $\pm$ 6.6		4	21		75.9 $\pm$ 21.2	
Smoke	Yes	92 (78)	5	74.1 $\pm$ 5.2	0.916	21	71	0.412	83 $\pm$ 17.7	0.758
	No	26 (22)		74.2 $\pm$ 7.5		4	22		81.8 $\pm$ 19.3	
Baby powder	Yes	92 (78)	5	74 $\pm$ 5.3	0.715	14	78	0.003 <sup>**</sup>	84.5 $\pm$ 17.5	0.049 <sup>*</sup>
	No	26 (22)		74.5 $\pm$ 7.2		11	15		76.6 $\pm$ 18.9	
Wintergreen	Yes	92 (78)	5	73.7 $\pm$ 5.5	0.13	20	72	0.782	83.9 $\pm$ 16.9	0.266
	No	26 (22)		75.6 $\pm$ 6.4		5	21		78.7 $\pm$ 21.4	
Soap	Yes	90 (76.3)	8	74.5 $\pm$ 5.5	0.157	21	69	0.306	83.3 $\pm$ 17.3	0.537
	No	28 (23.7)		72.8 $\pm$ 6.5		4	24		80.9 $\pm$ 20.2	
Menthol	Yes	89 (75.4)	9	73.7 $\pm$ 5.3	0.196	22	67	0.1	83.9 $\pm$ 16.7	0.274
	No	29 (24.6)		75.5 $\pm$ 6.8		3	26		79.1 $\pm$ 21.3	
Watermelon	Yes	87 (73.7)	10	73.9 $\pm$ 5.2	0.628	20	67	0.422	84.9 $\pm$ 16.3	0.058
	No	31 (26.3)		74.6 $\pm$ 7.3		5	26		76.7 $\pm$ 21.3	
Grass	Yes	87 (73.7)	10	73.9 $\pm$ 5.2	0.579	19	68	0.771	82.6 $\pm$ 17.8	0.907
	No	31 (26.3)		74.7 $\pm$ 7.1		6	25		83.1 $\pm$ 18.8	
Chocolate	Yes	86 (72.9)	12	74.2 $\pm$ 5.6	0.741	21	65	0.159	85.3 $\pm$ 16.7	0.011 <sup>*</sup>
	No	32 (27.1)		73.8 $\pm$ 6.3		4	28		75.9 $\pm$ 19.8	
Peach	Yes	86 (72.9)	13	74.3 $\pm$ 5.4	0.514	19	67	0.693	84.7 $\pm$ 16.6	0.078
	No	32 (27.1)		73.5 $\pm$ 6.7		6	26		77.4 $\pm$ 20.6	
Onion	Yes	85 (72)	14	74.5 $\pm$ 5.3	0.255	19	66	0.619	83.9 $\pm$ 17.1	0.255
	No	33 (28)		73 $\pm$ 6.9		6	27		79.7 $\pm$ 20	
Strawberry	Yes	85 (72)	14	74.4 $\pm$ 5.4	0.409	18	67	0.997	83.9 $\pm$ 17.2	0.269
	No	33 (28)		73.4 $\pm$ 6.8		7	26		79.8 $\pm$ 19.9	
Coffee	Yes	84 (71.2)	16	74.3 $\pm$ 5.5	0.613	20	64	0.273	86.1 $\pm$ 16.2	0.004 <sup>**</sup>
	No	34 (28.8)		73.7 $\pm$ 6.5		5	29		74.5 $\pm$ 19.8	
Banana	Yes	82 (69.5)	17	74.1 $\pm$ 5.5	0.908	19	63	0.426	85.2 $\pm$ 15.9	0.052
	No	36 (30.5)		74.2 $\pm$ 6.3		6	30		77.3 $\pm$ 21.4	
Daffodil	Yes	81 (68.6)	18	74.2 $\pm$ 5.4	0.817	13	68	0.043 <sup>*</sup>	82.2 $\pm$ 18.1	0.64
	No	37 (31.4)		73.9 $\pm$ 6.6		12	25		83.9 $\pm$ 18	
Garlic	Yes	79 (66.9)	19	74.2 $\pm$ 5.2	0.808	19	60	0.279	84.5 $\pm$ 16.4	0.166
	No	39 (33.1)		73.9 $\pm$ 6.9		6	33		79.2 $\pm$ 20.7	
Pineapple	Yes	78 (66.1)	20	74.7 $\pm$ 5.7	0.113	17	61	0.821	84.4 $\pm$ 16.8	0.181
	No	40 (33.9)		72.9 $\pm$ 5.9		8	32		79.5 $\pm$ 19.9	
Grape	Yes	78 (66.1)	20	74.5 $\pm$ 5.4	0.364	18	60	0.483	84.1 $\pm$ 16.8	0.247
	No	40 (33.9)		73.4 $\pm$ 6.4		7	33		80.1 $\pm$ 20	
Rose	Yes	78 (66.1)	20	74.5 $\pm$ 5.3	0.365	16	62	0.803	85 $\pm$ 16.6	0.062
	No	40 (33.9)		73.4 $\pm$ 6.6		9	31		78.4 $\pm$ 20	
Orange	Yes	77 (65.3)	23	75 $\pm$ 5.4	0.028 <sup>*</sup>	16	61	0.882	84.9 $\pm$ 16.3	0.097
	No	41 (34.7)		72.5 $\pm$ 6.2		9	32		78.7 $\pm$ 20.4	

	Odorant			Age (years)		Gender		p	Self-administered olfaction test (VAS)	
	Reminiscent experience	Number of subjects (%)	Ranking	Mean $\pm$ SD	p	Male	Female		p	p
Peanut	Yes	75 (63.6)	24	74.8 $\pm$ 5.6	0.109	19	56	0.145	83.9 $\pm$ 16.9	0.354
	No	43 (36.4)		73 $\pm$ 6		6	37		80.7 $\pm$ 19.8	
Gasoline	Yes	74 (62.7)	25	74.3 $\pm$ 5.3	0.635	24	50	<0.001***	83.8 $\pm$ 17.2	0.397
	No	44 (37.3)		73.8 $\pm$ 6.5		1	43		80.9 $\pm$ 19.4	
Mint	Yes	73 (61.9)	26	73.6 $\pm$ 5.3	0.26	15	58	0.829	86.4 $\pm$ 15.6	0.009**
	No	45 (38.1)		74.9 $\pm$ 6.5		10	35		76.9 $\pm$ 20.2	
Bubble gum	Yes	69 (58.5)	27	73.2 $\pm$ 5.3	0.044*	11	58	0.098	85.3 $\pm$ 16.6	0.063
	No	49 (41.5)		75.4 $\pm$ 6.2		14	35		79.1 $\pm$ 19.4	
Cinnamon	Yes	69 (58.5)	27	74 $\pm$ 5.6	0.897	13	56	0.459	83.8 $\pm$ 16.5	0.477
	No	49 (41.5)		74.2 $\pm$ 6		12	37		81.3 $\pm$ 20	
Leather	Yes	68 (57.6)	29	74.2 $\pm$ 5.7	0.795	16	52	0.468	86.5 $\pm$ 16.1	0.01*
	No	50 (42.4)		73.9 $\pm$ 6		9	41		77.7 $\pm$ 19.3	
Popcorn	Yes	68 (57.6)	30	74.1 $\pm$ 5.3	0.998	18	50	0.101	86.8 $\pm$ 16	0.005**
	No	50 (42.4)		74.1 $\pm$ 6.4		7	43		77.2 $\pm$ 19.2	
Natural gas	Yes	65 (55.1)	31	74.7 $\pm$ 5.2	0.23	14	51	0.917	83.5 $\pm$ 16.5	0.616
	No	53 (44.9)		73.4 $\pm$ 6.4		11	42		81.8 $\pm$ 19.8	
Turpentine	Yes	64 (54.2)	32	74.3 $\pm$ 5.1	0.645	16	48	0.27	82.4 $\pm$ 17.9	0.805
	No	54 (45.8)		73.8 $\pm$ 6.5		9	45		83.2 $\pm$ 18.3	
Grapefruit	Yes	61 (51.7)	33	74.7 $\pm$ 5.7	0.229	10	51	0.187	87.2 $\pm$ 15.3	0.006**
	No	57 (48.3)		73.4 $\pm$ 5.8		15	42		78 $\pm$ 19.6	
Rubber tyre	Yes	61 (51.7)	33	74.9 $\pm$ 5.3	0.136	20	41	0.001**	84.1 $\pm$ 16.8	0.398
	No	57 (48.3)		73.3 $\pm$ 6.2		5	52		81.3 $\pm$ 19.3	
Cheese	Yes	59 (50)	35	74 $\pm$ 5.3	0.8	12	47	0.822	86 $\pm$ 16	0.052
	No	59 (50)		74.2 $\pm$ 6.3		13	46		79.5 $\pm$ 19.4	
Cedar	Yes	57 (48.3)	36	74 $\pm$ 5.2	0.854	16	41	0.077	85.2 $\pm$ 16	0.153
	No	61 (51.7)		74.2 $\pm$ 6.3		9	52		80.5 $\pm$ 19.5	
Motor oil	Yes	53 (44.9)	37	74.2 $\pm$ 5.2	0.858	20	33	<0.001***	85.7 $\pm$ 16	0.1
	No	65 (55.1)		74 $\pm$ 6.2		5	60		80.3 $\pm$ 19.3	
Pizza	Yes	43 (36.4)	38	73.1 $\pm$ 5.1	0.171	10	33	0.677	88.3 $\pm$ 14.7	0.006**
	No	75 (63.6)		74.7 $\pm$ 6.1		15	60		79.6 $\pm$ 19	
Pickles	Yes	32 (27.1)	39	74.8 $\pm$ 5.8	0.417	3	29	0.055	86.3 $\pm$ 16.1	0.189
	No	86 (72.9)		73.8 $\pm$ 5.8		22	64		81.4 $\pm$ 18.6	
Coconut	Yes	25 (21.2)	40	75.6 $\pm$ 5.3	0.144	5	20	0.87	96.4 $\pm$ 5.6	<0.001***
	No	93 (78.8)		73.7 $\pm$ 5.9		20	73		79.1 $\pm$ 18.4	

<sup>a</sup>Fisher's exact test. \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

miliarity was different from the percentage of having reminiscence experiences for the aroma list. The first is that the previous study using the UPSIT-J investigated familiar aromas in both young and old participants. The present study was limited to older adults who were at least 65 years old, suggesting that the name for a scent that the participant perceived to be familiar with may have been different depending on his or her age. The second is that cultural experience or background may influence recalling an event from the

past through olfactory means<sup>24</sup>). It is likely that there were individual differences in the experience related to the scent depending on the participant's lifestyle and not just a simple familiarity with the aroma, and this may have led to reminiscence experiences in some cases but not in others, even for the same item.

### *Association between reminiscence experience for each aroma and age, gender, and olfactory function*

In the association between age and the reminiscence experience for each aroma, participants with reminiscence experience for bubble gum tended to be younger than those who did not have such a reminiscence experience. The opposite trend was observed for oranges. Oranges were imported from the United States prior to World War II and have been grown in various areas of Japan since then. In contrast, bubble gum was introduced to Japan after World War II, indicating that differences by age may have been detected because the experience and opportunity for being exposed to such food items differed depending on the participant's age.

In the association between gender and reminiscence experience for each aroma, more females had reminiscence experiences for baby powder and daffodil while more males had reminiscence experiences for gasoline, rubber tire, and motor oil. It has also been reported that females are generally more olfactory sensitive than men<sup>25</sup>; however, our results revealed aroma names that led to reminiscence experiences in more males. This indicated that gender differences in five scents were detected, not because of the difference in sensitivity toward aromas but because of the difference between males and females in their encounters with each scent. For males, aromas related to cars, which they had many opportunities since adolescence to become interested in, were extracted. In contrast, females are exposed to more situations involving baby powder while raising children and coming into contact with floral scents (e.g., daffodil) in everyday life. Such gender differences in experience most likely led to differences in reminiscence experiences.

In the association between olfactory VAS (olfactory function) and the reminiscence experience for each scent, our results demonstrated that differences in reminiscence experience were observed based on olfactory function for eight aromas (baby powder, chocolate, coffee, mint, leather, popcorn, grapefruit, and pizza). In general, a decline in olfactory function occurs in 26.5% of 65–74-year-old individuals and in 46.0% of  $\geq 75$ -year-old individuals<sup>26</sup>, the ability to distinguish odors declines in older individuals<sup>27</sup>, and individual differences in such decline are present<sup>28</sup>. Several studies have assessed the effects of aging on the ability to identify different smells. Seki *et al.*<sup>29</sup> used the Odor Stick Identification Test for Japanese people to investigate the effects of aging on 12 aromas in healthy older females (mean age approximately 69 years) and found that scent identification ability tended to decline for four aromas (wood, orange, gas for household use, and sautéed garlic) with aging. Umeda-Kameyama *et al.*<sup>30</sup> used a similar test to assess odor identification ability in healthy older individuals (mean age

approximately 77 years) and reported that the identification rate was less than 50% for menthol, condensed milk, Japanese orange, and wood.

The present study excluded participants who were determined to have a clear olfactory disorder using the cut-off point on the olfactory VAS. Nonetheless, the mean age of participants was about 74 years, and while they may not have shown obvious signs of olfactory disorder, it is still possible that some may have had decreased ability to identify odors due to aging.

According to Ayabe-Kanamura<sup>31</sup>, people can recognize aromas encountered in daily life based on their memories of the circumstances in which they smelled the scent in the past. A scent cannot trigger reminiscence unless the individual can relate the smell to their everyday life. The participants who answered that they had no reminiscence of the eight kinds of odorants that showed an association had significantly lower mean VAS scores than those who answered that they had reminiscence. This finding suggests that these odorants are susceptible to the perception of smell, even if olfactory dysfunction is mild, and may, therefore, not have developed into reminiscence. In other words, mild olfactory dysfunction when employing reminiscence therapy using olfactory sensations may influence identification of a smell depending on the type of odorant. An intervention that takes into consideration a person's ability to identify smells is, therefore, needed.

### *Study limitations and future research*

This study extracted specific aromas that lead to reminiscence experiences at a high frequency. This study also increases awareness for therapists making decisions about how to use olfactory stimuli as triggers, specifically taking into account the participant's age, gender, and olfactory function for reminiscence therapy.

There are two limitations to this study. The first is that the participants were older individuals residing in a particular region and were mostly female, making it difficult to generalize the results to all community-dwelling older adults in Japan. The second is that the presence or absence of reminiscence experiences was determined through a questionnaire sheet based on everyday reminiscence experiences through the name of each aroma and not on the reminiscence experience from actually smelling the scent. In summary, the possibility that participants answered that they had reminiscence of a smell based on the name of the odorant cannot be ruled out because the participants were not asked about their reminiscence at the time of actually smelling an odorant; therefore, further studies with higher degrees of accuracy are needed.

Future directions include continuing basic research on

reminiscence therapy to resolve the above issues, to simultaneously validate the effects of reminiscence therapy programs that use olfaction based on the results from the present study, and to conduct a longitudinal study for more effective reminiscence therapy.

## Conclusion

The present study focused on the 40 types of aromas on USIT-J that are familiar to Japanese people, and investigated the association between the presence or absence of reminiscence experience for each scent and other factors (age, gender, and olfactory function) in older individuals. The results demonstrated that reminiscence was present in at least 70% of the participants for 16 aromas including sandalwood, yuzu fruit, fish, apple, and smoke, and that age, gender, and olfactory function may affect such experiences with reminiscence. These findings suggest that it is necessary to select appropriate scents for use in the program based on the age and gender of the participant and to give attention to the method of presenting olfactory stimuli when conducting reminiscence therapy using olfactory stimuli in older individuals.

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