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Comparison of Taste and Smell Test Results Before and After COVID-19 in Yakumo Residents Health Checkup Comparison between 2019 and 2022

By Naomi Katayama

Nagoya Womens University

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But, in August 2022, we were finally able to obtain the results of taste and smell tests.

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Strictly as per the compliance and regulations of:



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Taste and smell were measured using a simple test kit, and height, weight, and blood pressure were also obtained.

129 males and 169 females participated in 2019 and 142 males and 202 females participated in 2022.

Each result was compared by age group (the 40s, 50s, 60s, 70s, 80s).

As our results, there were no statistically significant differences in gender, age, height, weight, systolic blood pressure, diastolic blood pressure, and salty taste test results in each age group between 2019 and 2022 (unpaired student t-test or Mann-Whitney test).

However, the olfactory test results were statistically significantly lower in 2022 than in 2019.

Keywords: simple salty taste test, simple olfactory test, resident medical examination, age group.

I. INTRODUCTION

From 2007 to 2019, every August in Yakumo Town, Hokkaido, the authors examined the sense of taste and olfactory tests during a health checkup for residents¹⁻¹².

However, in 2020 and 2021, we could not undergo a medical examination due to the COVID-19 epidemic.

As the COVID-19 epidemic has subsided, this fiscal year (August 2022), Hokkaido, August.

We obtained the taste and smell test results during the health checkup for the residents of Yakumo Town.

Therefore, we compared the taste and smell test results obtained in 2019 and the taste and smell test results obtained in 2022.

I decided to confirm whether or not there was an impact of COVID-19 by comparing two data.

II. MATERIAL AND METHOD

Among the participants in the health checkup for Yakumo town residents were measured for height, weight, blood pressure (systolic and diastolic), salty taste tests, and olfactory tests.

There were 298 subjects (129 males 169 females) in 2019.

And there were 344 subjects (142 males, 202 females) in 2022.

Survey items comparing 2019 and 2022 are age, height, weight, systolic blood pressure, diastolic blood pressure, the results of a simple olfactory test, and the results of a simple salty taste test.

The results of the simple salty taste test were performed by using Salsive (manufactured by Advantech). The Salsive is the filter paper. Salsive comes in 6 different salt concentrations (0.6% 0.8%, 1.0% 1.2%, 1.4%, 1.6%). Participants put Salsive in their mouth to check the salty taste.

Concentration was recorded when participants perceived salty taste¹³.

The results of the simple olfactory test were performed using an odor stick (Daiichi Yakuhin Kogyo Co., Ltd.).

Twelve kinds of odors are applied to the filter paper (Japanese ink, wood, perfume, menthol, mandarin orange, curry, household gas, roses, cypress, stuffy socks/sweaty, condensed milk, fried garlic). The number of odors perceived by participants was recorded.

The obtained data were statistically processed by sex and age groups.

2019 and 2022 data were F-tested, and the results were either unpaired Student-t test or Mann.

Whitney test was performed to confirm the presence or absence of statistical significance.

a) Ethical review board

This study conducted with the approval of the Ethical Review Board (Nagoya women's University Ethics Committee: "hitowomochiitakennkyuuni-kansuruiinnkai"). The approval number is 2019-26.

Author: Department of Health and Nutrition, Faculty of Health Sciences, Nagoya Women's University. e-mail: naomik@nagoya-wu.ac.jp

III. RESULT

There were 298 participants (129 male and 169 female) in 2019, and 344 participants (142 male and

2022 female) in 2022. The distribution of each age group is shown in Table 1. In both years, there were many participants in their 60s and 70s.

Table 1. Age composition of participants in 2019 and 2022 (number of people)

	40s	50s	60s	70s	80s	Total
2019 Male	10	24	49	40	6	129
2019 Female	23	40	66	37	3	169
2022 Male	13	20	38	59	12	142
2022 Female	34	37	64	57	10	202

Table 2 shows the average values and standard deviations by age group for each inspection item in FY2019.

The average systolic blood pressure for both males and females in their 70s and 80s was 140 mmHg, exceeding the normal range.

However, the average diastolic blood pressure was 90 mmHg or less in both men and women, which was within the normal range.

The average value of the simple olfactory test results in the 80s female was six, and half of the twelve

types of odors could be recognized. All females of other ages had a simple olfactory test result of six or higher.

However, the average value for males was six or less, resulting in a less recognizable odor.

The average value of salty taste test results for women in their 80s exceeds hers by 1.0%.

But otherwise, both males and females, in the age-specific salty taste test results, salty taste could be recognized less than 1.0%.

Table 2. FY2019 Yakumo Town Resident Health Check Basic Data (169 Female, 129 Male)

Female	40s		50s		60s		70s		80s	
	Average	S D	Average	S D	Average	S D	Average	S D	Average	S D
Age	45.22	2.61	54.33	3.04	64.52	2.77	72.84	2.57	82.00	2.00
Hight	158.01	5.17	155.52	6.01	153.80	5.15	150.56	5.38	147.37	2.84
Weight	57.15	11.48	56.42	9.08	55.66	8.91	52.82	10.01	49.57	11.37
Systolic blood pressure	122.26	15.75	131.58	20.57	137.14	19.05	140.11	24.48	149.00	29.44
Diastolic blood pressure	70.13	10.11	77.35	12.95	77.05	11.94	74.70	11.33	77.00	7.00
Olfactory test results	9.26	1.91	9.60	1.81	8.94	2.37	7.43	2.22	6.33	2.08
Salty taste test results	0.88	0.37	0.87	0.37	0.85	0.35	0.90	0.39	1.07	0.64

Male	40s		50s		60s		70s		80s	
	Average	S D	Average	S D	Average	S D	Average	S D	Average	S D
Age	45.50	3.21	54.83	3.14	64.84	3.32	73.03	3.17	84.83	3.76
Hight	170.05	4.63	167.96	6.29	167.28	5.89	164.69	5.35	159.13	1.75
Weight	74.15	11.32	71.34	8.93	68.93	9.35	66.23	10.08	63.50	6.39
Systolic blood pressure	136.80	18.35	131.00	18.98	138.27	14.50	145.53	24.70	134.67	14.94
Diastolic blood pressure	80.90	14.36	81.33	11.34	83.12	8.70	79.73	15.39	66.17	9.02
Olfactory test results	9.00	2.00	8.13	2.15	7.18	2.34	6.49	3.27	5.67	2.80
Salty taste test results	0.90	0.33	0.92	0.47	0.89	0.38	0.94	0.46	0.90	0.21

Table 3 shows the average values and standard deviations by age group for each inspection item in FY2022.

In females, the average systolic blood pressure in their 70s and 80s is over 140 mmHg, which exceeds the normal range.

And also in males, the average systolic blood pressure in their 80s is over 140 mmHg, which exceeds the normal range.

However, the mean diastolic blood pressure for both males and females was below 90 mmHg, which was within the normal range.

Females in their 80's and males in their 80's and 70's recognized six or less of the twelve odors. As a result, olfactory recognition decreased with age.

The results of the salty taste test showed that they could recognize less than 1.0% salty taste for both males and females.

Table 3. FY2022 Yakumo Town Resident Health Check Basic Data (202 Female, 142Male)

Female	40s		50s		60s		70s		80s	
	Average	S D	Average	S D	Average	S D	Average	S D	Average	S D
Age	44.85	2.65	55.08	2.95	65.02	3.00	73.84	2.77	82.50	2.46
Hight	156.21	10.80	157.30	5.44	174.61	169.53	151.48	6.46	149.02	6.68
Weight	55.26	11.65	68.28	74.94	54.65	10.21	59.21	36.86	53.38	12.22
Systolic blood pressure	122.59	22.51	131.95	20.20	135.20	19.31	144.80	20.63	149.70	16.81
Diastolic blood pressure	70.18	11.45	75.03	14.33	76.30	11.91	77.11	12.83	75.30	11.96
Olfactory test results	8.44	2.70	8.78	2.11	8.66	2.54	6.16	2.65	5.90	2.47
Salty taste test results	0.88	0.33	0.72	0.19	0.81	0.31	0.85	0.31	0.64	0.08

Male	40s		50s		60s		70s		80s	
	Average	S D	Average	S D	Average	S D	Average	S D	Average	S D
Age	46.00	3.14	53.90	2.75	63.66	2.68	73.63	2.41	84.67	3.89
Hight	168.51	7.80	168.45	5.49	167.91	6.13	164.59	5.88	159.70	7.10
Weight	78.64	19.32	71.61	10.67	70.14	8.93	65.49	9.75	63.61	10.38
Systolic blood pressure	131.15	16.12	130.85	16.79	135.61	18.27	137.32	21.84	144.92	20.75
Diastolic blood pressure	77.8	17.2	79.9	10.6	79.8	9.2	76.7	12.9	72.9	13.8
Olfactory test results	6.38	2.53	8.15	2.43	6.61	3.03	5.72	3.06	3.58	2.87
Salty taste test results	0.89	0.41	0.81	0.28	0.91	0.36	0.89	0.41	0.97	0.46

The results of 2022 and 2019 were compared using statistical methods.

The results of comparing the age distribution of females in 2022 and 2019 showed Table 4. As a result, there was no statistically significant difference between 2022 and 2019.

Table 4 Age Comparison Results for 2019 and 2022 Participants Female (169 in 2019, 202 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.476		P=0.422		P=0.260	
unpaired-t test	P=0.611		p=0.272		p=0.326	
Mann-Whitney test						

	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.295		P=0.405		p=0.022	
unpaired-t test	P=0.086		p=0.756		p=0.134	
Mann-Whitney test						

The results of comparing the age distribution of males in 2022 and 2019 showed Table 5. As a result, there was no statistically significant difference between 2022 and 2019.

Table 5 Age Comparison Results for 2019 and 2022 Participants Male (129 in 2019, 142 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.481		P=0.264		P=0.081	
unpaired-t test	P=0.199		p=0.306		p=0.082	
Mann-Whitney test						

	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.039*		P=0.293		p=0.119	
unpaired-t test			p=0.662		p=0.199	
Mann-Whitney test	p=0.063					

The results of comparing the height distribution of females in 2022 and 2019 showed Table 6. As a result, there was no statistically significant difference between 2022 and 2019.

Table 6 Hight Comparison Results for 2019 and 2022 Participants Female (169 in 2019, 202 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.0001**		P=0.263		P=0.443	
unpaired-t test			P=0.177		P=0.653	
Mann-Whitney test	P=0.987					
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.210		P=0.093		P=0.003**	
unpaired-t test	P=0.626		P=0.631			
Mann-Whitney test					P=0.311	

The results of comparing the height distribution of males in 2022 and 2019 showed Table 7. As a result, there was no statistically significant difference between 2022 and 2019.

Table 7 Hight Comparison Results for 2019 and 2022 Participants Male (129 in 2019, 142 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.063		P=0.262		P=0.392	
unpaired-t test	P=0.586		P=0.786		P=0.631	
Mann-Whitney test						
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.248		P=0.001**		P=0.115	
unpaired-t test	P=0.960				P=0.575	
Mann-Whitney test			P=0.235			

The results of comparing the weight distribution of females in 2022 and 2019 showed Table 8. As a result, there was no statistically significant difference between 2022 and 2019.

Table 8 Weight Comparison Results for 2019 and 2022 Participants Female (169 in 2019, 202 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.480		P=0.317		P=0.138	
unpaired-t test	P=0.547		P=0.819		P=0.550	
Mann-Whitney test						
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.450		P=0.510		P=0.146	
unpaired-t test	P=0.668		P=0.641		P=0.548	
Mann-Whitney test						

The results of comparing the weight distribution of males in 2022 and 2019 showed Table 9. As a result, there was no statistically significant difference between 2022 and 2019.

Table 9 Weight Comparison Results for 2019 and 2022 Participants Male (129 in 2019, 142 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.049*		P=0.201		P=0.377	
unpaired-t test			P=0.928		P=0.544	
Mann-Whitney test	P=0.789					
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.414		P=0.130		P=0.033**	
unpaired-t test	P=0.781		P=0.876			
Mann-Whitney test					P=0.776	

The results of comparing the systolic blood pressure distribution of females in 2022 and 2019 showed Table 10. As a result, there was no statistically significant difference between 2022 and 2019.

Table 10 Systolic Blood Pressure Comparison Results for 2019 and 2022 Participants Female (169 in 2019, 202 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.038*		P=0.453		P=0.455	
unpaired-t test			P=0.937		P=0.567	
Mann-Whitney test	P=0.552					
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.147		P=0.193		P=0.363	
unpaired-t test	P=0.343		P=0.958		P=0.618	
Mann-Whitney test						

The results of comparing the systolic blood pressure distribution of males in 2022 and 2019 showed Table 11. As a result, there was no statistically significant difference between 2022 and 2019.

Table 11 Systolic Blood Pressure Comparison Results for 2019 and 2022 Participants Male (129 in 2019, 142 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.346		P=0.281		P=0.064	
unpaired-t test	P=0.442		P=0.978		P=0.451	
Mann-Whitney test						
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.185		P=0.216		P=0.495	
unpaired-t test	P=0.117		P=0.300		P=0.292	
Mann-Whitney test						

The results of comparing the diastolic blood pressure distribution of females in 2022 and 2019 showed Table 12. As a result, there was no statistically significant difference between 2022 and 2019.

Table 12 Diastolic Blood Pressure Comparison Results for 2019 and 2022 Participants Female (169 in 2019, 202 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.269		P=0.266		P=0.493	
unpaired-t test	P=0.988		P=0.460		P=0.721	
Mann-Whitney test						
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.207		P=0.206		P=0.913	
unpaired-t test	P=0.324		P=0.822		P=0.747	
Mann-Whitney test						

Table 13 shows the results of comparing males' systolic blood pressure by age group.

Although there was no statistically significant difference by age group, $P < 0.05$ ($P = 0.045^*$) for all age groups.

The results showed that the diastolic blood pressure in 2022 was statistically significantly lower than the diastolic blood pressure in 2019.

Table 13 Diastolic Blood Pressure Comparison Results for 2019 and 2022 Participants Male (129 in 2019, 142 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.286		P=0.343		P=0.346	
unpaired-t test	P=0.648		P=0.669		P=0.090	
Mann-Whitney test						
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.119		P=0.172		P=0.438	
unpaired-t test	P=0.327		P=0.312		P=0.045*	
Mann-Whitney test						

Table 14 shows the results of a comparison of females' olfactory test results by age group.

A statistically significant difference comes out in their seventies. In 2022, olfactory recognition was statistically significantly lower than in 2019 ($P < 0.05$: $P = 0.024^*$). Comparing the results of the olfactory

cognition test in 2022 and 2019, there was no statistically significant difference in each age group. However, as a result of the overall comparison, olfactory recognition was statistically significantly lower ($P < 0.01$: $P = 0.001^{**}$) in 2022 than in 2019.

表14 Olfactory test results Comparison Results for 2019 and 2022 Participants Female (169 in 2019, 202 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.044*		P=0.170		P=0.284	
unpaired-t test			P=0.072		P=0.512	
Mann-Whitney test	P=0.257					
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.130		P=0.432		P=0.006**	
unpaired-t test	P=0.024*		P=0.789			
Mann-Whitney test					P=0.001**	

Table 15 shows the results of a comparison of male olfactory test results by age group.

A statistically significant difference comes out when he is in the 40s. In 2022, olfactory recognition was statistically significantly lower than in 2019 ($P < 0.05$: $P = 0.014^*$).

Comparing the results of the olfactory cognition test in 2022 and 2019, other were no statistically significant difference in each age group. However, as a result of the overall comparison, olfactory recognition was statistically significantly lower ($P < 0.01$: $P = 0.005^{**}$) in 2022 than in 2019.

Table 15 Olfactory test results Comparison Results for 2019 and 2022 Participants Male (129 in 2019, 142 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.229		P=0.281		P=0.049*	
unpaired-t test	P=0.014*		P=0.971			
Mann-Whitney test					P=0.568	
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.282		P=0.516		P=0.095	
unpaired-t test	P=0.315		P=0.138		P=0.005*	
Mann-Whitney test						

Table 16 shows the results of comparing females' salt taste tests by age group. Comparing the results of the salt taste cognition test in 2022 and 2019, other were no statistically significant difference in each age group.

Table 16 Salty taste test results Comparison Results for 2019 and 2022 Participants Female (169 in 2019, 202 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.305		P=0.001**		P=0.144	
unpaired-t test	P=0.985				P=0.501	
Mann-Whitney test			P=0.087			
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.060		P=0.003**		p=0.001*	
unpaired-t test	P=0.482					
Mann-Whitney test			P=0.093		P=0.187	

Table 17 shows the results of comparing males' salt taste tests by age group. Comparing the results of the salt taste cognition test in 2022 and 2019, other were no statistically significant difference in each age group.

Table 17 Salty taste test results Comparison Results for 2019 and 2022 Participants Male (129 in 2019, 142 in 2022)

	40s		50s		60s	
	2019	2022	2019	2022	2019	2022
F-test	P=0.261		P=0.019*		P=0.342	
unpaired-t test	P=0.962				P=0.807	
Mann-Whitney test			P=0.365			
	70s		80s		Total	
	2019	2022	2019	2022	2019	2022
F-test	P=0.255		P=0.005*		P=0.265	
unpaired-t test	P=0.597				P=0.551	
Mann-Whitney test			P=0.585			

IV. DISCUSSION

For both male and female participants, age, height, and weight were not statistically significantly differences for comparison between 2019 and 2022. Females had no statistically significant difference in blood pressure between 2019 and 2022. However, there was no significant difference in diastolic blood pressure among males by age group, but when compared overall, the year 2022 was lower than in 2019. There was no statistically significant difference in cognition between 2019 and 2022 for salty taste. Regarding the sense of smell, there will be a statistically significant ($P<0.05$) decline in cognition in 2022 compared to 2019.

Whether this is due to the COVID-19 epidemic cannot be determined based on the results of this test alone. However, the results of this olfactory cognition test showed that the olfactory cognition in 2022 was lower than the olfactory cognition in 2019.

Therefore, we believe that it is necessary to continue to investigate the participants' sense of smell. At that time, we think it is needed to investigate COVID-19 morbidity as well. We believe it is necessary to track individuals individually.

Previous studies have reported a positive correlation between salt intake and blood pressure¹⁵⁻¹⁹.

Therefore, in Japan and overseas, guidance to reduce salt intake is being carried out. Future studies will investigate the relationship dietary habits and blood pressure. It is necessary to investigate this in more detail. Relations with aging²⁰) and Alzheimer's disease^{21,22}) have also been reported regarding the decline in olfactory cognition. We could like to continue research on regional differences in Japan and clarify the results.

V. CONCLUSION

We compared taste and smelled simple test results before COVID-19 (2019) and after COVID-19 (2022). As a result, no statistically significant difference was observed in preference in all ages between 2019 and 2022. However, 2022 tended to have fewer olfactory perceptions in all ages than in 2019. But the smell was a statistically significant difference between 2019 and 2022 in the total participants. Compared to 2022, the value tends to be lower in 2022, with a significant difference overall, and 2022 is not recognizable. It was found that the number of certain odors decreased in 2022. However, on this data, it cannot be concluded that the decline in olfactory recognition in 2022 was due to COVID-19.

In the future, we would like to clarify the presence or absence of regional differences by conducting surveys on more items and comparing them.

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REFERENCES RÉFÉRENCES REFERENCIAS

1. Odour and Salt Taste Identification in Older Adults : Evidence from Yakumo Study Naomi Katayama, Shoko Kondo, Hironao Otake, Masaaki Teraichi, Michihiko Sone, Yasushi Fujimoto, Hirokazu Suzuki, Saiko Sugiura, Seiichi Nakata, Tsutomu Nakashima *Advances in Sciences and Engineering*, Vol. 9, No.1 P20-31 2017. January.
2. Odour and Salt Taste Identification in Older Adults: Evidence from The Yakumo Study in August, 2015 – 2017 Naomi Katayama, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Wakako Kinoshita, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Seiichi Nakata and Tsutomu Nakashima *OPEN ACCESS PUBLICATION NorCal Open Access Publications Recent Advancement in Food Science and Nutrition Research Volume 1 2018; Issue 02 56-64.* 2018. October.
3. Odour and salt taste identification in older adults: evidence from the Yakumo study in August 2014 Naomi Katayama, Shoko Kondo, Satofumi Sugimoto, Seiya Goto, Wakako Kinoshita, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Naoki Saji, Takafumi Nakada, Seiichi Nakata, Tsutomu Nakashima *Journal of Human Virology & Retrovirology* 2019; 7(1):10–12. 2019. January.
4. The olfactometry and taste examination results for ten years (2009-2018) in the Yakumo study by using the data of the testee list Naomi Katayama, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Wakako Kinoshita, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Seiichi Nakata and Tsutomu Nakashima 2019. February.
5. Odour and salt taste identification in older adults: Evidence from the Yakumo Study in August, 2018 Naomi Katayama, Shoko Kondo, Satofumi Sugimoto, Wakako Kinoshita, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Saiko Sugiura, Seiichi Nakata, Tsutomu Nakashima *Academia Journal of Medicinal Plants* 7(3): 066-071, March 2019 2019. March.
6. Odour and salt taste identification in older adults: Evidence from the Yakumo (2019). Naomi Katayama, Shoko Kondo, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Takafumi Nakada, Naoki Saji, Seiichi Nakata and Tsutomu Nakashima *Academia Journal of Medicinal Plants* 8(3): 030-035, March 2020 DOI: 10.15413/ajmp.2020.0106 2020. March.
7. Comparison between Threshold of Saltiness Perception and Blood Pressure for Resident Health Examination in Yakumo Town Naomi Katayama, Akemi Ito, Mayumi Hirabayashi, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Seiichi Nakata, Tsutomu Nakashima, Kenji Kondo, Takaki Miwa *Advances in Nutrition and Food Science ANAFS-181 ISSN: 2641-6816* 1-9 2020. April.
8. Comparison between Threshold of Sweetness Perception and Blood Glucose Level at Resident Health Examination in Yakumo Town Naomi Katayama, Mayumi Hirabayashi, Akemi Ito, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Seiichi Nakata, Tsutomu Nakashima, Kenji Kondo, Takaki Miwa *Advances in Nutrition and Food Science ANAFS-182 ISSN: 2641-6816* 1-8 2020. April.
9. Comparison between Threshold of Bitterness Perception and Blood Pressure for Resident Health Examination in Yakumo Town Naomi Katayama, Akemi Ito, Mayumi Hirabayashi, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Naoki Saji, Seiichi Nakata, Tsutomu Nakashima, Kenji Kondo & Takaki Miwa *Global Journal of Medical Research: K Interdisciplinary Volume 20 Issue 4 Version 1.0 Year 2020* 1-6 2020. June.
10. Odor Identification in Older Adults: Evidence from the Yakumo (2019)- Results by Gender and Age Naomi Katayama, Shoko Kondo, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Takafumi Nakada, Naoki Saji, Seiichi Nakata *Global Journal of Medical Research: K Interdisciplinary Volume 20 Issue 4 Version 1.0 Year 2020* 17-22 2020. June.



11. Comparison between Threshold of Sourness Perception and Blood Pressure for Resident Health Examination in Yakumo Town Naomi Katayama, Mayumi Hirabayashi, Akemi Ito, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranisi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Naoki Saji, Seiichi Nakata, Tsutomu Nakashima, Kenji Kondo & Takaki Miwa *Global Journal of Medical Research: K Interdisciplinary Volume 20 Issue 4 Version 1.0 Year 2020 35-40 2020. June.*
12. Comparison of Survey Results on Subjective Dissiness, Hearing and Tinnitus and Stabilometry Test Results in Yakumo Inhabitant Examination Study (Comparison of 2005, 2007 and 2015, 2017) Naomi Katayama, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Naoki Saji, Seiya Goto, Satofumi Sugimoto, Wakako Kinoshita, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Seiichi Nakata, Tsutomu Nagashima and Yukiharu Hasegawa. *Journal of Health Science 7(2019) 151-159 2019. June.*
味覚検査
13. Nishimoto K, Ohhori J, Shimomugi T, Kurono Y (2005) Reproducibility of taste examination with Salsave: Control study for healthy volunteers. *Japan Society of Stomato-pharyngology 17: 309-315.*
臭覚検査
14. Ayabe-Kanamura S, Sachiko S, Yasuhiro T, Gotow N, Naomi N, Takashi N, Miyako M, Yuichi D, Tatsu K (2005). Development of a smell identification test using a novel stick-type odor presentation kit : The generation and a sex factor. *J. Aroma Sci. Technol. 31(4): 52-55.*
15. Cho H, Kim SM, Jeong SS, Kim SB (2016) Comparison of salt taste thresholds and salt usage behaviours between adults in Myanmar and Korea. *Asia Pacific journal of clinical nutrition 25: 879-884.*
16. Kusabe U, Mori Y, Okagaki M, Neriya H, Adachi T et al. (2009) Sodium restriction improves the gustatory threshold for salty taste in patients with chronic kidney disease. *Kidney international 76: 638-643.*
17. Ferrante D, Apro N, Ferreira V, Virgolini M, Aguilar V et al. (2011) Feasibility of salt reduction in processed foods in Argentina. *Pan American journal of public health 29 69-75.*
18. Petrova TS, Bazhenov ND, Mazur VV, Mazur ES (2012) Gustatory sensitivity threshold to table salt and efficacy of the treatment of newly diagnosed patients with antihypertensive therapy. *Klin med 90: 32-34.*
19. Okoro EO, Uroghide GE, Jolayemi ET (1998) Salt taste sensitivity and blood pressure in adolescent school children in southern Nigeria. *East African medical journal 75: 199-203.*
20. Doty RL, Shaman P, Applebaum SL, Giberson R, Siksorski L, Rosenberg L (1984). Smell identification ability: changes with age. *Science. 226(4681): 1441-1443.*
21. Jimbo D, Kimura Y, Taniguchi M, Inoue M, Urakami K (2009). Effect of aromatherapy on patients with Alzheimer's disease. *Psychogeriatrics. 9(4): 173-179.*
22. Kobayashi M, Reiter ER, DiNardo LJ, Costanzo RM (2007). A new clinical olfactory function test: cultural influence. *Arch. Otolaryngol. Head Neck Surg. 133(4): 331-336.*

