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RESEARCH ARTICLE

QUESTIONNAIRE SURVEY RESULTS ON SWALLOWING IN YAKUMO TOWN RESIDENT'S HEALTH EXAMINATION (2018)

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ABSTRACT

We have been conducting a questionnaire survey since 2009 to obtain basic data on swallowing function related to eating habits and exercise habits. In 2018, a self-administered questionnaire survey was conducted to ask questions about swallowing function during the health examination of residents of Yakumo Town, Hokkaido, Japan. As a result, 191 males and 261 females were obtained. There were 15 questions, and more than 80% of both males and females answered that there was no problem with each question. However, females were statistically significantly more problematic than males in five items (When eating or drinking, can food or drink come out of your nose?, Do you swallow well-chewed food several times as it passes through your throat?, Do you feel like a lump of food in your throat while eating?, Do you cough when swallowing solid foods?, Do you have difficulty breathing while eating?). However, more than 80-90% of females answered that there was no problem. Participants who lived independently and could walk to participate in the resident health checkup were aware of their problem of swallowing function. In the future, it will be necessary to investigate the relationship with eating habits and exercise habits.

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INTRODUCTION

Problems in a super-aging society include undernutrition and sarcopenia (Rosenberg, 1989; Cruz-Jentoft, 2010). Many researchers have reported that these are related to swallowing function (Veldee, 1992; Hudson, 2000). Currently, it has been reported that it is important to carry out swallowing function training to prevent deterioration of swallowing function (Shaker, 1997; Autunes, Robbins, 2005). Therefore, in this study, we conducted a self-administered questionnaire survey on swallowing function at the time of resident health

examination in areas with low population migration, with the aim of understanding the swallowing function of elderly people from the middle age who live independently.

MATERIAL AND METHODS

Participants: A questionnaire survey was conducted among the participants of the Yakumo Town Residents' Health Examination, among the participants who consulted the otolaryngology department.

Questionnaire survey

There were a total of 15 items in the questionnaire survey on swallowing. The questionnaire was self-administered to the participants. The contents of the question show below.

-) Do you have a hard time chewing solid foods (apples, cookies, rice crackers, etc.)
-) Does food remain in the mouth (chin or back of tongue) or get caught in the upper jaw after swallowing?
-) When eating or drinking, can food or drink come out of your nose?
-) Can food what you chew well drips from your mouth?
-) Do you feel a lot of drooling? (Have you ever felt drooling or difficult to swallow?)
-) Do you swallow well-chewed food several times as it passes through your throat? Do you have a hard time swallowing solid food? Do you have a hard time swallowing mashed food?
-) Do you feel like a lump of food itches in your throat while eating?
-) Do you cough when swallowing liquid?
-) Do you cough when swallowing solid foods?
-) Does your voice change immediately after eating or drinking? (For example, the voice withers, the voice becomes quiet, etc.)
-) Can saliva enter the trachea and cause coughing or difficulty breathing except during meals (such as at night)?
-) Do you have difficulty breathing while eating?
-) Have you ever had pneumonia or bronchitis in the last year?

RESULTS

Participants Age and Sex: The number of participants in the otolaryngology area of the Yakumo Town Residents Examination in 2018 was 191 males and 261 females (To see Table 1). Looking at the participants by age group, males were most likely to participate in their 60's (77 people), and females were most likely to be in their 70's (118 people).

Table 1. Age distribution of participant in Yakumo study 2018 years

	40's	50's	60's	70's	80's
Male (n=191)	21	32	77	50	11
Female (n=261)	33	32	77	118	1
Total (n=452)	54	64	154	168	12

Questionnaire survey results: The average number of people who answered that there was no problem in answering Question 1 (Do you have a hard time chewing solid foods) was 83.0% for males and 66.0% for females, and males were 17.0% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.8856$). The average number of people who answered that there was no problem in answering Question 2 (Does food remain in the mouth or get caught in the upper jaw after swallowing) was 83.2% for males and 61.8% for females, and males were 21.4% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data.

Table 2. Do you have a hard time chewing solid foods (apples, cookies, rice crackers, etc.)? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	16	71	28	85
50's (M=32, F=32)	27	84	25	78
60's (M=77, F=77)	65	84	63	82
70's (M=50, F=118)	42	94	100	85
80's (M=11, F=1)	9	82	0	0
Average	31.8	83.0	43.2	66.0
Standard deviation	22.4	8.2	38.9	37.0
Average (40's-70's)	37.5	83.3	54.0	82.5
Standard deviation (40's-70's)	21.2	9.4	35.2	3.3
Unpaired t-test (40's-70's)	$P < 0.8856$			

By the age of 70s, males had 83.3% and females had 82.5%, which was 0.8% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.0996$).

Table 3. Does food remain in the mouth (chin or back of tongue) or get caught in the upper jaw after swallowing? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	17	81	27	82
50's (M=32, F=32)	27	84	23	72
60's (M=77, F=77)	61	79	61	79
70's (M=50, F=118)	45	90	90	76
80's (M=11, F=1)	9	82	0	0
Average	31.8	83.2	40.2	61.8
Standard deviation	21.1	4.2	35.4	34.7
Average (40's-70's)	37.5	83.5	50.3	77.3
Standard deviation (40's-70's)	19.5	4.8	31.5	4.3
Unpaired t-test (40's-70's)	$P < 0.0996$			

The average number of people who answered that there was no problem in answering Question 3 (When eating or drinking, can food or drink come out of your nose?) was 99.4% for males and 74.8% for females, and males were 24.6% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 99.3% and females had 93.5%, which was 5.8% higher than females. Since there was only one female in her 80s, there was a statistically significant difference when comparing males and females with the mean values from the 40s to 70s (unpaired t-test $P < 0.0024^{**}$). Females had worse results than males. However, the difference is that 90% or more of males and females answered that there was no problem.

Table 4. When eating or drinking, can food or drink come out of your nose? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	21	100	31	94
50's (M=32, F=32)	32	100	29	91
60's (M=77, F=77)	75	97	73	94
70's (M=50, F=118)	50	100	112	95
80's (M=11, F=1)	11	100	0	0
Average	37.8	99.4	49.0	74.8
Standard deviation	25.3	1.3	43.8	41.8
Average (40's-70's)	44.5	99.3	61.3	93.5
Standard deviation (40's-70's)	23.6	1.5	39.4	1.7
Unpaired t-test (40's-70's)	$P < 0.0024^{**}$			

The average number of people who answered that there was no problem in answering Question 4 (Can food what you chew well drips from your mouth) was 96.6% for males and 73.4% for females, and males were 23.2% higher than females.

However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 98.0% and females had 91.8, which was 6.2% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.0656$).

Table5. Can food what you chew well drips form your mouth? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	21	100	28	85
50's (M=32, F=32)	32	100	30	94
60's (M=77, F=77)	72	94	74	96
70's (M=50, F=118)	49	98	108	92
80's (M=11, F=1)	10	91	0	0
Average	36.8	96.6	48.0	73.4
Standard deviation	24.4	4.0	42.7	41.2
Average (40's-70's)	43.5	98.0	60.0	91.8
Standard deviation (40's-70's)	22.2	2.8	38.4	4.8
Unpaired t-test (40's-70's)	$P < 0.0656$			

The average number of people who answered that there was no problem in answering Question 5 (Do you feel a lot of drooling) was 90.6% for males and 71.6% for females, and males were 19.2% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 89.5% and females had 90.5%, which was 1.0% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.7732$).

Table6. Do you feel a lot of drooling? (Have you ever felt drooling or difficult to swallow? 2018)

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	19	90	27	82
50's (M=32, F=32)	29	91	30	94
60's (M=77, F=77)	70	91	74	96
70's (M=50, F=118)	45	90	102	86
80's (M=11, F=1)	10	91	0	0
Average	34.6	90.6	46.6	71.6
Standard deviation	23.7	0.5	40.8	40.4
Average (40's-70's)	40.8	90.5	58.3	89.5
Standard deviation (40's-70's)	22.2	0.6	36.2	6.6
Unpaired t-test (40's-70's)	$P < 0.7732$			

The average number of people who answered that there was no problem in answering Question 6 (Do you swallow well-chewed food several times as it passes through your throat) was 84.4% for males and 67.2% for females, and males were 17.2% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 89.5% and females had 84.0%, which was 5.5% higher than females. Since there was only one female in her 80s, there was a statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.0346^*$). Females had worse results than males. However, the difference is that 80% or more of males and females answered that there was no problem. The average number of people who answered that there was no problem in answering Question 7 (Do you have a hard time swallowing solid food) was 91.4% for males and 70.6% for females, and males were 20.8% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 89.5% and females had 88.3%, which was 3.2% higher than females.

Table7. Do you swallow well-chewed food several times as it passes through your throat? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	20	95	27	82
50's (M=32, F=32)	28	88	27	84
60's (M=77, F=77)	67	87	65	84
70's (M=50, F=118)	44	88	101	86
80's (M=11, F=1)	7	64	0	0
Average	33.2	84.4	44.0	67.2
Standard deviation	23.2	11.8	39.4	37.6
Average (40's-70's)	39.8	89.5	55.0	84.0
Standard deviation (40's-70's)	20.7	3.7	35.5	1.6
Unpaired t-test (40's-70's)	$P < 0.0346^*$			

Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.4427$).

Table8. Do you have a hard time swallowing solid food? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	20	95	32	97
50's (M=32, F=32)	28	88	27	84
60's (M=77, F=77)	67	87	64	83
70's (M=50, F=118)	48	96	105	89
80's (M=11, F=1)	10	91	0	0
Average	34.6	91.4	45.6	70.6
Standard deviation	22.9	4.0	40.2	39.9
Average (40's-70's)	40.8	91.5	57.0	88.3
Standard deviation (40's-70's)	21.1	4.7	36.0	6.4
Unpaired t-test (40's-70's)	$P < 0.4427$			

The average number of people who answered that there was no problem in answering Question 8 (Do you have a hard time swallowing mashed food) was 98.4% for males and 96.0% for females, and males were 2.4% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 98.0% and females had 95.0%, which was 3.0% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.0975$).

Table9. Do you have a hard time swallowing mashed food? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	21	100	32	97
50's (M=32, F=32)	32	100	30	91
60's (M=77, F=77)	72	94	74	96
70's (M=50, F=118)	49	98	113	96
80's (M=11, F=1)	11	100	1	100
Average	37.0	98.4	50.0	96.0
Standard deviation	24.1	2.6	43.8	3.2
Average (40's-70's)	43.5	98.0	62.3	95.0
Standard deviation (40's-70's)	22.2	2.8	39.4	2.7
Unpaired t-test (40's-70's)	$P < 0.0975$			

The average number of people who answered that there was no problem in answering Question 9 (Do you feel like a lump of food in your throat while eating) was 89.2% for males and 85.4% for females, and males were 3.8% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 91.0% and females had 81.8%, which was 9.2% higher than females. Since there was only one female in her 80s, there was a statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test $P < 0.0054^{**}$). Females had worse results than males.

However, the difference is that 80% or more of males and females answered that there was no problem.

Table10. Do you feel like a lump of food itch in your throat while eating? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	20	95	27	82
50's (M=32, F=32)	26	88	25	78
60's (M=77, F=77)	70	91	62	81
70's (M=50, F=118)	45	90	101	86
80's (M=11, F=1)	9	82	1	100
Average	34.0	89.2	43.2	85.4
Standard deviation	24.0	4.8	39.0	8.6
Average (40's-70's)	40.3	91.0	53.8	81.8
Standard deviation (40's-70's)	22.5	2.9	35.8	3.3
Unpaired t-test (40's-70's)	P<0.0054**			

The average number of people who answered that there was no problem in answering Question 10 (Do you cough when swallowing liquid) was 86.2% for males and 86.4% for females, and females were 0.2% higher than males. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 89.5% and females had 83.0%, which was 6.5% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test P<0.1244).

Table11. Do you cough when swallowing liquid? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	19	90	25	76
50's (M=32, F=32)	28	88	25	78
60's (M=77, F=77)	68	88	69	90
70's (M=50, F=118)	46	92	104	88
80's (M=11, F=1)	8	73	1	100
Average	33.8	86.2	44.8	86.4
Standard deviation	23.6	7.6	41.2	9.7
Average (40's-70's)	40.3	89.5	55.8	83.0
Standard deviation (40's-70's)	21.6	1.9	38.3	7.0
Unpaired t-test (40's-70's)	P<0.1244			

The average number of people who answered that there was no problem in answering Question 11 (Do you cough when swallowing solid foods) was 95.4% for males and 72.0% for females, and males were 23.4% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 96.5% and females had 90.0%, which was 6.5% higher than females. Since there was only one female in her 80s, there was a statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test P<0.0407*). Females had worse results than males. However, the difference is that 90% or more of males and females answered that there was no problem. The average number of people who answered that there was no problem in answering Question 12 (Does your voice change immediately after eating or drinking) was 94.2% for males and 95.8% for females, and females were 1.6% higher than males. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 97.3% and females had 94.8%, which was 2.5% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test P<0.1738).

Table12. Do you cough when swallowing solid foods? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	21	100	29	88
50's (M=32, F=32)	30	94	30	94
60's (M=77, F=77)	71	92	68	88
70's (M=50, F=118)	50	100	106	90
80's (M=11, F=1)	10	91	0	0
Average	36.4	95.4	46.6	72.0
Standard deviation	24.3	4.3	41.1	40.3
Average (40's-70's)	43.0	96.5	58.3	90.0
Standard deviation (40's-70's)	22.3	4.1	36.6	2.8
Unpaired t-test (40's-70's)	P<0.0407*			

Table13. Does your voice change immediately after eating or drinking? (For example, the voice withers, the voice becomes quiet, etc.) 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	21	100	32	97
50's (M=32, F=32)	31	97	31	97
60's (M=77, F=77)	74	96	71	92
70's (M=50, F=118)	48	96	110	93
80's (M=11, F=1)	9	82	1	100
Average	36.6	94.2	49.0	95.8
Standard deviation	25.3	7.0	42.2	3.3
Average (40's-70's)	43.5	97.3	61.0	94.8
Standard deviation (40's-70's)	23.2	1.9	37.6	2.6
Unpaired t-test (40's-70's)	P<0.1738			

The average number of people who answered that there was no problem in answering Question 13 (Can saliva enter the trachea and cause coughing or difficulty breathing except during meals) was 77.6% for males and 65.8% for females, and males were 11.8% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 83.3% and females had 82.3%, which was 1.0% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test P<0.6880).

Table14. Can saliva enter the trachea and cause coughing or difficulty breathing except during meals (such as at night)? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	17	81	29	88
50's (M=32, F=32)	27	84	25	78
60's (M=77, F=77)	66	86	63	82
70's (M=50, F=118)	41	82	95	81
80's (M=11, F=1)	6	55	0	0
Average	31.4	77.6	42.4	65.8
Standard deviation	23.2	12.8	37.0	37.0
Average (40's-70's)	37.8	83.3	53.0	82.3
Standard deviation (40's-70's)	21.3	2.2	32.8	4.2
Unpaired t-test (40's-70's)	P<0.6880			

The average number of people who answered that there was no problem in answering Question 14 (Do you have difficulty breathing while eating) was 100.0% for males and 96.0% for females, and males were 4.0% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 100.0% and females had 95.0%, which was 5.0% higher than females. Since there was only one female in her 80s, there was a statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test P<0.001**). Females had worse results than males. However, the difference is that 95% or more of males and females answered that there was no problem.

Table 15. Do you have difficulty breathing while eating? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	21	100	31	94
50's (M=32, F=32)	32	100	31	97
60's (M=77, F=77)	77	100	73	95
70's (M=50, F=118)	50	100	111	94
80's (M=11, F=1)	11	100	1	100
Average	38.2	100.0	49.4	96.0
Standard deviation	26.1	0.0	42.9	2.5
Average (40's-70's)	45.0	100.0	61.5	95.0
Standard deviation (40's-70's)	24.5	0.0	38.5	1.4
Unpaired t-test (40's-70's)	P<0.001**			

The average number of people who answered that there was no problem in answering Question 15 (Have you ever had pneumonia or bronchitis in the last year) was 97.6% for males and 96.2% for females, and males were 1.4% higher than females. However, since there is only one female in her 80's, it is difficult to compare with the male data. By the age of 70s, males had 97.0% and females had 95.3%, which was 1.7% higher than females. Since there was only one female in her 80s, there was no statistically significant difference when comparing males and females with the mean values from the 40s to 70s (Unpaired t-test P<0.2110).

Table 16. Have you ever had pneumonia or bronchitis in the last year? 2018

	Male (n=191)		Female (n=261)	
	No	%	No	%
40's (M=21, F=33)	20	95	31	94
50's (M=32, F=32)	31	97	31	97
60's (M=77, F=77)	74	96	73	95
70's (M=50, F=118)	50	100	112	95
80's (M=11, F=1)	11	100	1	100
Average	37.2	97.6	49.6	96.2
Standard deviation	25.2	2.3	43.3	2.4
Average (40's-70's)	43.8	97.0	61.8	95.3
Standard deviation (40's-70's)	23.7	2.2	38.9	1.3
Unpaired t-test (40's-70's)	P<0.2110			

DISCUSSION

A questionnaire survey on swallowing function was conducted at the annual Yakumo Town Residents' Health Examination. As a result, 191 males and 261 females participated. The questionnaire was self-administered with 15 items. However, since there is only one female in her 80's, it is difficult to compare with the male data. Therefore, we made a statistical comparison between males and females using the mean results from the 40s to 70s. For all questions, more than 80 percent of both males and females in their 40s to 70s said they have no problem. Males performed statistically significantly better than females on five questions (When eating or drinking, can food or drink come out of your nose?, Do you swallow well-chewed food several times as it passes through your throat?, Do you feel like a lump of food in your throat while eating?, Do you cough when swallowing solid foods?, Do you have difficulty breathing while eating?). However, more than 80-90% of females answered that there have no problem. Participants who lived independently and could walk to participate in the resident health checkup were aware of their problem of swallowing function. In the future, it will be necessary to investigate and consider lifestyle-related habits and eating habits, including exercise habits. It has also been reported that swallowing function is associated with malnutrition (Veldee, 1992; Hudson, 2000), frail, and sarcopenia (Chen, 2014; Anker, 2016; Rogers, 1993; Roubenoff, 2000;

Carmeli, 2002). We would like to increase the number of cases and examine it as a basic research for prevention in the aging society in the future.

Conclusion

A self-administered questionnaire survey on swallowing function was conducted at the time of resident health examination in Yakumo-cyo, Hokkaido, Japan. Participants were 191 males and 261 females in their 40s to 80s. More than 80% of participants answered that there was no problem with 15 items related to swallowing function. There were five items in which males had statistically significantly higher values than females, but female participants answered that more than 80% had no problem. The swallowing function was maintained in the participants who lived independently.

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