

## Effects of an educational program for improving the dietary quality of older adults at risk for dysphagia in South Korea\*

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### ABSTRACT

**Purpose:** Changes in eating habits and malnutrition due to dysphagia are important health problems for older adults. This study investigated the effects of an educational program aimed at improving diet quality in community-dwelling older adults at risk for dysphagia in South Korea. **Methods:** We assessed 27 individuals in the experimental group and 26 individuals in the control group between September and October 2015. All participants were aged 65 years or older and were at risk for dysphagia. A combined diet and exercise program was applied to the experimental group (n = 27) for six weeks. We examined changes in participants' eating habits and their knowledge and attitudes concerning dysphagia risk. The nutrition intake of all participants was measured before and after the intervention using 24-hr dietary recall. **Results:** There was a significant increase in knowledge of dysphagia risk in the experimental group, with scores increasing from 3.7 to 7.1, out of 10 points ( $p < 0.001$ ). There were also significant improvements in eating habits after the intervention in the experimental group, with scores increasing from 21.9 to 28.3, out of 36 points ( $p < 0.001$ ). The attitude score of participants in the experimental group increased significantly, from 15.2 to 16.7, out of 20 points ( $p = 0.016$ ). **Conclusion:** Developing educational programs can help older adults living in the community lead a healthier lifestyle and improve their ability to manage their diet.

**KEY WORDS:** chewing problem, swallowing problem, education program, dietary guides, exercise guides

### Introduction

Korea has been considered an aging society since the year 2000 when 7.2% of the population was 65 years or older. By 2017, this percentage increased to 13.8% of the total population and continues to grow.<sup>1</sup> As the elderly population increases, dealing with aging-associated and senile chronic diseases is becoming a progressively problematic social burden.

Aging is often accompanied by food intake disorders, including dysphagia. People with dysphagia have problems chewing and swallowing certain foods or liquids. The chewing function refers to the ability to chew food mix it well with saliva to facilitate swallowing. The swallowing function refers to the ability to swallow food and pass

it through the esophagus. A disorder in both chewing and swallowing is called dysphagia, and it is especially common in older adults. This condition can be caused by tooth loss, dry mouth, and lack of chewing and swallowing control due to pharyngeal, oral cavity, and esophageal muscle weakness. Previous studies have shown that 10% to 40% of older adults living at home suffer from swallowing difficulties.<sup>2-5</sup>

According to Korea Health Statistics, in 2012, 46.6% of older adults in Korea have experienced difficulties when chewing food.<sup>6</sup> This implies that one in two older adults is experiencing symptoms of dysphagia, meaning that chewing and swallowing difficulties are not negligible health problems in the older adults. Chewing and swallowing difficulties experienced by older adults can

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develop into various life-threatening complications, including dehydration, malnutrition, aspiration pneumonia, and other serious conditions.<sup>2</sup> In particular, aspiration pneumonia is a serious problem in older adults. When they suffer from dysphagia, the time required for swallowing is prolonged, and the duration of swallowing is increased. Failure to properly diagnose and treat swallowing disorders early may lead to complications such as pneumonia or chronic lung disease and may cause death in severe cases.<sup>2</sup>

Older adults who experience chewing and swallowing difficulties have few food choices, which can worsen diet quality and eventually lead to malnutrition. Those that experience dysphagia tend to reduce their consumption of vegetables and meat and instead consume more carbohydrates, which tend to be easier to chew and swallow. These diet changes can result in a nutritional imbalance.<sup>7</sup> It has been reported that older adults suffering from dysphagia have a narrow range of food choices and the quality of their meals decreases and causes malnutrition.<sup>2</sup>

Chewing, swallowing, and dietary management programs for the older adults in Korea include oral exercise programs to improve oral health using song mediation programs for older adults with swallowing difficulties.<sup>8-10</sup> However, education on the appropriate diet for those who experience swallowing problems is not available. Changes in eating habits and malnutrition due to dysphagia are important health problems for older adults. The nutritional status of older adults with dysphagia, which is accompanied by a decrease in food intake and dietary quality, is at risk.

Therefore, inappropriate management of dysphagia may cause chronic malnutrition and adversely affect the health of older adults.

There is a need for a dietary intake improvement programs for older adults who are at risk of dysphagia, and an integrated approach which incorporates nutritional aspects as well as occupational therapy when necessary. Most management programs for older adults with dysphagia are conducted only by specialized fields, such as occupational therapy and medicine.<sup>9-14</sup> However, there has been no development of a self-administered dietary improvement program for older adults who are at risk of dysphagia. In this study, a standardized manual that provides an educational program combined with nutritional and occupational therapies for older adults at risk for dysphagia was developed, and the effectiveness of this educational program was evaluated.

## Methods

### Subjects

The target population for this study was individuals aged 65 years or older living in the provinces of Gwangju and Gyeonggi-do. Those older adults who could understand the educational program and answer the questionnaire without cognitive impairment were included. In addition, all participants scored over six points on the dysphagia inspection scale,<sup>11</sup> indicating risk for dysphagia, and scored below 129 points on the chewing ability group inspection,

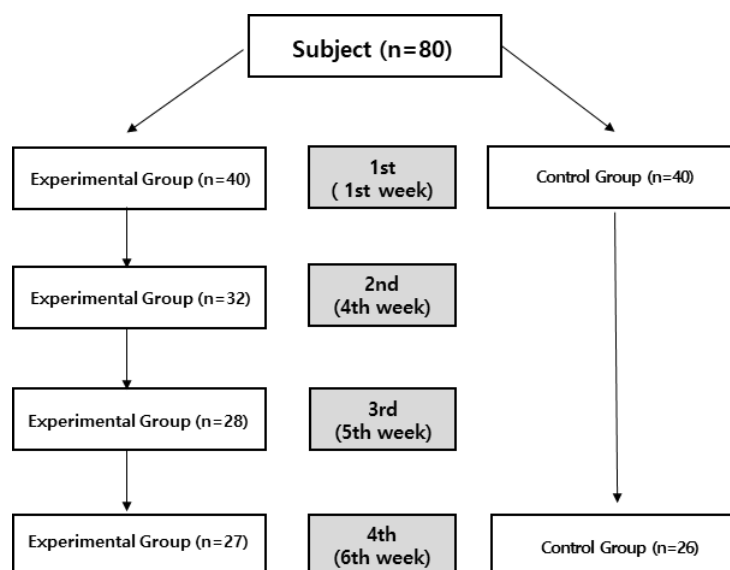


Fig. 1. Number of participants in the educational program

indicating low chewing abilities. These results indicated that all participants were at risk for dysphagia.

A total of 40 older adults (experimental group) who attended a senior welfare center in Gwangju and 40 older adults (control group) who attended a senior welfare center in Gyeonggi-do were enrolled in this study for six weeks from September 14, 2015, to October 23, 2015. At the end of the program, 27 participants in the experimental group and 26 in the control group remained (Fig. 1).

The sample size was calculated by Cohen's formula,<sup>15</sup> and 26 participants were defined as the appropriate size for each group at a mid-level effect size of 0.4, power

of 0.8, and a significance level of 0.05. Considering a drop-out rate, the total sample size required 40 participants in each group. This research was approved by the Myongji University Research Ethics Commission (Project Management Number MJU-2015-06-001-04).

## Procedures

### Educational program to improve dietary quality

The educational program was administered to the experimental group. Guides including dietary (food, cooking, and menus) and exercise (posture at mealtimes, 'Health Stretching', and 'Health Plus Stretching') were



Fig. 2. Contents of the educational program for improving the dietary quality: Dietary guide and exercise guide

Table 1. Schedule of the educational program for improving the dietary quality

Time	Main contents	Details
1 <sup>st</sup> (1 <sup>st</sup> week)	<ul style="list-style-type: none"> <li>• Test operation outlines</li> <li>• Exercise guide</li> </ul>	<ul style="list-style-type: none"> <li>• Test operation and total contents explanation</li> <li>• Right posture at a meal</li> <li>• 'Health Stretching' and 'Health Plus Stretching'</li> </ul>
2 <sup>nd</sup> (4 <sup>th</sup> week)	<ul style="list-style-type: none"> <li>• The review of 'Health Stretching'</li> <li>• Dietary life guide               <ul style="list-style-type: none"> <li>- Food guide</li> <li>- Cooking guide</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 'Health Stretching' and 'Health Plus Stretching'</li> <li>• Dietary life guide               <ul style="list-style-type: none"> <li>• How to drink water and beverage safely</li> <li>• How to eat bread and rice cake</li> </ul> </li> </ul>
3 <sup>rd</sup> (5 <sup>th</sup> week)	<ul style="list-style-type: none"> <li>• The review of 'Health Stretching'</li> <li>• Dietary life guide               <ul style="list-style-type: none"> <li>- Cooking guide</li> <li>- Menu guide</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 'Health Stretching' and 'Health Plus Stretching'</li> <li>• How to cook grains</li> <li>• How to cook meat/fish/egg/beans</li> <li>• How to cook vegetables</li> </ul>
4 <sup>th</sup> (6 <sup>th</sup> week)	<ul style="list-style-type: none"> <li>• Dietary life guide</li> <li>• Overall review</li> </ul>	<ul style="list-style-type: none"> <li>• 'Health Stretching' and 'Health Plus Stretching'</li> <li>• How to cook fruits</li> <li>• How to cook milk and dairy products</li> <li>• Standard menus for the aged who have the difficulty of chewing and swallowing</li> </ul>

developed (Fig. 2) by reviewing articles in Korea and foreign countries<sup>4,10,11,13</sup> and by consulting with 15 experts, including occupational therapists, clinical dietitians, food science professors, and dentists. Booklets and leaflets were created for educational purposes. Checklist books were prepared and utilized for regular implementation as exercise guides. Reminder messages about exercise and stretching guidelines were sent at 11:30 a.m. every day during the implementation of the educational program; related materials were posted in welfare centers, and demonstrations were given four times (Table 1).

## Measures

### Demographic characteristics

Surveys of the experimental and control groups were conducted, and height and weight measurements were taken for all participants. General characteristics, including age, gender, and perceived health status, were asked in the survey. Height (cm) was measured up to 0.1 cm, and body weight (kg) was measured up to 0.1 kg. Body mass index (BMI) was calculated based on the participants' height and weight. Perceived health status checked by the questionnaire about health conditions was also assessed.

### Knowledge about chewing and swallowing

Knowledge about chewing and swallowing was measured before and after administering the educational program by asking participants questions about attitudes and behaviors related to chewing and swallowing. These questions included 10 items based on research about chewing and swallowing (Cronbach's  $\alpha = 0.624$ ). Knowledge scores were calculated with 1 point for a correct answer and 0 points for an incorrect answer or no answer.

### Eating habits related to chewing and swallowing

Each participant was asked twelve questions on eating habits. These items were based on previous research on eating habits regarding chewing and swallowing (Cronbach's  $\alpha = 0.654$ ). Participants indicated agreement with each statement on a 4-point scale ranging from 0 (never) to 3 (always). Questions included statements such as "I eat vegetables every day" and "I eat fruits every day."

### Attitudes related to chewing and swallowing

Five questions on attitudes toward chewing and swallowing were asked to participants. These items were

based on previous researches on chewing and swallowing<sup>2,7,16</sup> (Cronbach's  $\alpha = 0.843$ ). Participants indicated their level of agreement with each statement on a 4-point scale (1 = strongly disagree, 4 = strongly agree).

### Dietary consumption

Dietary consumption changes were evaluated using the 24-hour recall method. To accurately estimate the amount of food consumed, a full-scale food model, bowls, and photographs were used. A trained researcher examined all the food and snacks consumed each day by participants. Dietary consumption was calculated by CAN-Pro (ver. 4.0), a computer-aided nutritional analysis software developed by the Korean Nutrition Society.

### Educational program satisfaction

Program satisfaction, including educational content and intention to participate in the future, were measured. The satisfaction survey was not given to the control group. Likert-type scales were used to measure program satisfaction, and participants rated items on a 4-point scale: 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree.

## Data analysis

All data were analyzed using IBM SPSS statistical software, version 18.0 (SPSS Inc, Chicago, IL, USA). To verify the consistency of research instruments, we measured reliability by calculating Cronbach's  $\alpha$  values. All data were subjected to descriptive statistics analysis. McNemar's test and paired t-tests were used to analyze the difference between before and after the administration of the educational program. A significant level of  $p < 0.05$  was established.

## Results

### General characteristics of participants

The experimental group consisted of 11 men (40.7%) and 16 women (59.3%), and the control group consisted of 14 men (53.8%) and 12 women (46.2%). The proportion of respondents who answered that their health condition was bad and very bad was 48.1% in the experimental group and 15.3% in the control group. On the other hand, the proportion of respondents who answered that their health status was good and very good was 14.8% in the experimental group, and 46.2% in the control group. This

**Table 2.** General character of the respondents before program (n (%) or mean  $\pm$  SD)

Character	Experimental group (n = 27)	Control group (n = 26)	t-value <sup>1)</sup>
Gender			
Men	11 (40.7)	14 (53.8)	0.913
Women	16 (59.3)	12 (46.2)	
Age			
65 ~ 74	5 (18.5)	14 (53.8)	7.188**
$\geq 75$	22 (81.5)	12 (46.2)	
Average	78.5 $\pm$ 4.5	75.0 $\pm$ 5.6	21.274*
Perceived health status			
Very bad	1 (3.7)	3 (11.5)	16.695**
Bad	12 (44.4)	1 (3.8)	
Fair	10 (37.0)	10 (38.5)	
Good	3 (11.1)	12 (46.2)	
Very good	1 (3.7)	0 (0.0)	
Average	2.7 $\pm$ 0.9	3.2 $\pm$ 1.0	-2.059*
Height (m)	1.6 $\pm$ 0.1	1.6 $\pm$ 0.1	-2.145*
Weight (kg)	58.5 $\pm$ 11.8	63.2 $\pm$ 10.2	-1.536
BMI (kg/m <sup>2</sup> )			
Underweight (< 18.5)	2 (7.4)	0 (0.0)	5.151
Normal (18.5 ~ 22.9)	14 (51.9)	12 (46.2)	
Overweight (23 ~ 24.9)	6 (22.2)	5 (19.2)	
Obese I (25 ~ 29.9)	4 (14.8)	9 (34.6)	
Obese II (30 ~ 39.9)	1 (3.7)	0 (0.0)	
Average	23.2 $\pm$ 3.4	23.8 $\pm$ 2.9	-0.693

1) by  $\chi^2$ -test or Student's t-test

\* p &lt; 0.05, \*\* p &lt; 0.01

**Table 3.** The knowledge<sup>1)</sup> change between before and after the educational program<sup>1)</sup> (n (%) or mean  $\pm$  SD)

Items	Experimental group (n = 27)			Control group (n = 26)		
	Before	After	p <sup>3)</sup>	Before	After	p <sup>3)</sup>
You can prevent choking if you slightly bend your heads while eating	11 (40.7)	25 (92.6)	0.001**	6 (23.1)	7 (26.9)	1.000
It is helpful to lie down for 30 minutes when you get choked while eating	6 (22.2)	20 (74.1)	0.001**	13 (50.0)	11 (42.3)	0.774
It is better to eat cooked rice in water or soup when you are having difficulties with swallowing	1 (3.7)	12 (44.4)	0.003**	2 (7.7)	1 (3.8)	1.000
It is better to abstain from meat if you are having difficulties with chewing and swallowing	11 (40.7)	16 (59.3)	0.267	14 (53.8)	8 (30.8)	0.109
Drinking water while eating is helpful to prevent choking	7 (25.9)	18 (66.7)	0.003**	6 (23.1)	8 (30.8)	0.754
Difficulty in chewing and swallowing can lead to deficiency of vitamin intake	9 (33.3)	19 (70.4)	0.013*	7 (26.9)	10 (38.5)	0.453
It is better to eat hard-boiled rice rather than soft-boiled rice if you are having difficulties with chewing and swallowing	16 (59.3)	17 (63.0)	1.000	22 (84.6)	22 (84.6)	1.000
It is better to eat clear soup rather than thick soup if you are having difficulties with chewing and swallowing.	15 (55.6)	20 (74.1)	0.227	7 (26.9)	5 (19.2)	0.687
When eating hard vegetables like carrots, you'd better eat them after cooking	20 (74.1)	26 (96.3)	0.070	23 (88.5)	24 (92.3)	1.000
It is better to drink yogurt and eat it with a spoon if you are having difficulties with swallowing	5 (18.5)	19 (70.4)	0.001**	5 (19.2)	6 (23.1)	1.000
Total (10 points) <sup>2)</sup>	3.7 $\pm$ 2.0	7.1 $\pm$ 1.8	< 0.001***	4.0 $\pm$ 1.5	3.9 $\pm$ 1.4	0.729

1) Percentage of respondents who correctly answered questions of nutrition knowledge 2) 0 point = incorrect or I do not know, 1 point = correct 3) p-value by McNemar test and paired t-tests

\* p &lt; 0.05, \*\* p &lt; 0.01, \*\*\* p &lt; 0.001

indicates that the control group perceived their health condition more positively than the experimental group did ( $p=0.002$ ). There was a significant difference in height between the two groups; however, BMI did not show any significant differences (Table 2).

### Knowledge about chewing and swallowing

In the experimental group, the number of questions answered correctly significantly improved from 3.7 to 7.1 out of 10 items, before and after the educational program ( $p<0.001$ ). The percentage of correct answers for the following items increased significantly after the program: “You can prevent choking if you slightly bend your head

while eating” (40.7 % to 92.6 %), “It is helpful to lie down for 30 minutes when you get choked while eating” (22.2% to 74.1%), and “It is better to drink yogurt and eat it with a spoon if you are having difficulties with swallowing” (18.5% to 70.4%). In contrast, the number of questions answered correctly by the control group was 4.0 before the program and 3.9 after the program, indicating no improvements (Table 3).

### Eating habits related to chewing and swallowing

The scores of the experimental group concerning eating habits related to chewing and swallowing showed statistically significant increases from 21.85 to 28.33 points ( $p<0.001$ ).

**Table 4.** The change of eating habits related to chewing and swallowing between before and after the educational program<sup>1)</sup> (mean  $\pm$  SD)

Items	Experimental group (n = 27)			Control group (n = 26)		
	Before	After	t-value <sup>2)</sup>	Before	After	t-value <sup>2)</sup>
I ate vegetables every day	2.33 $\pm$ 0.92	2.70 $\pm$ 0.54	-2.431*	2.85 $\pm$ 0.46	2.81 $\pm$ 0.57	0.254
I ate fruits every day	2.04 $\pm$ 1.06	2.37 $\pm$ 0.84	-2.082*	2.00 $\pm$ 0.98	2.08 $\pm$ 1.06	-0.570
I ate meat, fish, beans and so on as side dishes every day	1.59 $\pm$ 0.84	1.85 $\pm$ 0.82	-1.192	2.08 $\pm$ 0.85	2.15 $\pm$ 0.88	-0.337
I ate dairy products like milk or yogurt every day	1.37 $\pm$ 1.08	1.52 $\pm$ 1.12	-0.700	1.85 $\pm$ 1.19	1.62 $\pm$ 1.30	1.140
I ate three meals a day regularly	2.63 $\pm$ 0.79	2.89 $\pm$ 0.42	-1.568	2.27 $\pm$ 1.04	2.42 $\pm$ 0.99	-1.280
I had a balanced diet	1.89 $\pm$ 1.22	2.67 $\pm$ 0.68	-3.083**	1.96 $\pm$ 1.04	1.88 $\pm$ 1.14	0.420
I did warm-ups (mouth and tongue exercises) before having a meal	0.30 $\pm$ 0.78	2.19 $\pm$ 1.21	-7.174***	0.54 $\pm$ 1.03	0.50 $\pm$ 1.11	0.328
I had my meal with a correct posture	1.78 $\pm$ 1.25	2.37 $\pm$ 0.97	-2.126*	2.62 $\pm$ 0.75	2.27 $\pm$ 1.04	1.671
I ate slowly, chewing my food well	1.63 $\pm$ 1.25	2.48 $\pm$ 0.98	-3.426**	2.08 $\pm$ 1.16	1.92 $\pm$ 1.32	0.610
I was seated for about 30 minutes after meals	1.93 $\pm$ 1.21	2.19 $\pm$ 1.04	-0.908	1.54 $\pm$ 1.27	1.73 $\pm$ 1.22	-0.655
I cooked the hard and tough food until it was soft	1.56 $\pm$ 1.16	2.41 $\pm$ 0.84	-3.349**	1.31 $\pm$ 1.32	1.81 $\pm$ 1.33	-1.612
I brushed my teeth after meals	2.81 $\pm$ 0.48	2.70 $\pm$ 0.61	0.901	2.46 $\pm$ 0.95	2.23 $\pm$ 1.14	1.063
Total (36 points)	21.85 $\pm$ 5.75	28.33 $\pm$ 5.22	-5.530***	23.54 $\pm$ 4.84	23.42 $\pm$ 5.03	0.127

1) 0 = never, 1 = sometimes (2 ~ 3 times per week), 2 = usually (3 ~ 5 times per week), 3 = always (6 ~ 7 times per week) 2) by paired t-test

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 5.** The change of the attitude related to chewing and swallowing between before and after the educational program<sup>1)</sup> (mean  $\pm$  SD)

Items	Experimental group (n = 27)			Control group (n = 26)		
	Before	After	t-value <sup>2)</sup>	Before	After	t-value <sup>2)</sup>
I will try not to eat food difficult to chew and swallow	3.15 $\pm$ 0.60	3.15 $\pm$ 0.86	0.000	3.04 $\pm$ 0.77	2.96 $\pm$ 0.66	0.527
I will try to increase my ability to chew and swallow	3.30 $\pm$ 0.61	3.52 $\pm$ 0.75	-1.803	3.15 $\pm$ 0.68	3.04 $\pm$ 0.66	1.000
I will seek expert advice when I have a problem with chewing and swallowing	2.89 $\pm$ 0.80	3.41 $\pm$ 0.80	-2.762*	2.73 $\pm$ 0.92	2.73 $\pm$ 0.67	0.000
I will change the cooking method when I have a problem with chewing and swallowing	3.15 $\pm$ 0.66	3.44 $\pm$ 0.70	-1.986	2.85 $\pm$ 0.73	2.85 $\pm$ 0.78	0.000
To chew and swallow better, I will exercise before I eat a meal	2.70 $\pm$ 0.87	3.22 $\pm$ 0.80	-2.762*	2.50 $\pm$ 0.91	2.38 $\pm$ 0.85	0.570
Total (20 points)	15.19 $\pm$ 2.70	16.74 $\pm$ 2.74	3.678*	14.27 $\pm$ 3.23	13.96 $\pm$ 2.63	0.617

1) 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree 2) by paired t-test

\*  $p < 0.05$

In the control group, there were no significant changes (Table 4). Scores for the following items increased significantly after the program: “I ate vegetables every day” ( $p = 0.022$ ), “I ate fruits every day” ( $p = 0.047$ ), “I had a balanced diet” ( $p = 0.005$ ), “I did warm-ups (mouth and tongue exercises) before having a meal” ( $p < 0.001$ ), “I had my meal with a correct posture” ( $p = 0.043$ ), “I ate slowly, chewing my food well” ( $p = 0.002$ ), and “I cooked the hard and tough food until it was soft” ( $p = 0.002$ ).

#### Attitudes related to chewing and swallowing

Changes in attitudes toward chewing and swallowing are shown in Table 5. The experimental group scored 15.19 (out of 20 points) before the program, and 16.74 after

the program, representing a significant increase ( $p = 0.016$ ). In addition, significant improvements in responses to the following items were found: “I will seek expert advice when I have a problem with chewing and swallowing” (2.89 to 3.41) and “To chew and swallow better, I will exercise before I eat a meal” (2.70 to 3.22).

#### Dietary consumption

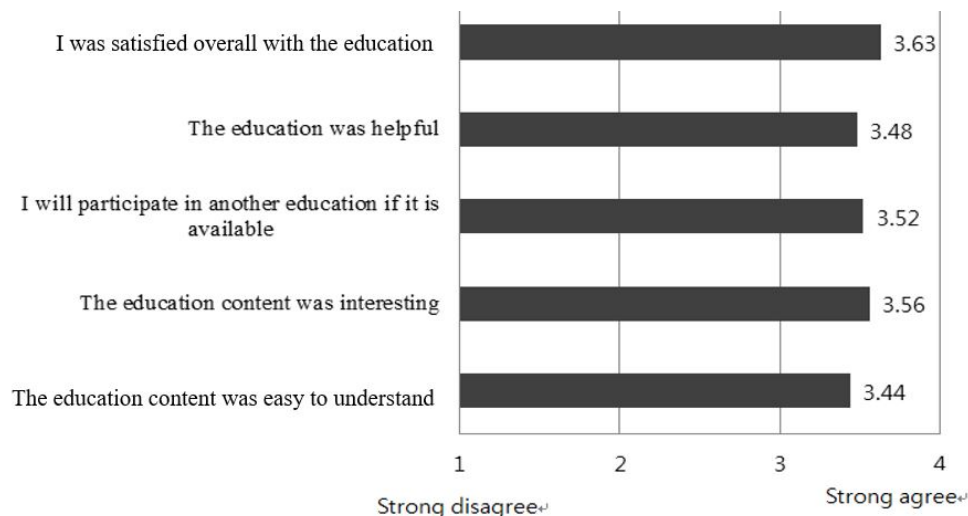
Changes in dietary consumption are shown in Table 6. There were no changes in nutrient consumption, except for carbohydrates, between before and after the program. In the control group, the intake of carbohydrates ( $p = 0.013$ ) increased over the same period.

**Table 6.** The change of dietary consumption between before and after educational program<sup>1)</sup> (mean  $\pm$  SD)

Nutrients	Experimental group (n = 27)			Control group (n = 26)		
	Before	After	t-value <sup>2)</sup>	Before	After	t-value <sup>2)</sup>
Energy (kcal)	1,347.76 $\pm$ 550.90	1,227.00 $\pm$ 511.61	0.960	1,513.67 $\pm$ 635.39	1,644.80 $\pm$ 522.99	-1.104
Protein (g)	53.73 $\pm$ 28.33	44.24 $\pm$ 17.29	1.820	62.54 $\pm$ 31.45	64.19 $\pm$ 26.10	-0.295
Fat (g)	22.50 $\pm$ 18.99	22.10 $\pm$ 18.29	0.099	34.76 $\pm$ 28.64	31.44 $\pm$ 14.73	0.593
Carbohydrate (g)	232.26 $\pm$ 102.58	220.51 $\pm$ 94.11	0.517	233.64 $\pm$ 69.62	277.94 $\pm$ 81.37	-2.659*
Calcium (mg)	388.86 $\pm$ 233.82	350.13 $\pm$ 179.26	0.803	575.00 $\pm$ 391.49	505.52 $\pm$ 297.03	0.759
Iron (mg)	13.37 $\pm$ 7.28	14.36 $\pm$ 7.41	-0.530	14.74 $\pm$ 6.91	16.87 $\pm$ 7.53	0.759
Sodium (mg)	3,268.75 $\pm$ 2,056.21	2,532.86 $\pm$ 1,108.29	1.640	4,121.39 $\pm$ 1,844.19	3,779.48 $\pm$ 1,984.22	0.988
Potassium (mg)	2,201.01 $\pm$ 1,237.25	2,308.15 $\pm$ 958.38	-0.438	2,665.66 $\pm$ 1,064.47	3,068.94 $\pm$ 1,279.80	-1.679
Vitamin A ( $\mu$ gRE)	638.30 $\pm$ 572.15	969.33 $\pm$ 808.34	-1.973	672.78 $\pm$ 568.67	989.59 $\pm$ 556.71	-2.006
Thiamine (mg)	0.94 $\pm$ 0.49	0.94 $\pm$ 0.69	0.011	1.06 $\pm$ 0.40	0.99 $\pm$ 0.39	0.696
Riboflavin (mg)	0.86 $\pm$ 0.62	0.90 $\pm$ 0.61	-0.280	1.07 $\pm$ 0.46	1.15 $\pm$ 0.47	-0.712
Niacin (mg)	12.66 $\pm$ 8.26	10.02 $\pm$ 5.55	1.426	13.21 $\pm$ 6.44	13.03 $\pm$ 5.52	0.130
Vitamin C (mg)	68.65 $\pm$ 49.60	71.59 $\pm$ 37.81	-0.272	76.77 $\pm$ 45.44	122.91 $\pm$ 68.40	-2.720

1) by paired t-test

\*  $p < 0.05$



**Fig. 3.** Satisfaction of participants with the educational program (n = 27)

### Educational program satisfaction

Satisfaction of participants with the educational program was noticeable. The average score in overall satisfaction was 3.63, out of 4 points. In addition, participants rated their interest in the program 3.56, out of 4 points, and rated their intention to participate in future programs as 3.52, out of 4 points (Fig. 3).

## Discussion

Dysphagia problems are crucial issues that negatively affect the nutritional condition of older adults. For this reason, it is necessary to create programs that help older adults prevent chewing and swallowing problems through self-action. The purpose of this study was to develop a program to improve chewing and swallowing abilities, increase knowledge about eating behaviors, and preemptively identify those older adults at risk for dysphagia.

Because the experimental and control groups were sampled for convenience and composed of voluntary participation, both groups showed significant differences in age, height, and perceived health status. In particular, the experimental group had older individuals, less height, and worse health status.

The results of this study indicate that the educational program significantly increased knowledge about dysphagia in older adults ( $p < 0.001$ ). Even though early detection of chewing and swallowing dysfunction is important, most older adults regard dysphagia symptoms as a normal part of the aging process.<sup>4</sup> Therefore, detection of these problems tends to be delayed. The educational program developed in this study can be effectively provided to older adults that are unaware of dysphagia risks.

In addition, the educational program resulted in changes in attitudes toward “exercise” before meals. This shows that the program is useful to generate positive behavioral changes in older adults with dysphagia by improving their attitudes about passive treatment.<sup>14</sup> However, other attitudes such as diet control, recipe change, and personal effort in chewing and swallowing revealed no significant overall improvements. These results could be explained because participants experienced directly only exercises and professional instruction during the program. Direct experience seems to be important for changing the attitudes of older adults. Therefore, it could be helpful to include time to plan and cook their own meals during the program.

The eating behaviors of the experimental group significantly improved after the program, and consumption of fruits and vegetables increased. Large improvements were found in “warming up” before a meal, swallowing in an upright position, eating slowly and chewing well, and making hard and tough food soft.

Unfortunately, it is difficult to compare the results of this study to previous research since no similar programs have been developed or examined. Kim et al. evaluated the effect of an oral health exercise program on 97 older adults over the course of three months.<sup>16</sup> Results revealed that consumption of minor nutrients increased after the program. The program was also effective in providing guidance on safe swallowing and chewing. Although it is difficult to change long-ingrained eating behaviors, these programs are thought to affect short-term changes in behavior. Further research about the program’s effectiveness in regard to maintaining and increasing altered eating behaviors is needed.

Discomfort while chewing food was mitigated through a customized integrated management program. Choking and coughing were also reduced. This was due to the program’s exercise guidelines, which were to maintain and improve basic chewing and swallowing abilities through an oral exercise program that generates improvement through alternative strategies, such as promoting a safe swallowing posture and introducing cooking methods that make food easy to swallow. No previous studies have included these components. However, Lee reported that oral function improved in 52 elderly patients after three months of oral exercise.<sup>17</sup> Yang et al. also reported that a 12-week function improvement program had positive effects on oropharyngeal function in 64 elderly participants.<sup>18</sup>

Participants in the experimental group were highly satisfied with all aspects of this program. General satisfaction was the highest aspect, followed by content satisfaction. All participants in this program were at risk for dysphagia, suffered from daily symptoms, and were not educated or informed about chewing and swallowing issues. Participants were satisfied with this program because it instructed them about their problems, allowed them to take some control over age-related complications, and was easy to apply.

There are several limitations to this study. There are few comparisons to this educational program, making it difficult to determine its effectiveness compared to other



options. In addition, the research period was limited, resulting in limited sampling and variability of socioeconomic status, weight, height, food intake, and daily lifestyle among participants. The duration of the educational program operation was short, which may not be sufficient time to detect changes. Another limitation was the sample's degree of representation and generalizability. The sample used in this study was recruited by convenient sampling, which may have limited the characteristics of the resulting data. Although this may have affected older adults' disease status, this study did not investigate chronic diseases in this population.

Despite these limitations, this research is important because it is the first time that a nutritional education program to prevent dysphagia in older adults has been developed and evaluated. In general, older adults are willing to follow a healthy lifestyle and comply with medical recommendations.<sup>19</sup> Therefore, the educational program developed in this study could be used as a standard program for older adults that are at risk for chewing and swallowing difficulties.

The educational program to improve the dietary quality of community-dwelling older adults at risk for dysphagia developed in this study resulted in significant improvements in participants' eating behaviors, and their knowledge and attitudes regarding dysphagia. Additionally, participants were satisfied with the program. This educational program makes it possible to detect and prevent chewing and swallowing difficulties in older adults; moreover, the cost of the program is likely to be less than the medical expenses resulting from health complications produced by chewing and swallowing problems.

## SUMMARY

This study developed an educational program for improving the dietary quality of community-dwelling older adults with risk of dysphagia in South Korea. To evaluate the program, we conducted an intervention program with 27 participants in the experimental group and 26 participants in the control group, all aged 65 years or older and with risk of dysphagia. We examined changes in participants' knowledge level, dietary behavior, and attitude score concerning dysphagia risk before and after the educational program. The nutrition intake of participants was measured. There were significant differences in

knowledge level, dietary behavior, and attitude in the experimental group; however, there were no significant differences in the control group regarding these aspects. In terms of nutrition intake, both groups did not change. This research is the first study to develop and analyze a nutritional program to prevent dysphagia in older adults whose contribution made it possible to detect and prevent chewing and swallowing difficulties in older adults. This study proposes an effective educational program for the management of dietary quality in older adults who are at risk of dysphagia, supporting their lives in the community and promoting healthy dietary intake.

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