Research Square

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Relationship between the Functional Oral Intake Scale and Self-efficacy Scale among Patients with Cancer: A Cross-sectional study

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Abstract

Background: A few studies suggest that self-efficacy pertaining to swallowing ability can lead to dysphagia. Therefore, this cross-sectional study verified the relationship between oral health-related self-efficacy and dysphagia severity during cancer treatment.

Methods: Participants included patients undergoing treatment for cancer at Shimane University Hospital, Shimane, Japan, and those receiving outpatient treatment at the hospital's Oral Care Center between August 2018 and April 2019. In all, 203 participants enrolled in the study and completed the Functional Oral Intake Scale (FOIS), Self-efficacy Scale for Advanced Cancer (SEAC), and Oral Health-related Self-Efficacy Scale for Patients with Cancer (OSEC).

Results: A multivariate analysis showed a statistically significant correlation between the low FOIS score category and the SEAC subscales of Activities of Daily Living Self-efficacy (ADE) (odds ratio 1.04, 95% confidence interval [CI] 1.00–1.07) and Symptom Coping Self-efficacy (SCE) (odds ratio 0.61, 95% [CI] 0.42–0.88). Based on the Jonckheere-Terpstra test, the SEAC and OSEC scores tended to increase as the FOIS category progressed.

Conclusion: These findings suggest that self-efficacy played an important role in dysphagia and it may affect the severity of dysphagia.

1. Background

In patients with cancer, it is highly likely that symptoms such as swallowing dysfunction (dysphagia) and appetite loss become a focus of supportive care [1]. Dysphagia may lead to greater distress for not only the patients with cancer but also their caregiver(s), especially if the intake of fluids and solids is discontinued or withheld [2]. Several factors can cause dysphagia in patients with cancer. It could significantly impact their physical and psychological wellbeing, and its management could become complex and multifactorial [3]. Numerous studies have reported dysphagia and appetite loss in patients with cancer (stomach, colorectal, lung, breast, and head/neck) [4–8]. Moreover, Frowen et al. [7] found that the following proportion of patients with 14 types of cancers reported dysphagic symptoms: any dysphagia (54%), dysphagia for liquids (20%), and dysphagia for solids (46%). Further, significantly more patients with head and neck cancer and significantly fewer patients with breast cancer reported dysphagia; however, there were no differences between other tumor types [7]. Additionally, dysphagia was associated with other symptoms, including taste changes, xerostomia, voice changes, smell changes, thick mucus, difficulty with teeth/dentures, mouth/throat pain, and trismus [7].

Dysphagia can be caused by any one or more of the following conditions: (1) severe neurological impairment (e.g., stroke, myasthenia gravis, and inflammatory myopathies), (2) structural damage (e.g., trauma caused by intubation or malignancies), (3) side-effects of a medication or toxic/drug, (4) presbyphagia, and (5) phagophobia [9]. It can not only lead to malnutrition, weight loss, and aspiration pneumonia but also affect health-related quality of life (HRQoL) and its psychological and social aspects

[10]. Youssof et al. reported that the severity of dysphagia had stronger associations with the mental rather than physical components of HRQoL in patients with oculopharyngeal muscular dystrophy [11]. The literature suggests that dysphagia may affect an individual on a psychological level, where risks of suffocation, severe coughing, and vomiting may increase anxiety and lower self-esteem [12]. From the social perspective, mealtimes may be very stressful, such that experiences such as visiting a restaurant may not be pleasant anymore [13, 14]. Furthermore, patients with dysphagia can become isolated, feel excluded by others, and experience anxiety and distress at mealtime [15].

However, dysphagia may not be determined by constitutional and functional factors. For instance, in stroke and laryngectomy patients with dysphagia, psychological aspects, such as self-efficacy, play an important role in rehabilitation and eating habits [16, 17]. In other words, what patients with dysphagia can or cannot eat is affected by their deglutition self-efficacy.

Bandura proposed that self-efficacy is an individual's expectation regarding the extent to which she/he can implement specific actions that are necessary for producing a specific result [18]. People's self-efficacy beliefs determine their emotions, thoughts, behaviors, and motives. In clinical practice, self-efficacy refers to patients' perceptions of their abilities to take actions required for improving and maintaining their health, such as controlling weight, engaging in physical activity, and controlling alcohol consumption [19–21]. In a prospective cohort study of 100 patients who had experienced either a transient ischemic attack or an ischemic stroke, Brouwer et al. found that baseline self-efficacy, as determined by the patient's responses to questionnaires, was the strongest predictor of his/her intention to adopt a healthy diet (95% CI, 0.23–0.75) [22].

Self-efficacy can be evaluated by several scales such as the General Self-Efficacy Scale (GSES) and Self-Efficacy for Advanced Cancer (SEAC). Hirai et al. described the SEAC as a scale designed specifically for oncology. It comprises 18 items across three factors (affect regulation self-efficacy, symptom coping self-efficacy, and activities of daily living self-efficacy)[23]. We developed the Oral Health-related Self-efficacy Scale for Cancer Patients (OSEC) in a previous study [24]. The OSEC is a 17-item scale comprising the following five subscales: Oral Function Self-efficacy (OFE; four items), Dental Visits Self-efficacy (DVE; three items), Adverse Effects Self-efficacy (AEE; four items), Symptom Coping Self-efficacy (SCE; three items), and Brushing Habits Self-efficacy (BHE; three items). A randomized controlled trial by Gillham and Endacott proved that preventive intervention, which consisted of providing patients with additional counseling, motivational interviewing, and frequent telephone follow-ups after suffering a minor stroke, enhanced their self-efficacy [25]. Of the 52 patients enrolled in the trial, half received this intervention, while the control group received "conventional care." On an average, patients in the "enhanced secondary prevention group" increased their consumption of fruits and vegetables by 7.6 servings per week, while those in the control group only increased it by 2.0 servings per week ($p = 0.03$), indicating that enhancing self-efficacy had a significant impact on the dietary choices of patients who had experienced a stroke [25].

However, only a few studies have explored if self-efficacy related to swallowing ability could lead to dysphagia in patients with cancer. Therefore, in the present cross-sectional study, we examined the relationship between self-efficacy and dysphagia severity during cancer treatment using.

2. Methods

This study used the same data set as that used in a previous study [24]. However, the purpose and statistical analysis are different from this cross-sectional study.

2.1. Participants

This study included participants from the population of patients with cancer who were being treated at Shimane University Hospital, Shimane, Japan, and who received outpatient treatment at the hospital's Oral Care Center. The inclusion criteria were (1) being treated for cancer at Shimane University Hospital, (2) receiving outpatient treatment at the Oral Care Center, Shimane University Hospital, (3) being aged 20 years or older, and (4) being able to complete the self-administered written questionnaire. The exclusion criteria were (1) currently being treated for a mental disorder and (2) having a history of mental disorder.

Data were collected from August 2018 to April 2019. Participants were recruited using a sequential sampling method.

2.2. Ethical Considerations

The medical ethics committee of Shimane University Faculty of Medicine approved this study (approval number 3243). Written informed consent was obtained from the 203 individual participants enrolled in the study.

2.3. Measurements

The surveyed items were as follows: patient characteristics (age, gender, body mass index [BMI], alcohol consumption, Brinkman index, number of co-residents, employment), underlying characteristics of solid cancer (primary tumor site, cancer stage, treatment type, number of months since last treatment, Eastern Cooperative Oncology Group Performance Status), and intraoral findings (number of teeth, dentures, brushing times per day, family dentist, dental visit[s] since last year).

2.3.1. Functional Oral Intake Scale (FOIS)

Oral intake and nutritional status were assessed using the FOIS. Scores ranged from one to seven, with higher scores indicating better swallowing function (Table 1) [26].

Table 1
The Functional Oral Intake Scale (FOIS)

Score	Performance	Implication	Deficit
1	Aspirates saliva/Tube dependent	Nothing by mouth	Profound
2	Tube dependent	Nothing by mouth/Minimal trials	Profound
3	Tube dependent	Full trials by mouth	Severe
4	Total oral	Single texture trials	Moderate
5	Total oral	Multiple texture trials	Mild
6	Total oral	By mouth/restrictions	Minimal
7	Regular diet	By mouth/No restrictions	None

2.3.2. Self-efficacy Scale for Advanced Cancer (SEAC)

The SEAC is an 18-item scale comprising the following three subscales: Symptom Coping Self-efficacy (SCE), Activities of Daily Living Self-efficacy (ADE), and Affect Regulation Self-efficacy (ARE). Each subscale includes six items on an 11-point response scale ranging from zero = not at all confident to 10 = totally confident. The final subscale scores are calculated by summing the scores of each subscale.

2.3.3. Oral Health-related Self-Efficacy Scale for Patients with Cancer (OSEC)

The OSEC is a 17-item scale comprising the following five subscales: Oral Function Self-efficacy (OFE) (four items), Dental Visits Self-efficacy (DVE) (three items), Adverse Effects Self-efficacy (AEE) (four items), Symptom Coping Self-efficacy (SCE) (three items), and Brushing Habits Self-efficacy (BHE) (three items). Responses are made on a four-point Likert scale ranging from 1 = not at all confident to 4 = totally confident. The scores on individual items within subscales are summed to obtain total subscale scores [24].

2.4. Statistical Analysis

There is no missing data and all statistical analyses were performed using SPSS (ver. 26; SPSS Japan Inc., Tokyo Japan). We calculated two-tailed p-values in all the analyses. The alpha level of significance was set at 0.05. The participants' characteristics were analyzed using descriptive statistics.

The grade of FOIS was categorized as Level 1 to 6 (Low FOIS) or Level 7 (High FOIS) based on the presence or absence of restrictions. In the inferential analysis, the Chi-squared test was used to compare proportions, while the Mann-Whitney U test was used to examine the non-parametric quantitative determinations of two groups. The correlation of each variable with FOIS grade was tested by a stepwise multivariate logistic regression analysis.

Additionally, for subgroup analysis, the FOIS grade was categorized as Level 1 to 3 (poor FOIS: tube feeding), Level 4 and 5 (moderate FOIS: total oral diet requiring special preparation) or Level 6 and 7 (good FOIS: total oral diet without special preparation). For verifying the stepwise increase or decrease in correlations between the FOIS and SEAC or OSEC's different subscales, the Jonckheere-Terpstra test was used as a trend test.

3. Results

3.1. Participants' characteristics

Table 2 presents the characteristics of the participants (*n* = 203). The median age was 71 years (male: 63.5%, female: 36.5%). The median BMI was 21.7 kg/m^2. The median number of days of alcohol consumption per week was 0 (range: 0–7) days and the Brinkman Index was 0 (range: 0–4480). The median number of co-residents was 2 (0–7). About 72 (35.5%) and 131 (64.5%) patients were employed and unemployed, respectively.

Table 2
Participants' characteristics (n = 203)

Variable	Percentage (n)	Median (range)
Age (year)		71 (34–93)
Gender		
Male	63.5 (129)	
Female	36.5 (74)	
Body Mass Index (kg/m^2)		21.7 (19.7–38.7)
Alcohol consumption per week (day)		0 (0–7)
Brinkman Index		0 (0–4480)
Number of co-residents		2 (0–7)
Employed		
Yes	35.5 (72)	
No	64.5 (131)	
Primary tumor site		
Stomach	13.8 (28)	
Colorectal	12.3 (25)	
Liver	5.4 (11)	
Lung	32.0 (65)	
Prostate	10.3 (21)	
Breast	8.4 (17)	
Head/neck	17.7 (36)	
Cancer stage		
I	38.4 (78)	
II	19.2 (39)	
III	20.7 (42)	
IV	21.7 (44)	
Treatment type		
Surgery	59.6 (121)	

Variable	Percentage (n)	Median (range)
Radiotherapy	2.5 (5)	
Chemotherapy	8.4 (17)	
Surgery and radiotherapy	3.0 (6)	
Surgery and chemotherapy	14.8 (30)	
Chemotherapy and radiotherapy	4.9 (10)	
Surgery, chemotherapy, and radiotherapy	6.9 (14)	
Number of months since last treatment		0 (0–297)
Eastern Cooperative Oncology Group Performance Status		
0	59.6 (121)	
1	23.2 (47)	
2	5.9 (12)	
3	10.8 (22)	
4	0.5 (1)	
Number of teeth		22 (0–32)
Dentures		
Upper		
None	63.5 (129)	
Partial	20.2 (41)	
Full	16.3 (33)	
Lower		
None	65.5 (133)	
Partial	18.7 (38)	
Full	15.8 (32)	
Brushing times per day		
0	5.9 (12)	
1	23.6 (48)	
2	34.5 (70)	
3 or more	36.0 (73)	

Variable	Percentage (n)	Median (range)
Family dentist		
Yes	69.5 (141)	
No	30.5 (62)	
Dental visit(s)in the past year		
Yes	41.1 (84)	
No	58.6 (119)	
Functional Oral Intake Scale		
1	3.4 (7)	
2	0 (0)	
3	0.5 (1)	
4	3.4 (7)	
5	12.8 (26)	
6	23.2 (47)	
7	56.7 (115)	
Functional Oral Intake Scale (FOIS) Category 1		
High FOIS	43.3(88)	
Low FOIS	56.7 (115)	
Category 2		
Good FOIS	79.8(162)	
Moderate FOIS	35 (17.2)	
Poor FOIS	3 (6)	
Self-efficacy Scale for Advanced Cancer		
Affect regulation self-efficacy		58.3 (8–100)
Symptom coping self-efficacy		51.7 (2–100)
Activities of daily living self-efficacy		63.3 (2–100)
Total Score		1050 (70–1800)
Oral Health-related Self-Efficacy Scale for Patients with Cancer		

Variable	Percentage (n)	Median (range)
Brushing Habits Self-efficacy		8 (3–12)
Oral Function Self-efficacy		11 (5–16)
Dental visit Self-efficacy		8 (3–12)
Symptom Coping Self-efficacy		9 (3–12)
Adverse Effects Self-efficacy		10 (4–16)
Total Score		45 (30–68)

Stomach, colorectal, liver, lung, prostate, breast, and head/neck were the primary tumor site in 28 (13.8%), 25 (12.3), 11 (5.4%), 65 (32%), 21 (10.3%), 17 (8.4%), and 36 (17.7%) patients, respectively. Concerning the cancer stage, 78 (38.4%), 39 (19.2%), 42 (20.7%), and 44 (21.7%) patients were at stage I, II, III, and IV, respectively. The treatment type included surgery (n = 121; 59.6%); radiotherapy (n = 5; 2.5%); chemotherapy (n = 17; 8.4%); surgery and radiotherapy (n = 6; 3%); surgery and chemotherapy (n = 30; 14.8%); chemotherapy and radiotherapy (n = 10; 4.9%); and surgery, chemotherapy, and radiotherapy (n = 14; 6.9%). The median number of months in the past year treatment was 0 (range: 0–297). Eastern Cooperative Oncology Group Performance Status was Grade 0, 1, 2, 3, and 4 for 121 (59.6%), 47 (23.2%), 12 (5.9%), 22 (10.8%), and 1 (0.5%) patient, respectively.

The median number of teeth was 22 (range: 0–32). Regarding upper dentures, 129 (63.5%), 41 (20.2%), and 33 (16.3%) patients had no, partial, and full dentures, respectively. Regarding lower dentures, 133 (65.5%), 38 (18.7%), and 32 (15.8%) patients had no, partial, and full dentures, respectively. About 12 (5.9%), 48 (23.6%), 70 (34.5%), and 73 (36%) patients brushed their teeth 0, 1, 2, and 3 or more times per day, respectively. About 141 (69.5%) patients had a family dentist and 84 (41.4%) patients had made a dental visit(s) in the past year. Regarding FOIS level, 7 (13.4%), 0 (0%), 1 (0.5%), 7 (3.4%), 26 (12.8%), 47 (23.2%), and 115 (56.7%) patients had scores at Level 1, 2, 3, 4, 5, 6, and 7, respectively. In FOIS Category 1, 88 (43.3%) and 115 (56.7%) patients were in high and low FOIS, respectively. In FOIS Category 2, 162 (79.8%), 35 (17.2%), and 3 (6%) patients were in good, moderate, and poor FOIS, respectively. The median SEAC total score was 1050, while that for the ARE, SCE, and ADE subscales was 58.3, 51.7, and 63.3, respectively. The median OSEC total score was 45, and that for the BHE, OFE, DVE, SCE, and AEE subscales was 8, 11, 8, 9, and 10, respectively.

3.2. Comparison of high and low FOIS groups

Table 3 summarizes the variables compared between the high and low FOIS groups. Statistically significant differences were found in age, gender, BMI, Brinkman index, primary tumor site (lung, breast, and head/neck), cancer stage, treatment type (surgery; surgery and chemotherapy; surgery, chemotherapy, and radiotherapy), performance status, number of teeth, brushing times, family dentist, dental visit(s),

SEAC (ARE, ADE, and total score), and OEAC (OFE and total score). No significant differences were found in other variables.

Table 3
Comparison of the high versus low Functional Oral Intake Scale analysis of each item

Variable	Percentage (n) or Median (range)		p-value
	High FOIS (n = 88)	Low FOIS (n = 115)	
Age (year)	72 (34–93)	69 (36–91)	< 0.01*
Gender			
Male	66 (75)	63 (54.8)	< 0.01*
Female	22 (25)	52 (45.2)	
Body Mass Index (kg/m^2)	21.3 (15.2–28.8)	22.4 (19.3 38.7)	0.04*
Alcohol consumption per week (day)	0 (0–7)	0 (0–7)	0.45
Brinkman Index	160 (0–4160)	0 (0–4480)	< 0.01*
Number of co-residents	2 (0–7)	1 (0–7)	0.08
Employed			
Yes	30 (34.1)	42 (36.5)	0.77
No	58 (65.9)	73 (63.5)	
Primary tumor site			
Stomach	18 (20.5)	10 (8.7)	0.02
Colorectal	13 (14.8)	12 (10.4)	0.35
Liver	4 (4.5)	7 (6.1)	0.63
Lung	18 (20.5)	47 (40.9)	< 0.01*
Prostate	9 (10.2)	12 (10.4)	0.96
Breast	1 (1.1)	16 (13.9)	< 0.01*
Head/neck	25 (28.4)	11 (9.6)	< 0.01*
Cancer stage			
I	20 (22.7)	58 (50.4)	< 0.01*

Variable	Percentage (n) or Median (range)		p-value
	High FOIS (n = 88)	Low FOIS (n = 115)	
II	16 (18.2)	23 (20)	
III	21 (23.9)	21 (18.3)	
IV	31 (35.2)	13 (11.3)	
Treatment type			
Surgery	38 (43.2)	83 (72.2)	< 0.01*
Radiotherapy	1 (1.1)	4 (3.5)	0.29
Chemotherapy	10 (11.4)	7 (6.1)	0.18
Surgery and radiotherapy	4 (4.5)	2 (1.7)	0.24
Surgery and chemotherapy	18 (20.5)	12 (10.4)	0.05*
Chemotherapy and radiotherapy	6 (6.8)	4 (3.5)	0.28
Surgery, chemotherapy, and radiotherapy	11 (12.5)	3 (2.6)	< 0.01*
Number of months since last treatment	1 (0–297)	0 (0–216)	0.06
Eastern Cooperative Oncology Group Performance Status			
0	29 (33)	92 (80)	< 0.01*
1	31 (35.2)	16 (13.9)	
2	9 (10.2)	3 (2.6)	
3	18 (20.5)	4 (3.5)	
4	1 (1.1)	0 (0)	
Number of teeth	15 (0–32)	25 (0–32)	< 0.01*
Brushing times per day			
0	10 (11.4)	2 (1.7)	< 0.01*
1	27 (30.7)	21 (18.3)	
2	25 (28.4)	45 (39.1)	
3 or more	26 (29.5)	47 (40.9)	

Variable	Percentage (n) or Median (range)		p-value
	High FOIS (n = 88)	Low FOIS (n = 115)	
Family dentist			
Yes	46 (52.3)	95 (82.6)	< 0.01*
No	42 (47.7)	20 (17.4)	
Dental visit(s) in the past year			
Yes	25 (28.4)	59 (51.3)	< 0.01*
No	63 (71.6)	56 (48.7)	
Self-efficacy Scale for Advanced Cancer			
Affect regulation self-efficacy	50.8 (8–97)	61.7 (13–100)	< 0.01*
Symptom coping self-efficacy	50 (2–90)	53.3 (7–100)	0.07
Activities of daily living self-efficacy	52.5 (2–93)	68.3 (17–100)	< 0.01*
Total Score	915 (70–1640)	1100 (280–1800)	< 0.01*
Oral Health-related Self-Efficacy Scale for Patients with Cancer			
Brushing Habits Self-efficacy	8 (3–12)	8 (3–12)	0.31
Oral Function Self-efficacy	10 (5–16)	11 (5–16)	< 0.01*
Dental visit Self-efficacy	8 (3–12)	9 (3–12)	0.31
Symptom Coping Self-efficacy	9 (6–12)	9 (3–12)	0.96
Adverse Effects Self-efficacy	10 (4–16)	10 (4–16)	0.53
Total Score	44 (33–64)	46 (30–68)	0.05*

3.3. Multivariate analysis

The multivariate analysis showed a statistically significant correlation between the low FOIS score category and number of co-residents (odds ratio 0.70, 95% confidence interval [CI] 0.53–0.92), stomach cancer (odds ratio 5.05, 95% [CI] 1.01–25.33), colorectal cancer (odds ratio 42.74, 95% [CI] 5.71–319.92), liver cancer (odds ratio 46.95, 95% [CI] 3.77–584.4), lung cancer (odds ratio 37.13, 95% [CI] 7.62–181.1), prostate cancer (odds ratio 11.2, 95% [CI] 1.69–74.29), breast cancer (odds ratio 334.15, 95% [CI] 6.21–

17969.17), cancer stage (odds ratio 0.60, 95% [CI] 0.38–0.94), Eastern Cooperative Oncology Group Performance Status (odds ratio 0.52, 95% [CI] 0.31–0.90), number of teeth (odds ratio 1.16, 95% [CI] 1.09–1.23), family dentist (odds ratio 6.55, 95% [CI] 2.07–20.75), ADE score on the SEAC (odds ratio 1.04, 95% [CI] 1.00–1.07), and SCE score on the SEAC (odds ratio 0.61, 95% [CI] 0.42–0.88) (Table 4).

Table 4
Correlation between related factor(s) and High or Low Functional Oral Intake Scale by multivariate analysis

Variable	Regression coefficient	Wald	Significance probability	Odds ratio (95% confidence interval)	EXP (B)	
					Lower limit	Upper limit
Number of co-residents	-0.36	6.54	< 0.01*	0.70	0.53	0.92
Employed	-0.94	2.79	0.10	0.39	0.13	1.18
Stomach cancer	1.62	3.87	0.05*	5.05	1.01	25.33
Colorectal cancer	3.76	13.37	< 0.01*	42.74	5.71	319.92
Liver cancer	3.85	8.95	< 0.01*	46.95	3.77	584.4
Lung cancer	3.62	20.0	< 0.01*	37.13	7.62	181.1
Prostate cancer	2.42	6.27	< 0.01*	11.2	1.69	74.29
Breast cancer	5.81	8.17	< 0.01*	334.15	6.21	17969.17
Cancer stage	-0.52	4.98	0.03*	0.60	0.38	0.94
Radiotherapy	3.48	2.38	0.12	32.38	0.39	2674.8
Surgery and chemotherapy	-1.19	2.82	0.09	0.30	0.08	1.22
Eastern Cooperative Oncology Group Performance Status	-0.65	5.56	0.02*	0.52	0.31	0.90
Number of teeth	0.15	25.2	< 0.01*	1.16	1.09	1.23
Family dentist	1.88	10.21	< 0.01*	6.55	2.07	20.75
Activities of daily living self-efficacy	0.04	4.42	0.04*	1.04	1.00	1.07
Symptom Coping Self-efficacy	-0.49	7.04	< 0.01*	0.61	0.42	0.88
Constant	2.66	0.88	0.35	14.354		

* = $p < 0.05$. The analysis was adjusted for age and gender.

3.4. Sub group analysis (trend test)

The Jonckheere-Terpstra test revealed a stepwise increase in scores on each subscale of the SEAC (ARE, SCE, ADE, and total score) and OSEC (OFE and total score) with the progression of the FOIS category (Fig. 1–2). Specifically, as the FOIS category progressed, the SEAC and OSEC scores tended to increase.

4. Discussion

4.1. Generalizability from the demographic data

This study represents several factors of self-efficacy that affect the swallowing function. The prevalence of malnutrition in Europe and North America is 1–15% among non-institutionalized older adults, 25–60% among older adults in geriatric care facilities, and 35–65% among older adults in hospitals, and our sample presented the same level of prevalence (43.3%) [27]. Additionally, Frowen et al. reported similar characteristics (male: 49%; mean age: 59 years; tumor type: 20.5% hematology, 18.4% breast, 11.3% head and neck, 10% Gynecology, 8.8% upper gastrointestinal, 8.8% colorectal, 8.4% skin/melanoma, 4.6% bone soft tissue, 3.8% lung, 5.4% other; patient setting: 21.3% inpatient, 56.1% chemotherapy, 22.6% radiotherapy) and prevalence of patient-reported dysphagia (54%) [7]. However, most patients in the present sample had solid cancer and the most common treatment type was surgery, which may lead to a low prevalence of dysphagia as compared to that observed in the previous study. With reference to oral health status, previous studies reported that the prevalence of denture use was 15.9% (57.4% in our study), and that of dental visit(s) in the last 12 months was 52.1% (41.1% in our study) [28, 29]. The number of teeth reported in our study was lesser than that reported in other studies, which may affect OSEC and FOIS scores. Globally, we may be the first to report the FOIS score of general cancer patients; however, those with head and neck cancer tended to exhibit poor FOIS scores, which was consistent with the findings of previous studies [30, 31]. The study by Hirai et al. on self-efficacy (SEAC) in patients with advanced cancer showed similar results (ARE: 57.7–84.8, SCE: 53.6–61.2, ADE: 64.8–72.9). Thus, the generalizability of the present study was limited to patients with early-stage cancer undergoing initial treatment.

4.2. Comparison of the High and Low FOIS groups by swallowing function

The factors influencing swallowing functions were age, sex, BMI > 30, smoking status, alcohol use, cognitive factors (depression, anxiety, and psychological distress), eating habits (loss of appetite, mouth pain, complaints about the taste of the food, intake of dietary supplements, and ability to eat independently), medical factors (vision or hearing problems, constipation, heart failure, hip fracture, stroke, dementia, Parkinson’s disease, weight loss, frailty and number of medications taken in the past week, physical limitations, toxic habits, and cancer), social factors (highest level of education, income satisfaction, type of housing, number of cohabitants, and perceived satisfaction with social support) and dental status [32–37]. The factors reported in the present study have also been reported by previous studies, thus, our results on comparisons between high and low FOIS groups were not contradicted. Notably, there were significant differences between the high and low FOIS groups’ scores on the SEAC (ARE, ADE, and total score) and OSEC (OFE and total score). These may be new findings on self-efficacy-related factors that influence swallowing functions. Self-efficacy expectations are positively and significantly associated with the initiation and maintenance of healthy behaviors [38, 39]. Thus, self-

efficacy may determine the ability of cancer patients to eat or select appropriate food. Moreover, these abilities may influence the probability of weight loss, appetite loss, and recurrence of cancer [40]. The multivariate analysis conducted in the present study revealed factors associated with the FOIS category (number of co-residents, cancer type and stage, performance status, number of teeth, family dentist, and ADE and SCE scores on the SEAC). However, contrary to our expectations, OSEC scores were not associated with the swallowing function. According to Bandura, the development of self-efficacy related to an activity is based upon past successful experiences with that specific behavior [18]. Therefore, patients who experience these swallowing disorders after the deterioration of their ability to perform activities of daily living may have difficulty in drawing from past successful experiences, thus reducing their confidence in performing the swallowing function. In other words, there may be an underlying interaction between swallowing function and OSEC scores.

4.3. Trends in FOIS scores and self-efficacy

In the sub-group analysis, all subscales of the SEAC, and the OFE and total score on the OSEC showed a stepwise increase in FOIS score. Thus, self-efficacy showed a stepwise correlation with the FOIS score. More attention should be paid to the provision of care and coaching focused on defusing negative emotional experiences in each stage of dysphagia and self-efficacy. Our previous report showed the stepwise correlation between the HRQoL and FOIS score [31]. Therefore, such interventions may enhance the patient's confidence in their swallowing abilities.

4.4. Intervention for cancer patients suffering from swallowing dysfunction

Oral care containing rehabilitation of dysphagia and oral function, whether self-performed or performed by dentists and dental hygienists, is fundamental to the prevention of some adverse events (postoperative pneumonia, chemoradiotherapy-induced oral mucositis, taste disturbance, infection of the oral cavity, and swallowing disorder)[41]. Dysphagia is widely recognized as a common and debilitating side-effect of head and neck cancer (HNC) and its treatment; however, minimal attention has been given to dysphagia in patients with other types of cancer [3]. A review highlighted several methods of rehabilitation for dysphagia in head and neck cancer, and their effectiveness was evidenced by a randomized control trial [42]. However, most of the rehabilitation efforts for head and neck cancer patients with dysphagia focus on the pathophysiology of dysphagia, including objective assessment (videoendoscopic evaluation of swallowing, videofluoroscopic examination of swallowing, dysphagia severity scale, and the FOIS) [43]. However, a psychosocial approach should be emphasized for cancer patients with dysphagia. The food judged by the medical staff as edible is not the same as what the patients can or want to eat. In a prospective cohort study of 100 patients with either transient ischemic attack or ischemic stroke, Brouwer et al. found that baseline self-efficacy, as determined by patients' responses on questionnaires, was the strongest predictor of his/her intention to adopt a healthy diet (95% CI, 0.23–0.75)[22]. Thus, based on the aforementioned studies, it may be beneficial for hospitals' neurosurgery and neurology departments to coordinate long-term stroke coaching programs and assess patients' behavioral patterns to increase patients' adherence to healthy lifestyles. On the other hand, in patients with head and neck cancer, Roganie et al. reviewed only 15 (8 randomized) behavior change technique (BCT) reports, and they reported that BCTs used more frequently in effective interventions were: practical social support; behavioral practice; self-monitoring of behavior; and credible source, for example,

a skilled clinician delivering the intervention. As a result, swallowing interventions feature multiple components that may potentially impact outcomes [44]. These BCTs may improve the discrepancy of objective and subjective dysphagia.

This study had some limitations. First, our study design was cross-sectional; therefore we could not determine the causal relationship between dysphagia and self-efficacy. Particularly, we observed the stepwise tendency between self-efficacy and FOIS; however, it was evaluated only at a specific instance. Thus, a future study should verify the stepwise relationship between self-efficacy and FOIS using a longitudinal design. Second, the participants who visited the oral care center had good oral health-related knowledge and attitudes; therefore, it is likely that they represented a higher oral health related-self-efficacy. Therefore, selection bias might exist. Although we consider that observational studies cannot avoid such selection bias, we believe that our findings provide important suggestions for randomized controlled trials in the future, which would reveal the actual impact of self-efficacy.

5. Conclusion

Generally, self-efficacy played an important role in dysphagia and may affect the severity of dysphagia.

Abbreviations

FOIS: functional oral intake scale; SEAC: self-efficacy scale for advanced cancer; SCE: symptom coping self-efficacy; ADE: activities of daily living self-efficacy; ARE: affect regulation self-efficacy; OSEC: oral health-related self-efficacy scale for patients with cancer; OFE: oral function self-efficacy; DVE: dental visits self-efficacy; AEE: adverse effects self-efficacy; SCE: symptom coping self-efficacy; BHE: brushing habits self-efficacy; GSES: general self-efficacy scale; HRQoL: health-related quality of life; BMI: body mass index; CI: confidence interval; HNC: head and neck cancer; BCT: behavior change technique

Declarations

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Availability of data and materials

The datasets used and analyzed in this study are unavailable.

Ethics Approval and Consent to Participate

All study participants provided informed consent, and the appropriate ethics review board (the medical ethics committee of Shimane University Faculty of Medicine approved this study, approval number: 3243) approved the study design.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests in this study. No

financial or non-financial interests influenced the interpretation of the data

or presentation of the information.

Author Contributions

Conceptualization, Y.M.; data curation, Y.M.; formal analysis, Y.M.; funding acquisition, Y.M.; investigation, Y.M.; methodology, Y.M.; project administration, T.K. and M.K.; supervision, T.K. and M.K.; validation, T.K. and M.K.; visualization, Y.M., T.K., and M.K.; writing—original draft, Y.M.; writing—review and editing, T.K. and M.K. All authors read and approved the final manuscript.

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Figures

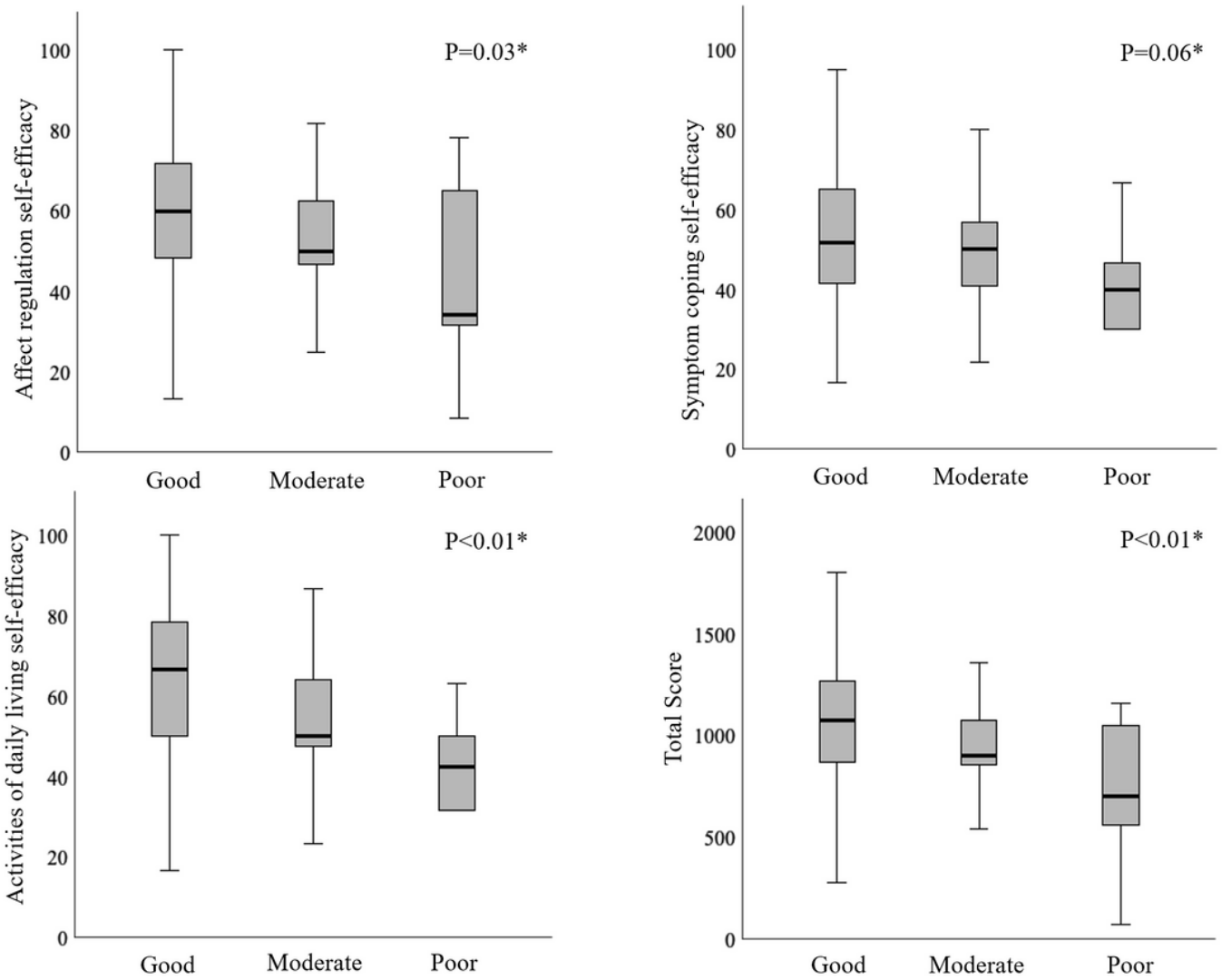

Figure 1

Stepwise correlation between the Self-efficacy Scale for Advanced Cancer and Functional Oral Intake Scale using the Jonckheere-Terpstra test

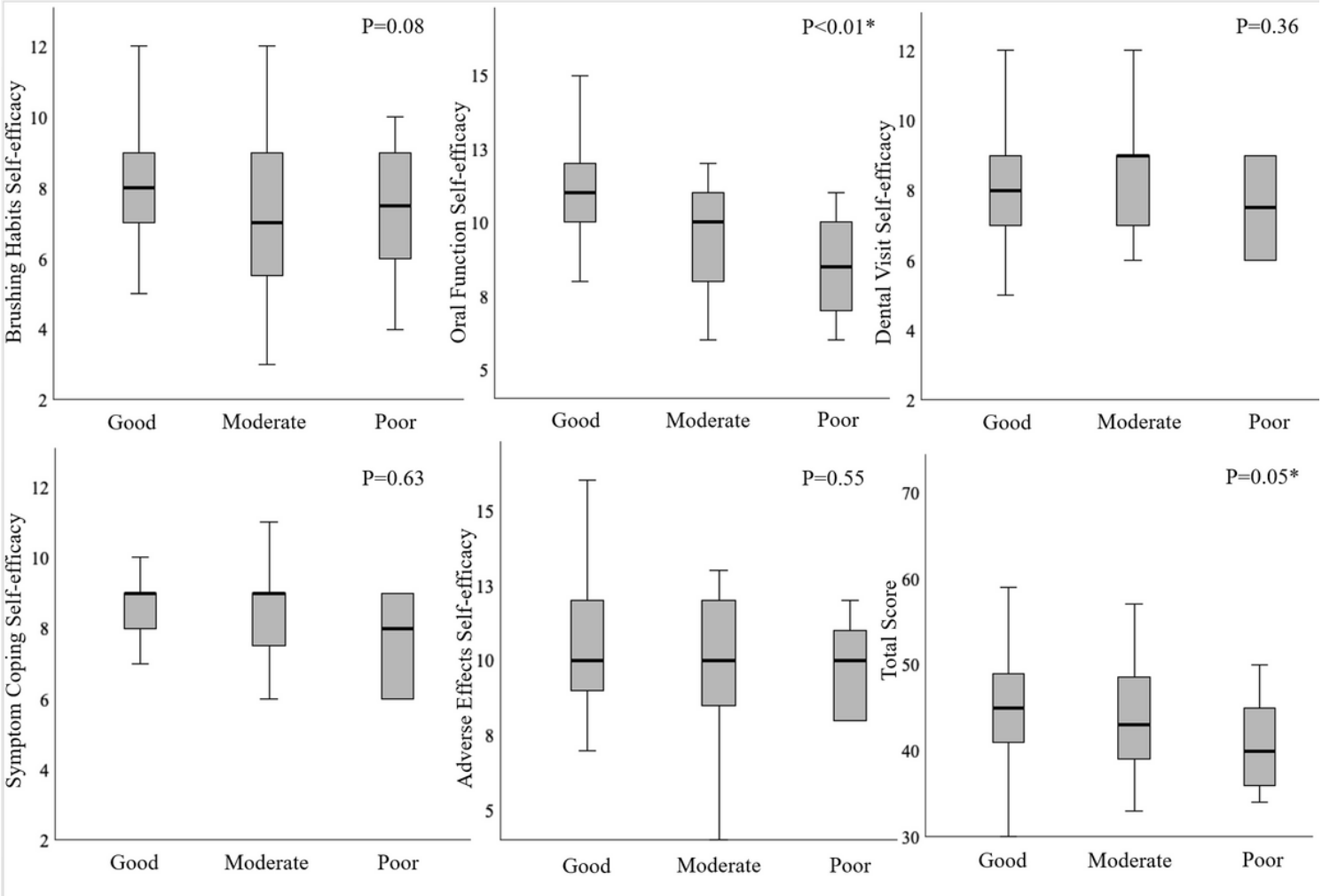

Figure 2

Stepwise correlation between the Oral Health-related Self-Efficacy Scale for Patients with Cancer and Functional Oral Intake Scale using the Jonckheere-Terpstra test

Supplementary Files

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