

## Original Article

## Factors affecting the change in fruit and vegetable intake and adherence to a diet plan in patients with gastric cancer

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## ABSTRACT

**Objective:** To investigate the factors affecting a healthy diet in patients with gastric cancer.

**Methods:** Data from 146 consecutive patients with gastric cancer were collected based on the integrated model for behavior change. Core theory constructs were operationalized with decisional balance on a healthy diet, self-efficacy in fruit and vegetable (F&V) intake and diet planning, coping planning and self-leadership, and stages of change in F&V intake and adhering to a diet plan.

**Results:** Higher self-efficacy in F&V intake and diet planning were associated with a higher readiness for change in F&V intake (adjusted odds ratio [aOR] for self-efficacy, 1.02; 95% confidence interval [CI], 1.01–1.04) and for adhering to a diet plan (aOR for self-efficacy, 1.02; 95% CI, 1.01–1.04; aOR for diet planning, 1.02; 95% CI, 1.01–1.04). Coping planning was a determinant of readiness for change in F&V intake (aOR, 1.02; 95% CI, 1.01–1.04). Self-leadership in behavioral awareness and volition (aOR, 1.02; 95% CI, 1.01–1.03) and task motivation (aOR, 1.02; 95% CI, 1.00–1.03) were determinants of readiness for change in adhering to a diet plan.

**Conclusions:** Self-efficacy and coping planning were determinants of readiness for change in F&V intake in patients with gastric cancer. Self-efficacy and self-leadership were determinants of readiness for change in adhering to a diet plan in patients with gastric cancer. Improving self-efficacy, coping planning, and self-leadership is essential for changing behaviors to adopt a healthy diet. Nurses caring for patients with gastric cancer should identify strategies that improve self-efficacy in F&V intake and diet planning.

## Introduction

Gastric cancer is the fifth most common cancer and third leading cause of deaths caused by cancer worldwide,<sup>1</sup> with the highest rates of incidence in eastern Asia.<sup>2</sup> In South Korea, the 5-year relative survival rate of patients with stomach cancer increased from 1993 to 2014 and was more than 74.4% from 2010 to 2014.<sup>3</sup> Because survival rates are increasing, addressing issues associated with self-management in adopting healthy behaviors has become increasingly important.

A healthy eating pattern for cancer survivors recommended by the American Cancer Society includes the consumption of foods high in nutrients in amounts that are adequate for patients to achieve and maintain a healthy body weight, including various vegetables and fruits of diverse colors and whole grains.<sup>4</sup> A healthy eating pattern excludes red and processed meats, sugar-sweetened beverages, highly processed foods, and refined grain products.<sup>4</sup> Particularly in the case of patients with gastric cancer, consuming large amounts of salted foods<sup>5</sup> and processed meats, frequent use of cooking oil, a low vitamin intake,<sup>6</sup> and consumption of fruits and vegetables (F&V) in low amounts<sup>7,8</sup> are associated

with an increased risk of gastric cancer. Thus, healthy dietary patterns, heavily relying on the consumption of F&V, soy products, seaweed products, milk, and yogurt, have been recommended for patients with gastric cancer.<sup>9</sup> Maintaining diet quality with a diet plan can improve the health-related quality of life (HRQoL), and symptoms,<sup>10,11</sup> recurrence,<sup>12</sup> immune function,<sup>13</sup> and cognitive function<sup>14</sup> in patients with cancer. The presence and treatment of gastric cancer can result in inadequate nutrient uptake and secretion of digestive enzymes. Moreover, early satiety after gastrectomy can impair the ability to consume a sufficient amount of calories to maintain or regain healthy body weight.<sup>12</sup> Thus, patients with gastric cancer have specific nutritional needs, which require a diet plan to optimize diet quality.

Many cancer survivors do not adequately follow guidelines that are recommended for a healthy diet despite its importance.<sup>10</sup> For instance, the consumption of vegetables, unsweetened dairy products, and nuts by gastrointestinal cancer survivors was nearly 50% lower than the recommended amounts, and these individuals were found to have at least one serving of unhealthy foods per day.<sup>15</sup> Adopting a healthy diet may be difficult to initiate and maintain, thereby highlighting the importance of

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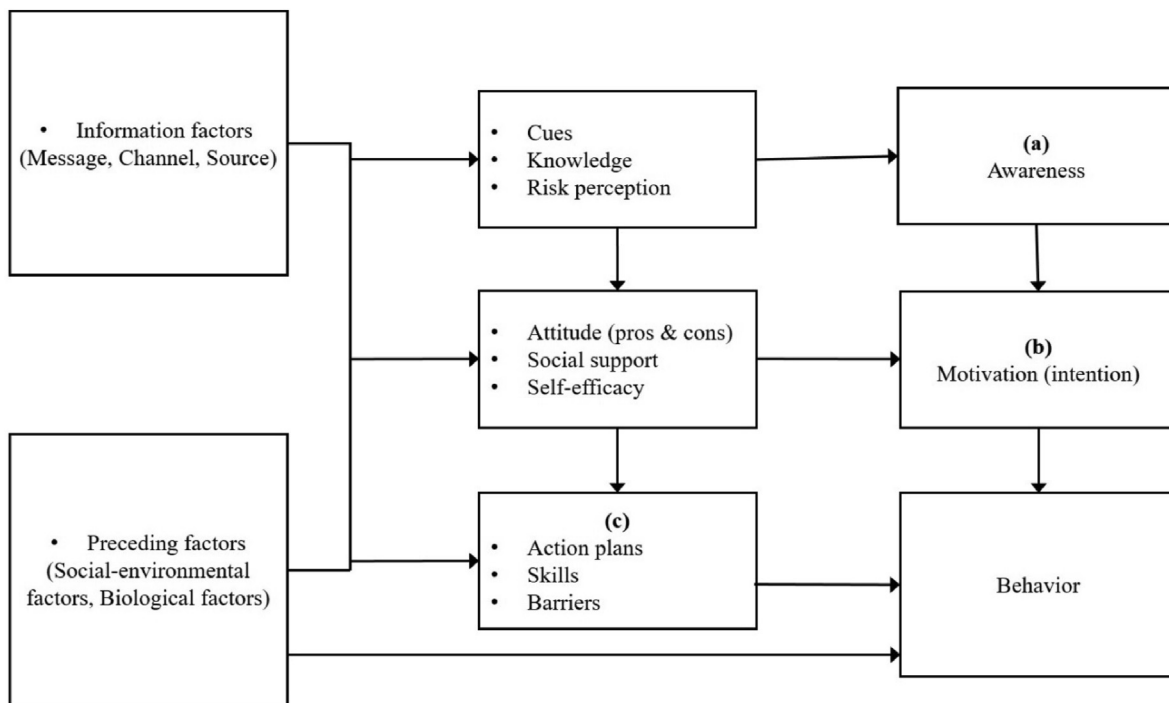


Fig. 1. Illustration of the I-change model version 2.0 used as a conceptual model in this study.

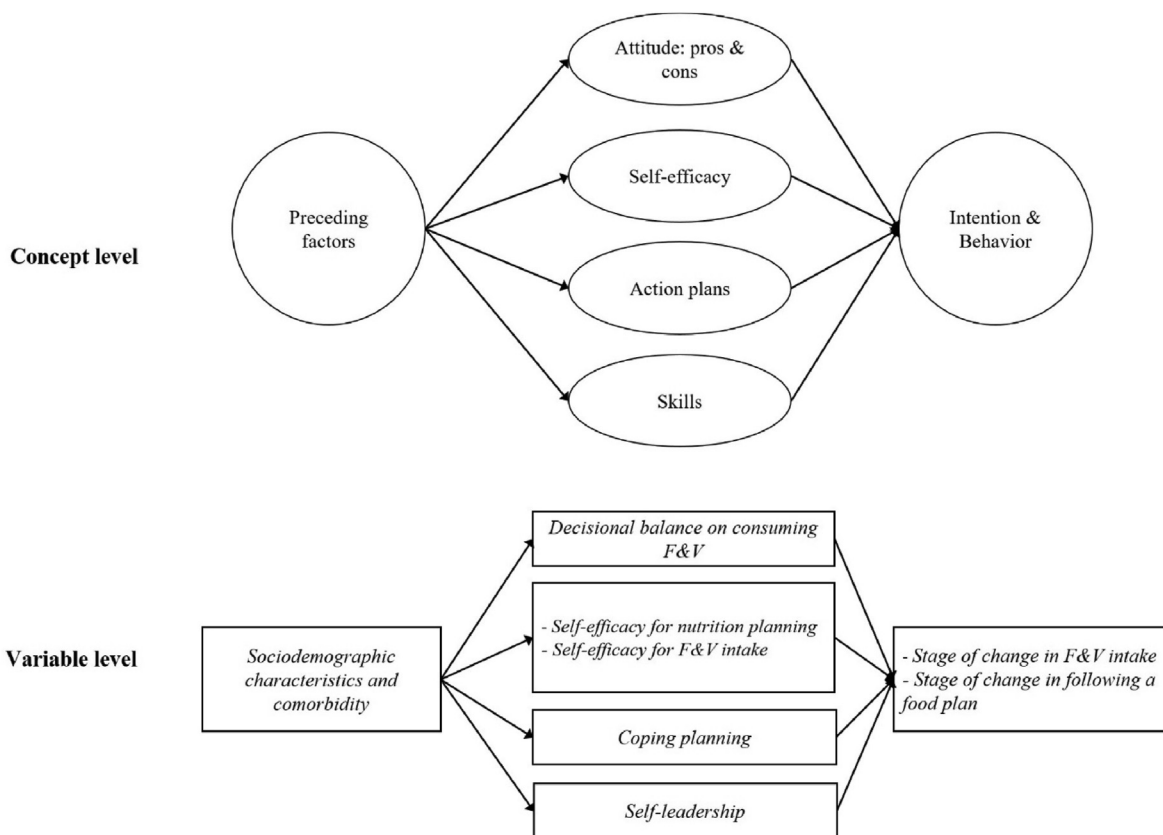


Fig. 2. Research framework of the study.

greater knowledge of the factors associated with changes in behavior for healthier eating.

Poor adherence to healthy diets among cancer survivors was associated with socio-demographic characteristics, including sex, age,

educational level,<sup>16-18</sup> and longer working hours,<sup>18</sup> as well as with cancer types.<sup>18</sup> Poor adherence to diet recommendations was also associated with obesity<sup>16</sup>; physical and emotional problems<sup>17</sup>; cognitive skills, such as self-control, self-leadership, and self-efficacy<sup>19</sup>;

knowledge<sup>19</sup>; and social support.<sup>19,20</sup> However, little is known about the factors affecting the adoption of a healthy diet by patients with gastric cancer. This lack of information emphasizes the need for a theory-based behavioral approach to evaluate diet in patients with gastric cancer.

The integrated model for behavioral change (I-change model; Fig. 1)<sup>21</sup> has been used successfully to alter multiple targeted health behaviors.<sup>22,23</sup> Essentially, the I-change model proposes that behavior is the result of a person's intention. The level of intention is regarded as a stage of change, which is determined by three phases during the behavioral change process: (1) raising awareness about the need to alter a behavior, (2) motivation to change the behavior, and (3) specifying actions required to translate intention into the desired behavior. Raising awareness assumes the existence of internal and external cues to action, knowledge, and risk perception. Motivation can be improved by changes in attitude, such as the pros and cons of the desired behavior, perceived social support, and self-efficacy. The actions required to translate intention into the desired behavior include an individual's skills, an action plan, and the identification of barriers (Fig. 1).<sup>21</sup>

The analysis of the constructs and propositions of the I-change model showed that concepts, such as abstract entities, were not directly measurable; thus, operational definitions that define concepts in terms of empirical measurements were searched. The pros and cons of a desired behavior can be described as decisional balance.<sup>21,24</sup> Self-efficacy is the belief by a person that they can perform certain behaviors.<sup>25</sup> Self-efficacy was measured using self-efficacy for diet planning and F&V intake. Self-leadership is a life skill that facilitates the improvement of self-management behaviors arising from living with a chronic condition.<sup>26</sup> This process involves behavioral and cognitive self-evaluation and self-influence to develop positive behaviors to ultimately improve overall performance.<sup>27</sup> Thus, this study matched self-leadership with the skills required to initiate the stages of behavior changes toward adopting a healthy diet. Planning bridges the gap between behavioral intentions and healthy behaviors.<sup>28</sup> Coping planning can help individuals overcome obstructions and learn to cope with difficulties by anticipating personal barriers and planning detailed coping responses.<sup>29</sup>

Because social support can predict lifestyle changes in gastric cancer survivors,<sup>19</sup> the present study evaluated other factors associated with stages of change in adopting a healthy diet. At the concept level, the correlations of the concepts of preceding factors, pros and cons of the desired behavior, self-efficacy, action plans, and skills required to translate intention into desired behavior were assessed. At the variable level, the correlations of sociodemographics, comorbidities, decisional balance on consuming F&V, self-efficacy for diet planning and F&V intake, coping planning, and self-leadership with stages of change in F&V intake and adhering to a diet plan were evaluated (Fig. 2).

This study was designed to determine the associations of decisional balance on healthy diet, self-efficacy in F&V intake and diet planning, coping planning, and self-leadership with the stage of change in adopting F&V intake and adhering to a diet plan among patients with gastric cancer based on the I-change model.

## Methods

### Study design and participant recruitment

This cross-sectional study included patients with gastric cancer treated in March 2021 at two tertiary hospitals (more than 1000 beds each) in two different provinces in South Korea. All the participants were of Korean descent. Patients were included if they had been diagnosed with primary gastric cancer (stage I, II, or III) within the previous 2 years, were currently receiving or had completed cancer therapy, and had no other history of cancer. Other inclusion criteria included residency in South Korea, provision of written consent to participate in the study, and provision of contact details. Potentially eligible patients were identified by reviewing the hospital registry. Patients were excluded if they had comorbidities that could possibly contraindicate the consumption of a

balanced diet and F&V (e.g., those with kidney diseases, such as glomerulonephritis, nephrotic syndrome, diabetic nephropathy, or renal failure diagnosed within 1 year), had physical or cognitive conditions that could contraindicate changes in eating behavior, had recurrent cancer, or refused to participate.

All procedures in this study involving human participants were conducted in accordance with the Declaration of Helsinki. The study protocol was approved by the local ethics review board (Approval No. KNU-2021-0014).

### Data collection

Patients with gastric cancer who had visited outpatient clinics or self-help group meetings were contacted by research staff members and asked whether they would like to participate in the study. Subsequently, patients were screened for eligibility using a checklist. They deemed eligible were informed about the purpose and procedure of the study and the criteria for cooperation. Patients who provided written informed consent were asked to complete a self-reported questionnaire together with the research staff in a meeting room. Patients could ask for clarification while completing the questionnaire. Those who were unable to complete the questionnaire immediately were offered the opportunity to complete it at home or in the admission ward, and they were asked to return it in a stamped return envelope. To increase the response rate, participants were followed up with reminders. Patients with incomplete responses or missing questionnaires were contacted by research staff via telephone.

Approximately 29,207 patients with gastric cancer were identified in South Korea, which included 19,545 (66.9%) men and 9662 (33.1%) women.<sup>3</sup> Because of the skewed male–female incidence ratio of gastric cancer in South Korea, quota sampling was used to match this ratio. Of the 172 consecutive patients who visited outpatient clinics and were initially deemed eligible, 146 (85%) agreed to participate, signed the informed consent form, and completed the questionnaire. The most frequent reasons for non-participation were discomfort and time constraints ( $n = 14$ ; 55%).

Sample size was calculated using G\*power 3.1.9.4 software based on the following analytical indices: significance level,  $\alpha = 0.05$ ; effect size = 0.15 (small effect size); power = 80%; and number of predictors = 15. The minimum sample size obtained was 139. Based on a 5% dropout rate, the final sample consisted of 146 patients.

### Measures

The socio-demographic characteristics of patients were obtained from their medical records. Comorbidities were recorded using the one-page modified patient-reported Charlson Comorbidity Index (PRO-CCI) questionnaire, which assesses the level of 18 comorbidities or complications by considering both the number and severity of the comorbid conditions.<sup>30</sup> This questionnaire provides a weighted score of an individual's comorbidities, which can be used to predict their treatment adherence and HRQoL.<sup>31</sup>

The measures of decisional balance on consuming F&V, self-efficacy for a diet plan, self-efficacy for F&V intake, coping planning, self-leadership, and stages of change in adopting a healthy diet underwent translation and linguistic validation. The linguistic validation procedure consisted of permission for translation, forward translations, reconciliation, back-translation, cognitive debriefing, and proofreading.

### Decisional balance on consuming F&V

Decisional balance on adopting healthy behaviors is a measure of the benefits and drawbacks of decisions made to adopt healthy behaviors.<sup>32</sup> The perceived benefits and drawbacks of consuming more F&V were determined based on a decisional balance scale that originally included 33 items of 5 subscales.<sup>33</sup> The scale of decisional balance on consuming F&V used in the present study consisted of 15 items of 3 subscales, including 6

items measuring health benefits, 5 measuring general barriers, and 4 measuring inconvenience. Based on the content validity from five field experts, we included additional three items measuring the degree to which Koreans prefer a problematic dietary pattern (including the consumption of salty foods; preference for red meat, such as grilled or roasted pork belly; and desire to eat vegetables soaked in soy sauce or salted seafood) which are appropriate in terms of Korean food culture. The participants rated the importance of each item on a 5-point Likert scale, with 1 indicating extreme unimportance and 5 indicating extreme importance of consuming more F&V. The responses were summed across the four subscales and converted to a scale of 0–100 points. Higher scores indicate a greater recognition of the health benefits of consuming F&V, a greater recognition of the general barriers and inconveniences of consuming F&V, and a greater preference for problematic Korean dietary patterns.

The decisional balance scale on consuming F&V showed an acceptable reported internal consistency of all items (Cronbach's  $\alpha \geq 0.7$ ), with a reliability for the advantages of health benefits (Cronbach's  $\alpha = 0.83$ ), the disadvantages of general barriers (Cronbach's  $\alpha = 0.75$ ), and inconvenience (Cronbach's  $\alpha = 0.79$ ).<sup>33</sup> In the present study, the internal consistency was also reliable for the advantages of health benefits (Cronbach's  $\alpha = 0.82$ ) and for the disadvantages of general barriers, inconvenience, and preference for problematic Korean dietary patterns (Cronbach's  $\alpha = 0.71$ ).

#### *Self-efficacy for healthy diet*

Self-efficacy in adopting a healthy diet consisted of self-efficacy in following a diet plan and self-efficacy in F&V intake.

#### *Self-efficacy for a diet plan*

The participants with stomach cancer routinely received diet education during hospitalization. The nutrition education emphasized that a healthy diet includes consuming adequate amounts of food items, including liquids, which contain nutrients essential for the body. Patients were recommended to perform diet planning for each meal a day to ensure that each meal consisted of a balanced diet. The health-specific self-efficacy scale, consisting of nutrition, physical exercise, and alcohol resistance, and self-efficacy subscales assessed construct validity through principal component analyses.<sup>34</sup> The present study used the five-item nutrition self-efficacy scale to measure the level of confidence in the ability to overcome the barriers to consuming healthy foods. These five items included requiring a long time to develop routines, trying several times until the routine works, complete rethinking of nutrition, not receiving much support from others, and making a detailed plan. Each item was measured on a 4-point Likert scale, with 1 indicating definitely not and 4 indicating extremely sure. The scores on the five items were summed to obtain the total nutrition self-efficacy score, which was converted to a scale of 0–100 points, with higher scores indicating greater self-efficacy. Measurements of internal consistency showed Cronbach's  $\alpha = 0.87$  for the validation study of this instrument<sup>34</sup> and  $\alpha = 0.93$  for the current study.

#### *Self-efficacy for F&V intake*

The self-efficacy scale for F&V intake consisted of nine items measuring confidence in the ability to perform behaviors that enabled F&V intake in difficult situations, such as when the respondent was in a rush, tired, or away from home, and in various dining situations, such as during lunch or dinner.<sup>33</sup> Each item was measured on a 5-point Likert scale, with 1 indicating not at all sure and 5 indicating extremely sure. The scores for the nine items were summed to obtain the total F&V intake self-efficacy score, which was then converted to a scale of 0–100 points, with higher scores indicating greater self-efficacy. Internal consistency measurements yielded Cronbach's  $\alpha = 0.90$  for the development study of this instrument<sup>33</sup> and  $\alpha = 0.85$  for the current study.

#### *Coping planning*

Coping planning was measured using a validated psychometric assessment instrument<sup>28</sup> consisting of five items, each of which were scored on a 4-point Likert scale, with 1 indicating completely disagree; 2, disagree; 3, agree; and 4, completely agree. The scores on these items were summed and converted to a scale of 0–100 points, with higher scores indicating a higher level of coping planning. This instrument reported good internal consistency, with a Cronbach's  $\alpha = 0.91$  for the development study<sup>28</sup> and  $\alpha = 0.87$  for the current study.

#### *Self-leadership*

Self-leadership was measured using the validated Abbreviated Self-Leadership Questionnaire (ASLQ),<sup>35</sup> consisting of nine items in three different dimensions: behavior awareness and volition, task motivation, and constructive cognition. Each item was measured using a 5-point Likert scale, with 1 indicating strongly disagree and 5 indicating strongly agree. The scores on the items in each subscale were summed, and the subscale scores were converted to a scale of 0–100 points, with higher scores indicating greater self-leadership. The ASLQ showed acceptable reliability, with a Cronbach's  $\alpha = 0.73$  for the development study of the original instrument,<sup>35</sup> and  $\alpha = 0.93$  for the current study.

#### *Readiness for change in adopting a healthy diet*

The stages of change items characterized participants into five stages: pre-contemplation, contemplation, preparation, action, and maintenance. The stages of change in adopting a healthy diet consisted of the stages of change in F&V intake<sup>33</sup> and in adhering to a diet plan.<sup>36</sup> These stages of change instruments have been used as a novel dietary goal measure.<sup>37</sup> Participants were asked to choose the stage that corresponded the most with their intention.

#### *Stage of change in F&V intake*

Each stage of change in F&V intake and diet plan was evaluated using a two-step process. In the first step, each participant was asked to precisely record the food intake, including F&V and non-alcoholic beverages, on three non-consecutive days (two weekdays and one weekend day), including serving size and methods of food preparation, with all the ingredients of each listed food. The dietician, who was part of the research team, evaluated the food diaries and analyzed the diets. The types and portion sizes of foods recorded in the food diary were entered into the Korean Nutrition Society nutritional analysis program (CAN Pro 5.0) to estimate nutrient intake, which was compared with the recommended daily allowance (RDA) by a dietician. The daily nutrient intake of the patients with gastric cancer was calculated relative to the RDA of nearly all healthy Koreans. Diet quality was evaluated using the diet quality index (DQI)<sup>38</sup> adapted for the Korean population.<sup>39</sup> The DQI consisted of eight questions that assessed the proportions of energy obtained from fats, saturated fatty acids, and carbohydrates; cholesterol, protein, calcium, and sodium intake; and servings per day of F&V. Each category was scored from 0 to 2, and the scores of the eight items were summed to assess diet quality. Higher scores indicated poorer diet quality.<sup>40</sup> The parameters used in this study included total diet quality score and servings per day of F&V.

The second step involved classification by stage based on estimated intake and intention.<sup>33</sup> Participants who consumed fewer than five servings of F&V per day (except for servings of kimchi, a salted and fermented vegetable side dish) were classified by stage according to their responses, with stage 1 indicating the subjects did not intend to change their diets (pre-contemplation), stage 2 indicating they were thinking about changing within 6 months (contemplation), and stage 3 indicating that they were thinking about changing within 30 days (preparation). Participants who consumed five or more servings of F&V

Table 1

Relationships of Patients' Socio-demographic Characteristics With Decisional Balances on Healthy Diet, Self-efficacy for Healthy Diet, Coping Planning, and Self-leadership.

Socio-demographic Characteristics	n = 146	Decisional Balance on Consuming F&V								Self-efficacy for Healthy Diet				Coping Planning		Self-leadership				
		Advantages				Disadvantages				Self-efficacy for diet plan		Self-efficacy for F&V intake		Behavior awareness and volition		Task motivation		Constructive cognition		
		Health benefit <sup>a</sup>		General barriers <sup>b</sup>		Inconvenience <sup>b</sup>		Prefer problematic Korean dietary pattern <sup>c</sup>												
		n (%)	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P		
Gender																				
Male	98 (67.1)	73.9 (16.9)		54.4 (16.6)		60.3 (19.3)		46.0 (12.9)		55.7 (23.0)		42.2 (18.9)		62.2 (17.0)		52.0 (23.6)		53.8 (24.1)		59.1 (23.4)
Female	48 (32.9)	70.7 (19.6)	0.311	49.7 (18.4)	0.124	56.4 (21.7)	0.266	50.7 (14.3)	<b>0.048</b>	53.6 (23.4)	0.613	44.1 (22.7)	0.591	55.8 (18.0)	<b>0.039</b>	44.8 (27.9)	0.107	48.1 (31.2)	0.224	54.0 (29.5)
Age (years)																				
< 65	90 (61.6)	71.0 (16.2)		54.9 (16.6)		60.6 (19.9)		46.1 (13.5)		55.3 (23.1)		43.6 (20.1)		60.8 (14.9)		48.5 (23.9)		52.2 (26.2)		55.5 (25.1)
≥ 65	56 (38.4)	76.0 (19.9)	0.099	49.5 (18.0)	0.063	56.5 (20.4)	0.226	49.9 (13.2)	0.104	54.6 (24.2)	0.878	41.5 (20.4)	0.544	58.9 (21.2)	0.529	51.3 (27.3)	0.513	51.5 (27.8)	0.872	60.6 (26.2)
Marital status																				
No spouse	38 (26.0)	68.4 (16.5)		52.5 (18.7)		57.4 (20.1)		48.5 (15.2)		51.1 (22.5)		42.1 (19.8)		60.7 (17.7)		50.9 (21.8)		54.4 (24.1)		62.7 (19.8)
With spouse	108 (74.0)	74.5 (18.1)	0.072	53.0 (16.9)	0.888	59.6 (20.1)	0.562	47.2 (12.9)	0.627	56.4 (23.7)	0.227	43.1 (20.4)	0.804	59.9 (17.6)	0.804	49.2 (26.4)	0.718	51.1 (27.6)	0.513	55.6 (27.2)
Practicing a religion																				
No	56 (38.4)	73.8 (15.8)		55.9 (14.8)		58.9 (20.7)		47.9 (12.0)		55.8 (22.0)		47.1 (18.3)		60.8 (17.3)		48.5 (22.4)		51.6 (27.4)		54.0 (26.2)
Yes	90 (61.6)	72.3 (19.0)	0.624	50.9 (18.5)	0.093	59.1 (19.8)	0.961	47.3 (14.4)	0.794	54.5 (24.4)	0.743	40.2 (20.9)	<b>0.043</b>	59.6 (17.7)	0.688	50.3 (26.9)	0.682	52.1 (26.4)	0.914	59.5 (25.1)
Currently employed																				
No	88 (60.3)	72.2 (17.6)		52.4 (18.1)		57.7 (21.6)		50.3 (12.8)		54.8 (23.5)		42.4 (20.3)		58.8 (18.1)		47.3 (24.9)		48.4 (26.8)		55.7 (26.3)
Yes	58 (39.7)	74.0 (18.2)	0.544	53.5 (16.2)	0.697	61.0 (17.5)	0.341	43.4 (13.6)	<b>0.002</b>	55.3 (23.6)	0.912	43.5 (20.0)	0.743	62.1 (16.6)	0.270	53.2 (25.5)	0.167	57.3 (25.9)	0.047	60.1 (24.4)
Monthly household income (in US\$)																				
< 2000	90 (61.6)	71.3 (17.8)		51.1 (17.5)		58.8 (22.0)		48.1 (13.0)		54.1 (22.1)		41.2 (19.9)		58.4 (17.3)		47.4 (25.4)		48.8 (27.5)		58.6 (25.9)
≥ 2000	56 (38.4)	75.4 (17.6)	0.185	55.6 (16.8)	0.126	59.5 (16.8)	0.830	46.6 (14.3)	0.496	56.4 (25.6)	0.570	45.3 (20.5)	0.233	62.9 (17.7)	0.133	53.1 (24.7)	0.184	57.0 (24.8)	0.071	55.5 (25.1)
Residence																				
Small town, rural area	34 (23.3)	76.1 (17.4)		49.7 (16.6)		68.4 (17.7)		48.3 (11.4)		53.5 (22.1)		38.3 (18.7)		57.1 (15.8)		41.9 (25.7)		42.2 (28.3)		52.5 (28.3)
Metropolitan area	112 (76.7)	71.9 (17.9)	0.231	53.8 (17.5)	0.229	56.2 (20.0)	<b>0.002</b>	47.3 (14.1)	0.717	55.5 (23.9)	0.673	44.2 (20.5)	0.139	61. (18.0)	0.251	51.9 (24.7)	<b>0.042</b>	54.9 (25.6)	<b>0.014</b>	58.9 (24.6)
Public health insurance																				
National health insurance	112 (76.7)	72.1 (18.1)		53.4 (17.8)		59.2 (20.1)		47.4 (13.6)		54.1 (23.1)		43.3 (19.4)		60.4 (17.9)		48.7 (24.9)		51.9 (25.4)		57.4 (24.6)
Medical aid	27 (18.5)	76.5 (16.3)	0.239	50.4 (15.3)	0.413	58.1 (20.6)	0.791	48.1 (13.1)	0.798	59.3 (25.0)	0.301	40.6 (23.5)	0.538	58.8 (16.1)	0.665	53.7 (26.2)	0.351	52.2 (32.4)	0.962	57.7 (30.2)
Number of family members																				
0-1	40 (27.4)	74.2 (18.9)		48.8 (18.0)		57.0 (22.5)		48.1 (12.6)		57.3 (22.9)		44.8 (19.5)		64.0 (12.0)		58.3 (20.9)		63.1 (22.2)		66.3 (21.8)
≥ 2	106 (72.6)	72.4 (17.4)	0.596	54.4 (16.9)	0.079	59.8 (19.2)	0.462	47.3 (13.9)	0.751	54.2 (23.7)	0.467	42.1 (20.4)	0.467	58.6 (19.1)	<b>0.044</b>	46.3 (26.0)	<b>0.009</b>	47.7 (27.1)	<b>0.002</b>	54.1 (26.2)
Private health insurance																				

(continued on next page)

**Table 1 (continued)**

Socio-demographic Characteristics	Decisional Balance on Consuming F&V						Self-efficacy for Healthy Diet			Coping Planning			Self-leadership			
	n (%)	Advantages		Disadvantages		Prefer problematic Korean dietary pattern <sup>c</sup>	Self-efficacy for diet plan		Self-efficacy for F&V intake		Behavior awareness and volition		Task motivation		Constructive cognition	
		Mean (SD)	P	Mean (SD)	P		Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P
No	81 (55.5)	74.1 (17.4)	0.351	51.0 (17.7)	56.3 (21.5)	50.7 (12.9)	58.1 (23.4)	45.2 (22.7)	61.2 (16.4)	50.3 (24.8)	52.3 (26.8)	59.1 (24.6)	52.3 (26.8)	0.871	55.4 (26.9)	0.391
Yes	65 (44.5)	71.3 (18.3)	0.163	55.1 (16.7)	62.5 (17.7)	43.6 (13.3)	51.2 (23.2)	39.8 (16.1)	58.8 (18.9)	48.7 (25.9)	51.5 (26.8)	55.4 (26.9)	48.7 (25.9)	0.706	55.4 (26.9)	0.391
Comorbidity (modified PRO-CCI questionnaire)																
0	82 (56.2)	71.5 (16.6)	0.304	53.8 (17.6)	58.6 (21.4)	47.6 (14.6)	56.5 (24.2)	44.5 (20.0)	57.1 (19.5)	46.8 (25.9)	47.5 (28.2)	54.6 (27.1)	46.8 (25.9)	0.018	54.6 (27.1)	0.128
≥ 1	64 (43.8)	74.6 (19.2)	0.432	51.6 (17.0)	59.6 (18.5)	47.5 (12.1)	53.1 (22.6)	40.6 (20.3)	64.0 (13.9)	53.1 (23.9)	57.7 (23.6)	61.1 (23.2)	53.1 (23.9)	0.136	61.1 (23.2)	0.128

Bold type indicates statistically significant results.  
 F&V, fruits and vegetables; PRO-CCI, Patient-Reported Charlson Comorbidity Index; SD, standard deviation  
<sup>a</sup> Higher scores indicate greater recognition of the health benefits of consuming F&V.  
<sup>b</sup> Higher scores indicate greater recognition of the general barriers and inconveniences in consuming F&V.  
<sup>c</sup> Higher scores indicate greater preference for a problematic Korean diet pattern.

per day were also classified by stage, with stage 4 indicating that they had changed their diets in the past 6 months (action) and stage 5 indicating that they had changed their diets for more than 6 months (maintenance). Higher scores indicated higher readiness for change in consuming F&V.

*Stage of change in adhering to a diet plan*

The five stages of change in adhering to a diet plan were as follows<sup>36</sup>: (1) pre-contemplation (i.e., “I do not follow a diet plan and do not plan to start in the near future”); (2) contemplation (i.e., “I do not follow a diet plan now, but I have been thinking of starting one”); (3) preparation (i.e., “I am planning to begin following a diet plan in the next month”); (4) action (i.e., “I have been following a diet plan for the past 1–6 months”); and (5) maintenance (i.e., “I have been following a diet plan for over 6 months”). A diet plan for patients with gastric cancer consisted of planning daily balanced meals containing five nutrients, a high F&V intake, and a low intake of salt (e.g.,, reducing foods preserved using salt) and processed meats. A higher score indicated higher readiness for change in adhering to a diet plan.

*Data analysis*

Descriptive statistics was used for data analysis. The associations of the socio-demographic characteristics with decisional balance, self-efficacy, coping planning, and self-leadership were evaluated by independent *t*-tests to identify confounding variables. The Pearson correlation coefficient was used to determine the correlation between not only the stages of change in F&V intake and F&V servings a day but also between the stage of change in adhering to a diet plan and diet quality score.

The associations of the degree of decisional balance, self-efficacy, coping planning, and self-leadership with the five categorized stages of change in F&V intake and adhering to a diet plan were evaluated using a multivariate ordinal logistic regression model, adjusting for confounding variables, other socio-demographic characteristics, and comorbidity index scores.

All data analyses were two-sided, with *P*-values of <0.05 considered statistically significant. All statistical analyses were performed using SAS 9.4 (SAS Institute, Cary, NC).

*Ethical consideration*

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Kyungpook National University (Approval No. KNU-2021-0014). Written informed consent was obtained from all participants.

**Results**

*Characteristics of the participants*

The socio-demographic and clinical characteristics of the 146 study participants are shown in Table 1. The mean ± standard deviation age of the participants was 60.0 ± 10.7 (range, 37–84) years.

*Differences in decisional balance on healthy diet, self-efficacy in F&V intake and diet planning, coping planning, and self-leadership based on the socio-demographic characteristics.*

Living in a rural area or small town was associated with recognizing inconveniences in consuming F&V (*P* = 0.002). Female sex (*P* = 0.048), unemployment (*P* = 0.002), and a lack of private health insurance (*P* = 0.001) were significantly associated with a preference for a problematic Korean dietary pattern. Patients not practicing a religion (*P* = 0.043) had higher self-efficacy in F&V intake. Male sex (*P* = 0.039), fewer family

**Table 2**  
Stages of Change in Adopting a Healthy Diet.

Stage of change	Intake of Fruits and Vegetables			Following a Diet Plan		
	Stage of change, n (%) n = 146	Fruit and vegetable daily servings Mean (SD)	Correlation coefficient r (P)	Stage of change, n (%) n = 146	Diet quality index score <sup>a</sup> Mean (SD)	Correlation coefficient r (P)
Pre-contemplation	20 (13.7)	3.0 (1.8)	0.61 (< 0.0001)	14 (9.6)	8.1 (4.0)	-0.43 (< 0.0001)
Contemplation	53 (36.3)	4.4 (1.1)		15 (10.3)	6.3 (1.0)	
Preparation	13 (8.9)	4.5 (0.5)		46 (31.5)	6.8 (1.6)	
Action	24 (16.4)	7.7 (2.9)		37 (25.3)	5.6 (1.2)	
Maintenance	36 (24.7)	9.0 (2.5)		34 (23.3)	4.8 (1.9)	

SD, standard deviation

<sup>a</sup> Higher scores indicate poorer quality diet.

members ( $P = 0.044$ ), and more comorbidities ( $P = 0.018$ ) were associated with higher coping planning. Living in a metropolitan area (behavior awareness and volition,  $P = 0.042$  and task motivation,  $P = 0.014$ ), fewer family members (behavior awareness and volition,  $P = 0.009$ ; task motivation,  $P = 0.002$ ; constructive cognition,  $P = 0.009$ ), and more comorbidities (task motivation  $P = 0.021$ ) were associated with higher self-leadership (Table 1).

#### Readiness for change in F&V intake and adhering to a diet plan

Among the study participants, 36.3% were at stage 2 (contemplation; mean of 5.4 F&V servings per day), which was the most frequent, followed by stage 5 at 24.7% (maintenance; mean of 10 F&V servings per day) and stage 4 at 16.4% (action; mean of 8.7 F&V servings per day). Higher readiness for changes in F&V intake was significantly correlated with more F&V intake ( $r = 0.61$ ,  $P < 0.0001$ ).

Evaluation of the readiness for changes in adhering to a diet plan showed that 31.5% of participants were at stage 3 (preparation; mean DQI score 6.8), 25.3% at stage 4 (action; mean DQI score 5.6), and 23.3% at stage 5 (maintenance; mean DQI score 4.8). A higher readiness for changes in adhering to a diet plan was significantly correlated with better diet quality ( $r = -0.43$ ,  $P < 0.0001$ ) (Table 2).

#### Associations of decisional balance on consuming F&V, self-efficacy in F&V intake and diet planning, coping planning, and self-leadership with the readiness for change in F&V intake and adhering to a diet plan.

After controlling for confounding and other sociodemographic variables and comorbidities, patients with a higher self-efficacy in F&V

intake (adjusted odds ratio [aOR], 1.02; 95% confidence interval [CI], 1.01–1.04) and higher coping planning (aOR, 1.02; 95% CI, 1.01–1.04) were more likely to be ready for a change in F&V intake.

Patients with a higher self-efficacy in F&V intake (aOR, 1.02; 95% CI, 1.01–1.04) and diet planning (aOR, 1.02; 95% CI, 1.01–1.04), higher self-leadership in behavior awareness and volition (aOR, 1.02; 95% CI, 1.01–1.03), and task motivation (aOR, 1.02; 95% CI, 1.00–1.03) were more likely to be ready for a change in adhering to a diet plan (Table 3).

#### Discussion

This study suggested that self-efficacy in F&V intake and diet planning were associated with readiness for change in F&V intake or adhering to a food plan. Self-leadership in behavior awareness and task motivation were also associated with readiness for change in adhering to a food plan.

Patients with gastric cancer who showed a higher self-efficacy in F&V intake and diet planning showed higher readiness for changes in F&V intake and adhering to a food plan. Although few studies till date have evaluated the relationship between self-efficacy and dietary behaviors in gastric cancer survivors, our findings were consistent with those of studies on African American breast cancer survivors,<sup>41</sup> African American women,<sup>42</sup> adolescents,<sup>43</sup> and a low-income population,<sup>44</sup> which showed that self-efficacy for healthy eating behaviors showed a positive association with diet quality or pattern. Similarly, self-efficacy showed a positive association with healthy eating behaviors, including the selection of healthier foods.<sup>45</sup> Our finding is also theoretically supported by social cognitive theory, which posits that an individual's confidence in the ability to consume healthy food on a daily basis is a major determinant of the ability to achieve a healthy balanced diet.<sup>46</sup> Higher self-efficacy is

**Table 3**

Associations of Decisional Balance on Consuming F&V, Self-efficacy for F&V Intake and Diet Planning, Coping Planning, and Self-leadership With Readiness for Change in F&V Intake and Adhering to a Diet Plan.

Main Independent Variable	Higher Readiness for Change in F&V Intake		Higher Readiness for Change in Following a Food Plan	
	aOR (95% CI) <sup>a</sup>	P	aOR (95% CI) <sup>a</sup>	P
Decisional balance on consuming fruits and vegetables				
Health benefit	1.01 (0.99–1.03)	0.340	1.01 (0.99–1.03)	0.126
General barriers	1.01 (0.99–1.03)	0.255	0.99 (0.98–1.01)	0.483
Inconvenience	1.01 (0.99–1.03)	0.102	0.99 (0.98–1.01)	0.700
Preferring problematic Korean diet pattern	0.99 (0.97–1.02)	0.958	1.01 (0.99–1.04)	0.367
Self-efficacy for healthy diet				
Self-efficacy for F&V intake	<b>1.02 (1.01–1.04)</b>	<b>0.001</b>	<b>1.02 (1.01–1.04)</b>	<b>0.003</b>
Self-efficacy for diet plan	1.01 (0.99–1.03)	0.060	<b>1.02 (1.01–1.04)</b>	<b>0.004</b>
Coping planning	<b>1.02 (1.01–1.04)</b>	<b>0.026</b>	1.01 (0.99–1.03)	0.203
Self-leadership				
Behavior awareness and volition	1.01 (0.99–1.02)	0.096	<b>1.02 (1.01–1.03)</b>	<b>0.017</b>
Task motivation	1.00 (0.99–1.02)	0.573	<b>1.02 (1.00–1.03)</b>	<b>0.037</b>
Constructive cognition	1.01 (0.99–1.02)	0.327	1.01 (0.99–1.02)	0.378

Bold type indicates statistically significant results.

aOR, adjusted odds ratio; CI, confidence interval; F&V, fruits and vegetables

aOR<sup>a</sup> (95% CI) was derived from multivariate ordinal logistic regression analyses to calculate the probabilities of higher readiness for change in F&V intake or adhering to a food plan adjusted for sex, age, practicing a religion, current job status, monthly household income, residence area, national health insurance type, number of family members living together, private health insurance, and comorbidity index.

associated with a higher confidence in cooking skills and low perception of difficulties in planning, choosing, cooking, and restricting foods.<sup>47</sup> Self-efficacy may determine the ability of patients with cancer to consume appropriate food or select the food. Moreover, self-efficacy may influence the probability of appetite loss.<sup>48</sup> Perhaps for patients with gastric cancer, a higher self-efficacy in F&V intake may also be associated with decreased appetite. Patients with gastric cancer may experience changes in smell and taste of foods; have trouble tasting foods; or experience gastrointestinal symptoms, such as nausea, vomiting, and constipation; which may a decline in their appetite. Patients with gastric cancer may experience less confidence regarding F&V intake or have barriers to consuming F&V. Patients with gastrointestinal cancers may experience difficulties in maintaining an appropriate diet owing to psychosocial and physical stresses; lack of knowledge about food choices, including ingredients to be restricted; and cooking and intake methods to be avoided. Thus, a greater confidence in F&V intake and diet planning may considerably enhance readiness for change in a healthy diet among patients with gastric cancer.

Coping planning was identified as a determinant of higher readiness for change in F&V intake. A study investigating the interplay of intention and coping planning in facilitating healthy nutrition behaviors found that coping planning mediated the link from transition of intention into healthy nutrition behaviors.<sup>49</sup> Dietary management for patients with gastric cancer can be challenging. Individuals who used emotion-focused coping, a negative coping strategy, had a greater difficulty in making the necessary changes in their lifestyles to cope with gastrointestinal disease.<sup>50</sup> Patients with cancer require planning for problem-focused coping with a healthy diet. In another study, a dietary self-management program used as a component of planning for breast cancer survivors improved patient readiness for change in F&V intake.<sup>51</sup> The present study provides additional information about the significant association between coping planning and motivational readiness for change in healthy eating behaviors in patients with gastric cancer. To promote the coping planning among patients, nurses can help patients by assisting them in setting realistic goals; identifying personal skills and knowledge; providing chances to express concerns, fears, feelings, and expectations; encouraging patients to make choices and participate in the planning of care and scheduled activities; and assisting patients with accurately evaluating the situation and their own accomplishments.

Self-leadership in behavior awareness and volition and task motivation were associated with readiness for change in adhering to a food plan, suggesting that self-leadership skills can help patients with cancer make healthier dietary choices. This finding is supported by several previous studies that showed that self-leadership promoted healthy eating and physical activity.<sup>52-54</sup> Furthermore, the early application of self-leadership factors promoted behavioral changes.<sup>55</sup> The promotion of leadership skills was identified as a core area for action in the Ottawa Charter for Health Promotion.<sup>56</sup> Self-leadership, defined as leadership directed inwardly, has been found essential to self-management<sup>57,58</sup> and in creating productive thought patterns such as task motivation, volition, and awareness of one's own actions.<sup>59</sup> Thus, unsurprisingly, these habits would lead to motivational readiness for change in following a food plan. The results of this study therefore reinforce the importance of self-leadership skills in promoting healthy eating habits in patients with gastric cancer. Self-leadership consists of several strategies in which nurses may help patients use a series of behavior-focused, natural reward, and constructive thinking strategies to help manage their behavior and encourage and lead themselves.<sup>27</sup> Behavior-focused strategies center on behaviors that help individuals determine ineffective actions through self-reflective consideration. Natural reward strategies emphasize the enjoyable aspects of a task or activity being conducted. Constructive thinking strategies involve the process of self-analysis. Through a process of self-analysis, individuals can identify, face, and respond more rationally to ineffective actions.

Living in a rural area or small town was associated with recognizing inconveniences in consuming F&V. Ironically, food shortage occurs in

rural areas where farming is important to the local economy. Gaining access to healthy and affordable food can be a challenge for residents of rural areas. Many rural areas lack food retailers and are considered food deserts, areas with limited supplies of fresh affordable foods, were considered to be associated with a sensitive perception preference for a problematic Korean dietary pattern. Preferences for an unhealthy diet pattern were associated with the female sex, unemployment, and a lack of private health insurance, resulting in poorer dietary quality and inferior health outcomes for certain population groups and an unequal burden in terms of disease incidence, morbidity, survival, and quality of life. Fewer family members and more comorbidities were associated with higher coping planning. Fewer family members and more comorbidities were associated with higher self-leadership. Furthermore, members can pose barriers to self-care.<sup>60</sup> For instance, family members may refuse to eat the type of food the patient would like to eat, may cause the patient to be embarrassed about their self-care. Individuals with more comorbidities might need to develop strategies to promote healthy behaviors and facilitate effective adaptation to and coping with the illness.

This study has several limitations, including its cross-sectional design, allowing a determination of statistically significant relationships but not causality. The small number of patients included in this study pose the risk of type II error or false negatives. Thus, predictors that did not show significance in the results may actually predict the stages of changes in F&V intake and adhering to a food plan. Because all patients with gastric cancer in this study were recruited from one large city in South Korea, generalizing the results of the study to cancer survivors in other regions or countries may not be possible. However, South Korea has national standards for gastric cancer treatment, suggesting that the patients in the present study may have similar treatment-related experiences as other patients throughout South Korea.

This study also has practical implications. Because this study tested hypotheses derived from the theoretical framework of the I-change model, the findings of this study can be applied in nursing practice. Nurses caring for patients with gastric cancer should identify strategies on how to improve self-efficacy for F&V intake and diet planning. Because self-efficacy may be achieved through repeated experiences of success, oncology nurses should encourage patients to set low initial goals for adhering to a diet plan and F&V intake, followed by higher dietary goals in a step-by-step manner. In addition, incorporating practical cooking classes into evidence-based diet education may enhance participant self-efficacy.<sup>61</sup> These strategies of fostering self-efficacy in adopting a healthy diet can be incorporated into intervention programs for regular and persistent healthy eating behaviors in nursing practice.

## Conclusions

Self-efficacy in F&V intake and coping planning may be determinants of readiness for change in F&V intake in patients with gastric cancer. Self-efficacy in diet planning and self-leadership in behavior awareness, volition, and task motivation were determinants of readiness for change in adhering to a food plan among patients with gastric cancer.

Maintaining a healthy diet and ensuring that the nutritional needs of patients are met are key to recovery during and after treatment. Strategies that foster self-efficacy, coping planning, and self-leadership will reduce the proportion of gastric cancer survivors who do not follow the dietary guidelines recommended to them. Oncology nurses should identify strategies for improving self-efficacy in F&V intake and diet planning and for promoting coping planning and self-leadership.

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## Ethics statement

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Kyungpook National University (Approval No. KNU-2021-0014).

## Data availability statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy.

## Declaration of competing interest

None declared.

## References

- Rawla P, Barsouk A. Epidemiology of gastric cancer: global trends, risk factors and prevention. *Przeglad Gastroenterol.* 2019;14:26–38. <https://doi.org/10.5114/pg.2018.80001>.
- Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *Ca - Cancer J Clin.* 2018;68:394–424.
- Jung KW, Won YJ, Oh CM, Kong HJ, Lee DH, Lee KH. Cancer statistics in Korea: incidence, mortality, survival, and prevalence in 2014. *Cancer Res Treat.* 2017;49:292–305.
- Rock CL, Thomson C, Gansler T, et al. American Cancer Society guideline for diet and physical activity for cancer prevention. *CA: A Cancer J Clinicians.* 2020;70:245–271.
- Takachi R, Inoue M, Shimazu T, et al. Consumption of sodium and salted foods in relation to cancer and cardiovascular disease: the Japan public health center-based prospective study. *Am J Clin Nutr.* 2010;91:456–464.
- Ngoan L, Mizoue T, Fujino Y, Tokui N, Yoshimura T. Dietary factors and stomach cancer mortality. *Br J Cancer.* 2002;87:37–42.
- Kobayashi M, Tsubono Y, Sasazuki S, Sasaki S, Tsugane S. Vegetables, fruit and risk of gastric cancer in Japan: a 10-year follow-up of the JPHC Study Cohort I. *Int J Cancer.* 2002;102:39–44.
- McCullough ML, Robertson AS, Jacobs EJ, Chao A, Calle EE, Thun MJ. A prospective study of diet and stomach cancer mortality in United States men and women. *Cancer Epidemiol Biomark Prev.* 2001;10:1201–1205.
- Kim MK, Sasaki S, Sasazuki S, Tsugane S. Prospective study of three major dietary patterns and risk of gastric cancer in Japan. *Int J Cancer.* 2004;110:435–442.
- Blanchard CM, Courneya KS, Stein K. Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: results from the American Cancer Society's SCS-II. *J Clin Oncol.* 2008;26:2198–2204.
- Pisegna J, Xu M, Spees C, Krok-Schoen JL. Mental health-related quality of life is associated with diet quality among survivors of breast cancer. *Support Care Cancer.* 2021;29:2021–2028.
- Kushi LH, Doyle C, McCullough M, et al. American Cancer Society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *Ca - Cancer J Clin.* 2012;62:30–67.
- van Bokhorst-De Van Der Schueren MA, Quak JJ, von Blomberg-van der Flier BM, et al. Effect of perioperative nutrition, with and without arginine supplementation, on nutritional status, immune function, postoperative morbidity, and survival in severely malnourished head and neck cancer patients. *Am J Clin Nutr.* 2001;73:323–332.
- Coro D, Hutchinson A, Dahlenburg S, Banks S, Coates A. The relationship between diet and cognitive function in adult cancer survivors: a systematic review. *J Cancer Surviv.* 2019;13:773–791.
- Moazzen S, Cortés-Ibañez FO, van Leeuwen BL, Alizadeh BZ, de Bock GH. Assessment of diet quality and adherence to dietary guidelines in gastrointestinal cancer survivors: a cross-sectional study. *Nutrients.* 2020;12:2232.
- Andersen JLM, Halkjær J, Rostgaard-Hansen AL, et al. Intake of whole grain and associations with lifestyle and demographics: a cross-sectional study based on the Danish diet, cancer and health-next generations cohort. *Eur J Nutr.* 2021;60:883–895.
- Arthur AE, Delk A, Demark-Wahnefried W, et al. Pancreatic cancer survivors' preferences, barriers, and facilitators related to physical activity and diet interventions. *J Cancer Surviv.* 2016;10:981–989.
- Kane K, Ilic S, Paden H, et al. An evaluation of factors predicting diet quality among cancer patients. *Nutrients.* 2018;10:1019.
- Ryu SW, Son YG, Lee MK. Motivators and barriers to adoption of a healthy diet by survivors of stomach cancer: a cross-sectional study. *Eur J Oncol Nurs.* 2020;44:101703.
- Ligibel JA, Jones LW, Brewster AM, et al. Oncologists' attitudes and practice of addressing diet, physical activity, and weight management with patients with cancer: findings of an ASCO survey of the oncology workforce. *J Oncol Pract.* 2019;15:e520–e528.
- De Vries H. An integrated approach for understanding health behavior; the I-change model as an example. *Psychol Behav Sci Int J.* 2017;2:555–585.
- Boudreau F, Walthouwer MJL, de Vries H, et al. Rationale, design and baseline characteristics of a randomized controlled trial of a web-based computer-tailored physical activity intervention for adults from quebec city. *BMC Publ Health.* 2015;15:1–10.
- De Vries H, Kremers S, Smeets T, Brug J, Eijmael K. The effectiveness of tailored feedback and action plans in an intervention addressing multiple health behaviors. *Am J Health Promot.* 2008;22:417–424.
- Prochaska JO, DiClemente CC. *The Transtheoretical Approach: Crossing Traditional Boundaries of Therapy.* 2nd ed. Krieger Publishing Company; 1994.
- Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev.* 1977;84:191.
- Barlow J, Wright C, Sheasby J, Turner A, Hainsworth J. Self-management approaches for people with chronic conditions: a review. *Patient Educ Counsel.* 2002;48:177–187.
- Neck CP, Manz CC. *Mastering Self-Leadership: Empowering Yourself for Personal Excellence.* 6th ed. Pearson; 2010.
- Sniehotta FF, Schwarzer R, Scholz U, Schüz B. Action planning and coping planning for long-term lifestyle change: theory and assessment. *Eur J Soc Psychol.* 2005;35:565–576.
- Sniehotta FF, Scholz U, Schwarzer R. Action plans and coping plans for physical exercise: a longitudinal intervention study in cardiac rehabilitation. *Br J Health Psychol.* 2006;11:23–37.
- Habbous S, Chu KP, Harland LT, et al. Validation of a one-page patient-reported Charlson comorbidity index questionnaire for upper aerodigestive tract cancer patients. *Oral Oncol.* 2013;49:407–412.
- Dzrayich Antol D, Waldman Casebeer A, Khoury R, et al. The relationship between comorbidity medication adherence and health related quality of life among patients with cancer. *J Patient Rep Outcomes.* 2018;2:29.
- Nigg CR, Rossi J, Norman G, Benisovich S. Structure of decisional balance for exercise adoption. *Ann Behav Med.* 1998;20:211.
- Henry H, Reimer K, Smith C, Reicks M. Associations of decisional balance, processes of change, and self-efficacy with stages of change for increased fruit and vegetable intake among low-income, African-American mothers. *J Am Diet Assoc.* 2006;106:841–849.
- Schwarzer R, Renner B. Health-specific self-efficacy scales. *Freie Universität Berlin.* 2009;14:2009.
- Houghton JD, Dawley D, DiLiello TC. The abbreviated self-leadership questionnaire (ASLQ): a more concise measure of self-leadership. *Int J Leadership Studies.* 2012;7:216–232.
- Briggs Early K, Armstrong Shultz J, Evans M, Corbett CF, Nicholson Butkus S, Massey L. Dietary goal attainment measures and psychosocial factors among Mexican Americans and non-Hispanic whites with type 2 diabetes. *Ecol Food Nutr.* 2012;51:227–246.
- Cox-Martin E, Cox MG, Basen-Engquist K, Bradley C, Blalock JA. Changing multiple health behaviors in cancer survivors: smoking and exercise. *Psychol Health Med.* 2020;25:331–343.
- Patterson RE, Haines PS, Popkin BM. Diet quality index: capturing a multidimensional behavior. *J Am Diet Assoc.* 1994;94:57–64.
- Oh K-W, Nam J-M, Park J-H, et al. A case-control study on dietary quality and risk for coronary heart disease in Korean men. *J Nutr Health.* 2003;36:613–621.
- Wayne SJ, Baumgartner K, Baumgartner RN, Bernstein L, Bowen DJ, Ballard-Barbash R. Diet quality is directly associated with quality of life in breast cancer survivors. *Breast Cancer Res Treat.* 2006;96:227–232.
- Springfield S, Odoms-Young A, Tussing-Humphreys LM, Freels S, Stolley MR. A step toward understanding diet quality in urban African-American breast cancer survivors: a cross-sectional analysis of baseline data from the moving forward study. *Nutr Cancer.* 2019;71:61–76.
- Nassim G, Redmond ML, Ofei-Dodoo S, Benton M, Lu K. Nutrition self-efficacy and dietary patterns among older African American women in Kansas. *Kans J Med.* 2020;13:209.
- Fitzgerald A, Heary C, Kelly C, Nixon E, Shevlin M. Self-efficacy for healthy eating and peer support for unhealthy eating are associated with adolescents' food intake patterns. *Appetite.* 2013;63:48–58.
- Gase LN, Glenn B, Kuo T. Self-efficacy as a mediator of the relationship between the perceived food environment and healthy eating in a low income population in Los Angeles County. *J Immigr Minority Health.* 2016;18:345–352.
- Guillaumie L, Godin G, Vézina-Im L-A. Psychosocial determinants of fruit and vegetable intake in adult population: a systematic review. *Int J Behav Nutr Phys Activ.* 2010;7:1–12.
- Bandura A. Health promotion by social cognitive means. *Health Educ Behav.* 2004;31:143–164.
- Moon J-A, Yoo C-H, Kim MH, et al. Knowledge, self-efficacy, and perceived barriers on the low-iodine diet among thyroid cancer patients preparing for radioactive iodine therapy. *Clin Nutr Res.* 2012;1:13–22.
- Tiwari P, Kumar L, Thulkar S, Singh G, Malik P, Seth A. Patient reported weight loss predicts recurrence rate in renal cell cancer cases after nephrectomy. *Asian Pac J Cancer Prev APJCP.* 2018;19:891–895.
- Paech J, Lippke S. Put two (and two) together to make the most of physical activity and healthy nutrition—A longitudinal online study examining cross-behavioural mechanisms in multiple health behaviour change. *Res Sports Med.* 2017;25:357–372.
- Smith MM, Goodfellow L. The relationship between quality of life and coping strategies of adults with celiac disease adhering to a gluten-free diet. *Gastroenterol Nurs.* 2011;34:460–468.
- Lee MK, Yun YH, Park HA, Lee ES, Jung KH, Noh DY. A Web-based self-management exercise and diet intervention for breast cancer survivors: pilot randomized controlled trial. *Int J Nurs Stud.* 2014;51:1557–1567.
- Ferland A, Chu YL, Gleddie D, Storey K, Veugelers P. Leadership skills are associated with health behaviours among Canadian children. *Health Promot Int.* 2015;30:106–113.

53. Lee MK, Park SY, Choi GS. Association of support from family and friends with self-leadership for making long-term lifestyle changes in patients with colorectal cancer. *Eur J Cancer Care*. 2018;27, e12846.
54. Yun YH, Sim JA, Jung JY, et al. The association of self-leadership, health behaviors, and posttraumatic growth with health-related quality of life in patients with cancer. *Psycho Oncol*. 2014;23:1423–1430.
55. Armitage CJ, Conner M. Social cognition models and health behaviour: a structured review. *Psychol Health*. 2000;15:173–189.
56. Organization WH. *The Ottawa Charter for Health Promotion*; 1986. Retrieved from <https://www.who.int/teams/health-promotion/enhanced-wellbeing/first-global-conference>.
57. Manz CC. Self-leadership... the heart of empowerment. *J Qual Participation*. 1992;15:80.
58. Manz CC, Sims Jr HP. Self-management as a substitute for leadership: a social learning theory perspective. *Acad Manag Rev*. 1980;5:361–367.
59. Manz CC, Neck CP. Inner leadership: creating productive thought patterns. *Acad Manag Perspect*. 1991;5:87–95.
60. Rosland A-M, Heisler M, Choi H-J, Silveira MJ, Piette JD. Family influences on self-management among functionally independent adults with diabetes or heart failure: do family members hinder as much as they help? *Chron Illness*. 2010;6: 22–33.
61. Brown BJ, Hermann JR. Cooking classes increase fruit and vegetable intake and food safety behaviors in youth and adults. *J Nutr Educ Behav*. 2005;37:104–105.