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

Myung Kyung Lee

College of Nursing, Research Institute of Nursing Science, Kyungpook National University, Daegu, Republic of Korea

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, with the highest rates of incidence in eastern Asia. 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. 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. A healthy eating pattern excludes red and processed meats, sugar-sweetened beverages, highly processed foods, and refined grain products. Particularly in the case of patients with gastric cancer, consuming large amounts of salted foods and processed meats, frequent use of cooking oil, a low vitamin intake, and consumption of fruits and vegetables (F&V) in low amounts 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. Maintaining diet quality with a diet plan can improve the health-related quality of life (HRQoL) and symptoms, recurrence, immune function, and cognitive function 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. 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. 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. Adopting a healthy diet may be difficult to initiate and maintain, thereby highlighting the importance of...
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, and longer working hours, as well as with cancer types. Poor adherence to diet recommendations was also associated with obesity; physical and emotional problems; cognitive skills, such as self-control, self-leadership, and self-efficacy; 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.
knowledge\textsuperscript{19}; and social support.\textsuperscript{19,20} 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)\textsuperscript{11} has been used successfully to alter multiple targeted health behaviors.\textsuperscript{21,25} 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).\textsuperscript{21}

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.\textsuperscript{21,24} Self-efficacy is the belief by a person that they can perform certain behaviors.\textsuperscript{25} Self-efficacy was measured using self-efficacy for diet planning and F&amp;V intake. Self-leadership is a life skill that facilitates the improvement of self-management behaviors arising from living with a chronic condition.\textsuperscript{26} This process involves behavioral and cognitive self-evaluation and self-influence to develop positive behaviors to ultimately improve overall performance.\textsuperscript{27} 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.\textsuperscript{26} Coping planning can help individuals overcome obstructions and learn to cope with difficulties by anticipating personal barriers and planning detailed coping responses.\textsuperscript{29}

Because social support can predict lifestyle changes in gastric cancer survivors,\textsuperscript{13} 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&amp;V, self-efficacy for diet planning and F&amp;V intake, coping planning, and self-leadership with stages of change in F&amp;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&amp;V intake and diet planning, coping planning, and self-leadership with the stage of change in adopting F&amp;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 decent. 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&amp;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.\textsuperscript{3} 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.\textsuperscript{32} This questionnaire provides a weighted score of an individual’s comorbidities, which can be used to predict their treatment adherence and HRQoL.\textsuperscript{32}

The measures of decisional balance on consuming F&amp;V, self-efficacy for a diet plan, self-efficacy for F&amp;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&amp;V

Decisional balance on adopting healthy behaviors is a measure of the benefits and drawbacks of decisions made to adopt healthy behaviors.\textsuperscript{32} The perceived benefits and drawbacks of consuming more F&amp;V were determined based on a decisional balance scale that originally included 33 items of 5 subscales.\textsuperscript{33} The scale of decisional balance on consuming F&amp;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 $\alpha = 0.7$), 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 $\alpha = 0.79$). 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. 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 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. Each item was measured on a 5-point Likert scale, with 1 indicating not at all 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 and $\alpha = 0.85$ for the current study.

Coping planning

Coping planning was measured using a validated psychometric assessment instrument 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 and $\alpha = 0.87$ for the current study.

Self-leadership

Self-leadership was measured using the validated Abbreviated Self-Leadership Questionnaire (ASLQ), 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 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 and in adhering to a diet plan. These stages of change instruments have been used as a novel dietary goal measure. 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) adapted for the Korean population. 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. 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. 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 | Decisional Balance on Consuming F&V | Self-efficacy for Healthy Diet | Coping Planning | Self-leadership |
|-----------------------------------|-------------------------------------|-------------------------------|-----------------|-----------------|
|                                   | Advantages                          | Disadvantages                 | Self-efficacy   | Behavior         | Task motivation | Constructive    |                 |
|                                   |                                     |                               | for F&V intake  | awareness and    | cognition       | cognition       |                 |
|                                   | Health benefit                      | General barriers              | Korean dietary  | volition          |                 |                 |                 |
|                                   |                                     |                               | pattern         |                 |                 |                 |                 |
| Gender                            |                                     |                               |                 |                 |                 |                 |                 |
| Male                              | 98 (67.1)                           | 73.9                          | 54.4            | 46.0             | 55.7             | 42.2             | 62.2             | 52.0             | 53.8             | 59.1             |
| Female                            | 48 (32.9)                           | 70.7                          | 0.311           | 49.7             | 0.124           | 50.7             | 0.048           | 53.6             | 0.613           | 0.039           |
| Age (years)                       |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| < 65                              | 90 (61.6)                           | 71.0                          | 54.9            | 46.1             | 55.3             | 43.6             | 60.8             | 48.5             | 52.2             | 55.5             |
| ≥ 65                              | 56 (38.4)                           | 76.0                          | 0.099           | 49.5             | 0.063           | 49.9             | 0.104           | 54.6             | 0.878           | 0.544           |
| Marital status                    |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| No spouse                         | 38 (26.0)                           | 68.4                          | 0.072           | 53.0             | 0.088           | 56.4             | 0.227           | 43.1             | 0.804           | 59.1             | 0.087           |
| With spouse                       | 108 (74.0)                          | 74.5                          | 0.022           | 50.9             | 0.093           | 54.5             | 0.743           | 57.3             | 0.403           | 59.6             | 0.688           |
| Practicing a religion             |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| No                                | 56 (38.4)                           | 73.8                          | 0.224           | 50.9             | 0.093           | 54.5             | 0.743           | 57.3             | 0.403           | 59.6             | 0.688           |
| Yes                               | 90 (61.6)                           | 70.0                          | 0.191           | 49.5             | 0.063           | 49.9             | 0.104           | 54.6             | 0.878           | 0.544           |
| Currently employed                |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| No                                | 88 (60.3)                           | 72.2                          | 0.544           | 53.5             | 0.597           | 53.5             | 0.912           | 43.5             | 0.743           | 62.1             | 0.270           |
| Yes                               | 54 (37.9)                           | 74.0                          | 0.224           | 50.9             | 0.093           | 54.5             | 0.743           | 57.3             | 0.403           | 59.6             | 0.688           |
| Monthly household income (in US$) |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| 2000                               | 90 (61.6)                           | 71.3                          | 0.224           | 50.9             | 0.093           | 54.5             | 0.743           | 57.3             | 0.403           | 59.6             | 0.688           |
| ≥ 2000                            | 56 (38.4)                           | 75.4                          | 0.185           | 55.6             | 0.126           | 55.9             | 0.300           | 45.3             | 0.233           | 62.9             | 0.133           |
| Residence                         |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| Small town, rural area            | 34 (23.3)                           | 76.1                          | 0.211           | 53.8             | 0.329           | 55.5             | 0.673           | 47.3             | 0.139           | 57.1             |
| Metropolitan area                 | 112 (76.7)                          | 71.9                          | 0.231           | 53.8             | 0.299           | 56.2             | 0.002           | 47.3             | 0.717           | 51.9             | 0.042           |
| Public health insurance           |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| National health insurance         | 112 (76.7)                          | 72.1                          | 0.239           | 54.0             | 0.413           | 58.1             | 0.791           | 48.1             | 0.798           | 59.3             | 0.301           |
| Medical aid                       | 27 (18.5)                           | 76.5                          | 0.239           | 54.0             | 0.413           | 58.1             | 0.791           | 48.1             | 0.798           | 59.3             | 0.301           |
| Number of family members          |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
| 0-1                                | 40 (27.4)                           | 74.2                          | 0.596           | 54.4             | 0.097           | 59.8             | 0.462           | 47.3             | 0.751           | 54.2             | 0.467           |
| 2+                                | 106 (72.6)                          | 72.4                          | 0.596           | 54.4             | 0.097           | 59.8             | 0.462           | 47.3             | 0.751           | 54.2             | 0.467           |
| Private health insurance          |                                     |                               |                 |                 |                 |                 |                 |                 |                 |                 |
Table 1 (continued)

| Socio-demographic Characteristics | Behavioral and Cognitive | Task Motivation | Constructive Cognition | Self-efﬁcacy for Diet Planning | Self-efﬁcacy for Diet Quality | Self-efﬁcacy for Problematic Korean Dietary Pattern |
|----------------------------------|-------------------------|----------------|------------------------|-------------------------------|-----------------------------|----------------------------------|
| n (%)                            | Mean (SD)               | P              | Mean (SD)              | P                           | Mean (SD)                  | P                               |
| No                               | 61 (43.6)               | 57.5 (16.3)    | 0.214 (1.3)            | 0.079 (1.5)                 | 61.2 (17.6)                | 0.214 (1.3)                     |
| Yes                              | 85 (56.4)               | 57.8 (15.9)    | 0.214 (1.3)            | 0.079 (1.5)                 | 61.2 (17.6)                | 0.214 (1.3)                     |

Bold type indicates statistically significant results.
F & V, fruits and vegetables; PRO-CCI, Patient-Reported Charlson Comorbidity Index; SD, standard deviation.

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 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 years (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
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 6.5), 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,41 African American women,42 adolescents,43 and a low-income population,44 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.45 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.46 Higher self-efficacy is

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### Table 2

| 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) | Stage of change, n (%) n = 146 | Diet quality index score Mean (SD) | Correlation coefficient r (P) | Correlation coefficient r (P) |
| Pre-contemplation                | 20 (13.7)                       | 3.0 (1.8)               | 14 (9.6)                       | 8.1 (4.0)                         | 0.72 (0.0001)                 | 0.57 (0.0001)                 |
| Contemplation                    | 53 (36.3)                       | 4.4 (1.1)               | 15 (10.3)                      | 6.3 (1.0)                         | 0.51 (0.0001)                 | 0.52 (0.0001)                 |
| Preparation                      | 13 (8.9)                        | 4.5 (0.5)               | 46 (31.5)                      | 6.8 (1.6)                         | 0.61 (0.0001)                 | 0.43 (0.0001)                 |
| Action                           | 24 (16.4)                       | 7.7 (2.9)               | 37 (25.3)                      | 5.6 (1.2)                         | 0.61 (0.0001)                 | 0.43 (0.0001)                 |
| Maintenance                      | 36 (24.7)                       | 9.0 (2.5)               | 34 (23.3)                      | 4.8 (1.9)                         | 0.57 (0.0001)                 | 0.43 (0.0001)                 |

SD, standard deviation

### Table 3

| Main Independent Variable                  | Higher Readiness for Change in F&V Intake | Higher Readiness for Change in Following a Food Plan |
|--------------------------------------------|------------------------------------------|-----------------------------------------------------|
|                                            | aOR (95% CI)                              | P                                                   | aOR (95% CI)                              | 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                                               |
| Preference of 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               | 1.02 (1.01–1.04)                          | 0.001                                               | 1.02 (1.01–1.04)                          | 0.003                                               |
| Self-efficacy for diet plan                | 1.01 (0.99–1.03)                          | 0.060                                               | 1.02 (1.01–1.04)                          | 0.004                                               |
| Coping planning                            | 1.02 (1.01–1.04)                          | 0.026                                               | 1.01 (0.99–1.03)                          | 0.203                                               |
| Self-leadership                            |                                         |                                                     |                                       |                                                     |
| Behavior awareness and volition            | 1.01 (0.99–1.02)                          | 0.096                                               | 1.02 (1.01–1.03)                          | 0.017                                               |
| Task motivation                            | 1.00 (0.99–1.02)                          | 0.573                                               | 1.02 (1.00–1.03)                          | 0.037                                               |
| 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 (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.57 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.58 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 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 psycho-social 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.45 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.46 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.47 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.52-54 Furthermore, the early application of self-leadership factors promoted behavioral changes.55 The promotion of leadership skills was identified as a core area for action in the Ottawa Charter for Health Promotion.56 Self-leadership, defined as leadership directed inwardly, has been found essential to self-management and in creating productive thought patterns such as task motivation, volition, and awareness of one’s own actions.57 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 behaviors and encourage and lead themselves.57 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.50 For instance, family members may refuse to eat the type of food the patient would like to eat, which 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.61 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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8
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.

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