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Knowledge, attitudes, and practices of primary caregivers of gastric cancer patients regarding postoperative dietary management

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Abstract

Background Family caregivers of gastric cancer (GC) patients after gastrectomy have a strong demand for nutrition knowledge. This study investigates the knowledge, attitudes, and practices (KAP) of primary caregivers of GC patients regarding postoperative dietary management.

Methods We conducted a cross-sectional study, collecting data through questionnaire distribution. Demographic information of the respondents and KAP scores were assessed and analyzed.

Results Of 508 included participants, majority were female (59.84%) urban residents (78.94%), aged 40–60 years (53.15%). Caretakers were primarily spouses of GC patient (50.39%) or parents (10.43%), only child (12.99%) or non-only child (24.21%). Notable percentage of poor knowledge and practice was found among participants (45.05% and 40.55%, respectively), while attitude was predominantly positive (99.41%). Correlation analysis revealed a weak positive correlation between knowledge and attitude scores ($r=0.150$, $P<0.001$) and negative link to practice scores ($r=-0.228$, $P<0.001$); attitude scores were positively correlated with practice ($r=0.117$, $P=0.008$). Multivariate logistic regression analysis found that higher attitude scores were independently associated with higher practice scores (OR=1.360; 95%CI, 1.223–1.513), $P<0.001$), while higher knowledge scores (OR=0.684; 95%CI, 0.575–0.815), $P<0.001$), older age (OR=0.951; 95%CI, 0.918–0.985), $P=0.005$), duration of caregiving > 3 months (3–6 months (OR=0.415; 95%CI, 0.193–0.894, $P=0.025$); 6 months–1 year (OR=0.269; 95%CI, 0.120–0.606), $P=0.002$); >1 year (OR=0.290; 95%CI, 0.120–0.705), $P=0.006$), and follow-up location after patient's surgery (OR=0.072 (0.033–0.160), $P<0.001$) were independently associated with lower practice scores.

Conclusions Family caregivers of GC patients that participated in this study demonstrated moderate knowledge and practice, but positive attitude towards dietary management after gastrectomy.

Keywords Gastric cancer, Caregivers, Knowledge, Attitudes, Practices

Background

Gastric cancer (GC) is highly heterogeneous disease that remains a major unmet clinical problem worldwide [1, 2]. During the last decade GC was reported as the third or fourth leading cause of cancer deaths, and 1.1 million new cases were diagnosed in 2020 (~ 6% of all cancer cases globally) [3, 4]. The lifetime risk of GC is about 1 in 54 men and 1 in 126 women, progressing

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with age [5]. Different regions report specific patterns of the GC presentation, with the highest incidence reported in Eastern Asia, followed by eastern and central Europe [6]. Thereby, Asia presents approximately 75% of all new cases or deaths from GC [4]. To combat this challenge, GC diagnosis and treatment possibilities are rapidly evolving along with the progress of modern medicine, allowing for better recognition and recovery. Besides surgical resection, fundamental treatment methods include systemic chemoradiation or chemotherapy, as well as novel targeted and immune therapies [7]. Comprehensive surgical resection with lymphadenectomy is regarded as the choice strategy aimed to cure GC [1, 3]. However, although the 5-year survival rate of early GC can reach 90%, late stage patients undergoing surgical resection in many cases have a 5-year survival rate less than 30% [1, 8].

Among the reasons for negative outcome, the functional and anatomical changes of the digestive tract after gastrectomy play the major role, leading to the appearance of “post-gastrectomy syndromes” [9, 10]. Malnutrition, consistently associated with unfavorable prognosis, occurs in more than half of patients after surgery for gastric cancer, particularly after discharge from hospital [11, 12]. Micronutrients deficiency and reduction of albumin levels are found in about 2/3 of GC patients after gastrectomy, which is highly correlated with infectious complications, longer hospital stay, and, as the result, higher treatment costs and mortality [13–15]. Recent studies demonstrated that early nutritional support might significantly reduce postoperative complications discussed above, but to date there are no specific evidence-based guidelines in this field [13, 16].

The effectiveness of nutrition education was discussed before in changing practice habits associated with gastric cancer [17], as well as other types of cancer [18, 19]. Knowledge, Attitude and Practice (KAP) study is a valuable tool to evaluate the impact of education on understanding and habits. Previous KAP studies reported low knowledge regarding the post-surgery nutritional support not only in cancer patients [20], but in surgeons [21, 22] and nurses [23], calling for a discussion on the possible ways to improve this knowledge. Moreover, recent study reported the lack of acceptance of novel technologies for delivering nutrition care by health professionals [24]. In this scenario, family caregivers of GC patients have a strong demand for nutrition knowledge, driven by the necessity to battle malnourishment and arrange the adequate diet after discharge [25]. To the best of our knowledge, no previous study assessed the KAP towards nutrition support after gastrectomy among primary caregivers of GC patients.

Based on the above, this study aimed to investigate the KAP of primary caregivers of GC patients regarding postoperative dietary management, based on hypothesis that there are differences between the knowledge that caregivers have, their attitudes toward diet management, and the practices they implement, with demographics of caregivers and their relationship with patients influencing KAP scores. Obtained results might help to identify potential gaps in caregiver knowledge and practice to enable the development of targeted educational interventions and support services to optimize postoperative nutritional care for patients with GC.

Methods

Study design and participants

This cross-sectional study was conducted from August 21, 2023, to November 15, 2023, at the author's Hospital, focusing on primary caregivers of GC patients. The research received ethical approval from the Ethics Committee of the author's Hospital and informed consent was obtained from all participants.

Inclusion Criteria: 1. Caregivers of patients with GC confirmed by our hospital's pathological examination. 2. Age between 18 and 75 years. 3. Adequate language communication abilities with a reasonable level of reading and writing skills. 4. Willingness to participate in the study and sign informed consent form.

Exclusion Criteria: 1. History of psychiatric disorders. 2. Refusal to participate or withdrawal during the study. 3. Incomplete questionnaire during data collection. 4. Death or withdrawal of GC patient.

We distributed questionnaire QR codes to invite family members of gastric cancer patients to participate in a survey through WeChat follow-up groups for gastric cancer patients and WeChat groups for family members. Simultaneously, we placed questionnaire QR codes in the outpatient waiting areas to encourage family members accompanying gastric cancer patients for follow-up visits to fill out the survey.

Questionnaire introduction

The questionnaire design was guided by relevant guidelines [26, 27] and recent published KAP studies that included participants providing nutrition care to patients on treatment for upper gastrointestinal cancers [21, 24]. Following the initial design, feedback from a panel of 5 experts (2 specialists in gastrointestinal surgery, 2 specialists in gastroenterology, and 1 expert in public health) was incorporated to refine the questionnaire. After the initial draft, a pilot study involving 30 participants was conducted. The reliability of the pre-experimental feedback questionnaire, assessed by Cronbach's α coefficient, was 0.906 (with Cronbach's α values of 0.651 for

knowledge, 0.885 for attitude, and 0.907 for practice dimensions).

The final questionnaire comprises four sections: basic information, knowledge dimension, attitude dimension, and practice dimension. The knowledge dimension consisted of 12 questions, with a score range of 0–12 points, where correct answers were awarded 1 point and incorrect or unclear responses received 0 points. The attitude dimension included 8 questions, utilizing a five-point Likert scale ranging from very positive (5 points) to very negative (1 point), with a total score range of 8–40 points. The practice dimension consisted of 10 questions, employing a five-point Likert scale ranging from always (5 points) to never (1 point), with a total score range of 10–50 points. After scores were calculated, following qualitative (truncated) interpretation was used: Good (>75% of maximal); Upper middle (75%–50% of maximal); Middle and lower (50%–25% of maximal); Poor (25% or less of maximal). Percentage of participants with “good” scores, signifying “good knowledge”, “positive attitude” and “proactive practice”, was calculated and compared between different categories, suggesting areas where caregivers may need more focused educational interventions to optimize patient care.

Statistical methods

1. Descriptive analysis was conducted for demographic data and KAP scores: continuous variables were presented using Mean \pm SD. Categorical variables and responses to each question were described using frequency counts and percentages.
2. Differences in knowledge (K), attitude (A), and practice (P) scores among subjects with different demographic characteristics was assessed using independent sample analysis: group comparisons were performed using Mann-Whitney U test or Kruskal-Wallis H test.
3. Spearman correlation analysis was employed to explore the correlation between knowledge, attitude, and practice scores.
4. Single and multiple logistic regression analyses were conducted to investigate factors influencing practice.

All statistical results with a *p*-value less than 0.05 were considered statistically significant. Statistical analysis was performed using SPSS version 26.0.

Results

Basic characteristics of survey participants

A total of 532 questionnaires were collected. Of them 23 invalid questionnaires were excluded: (1) Disagreement with the study (3 cases); (2) Response time less than 43 s

(15 cases) or greater than 2580 s (2 cases); (3) Age outliers (3 cases). A total of 508 remaining valid questionnaires were analyzed in this study, with the Cronbach's α for the formal experiment feedback scale of 0.764 (Knowledge: 0.596, Attitude: 0.629, Practice: 0.764). The Kaiser-Meyer-Olkin (KMO) value was 0.844.

Characteristics of included participants are demonstrated in Table 1. The majority of responders were female (59.84%) urban residents (78.94%), aged 40–60 years (53.15%). Based on the relationship with GC patients, caretakers were primarily spouses (50.39%); other relationships included parents (10.43%), only child (12.99%) or non-only child (24.21%) of GC patient. Only 22.83% were sole caregivers, others reported to receive assistance from family members. Strict adherence to 3-month follow-up frequency was demonstrated by 81.69% of participants.

Knowledge, attitude, and practice patterns

The mean knowledge score was 6.40 ± 1.96 (53.33% from maximum 12 points), with 43.70% of participants characterized by “good knowledge” according to quartile distribution, and 45.08 by “poor knowledge”. Attitude scores were 32.87 ± 2.81 (82.18% from maximum 40 points), with the majority of participants demonstrating positive (48.03%) or very positive (51.38%) attitudes. The mean practice score was 33.24 ± 6.38 (66.48% from maximum 50 points), with 41.73% characterized by proactive practice, while 40.55% had scores corresponding to inactive practice. Distribution of scores according to quartiles was demonstrated in Fig. 1.

Knowledge scores significantly differed according to age ($p=0.001$), marriage status ($p<0.001$), education ($p<0.001$), residence ($p<0.001$), occupation ($p<0.001$), income ($p<0.001$) and relationship to the patient ($p<0.001$). Among participants who performed caregiving duty for more than 1 year, number of responders with good knowledge was almost twice higher compared to <3 months (60.92% VS 32.61%); percentage of “good knowledge” was also higher in those not living with the patient (64.76% VS 43.42%), and participants who strictly adhered to 3-month follow-up frequency (52.77% VS 25.81%) (Table 1). The least known points included the potential of liquid diet after surgery (17.32% correct answers) and nutritional value of liquid dishes (25.79% correct answers) (Table 2).

Attitude scores significantly differed in participants with different relationship to the patient ($p=0.026$). Percentage of participants with “positive attitude” was also higher among those who strictly adhered to 3-month follow-up frequency (99.52% VS 98.92%) (Table 1). Points with less positive attitudes included the capability of dietary management to reduce the tumor recurrence rate

Table 1 Basic information of participants and their knowledge, attitude and practice scores

	N (%)	Good* knowledge (6–9) N (%)	Knowledge, P mean ± SD	Positive* attitude (24–40) N (%)	Attitude, mean ± SD P	Proactive* practice (30–50) N (%)	Practice, mean ± SD P
N = 508							
Total Score			6.40 ± 1.96		32.87 ± 2.81		33.24 ± 6.38
Gender							0.134
Male	204 (40.16)	92 (45.10)	6.28 ± 1.82	203 (99.51)	33.01 ± 2.77	121 (59.31)	33.75 ± 6.69
Female	304 (59.84)	151 (49.67)	6.48 ± 2.05	302 (99.34)	32.77 ± 2.84	176 (57.89)	32.89 ± 6.16
Age							<0.001
18–40 years	165 (32.48)	88 (53.33)	6.71 ± 2.08	163 (98.79)	32.95 ± 2.94	124 (75.15)	36.07 ± 6.88
40–60 years	270 (53.15)	129 (47.78)	6.41 ± 1.78	269 (99.63)	32.86 ± 2.51	137 (50.74)	31.89 ± 5.61
> 60 years	73 (14.37)	26 (35.62)	5.64 ± 2.14	73 (100.00)	32.74 ± 3.53	36 (49.32)	31.82 ± 5.86
Marital Status							<0.001
Married	427 (84.06)	220 (51.52)	6.61 ± 1.92	425 (99.53)	32.93 ± 2.78	222 (51.99)	32.15 ± 6.01
Unmarried/ divorced/ widowed	81 (15.94)	23 (28.40)	5.31 ± 1.83	80 (98.77)	32.53 ± 2.98	75 (92.59)	38.98 ± 5.14
Education							<0.001
Junior high school and below	149 (29.33)	55 (36.91)	5.83 ± 1.94	149 (100.00)	32.79 ± 3.19	83 (27.95)	32.95 ± 6.49
High school/ technical school	200 (39.37)	110 (50.65)	6.68 ± 1.85	199 (99.50)	32.87 ± 2.57	93 (46.50)	31.34 ± 5.52
Associate/ bachelor's degree and above	157 (30.31)	78 (50.65)	6.58 ± 2.02	157 (100.00)	32.95 ± 2.75	121 (77.07)	35.90 ± 6.42
Residence							0.031
Urban	401 (78.94)	209 (52.12)	6.65 ± 1.84	398 (99.25)	32.93 ± 2.71	243 (60.60)	33.55 ± 6.33
Rural	107 (21.06)	34 (31.78)	5.48 ± 2.11	107 (100.00)	32.66 ± 3.17	54 (50.47)	32.06 ± 6.49
Occupation							<0.001
Enterprise employee	101 (19.88)	64 (63.37)	7.21 ± 1.57	101 (100.00)	33.09 ± 2.47	52 (51.49)	31.92 ± 5.18
Farmer	114 (22.44)	41 (35.97)	5.61 ± 2.10	114 (100.00)	32.82 ± 3.11	54 (47.37)	31.69 ± 6.43
Public official	66 (12.99)	31 (46.97)	6.88 ± 2.05	66 (100.00)	33.17 ± 2.45	54 (81.82)	36.23 ± 6.01
Worker	85 (16.73)	30 (35.29)	5.79 ± 1.73	84 (98.82)	32.86 ± 2.76	55 (64.71)	34.71 ± 6.55
Self-employed/ businessperson	60 (11.81)	36 (60.00)	6.78 ± 1.84	60 (100.00)	32.73 ± 2.84	39 (65.00)	34.08 ± 7.31
Other	82 (16.14)	41 (50.00)	6.46 ± 1.88	80 (97.56)	32.55 ± 3.11	43 (52.44)	32.45 ± 5.97
Monthly per capita income							0.650
4000	64 (12.60)	19 (29.69)	5.16 ± 2.35	63 (98.44)	32.73 ± 3.94	34 (53.13)	32.75 ± 7.47
4000–6000	310 (61.02)	147 (47.42)	6.41 ± 1.80	308 (99.35)	32.81 ± 2.65	177 (57.10)	33.17 ± 6.24
6000	134 (26.38)	77 (57.46)	6.96 ± 1.85	134 (100.00)	33.07 ± 2.53	86 (64.18)	33.61 ± 6.17

Table 1 (continued)

	N (%)	Good* knowledge (6–9) N (%)	Knowledge, mean ± SD	P	Positive* attitude (24–40) N (%)	Attitude, mean ± SD	P	Proactive* practice (30–50) N (%)	Practice, mean ± SD	P
Relationship with gastric cancer patient										
Spouse	256 (50.39)	126 (49.22)	6.57 ± 1.59	<0.001	255 (99.61)	32.98 ± 2.35	0.026	113 (44.14)	30.98 ± 5.08	<0.001
Parent	53 (10.43)	12 (22.64)	4.77 ± 2.35		53 (100.00)	31.72 ± 3.71		43 (81.13)	36.15 ± 6.92	
Only child	66 (12.99)	35 (53.03)	6.65 ± 2.05		66 (100.00)	33.29 ± 2.65		55 (63.41)	36.77 ± 6.35	
Non-only child	123 (24.21)	65 (52.85)	6.63 ± 1.96		121 (98.37)	32.87 ± 2.98		78 (63.41)	34.54 ± 6.79	
Other	10 (1.97)	5 (50.00)	6.00 ± 3.59		10 (100.00)	33.30 ± 5.42		8 (80.00)	36.00 ± 7.38	
Duration of caregiving										
< 3 months	92 (18.11)	30 (32.61)	5.50 ± 2.29	<0.001	91 (98.91)	33.26 ± 3.40	0.263	72 (78.26)	37.22 ± 6.72	<0.001
3–6 months	161 (31.69)	66 (40.99)	6.14 ± 1.65		159 (98.76)	32.65 ± 2.63		93 (57.76)	33.57 ± 6.50	
6 months–1 year	168 (33.07)	94 (55.95)	6.77 ± 1.84		168 (100.00)	32.73 ± 2.51		79 (47.02)	31.21 ± 6.51	
> 1 year	87 (17.13)	53 (60.92)	7.10 ± 1.92		87 (100.00)	33.14 ± 2.99		53 (60.92)	32.31 ± 6.51	
Assistance in caregiving										
Yes	392 (77.17)	195 (49.74)	6.51 ± 1.98	0.026	390 (99.49)	33.04 ± 2.83	0.012	228 (58.16)	33.39 ± 6.37	0.334
No	116 (22.83)	48 (41.38)	6.04 ± 1.84		115 (99.14)	32.29 ± 2.71		69 (59.48)	32.73 ± 6.44	
Living with the patient										
Yes	403 (79.33)	175 (43.42)	6.17 ± 1.84	<0.001	401 (99.50)	32.76 ± 2.70	0.075	240 (59.55)	33.57 ± 6.45	0.020
No	105 (20.67)	68 (64.76)	7.28 ± 2.15		104 (99.05)	31.94 ± 5.99	0.004	57 (54.29)	31.59 ± 5.53	<0.001
Follow-up location after patient's surgery										
Country and below	121 (23.82)	21 (17.36)	4.99 ± 2.01		120 (99.17)	32.22 ± 3.31		105 (86.78)	38.50 ± 6.09	
City and above	387 (76.18)	222 (57.36)	6.84 ± 1.72		385 (99.48)	33.07 ± 2.61		192 (49.61)	31.59 ± 5.53	
Strict adherence to 3-month follow-up frequency										
Yes	415 (81.69)	219 (52.77)	6.63 ± 1.86	<0.001	413 (99.52)	33.08 ± 2.75	<0.001	240 (57.83)	33.14 ± 6.19	0.461
No	93 (18.31)	24 (25.81)	5.37 ± 2.06		92 (98.92)	31.95 ± 2.92		57 (61.29)	33.68 ± 7.22	

*Percentage of participants in upper quartile, with the scores > 75% of maximal

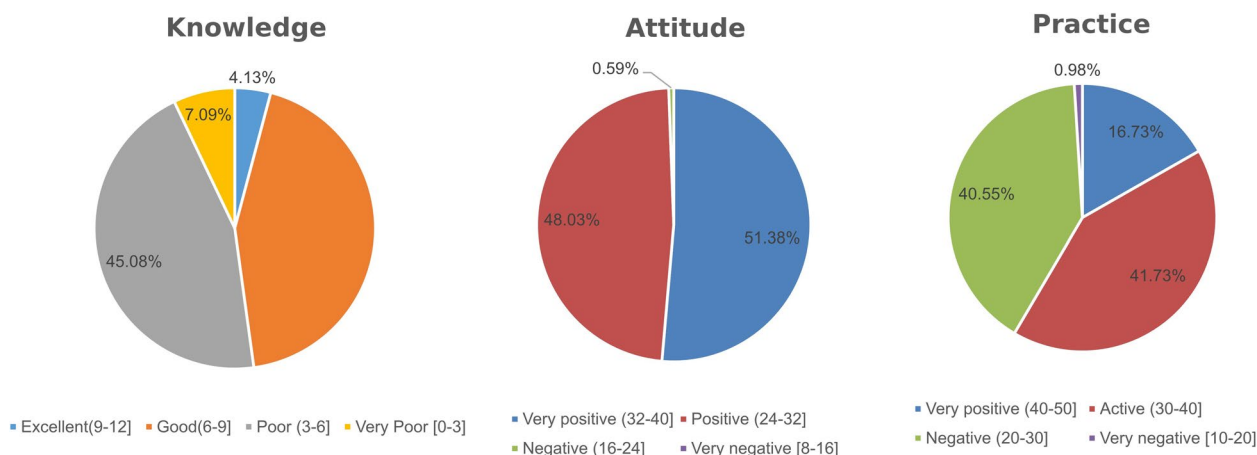


Fig. 1 Knowledge, Attitude, and Practice (KAP) Score Distribution Percentage, According to the 4 parts of the total range: >75%; 75%–50%; 50%–25%; 25% or less

and extend the survival period (31.89% neutral, 4.92% disagree), as well as to reduce the risk of adverse drug reactions (13.39% neutral, 0.98% disagree) (Table 3).

Practice scores significantly differed according to age ($p < 0.001$), marriage status ($p < 0.001$), education ($P < 0.001$), residence ($p = 0.031$), occupation ($p < 0.001$) and relationship to the patient ($P < 0.001$). Scores were significantly decreased, and percentage of participants with “proactive practice” lower in those who performed caregiving duty for more than 6 month compared to < 3 months (47.02% VS 78.26%), and those not living with the patient (54.29% VS 59.55%) (Table 1). Of all participants 45.67% seldom or never assessed the patient’s dietary calorie and other nutrient intake, while 27.16% seldom or never seek nutritional knowledge by themselves, accessing various websites or platforms (Table 4).

Correlation analysis of KAP scores

As demonstrated in Table 5, correlation analysis revealed a weak positive correlation between knowledge and attitude scores ($r = 0.150$, $P < 0.001$), while link to practice scores was negative ($r = -0.228$, $P < 0.001$). Additionally, attitude scores were positively correlated with practice scores ($r = 0.117$, $P = 0.008$).

Univariate and multivariate analyses of practice dimensions

To further investigate the associations between practice scores, knowledge, attitude and demographic characteristics of participants, logistic regression model was applied (Table 6). It was found that higher attitude scores were independently associated with higher practice scores (OR = 1.360; 95%CI, 1.223–1.513), $P < 0.001$, while higher knowledge scores (OR = 0.684; 95%CI,

0.575–0.815), $P < 0.001$), older age (OR = 0.951; 95%CI, 0.918–0.985), $P = 0.005$), duration of caregiving > 3 months (3–6 months (OR = 0.415; 95%CI, 0.193–0.894), $P = 0.025$); 6 months-1 year (OR = 0.269; 95%CI, 0.120–0.606), $P = 0.002$); > 1 year (OR = 0.290; 95%CI, 0.120–0.705), $P = 0.006$), and follow-up location after patient’s surgery (OR = 0.072 (0.033–0.160), $P < 0.001$) were independently associated with lower practice scores.

Discussion

This study have found moderate knowledge and practice, but positive attitude towards implementing the principals of postoperative dietary management among primary caregivers of GC patients after gastrectomy. Gaps in knowledge were identified, such as lack of understanding of liquid diet and some dietary components and principles that might be addressed by engaging educational help from nutrition specialists more often. In some sub-populations, especially older caregivers and those performing caregiving duty for a longer time period, lower practice scores were demonstrated; those categories might benefit from the special attention, including additional help from nurses and/or post-discharge consultations with patients and their caregivers using modern methods of communication.

To the best of our knowledge, this was a first study assessing KAP towards clinical nutrition after gastrectomy undertaken among primary caregivers of GC patients, however some of the obtained results are in line with the KAP assessment in other populations. In particular, the mean knowledge scale score in this study was barely over 50% of maximum, indicating limited knowledge – similar to the poor knowledge of GC related dietary management among medical personnel

Table 2 Distribution of answers in the knowledge dimension

	Accuracy N (%)
K1. After tumor resection, surgical doctors will perform digestive tract reconstruction for gastric cancer patients.	405 (79.72)
K2. Gastric cancer patients are prone to anorexia due to immune response imbalance and metabolic disorders.	405 (79.72)
K3. Anti-tumor treatments such as surgery and chemotherapy can cause digestive absorption disorders, leading to insufficient dietary intake and resulting in malnutrition.	345 (67.91)
K5. Within 1–2 days after gastric cancer surgery, patients are in the postoperative trauma period and should wait until anal gas is discharged before eating.	459 (90.35)
K6. The dietary care process for gastric cancer patients after surgery usually involves transitioning gradually from clear liquid diet to liquid diet, semi-liquid diet, soft diet, and finally to a regular diet.	425 (83.66)
K7. Generally, it is recommended that gastric cancer patients change from liquid diet to semi-liquid foods, such as lotus root powder and steamed egg custard, starting from the fifth day after surgery.	363 (71.46)
K9. It is advisable for gastric cancer patients to avoid eating fruits as they are considered “cooling” in nature.	188 (37.01)
K10. Compared to meat (such as chicken or fish), soup (such as chicken soup or fish soup) is more nutritious.	131 (25.79)
K11. After gastric cancer surgery, it is important to supplement iron elements appropriately to prevent iron-deficiency anemia.	415 (81.69)
K12. It is preferable for gastric cancer patients to stick to a liquid diet to nourish the stomach after surgery.	88 (17.32)
Multiple choices	N (%)
K4. The following dietary or eating habits are risk factors for gastric cancer: (multiple choices)	
High-salt diet	231 (45.47)
Pickled food	399 (78.54)
Fried food	355 (69.88)
Roasted food	195 (38.39)
Red meat and processed meat	81 (15.94)
Leftover food	132 (25.98)
Heavy alcohol consumption	208 (40.94)
Fast eating	26 (5.12)
Skipping breakfast	51 (10.04)
Adequate intake of vegetables and fruits	9 (1.77)
Binge eating	234 (46.06)
K8. Principles of postoperative diet for gastric cancer patients include: (multiple choices)	
Small, frequent meals at regular intervals	431 (84.84)
No alcohol consumption	208 (40.94)
Light, soft diet	224 (44.09)
Balanced nutrition	223 (43.90)
Intake of high-protein foods	134 (26.38)
Intake of large amounts of high-sugar foods	19 (3.74)
Intake of fibrous foods to promote gastrointestinal motility	31 (6.10)
Chewing food thoroughly	327 (64.37)

demonstrated in the study by Durán-Poveda et al. [21]. Moreover, previous study by Qu et al. [25] showed that caregivers of cancer patients have insufficient nutrition knowledge and a strong demand for education in this specific field. Although the importance of the oral nutritional supplements [11, 28] in recovering the deficiency caused by cancer treatment was known to the majority of responders (81.69%), some specific gaps in knowledge were identified in this study. For GC patients after gastrectomy early oral feeding is recommended with the transfer from liquid diet to regular diet [28, 29], however

in this study the contents and specifications of liquid/semi-liquid diet were not clear for >80% of participants. According to the recent sources including American Institute for Cancer Research [5] high salt diet may act synergistically with *H. pylori* infection and has been associated with a higher GC risk, which was unknown to 55.53% of responders in the present study. Points discussed above should be taken into account during the future educational interventions in the similar populations; the lack of specific knowledge might be addressed by engaging educational help from nutrition specialists

Table 3 Distribution of answers in the attitude dimension

	N (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
A1. Gastric cancer patients should follow a regulated diet after surgery to prevent malnutrition. (P)	283 (55.71)	173 (34.06)	50 (9.84)	2 (0.39)	/
A2. Healthy dietary management after gastric cancer surgery enhances the body's defense against pathogenic microorganisms, reducing the risk of infection. (P)	151 (29.72)	315 (62.01)	40 (7.87)	1 (0.2)	1 (0.2)
A3. Healthy dietary management after gastric cancer surgery reduces the risk of adverse drug reactions. (P)	161 (31.69)	274 (53.94)	68 (13.39)	5 (0.98)	/
A4. Healthy dietary management after gastric cancer surgery lowers the risk of postoperative complications. (P)	134 (26.38)	308 (60.63)	61 (12.01)	5 (0.98)	/
A5. Healthy dietary management after gastric cancer surgery increases the chemotherapy tolerance. (P)	120 (23.62)	278 (54.72)	103 (20.28)	4 (0.79)	3 (0.59)
A7. Healthy dietary management after gastric cancer surgery reduces the tumor recurrence rate and extends the survival period. (P)	79 (15.55)	241 (47.44)	162 (31.89)	25 (4.92)	1 (0.2)
A6. Gastric cancer patients should prioritize hospital outpatient nutrition consultations, scheduling at least one every three months. (P)	124 (24.41)	315 (62.01)	67 (13.19)	1 (0.2)	1 (0.2)
A8. Support from primary caregivers promotes gastric cancer patients' adherence to healthy dietary management after surgery. (P)	106 (20.87)	342 (67.32)	59 (11.61)	1 (0.2)	/

Table 4 Practice dimension of the participants

	N (%)				
	Always	Often	Sometimes	Seldom	Never
K1. Assist patients in keeping a food diary to thoroughly document their food intake over several days (3 or 7 days). (P)	66 (12.99)	103 (20.28)	103 (20.28)	218 (42.91)	18 (3.54)
K2. Assess the patient's dietary calorie and other nutrient intake. (P)	47 (9.25)	106 (20.87)	123 (24.21)	130 (25.59)	102 (20.08)
K3. Emphasize cooking methods such as steaming, boiling, and stir-frying, while minimizing the use of frying, deep-frying, and grilling. Reduce the use of condiments. (P)	60 (11.81)	287 (56.5)	109 (21.46)	51 (10.04)	1 (0.2)
K4. Prepare a variety of foods known for their anti-cancer properties. (P)	44 (8.66)	165 (32.48)	227 (44.69)	68 (13.39)	4 (0.79)
K5. When the patient's appetite is diminished, encourage them to eat small, frequent meals or to eat whenever they feel hungry. (P)	56 (11.02)	231 (45.47)	160 (31.5)	60 (11.81)	1 (0.2)
K6. Tailor the preparation of healthy foods based on the patient's dietary preferences, creating a comfortable eating environment. (P)	60 (11.81)	241 (47.44)	146 (28.74)	59 (11.61)	2 (0.39)
K7. Encourage patients to voice any questions or concerns encountered during the dietary recovery process, providing explanations and interventions. (P)	60 (11.81)	211 (41.54)	162 (31.89)	75 (14.76)	/
K8. Motivate patients to participate in support group meetings, health lectures, and other activities to boost enthusiasm for dietary management. (P)	53 (10.43)	183 (36.02)	177 (34.84)	90 (17.72)	5 (0.98)
K9. Mobilize family support by establishing a family-centered dietary care model, offering both emotional and material assistance to the patient. (P)	61 (12.01)	154 (30.31)	173 (34.06)	117 (23.03)	3 (0.59)
K10. Stay informed about post-gastric cancer surgery healthy dietary practices by accessing various websites and platforms. (P)	57 (11.22)	118 (23.23)	195 (38.39)	133 (26.18)	5 (0.98)

Table 5 Results of correlation analysis

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.150 ($P=0.001$)	1	
Practice	-0.228 ($P<0.001$)	0.117 ($P=0.008$)	1

more often to improve post-discharge nutritional outcomes and quality of life [11].

Despite moderate knowledge, almost all participants in this study demonstrated positive attitude, with the mean attitude scores being 82.18% of maximum, in line with other GC studies conducted in China [20, 25, 30].

Table 6 Univariable and multivariable logistic regression analysis of factors influencing practice scores

Practice (total score above 70% as positive)	Univariate logistic regression		Multivariate logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Knowledge score	0.682 (0.612–0.761)	< 0.001	0.684 (0.575–0.815)	< 0.001
Attitude score	1.104 (1.032–1.181)	0.004	1.360 (1.223–1.513)	< 0.001
Gender				
Male	1.252 (0.861–1.821)	0.239		
Female	ref			
Age	0.951 (0.935–0.966)	< 0.001	0.951 (0.918–0.985)	0.005
Marital Status				
Married	0.111 (0.064–0.192)	< 0.001	0.329 (0.139–0.783)	0.012
Unmarried/ divorced/ widowed	ref		ref	
Education				
Junior high school and below	ref		ref	
High school/ technical school	0.478 (0.291–0.784)	0.003	0.382 (0.169–0.864)	0.021
Associate/ bachelor's degree and above	2.357 (1.482–3.747)	< 0.001	1.048 (0.435–2.525)	0.917
Residence				
Urban	1.362 (0.852–2.177)	0.197		
Rural	ref			
Occupation				
Enterprise employee	0.633 (0.319–1.259)	0.192	1.333 (0.479–3.711)	0.582
Farmer	0.916 (0.484–1.732)	0.788	0.382 (0.131–1.119)	0.079
Public official	3.273 (1.651–6.489)	0.001	4.585 (1.594–13.192)	0.005
Worker	1.796 (0.940–3.430)	0.076	1.684 (0.613–4.627)	0.312
Self-employed/ businessperson	1.710 (0.844–3.466)	0.137	1.736 (0.595–5.071)	0.313
Other	ref		ref	
Monthly per capita income				
4000	ref			
4000–6000	0.759 (0.433–1.329)	0.335		
6000	0.930 (0.502–1.724)	0.818		
Relationship with gastric cancer patient				
Spouse	ref		ref	
Parent	7.389 (3.895–14.019)	< 0.001	1.659 (0.589–4.676)	0.338
Only child	5.921 (3.290–10.655)	< 0.001	0.911 (0.338–2.457)	0.854
Non-only child	4.241 (2.604–6.908)	< 0.001	1.982 (0.936–4.200)	0.074
Other	12.236 (3.038–49.279)	< 0.001	4.235 (0.559–32.054)	0.162
Duration of caregiving				
< 3 months	ref		ref	
3–6 months	0.332 (0.195–0.566)	< 0.001	0.415 (0.193–0.894)	0.025
6 months–1 year	0.112 (0.062–0.201)	< 0.001	0.269 (0.120–0.606)	0.002
> 1 year	0.189 (0.099–0.361)	< 0.001	0.290 (0.120–0.705)	0.006
Assistance in caregiving				
Yes	1.410 (0.893–2.227)	0.140		
No	ref			
Living with the patient				
Yes	1.572 (0.970–2.548)	0.067		
No	ref			
Follow-up location after patient's surgery				
Country and below	ref		ref	
City and above	0.078 (0.048–0.127)	< 0.001	0.072 (0.033–0.160)	< 0.001

Table 6 (continued)

Practice (total score above 70% as positive)	Univariate logistic regression		Multivariate logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Strick adherence to 3-month follow-up frequency				
Yes	0.632 (0.398–1.002)	0.051		
No	ref			

Neutral or negative attitude was demonstrated in less direct questions such as the capability of dietary management to reduce the tumor recurrence rate, extend survival or reduce the risk of adverse drug reactions, also noted before and understandable in the context of the statistical probability [30]. One of the less expected findings of this study is that despite attitude scores directly correlated with knowledge ($r=0.150, P<0.001$) and practice scores ($r=0.117, P=0.008$), the correlation between knowledge and practice scores was negative ($r=-0.228, P<0.001$). It partly contradicts the results reported in the previous study by Qu et al. [25] conducted in the population of the family caregivers of cancer patients, which demonstrated a significant positive correlation between nutrition knowledge and attitude ($r=0.88, P<0.05$), knowledge and practice ($r=0.766, P<0.01$), attitude and practice ($r=0.186, P<0.01$). The difference suggests that other factors might play prominent role in forming practice patterns after gastrectomy – for instance present study found that participants who performed caregiving duty for more than 1 year, and those not living with the patient had both significantly higher knowledge scores and lower practice scores. Conversely, GC patients themselves might have lesser control of their practices, as was discussed in the study by Tian et al. [20], which did not find significant correlation links between the weight loss after gastrectomy and higher nutrition knowledge. It might suggest that sub-population of caregivers, although having sufficient knowledge and positive attitude, might benefit from special help in maintaining the GC patients’ dietary support for a longer periods of time.

The mean practice score in this study was only 66.48% of maximum, which might be described as moderate, and some questions demonstrated notably lower scores. It seems slightly better than results reported by Qu et al. [25], where only 78 of 208 family caregivers of GC patients (37.5%) carried out sufficient nutrition practice. Study by Jiang et al. [31], which evaluated the adherence to the prescribed oral nutrient supplements in GC patients during preoperative and adjuvant chemotherapy periods, also reported very low compliance (24.7%), citing low motivation as the main barrier. The notable difference in the post-operative period is the even lower ability of patient to tend to their own needs and adhere

to the dietary prescriptions. As the result, responsibility for the nutrition practice is at least partly shared with the nurse before discharge and the family caregiver after discharge. While the guidance of nurses was shown to be essential in improving the nutritional status of GC patients after gastrectomy [23, 32], the transfer of dietary management to the caregiver is less studied. Results obtained in the present study might provide some context to the situation around GC patients after discharge and help to plan educational interventions based on the KAP model in order to improve the self-management ability of GC patients.

Thai study has some limitations. Firstly it was a single-center study and, although the sample was comparatively big, results should be interpreted with caution to specific regional and other peculiarities. Secondly, only subjective features were accessed, and in the future the comparison of KAP with the objective measurements, such as body weight loss of GC patient after discharge, is necessary. And finally, KAP study is subjected to the inherited biases, as all questions are answered by the participants themselves, with a possibility to guess more socially accepted answer.

Conclusions

In conclusion, family caregivers of GC patients that participated in this study demonstrated moderate knowledge and practice, but positive attitude towards dietary management after gastrectomy. The lack of knowledge might be addressed by engaging educational help from nutrition specialists, while some of caregivers, although having sufficient knowledge and positive attitude, might benefit from special help in maintaining the GC patients’ dietary support for a longer periods of time.

Abbreviations

- GC Gastric cancer
- KAP Knowledge, Attitude and Practice
- KMO Kaiser-Meyer-Olkin

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Authors’ contributions

DSL and HTX carried out the studies, participated in collecting data, and drafted the manuscript. DSL, HTX, CJ and JJZ performed the statistical

analysis and participated in its design. DSL, HTX, CJ, JJZ, DW, LZT, HFQ and ZS participated in acquisition, analysis, or interpretation of data and draft the manuscript. DSL, HTX, CJ, JJZ, DW, LZT, HFQ and ZS read and approved the final manuscript.

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Impact and significance of different digestive tract reconstruction methods on pancreatic exocrine function after laparoscopic early proximal gastric cancer resection. [2022KY1429].

Data availability

All data generated or analysed during this study are included in this published article.

Declarations

Ethics approval and consent to participate

The research received ethical approval from the Ethics Committee of Lishui Central Hospital [No: 2023(525)], and informed consent was obtained from all participants. I confirm that all methods were performed in accordance with the relevant guidelines. All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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