

## Original Article

# Compliance of postoperative gastric cancer patients with oral nutritional supplementation and its influencing factors

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**Abstract:** Objectives: To evaluate the compliance of postoperative gastric cancer patients with oral nutritional calcium supplementation and explore its influencing factors, in order to provide a reference for formulating relevant nursing interventions. Methods: A total of 269 postoperative patients with gastric cancer admitted to the third department of surgery of the Fourth Hospital of Hebei Medical University from February to July 2020 were selected retrospectively through convenient sampling. A general information questionnaire and the Chinese version of the modified medication adherence eight-item scale were used to conduct a cross-sectional survey, in order to evaluate the compliance of postoperative gastric cancer patients with oral nutritional supplementation. Results: A total of 269 questionnaires were distributed in this study, and 228 valid questionnaires were finally recovered. The compliance score for oral nutritional calcium supplements in postoperative patients with gastric cancer was  $(6.43 \pm 0.21)$ . The results of multiple linear regression analysis showed that the patients' education level, family monthly average income, postoperative time, medication belief and social support were factors influencing postoperative compliance with oral nutritional supplementation ( $P < 0.05$ ). Conclusions: The compliance of postoperative gastric cancer patients with oral nutritional calcium supplements is at a medium to low level. Patients' education level, family monthly average income, postoperative time, medication belief, and social support are the main influencing factors. It is necessary to formulate and implement relevant interventions to improve compliance.

**Keywords:** Gastric cancer, surgical treatment, nutritional supplement, medication compliance

## Introduction

Gastric cancer is the fifth most diagnosed cancer and the fourth most common cause of death in cancer patients [1]. Malnutrition is a major risk factor for poor clinical outcome in gastric cancer patients, with 19-71% of gastric cancer patients having an impaired nutritional status, so nutritional support has been widely accepted as an adjuvant treatment [2]. Several international guidelines for nutritional therapy have recommended the use of oral nutritional supplements (ONSs) for patients with gastric cancer who are at nutritional risk [3, 4]. Some studies have shown that patient adherence to ONS remains poor, ranging from 30.6% to 78% [5, 6].

Malnutrition is a common public health problem that can occur in up to 60%-80% of elderly

patients with malignancies and other chronic wasting diseases [7]. Malnutrition leads to adverse outcomes such as decreased treatment tolerance [8], increased complication rate [9], prolonged hospital stay [10], reduced quality of life [11] and shorter overall survival [9]. Systematic evaluations [12, 13] suggest that both in-hospital and community malnourished individuals can benefit from ONSs, which are dietary foods consumed orally in addition to normal foods for specific medical purposes [14]. ONSs are the preferred nutritional therapy for malnourished or nutritionally at-risk individuals without contraindications to supplements [14]. The current status of patient compliance with ONS is low because of the influence from patients, medical institutions, medical personnel and preparations, as evidenced by the fact that the actual intake of ONS is often less than

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the recommended dose, making their nutrient intake unable to meet the target amount of individual need and affecting the effectiveness of the nutritional therapy [15].

Studies have shown that Chinese beliefs about healthy eating and ONS are quite different from those of other countries, and few other cultures are as food-oriented as Chinese culture [16]. Therefore, adherence to ONS as a patient health behavior may be influenced by the health beliefs of the patient's diet. However, there have not been any studies on factors associated with ONS adherence. The aim of this study was to report the adherence to ONS in Chinese gastric cancer patients and to analyze the influencing factors, thus providing a basis for the development of relevant nursing interventions.

### Patients and methods

#### *General information*

This retrospective study, using a convenience sampling method, selected 269 postoperative patients with gastric cancer who were admitted to the Third Department of Surgery of the Fourth Hospital of Hebei Medical University from February to July 2020, as survey subjects. Inclusion criteria were as follows: (1) Patients diagnosed with primary gastric cancer and in the postoperative phase or adjuvant chemotherapy; (2) Patients had a Nutrition Risk Screening 2002 (NRS2002) score  $\geq 3$ ; (3) Patients were prescribed and received ONS continuously for  $\geq 7$  days; (4) Patients consumed ONS between meals rather than in place of a regular meal; (5) Patients were  $>18$  years of age; and (6) Patients volunteered to participate in this study. Patients were excluded if (1) They had incomplete clinical data; (2) Their family refused to cooperate; (3) They had other malignant tumors.

#### *Instruments*

*General information questionnaire:* This questionnaire was self-designed and compiled, including gender, age, marital status, educational background, primary caregiver, average monthly family income, type of medical insurance and postoperative time of gastric cancer.

*Chinese version of the modified medication adherence eight-item scale (CMMA):* This scale was developed in-house by our center. The Cronbach's  $\alpha$  coefficient was 0.81, test-retest reliability was 0.95, and face validity was 1.00, indicating well reliability and validity. The total score of the scale is 8 points. The score is positively correlated with medication compliance, with poor compliance ( $<6$  points), medium compliance ( $6-8$  points), and good compliance (8 points).

*Chinese version of medication belief specificity scale:* This scale was translated into Chinese by Lv et al. [17], and divided into two dimensions, including the necessity of taking medicine and the concern of taking medicine, with a total of 10 items. Likert's 5-level rating method was used, with "1" to "5" representing "strongly disagree" to "strongly agree". High scores represent strong individual's perceived belief in the corresponding dimension. Medication belief is the difference between medication necessity and medication concern. When patients think that the necessity of medication is stronger than their concern, the difference is positive. The score range is from "-20" to "20" points, and Cronbach's  $\alpha$  coefficient is 0.701.

*Social support rating scale:* This scale was compiled by Xiao [18], and is divided into three dimensions, including objective support, subjective support, and support utilization, with a total of 10 items. The total score ranges from 12 to 66 points, with higher scores indicating better social support. The Cronbach's  $\alpha$  coefficients of the total scale and the three subscales were 0.896, 0.849, 0.825, and 0.833, respectively, indicating good reliability and validity.

*Treatment methods:* All patients in the group underwent radical gastric cancer surgery and were resected at R0. Postoperative adjuvant therapy was given according to TNM stage. High-risk patients at T1 stage and patients at T2 stage or above underwent adjuvant chemotherapy based on 5-FU class. The chemotherapy regimens included XELOX [oxaliplatin (Batch number: 11010612, produced by Jiangsu Hengrui Pharmaceutical Co., Ltd.) + capecitabine (Batch number: SH0104, produced by Shanghai Roche Pharmaceutical Co.,

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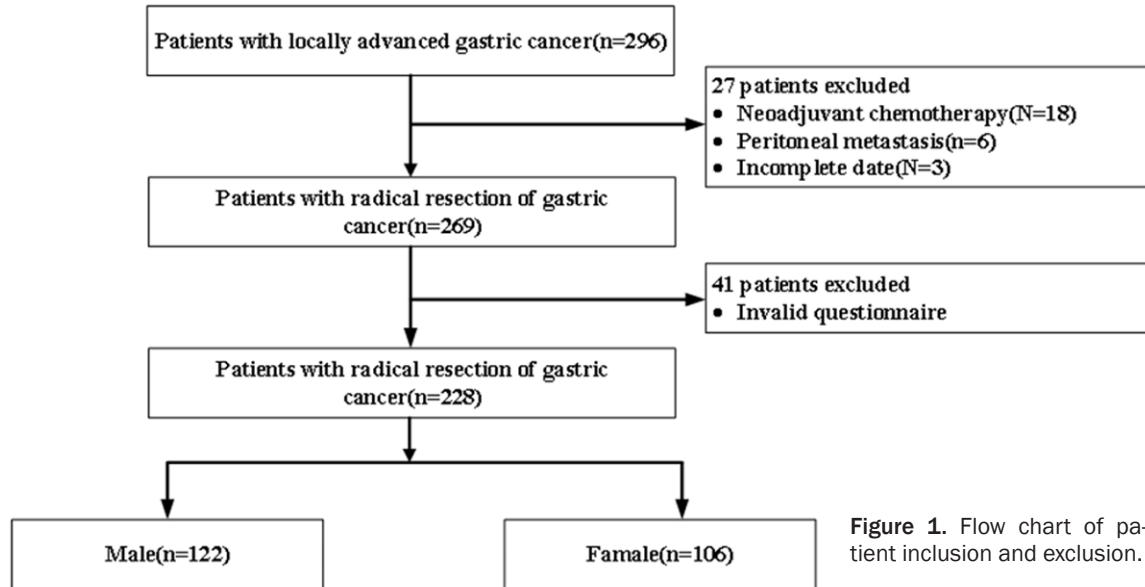


Figure 1. Flow chart of patient inclusion and exclusion.

Ltd.], SOX [oxaliplatin + S-1 (Batch number: H20080802, produced by Shandong New Times Pharmaceutical Co., Ltd.)], single-agent S-1 or single-agent capecitabine.

### Investigation methods

Investigators needed to be trained before they could conduct the questionnaire. The best time for completing the questionnaire was when the patients are in a quiet and rest state, and it was not allowed to conduct the questionnaire when receiving treatment and during tiredness. The purpose, significance and notes for filling in the scale were explained before filling in the scale. Patients were aware of the anonymity of the questionnaire, and that they could ask for explanation from the investigators in time if they cannot understand the items of the questionnaire. However, patients could not be induced to fill in the scale. The questionnaires were collected and sorted out after being completed, and invalid questionnaires (such as multiple selections and missing selections) were excluded. A total of 269 questionnaires were distributed in this survey, and 228 general information questionnaires were finally recovered after eliminating unqualified and invalid questionnaires, with a recovery rate of 84.75%.

### Statistical methods

SPSS25.0 was used for data analysis. The measured data obtained in this study included the average distribution of age, family monthly

average income and postoperative time of gastric cancer, which were expressed as  $X \pm S$ . T test was used for comparison between two samples, and analysis of variance (ANOVA) was used to analyze the comparison of means between more than two groups. Enumerated data, including gender, education background, occupation and type of medical insurance, were tested by Chi-square test.  $P < 0.05$  was statistically significant.

## Results

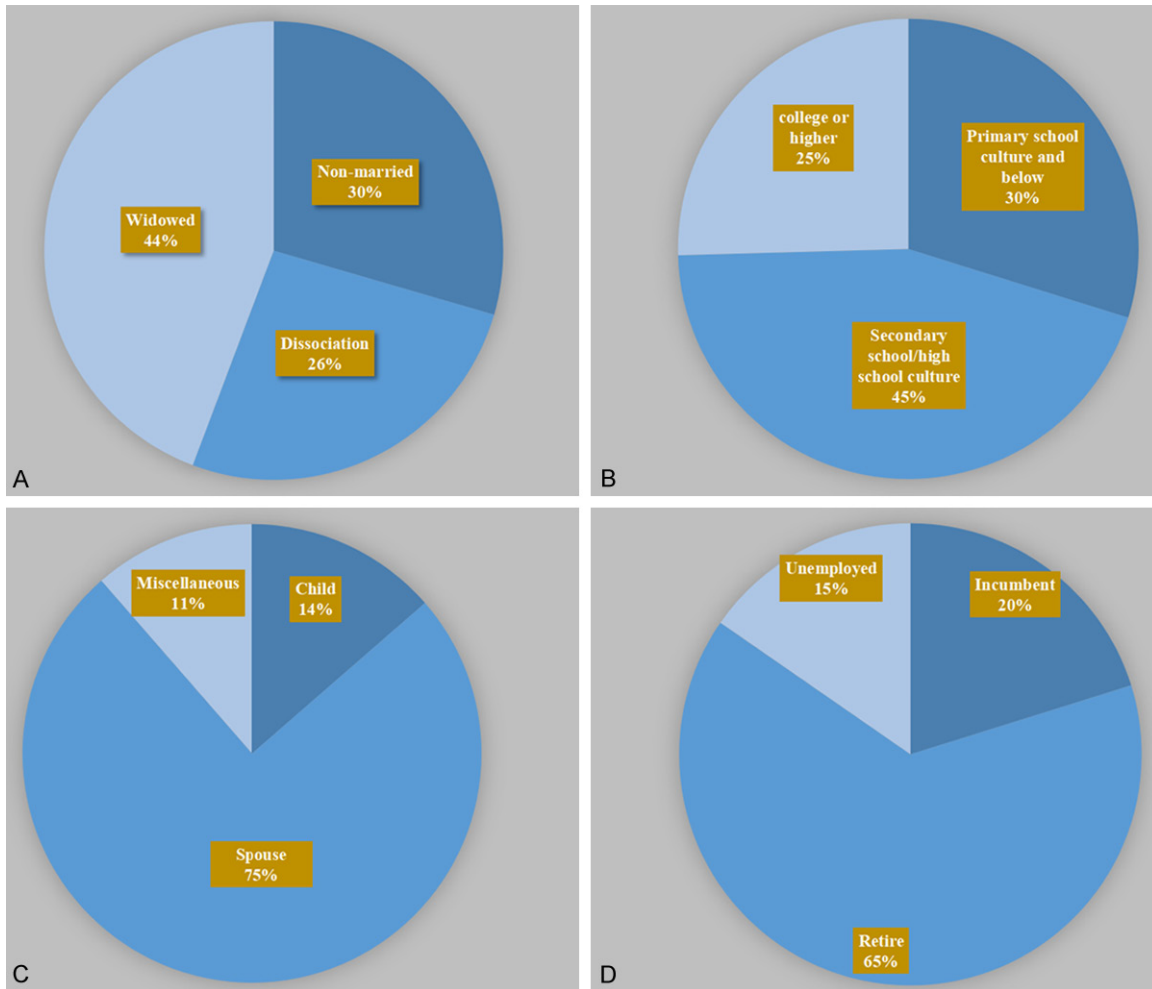
### General information of patients

In the included 228 patients with oral nutrition after gastric cancer surgery (Figure 1), the age range was 54-70 years old, with a mean age of  $61.72 \pm 3.24$  years. There were 106 women and 122 men; 167 married, 18 unmarried, 16 divorced and 27 widowed; 68 with elementary school education and below, 102 with secondary/high school education, and 58 with college education and above. As for family situation, primary caregivers included 31 for children, 171 for spouses and 26 for others. There were 42 cases with average monthly family income  $< 3000$  RMB, 145 with 3000-6000 RMB, 41 with  $> 6000$  RMB, and 46 of them were working, 147 retired, 35 jobless (Figure 2).

### Score of the scale

The score of the Chinese version of CMMA was  $(6.43 \pm 0.21)$  in the 228 patients, with a lowest

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**Figure 2.** General information of the patients. A. Marital status; B. Educational situation; C. Family situation; D. Working situation.

score of 2 and a highest score of 8. There were 62 patients (27.19%) with good medication compliance (8 points), 124 patients (54.38%) with medium medication compliance (6-<8 points), and 42 patients (18.42%) with poor medication compliance (<6 points).

The score of the Chinese version of Medication Belief Specificity Scale in the 228 patients - was  $(7.43\pm 3.62)$ , with a lowest score of -6, and a highest score of 19. The scores of the two dimensions of medication necessity and medication concern were  $(17.68\pm 3.41)$  and  $(10.23\pm 2.82)$ , respectively.

The score of social support rating scale was  $(36.72\pm 28.21)$  in the 228 patients, with a lowest score of 7 and a highest score of 42. The scores of subjective support, objective support,

and utilization of support were  $(17.24\pm 2.63)$ ,  $(11.14\pm 3.12)$ , and  $(8.92\pm 3.16)$ , respectively.

The scores of oral nutritional calcium supplements after gastric cancer surgery were assessed. Univariate analysis and correlation results showed that age, education level, monthly average family income, and postoperative time posed statistically significant differences in their compliance scores ( $P<0.05$ ), as shown in **Table 1**. Medication belief and social support were positively correlated with medication compliance ( $P<0.05$ ), as shown in **Table 2**.

A multiple regression linear analysis of compliance is shown in **Tables 3** and **4**. Taking the compliance with oral calcium supplements as the dependent variable, and age, education level, monthly average family income, postop-

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**Table 1.** Single factor analysis and scores of the compliance with oral calcium supplementation (n,  $\bar{X} \pm S$ )

Variable	Cases (n)	Scores	F/t value	P-value
Age, years				
54-60	48	6.81±1.35	13.254	0.000
61-65	113	5.16±1.12		
66-70	67	4.23±1.31		
Sex				
Male	106	6.79±1.16	-0.569	0.570
Female	122	6.91±1.97		
Education degree				
Primary school or below	68	5.18±1.03	6.321	0.016
Secondary/High	102	6.63±1.62		
College or above	58	7.43±1.41		
Post-operation time, year				
1-2	96	6.81±1.25	1.103	0.021
3-6	64	5.14±1.33		
7-10	45	4.23±1.63		
>10	23	4.06±1.08		
Average income monthly (CNY)				
<3000	42	4.43±1.71	6.121	0.003
3000-6000	145	5.34±1.24		
>6000	41	7.68±1.47		
Occupation status				
On-the-job	46	6.63±1.54	3.214	0.143
Retired	147	6.72±1.67		
Unemployed	35	6.28±1.34		
Caretakers				
Children	31	6.89±1.32	0.673	0.410
Spouse	171	6.71±1.25		
Others	26	6.91±1.53		

**Table 2.** Correlation analysis of oral calcium supplement compliance, medication belief, and social support

Factor	Contents	R-value	P-value
Medication belief	Necessity	0.657	<0.001
	concerns	-0.689	<0.001
	Total score	0.568	<0.001
Social support	Subjective support	0.721	<0.001
	Objective support	0.698	<0.001
	Availability	0.691	<0.001

erative time, medication belief and social support as independent variables, multiple linear regression analysis showed that education level, family monthly average income, postoperative time, medication belief, and social sup-

port were influencing factors for patients' compliance with calcium supplementation ( $P<0.05$ ).

### *Influence of adherence to oral nutritional supplemental calcium on adverse effects of adjuvant chemotherapy*

There were 186 cases with good compliance and 42 cases with poor compliance among the 228 patients. All patients in this study were treated with postoperative adjuvant chemotherapy, and 78 of them had adverse reactions, while 24 had grade  $\geq 3$  adverse reactions (Table 5). The differences between patients with good compliance and poor compliance were significant in terms of incidence of adverse reactions ( $P<0.001$ ) and the incidence of grade  $\geq 3$  adverse reactions ( $P<0.001$ ).

### *Effect of oral nutritional supplementation compliance on prognosis*

The 2-year overall survival (OS) rate for the whole group was 85.52% (195/228), while the 2-year disease-free survival (DFS) rate was 78.95% (180/228). The 2-year OS and DFS were 89.25% (166/186) and 83.33% (155/186), respectively, among patients with good compliance to postoperative oral nutritional supplementation, compared to 69.05% (29/42) and 59.52% (25/42), respectively, among patients with poorer compliance, with statistically significant differences (OS,  $P=0.0005$ ; DFS,  $P=$

0.0003) (Figure 3). Cox multifactorial analysis found that patient pathology type, TNM stage, and compliance with postoperative oral nutrition were independent risk factors for patients' 2-year OS and DFS (Table 6).

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**Table 3.** Multivariate linear regression independent variable assignment table of factors influencing compliance

Independent variable	Assignment
Age	54-60=1; 61-65=2; 61-70=3
Education degree	Primary school or below =1; Secondary/high =2; College or above =3
Average income monthly	<3000=1; 3000-6000=2; >6000=3
Post-operation time	1-2=1; 3-6=2; 7-10=3; >10=4
Medication belief	Original value entry
Social support	Original value entry

**Table 4.** Multiple linear regression analysis of factors influencing compliance

Independent variable	Partial regression coefficient	Standard error	Standardized coefficient of regression	t-value	P-value
Constant	23.341	1.231	-	17.246	0.000
Age	0.335	0.051	0.003	2.849	0.067
Education degree	1.136	0.564	0.032	8.946	0.034
Average income monthly	0.842	0.251	0.055	3.442	0.033
Post-operation time	-1.312	0.813	-0.541	3.672	0.001
Medication belief	1.265	0.731	0.233	5.137	0.002
Social support	0.417	0.137	0.005	1.013	0.000

Notes: R<sup>2</sup>=0.678, F=19.47, P<0.001.

### Discussion

With ongoing improvements of medical treatment, the survival rate of cancer patients has been improved accordingly, but the postoperative quality of life of cancer patients also needs attention. Currently, it has been reported [6-10] that postoperative patients with gastric cancer are prone to chondromalacia due to less calcium absorption and insufficient intake after gastric resection, and postoperative calcium supplementation has become an important means to prevent calcium deficiency. Since long-term oral calcium supplementation is required, patients need a high level of compliance to adhere to it. The results of this survey showed that the adherence score of supplementing oral nutritional calcium in postoperative patients with gastric cancer was (6.43±0.21), at a medium-low level, which is similar to the results of an evaluation by Sun [19], who evaluated the adherence of patients with pulmonary hypertension to medication. Therefore, relevant nursing measures and health education need to be taken.

Oral nutritional calcium supplementation is to prevent calcium deficiency complications after

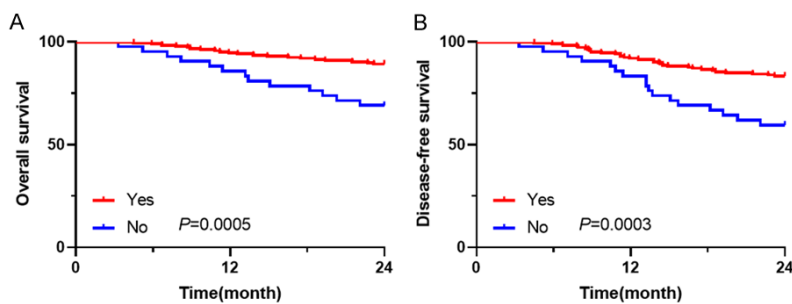
resection of gastric cancer and is not a direct treatment for gastric cancer, and because calcium deficiency is not a short-term cause of the disease, patients pay less attention to it. If patients do not receive adequate health education, there is often a decrease in compliance with taking calcium supplements. Patients with higher literacy levels were able to obtain information on postoperative health management from more sources on the one hand, so they were more able to value the importance of postoperative calcium supplementation, were more self-disciplined, and therefore had higher compliance ( $P<0.05$ ). Oral calcium should be purchased after discharge from the hospital, and the economic level directly influenced the postoperative calcium supplementation of gastric cancer patients. Patients with low average monthly family income are more likely to choose to prefer the direct treatment for gastric cancer, and the improvement in postoperative nutritional status is more focused on dietary supplementation, so the compliance with postoperative calcium supplementation was lower ( $P<0.05$ ). The longer after the surgery, the more likely it was that the patients considered themselves to be completely cured, which often lead to a decrease in patient compliance, including

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**Table 5.** Relationship between oral nutritional supplement compliance and adverse reactions to adjuvant chemotherapy

Adverse effect	N	Nutritional supplement compliance		P
		Yes (N=186)	No (N=42)	
<b>Leukopenia</b>				
Yes/No	38/190	18/168	20/22	<0.001
≥3 grade/<3 grade	12/26	3/15	9/11	0.061
<b>Neutropenia</b>				
Yes/No	34/194	11/175	23/19	<0.001
≥3 grade/<3 grade	11/23	2/9	9/14	0.701*
<b>Thrombocytopenia</b>				
Yes/No	25/203	10/176	15/27	<0.001
≥3 grade/<3 grade	15/10	4/6	11/4	0.122*
<b>Decreased hemoglobin</b>				
Yes/No	30/198	14/172	16/26	<0.001
≥3 grade/<3 grade	17/13	7/7	10/6	0.491
<b>Nausea/vomiting</b>				
Yes/No	57/171	32/154	25/17	<0.001
≥3 grade/<3 grade	20/37	11/21	9/16	0.898
<b>Diarrhea</b>				
Yes/No	16/212	7/179	9/33	<0.001
≥3 grade/<3 grade	7/9	2/5	5/4	0.358*
<b>Anorexia</b>				
Yes/No	42/184	20/166	22/20	<0.001
≥3 grade/<3 grade	18/24	6/14	12/10	0.108
<b>Peripheral sensory neuropathy</b>				
Yes/No	35/193	22/164	13/29	<0.001
≥3 grade/<3 grade	15/20	9/13	6/7	0.762
<b>AST/ALT increased</b>				
Yes/No	12/215	7/179	5/37	<0.001
≥3 grade/<3 grade	7/5	4/3	3/2	1.000*
<b>Fatigue</b>				
Yes/No	18/210	14/172	4/38	<0.001
≥3 grade/<3 grade	8/10	6/8	2/2	1.000*

Abbreviations: According to Common Terminology Criteria for Adverse Events (version 3.0). AST, Aspartate Transaminase; ALT, Alanine Aminotransferase. \*, Fisher's exact test.



**Figure 3.** Relationship between oral nutritional supplement compliance and prognosis. A. 2-year overall survival; B. 2-year disease-free survival.

related health promotion behaviors, and the patients tends to forget to take medication [20]. Patients with high social support are more likely to be reminded and monitored by the surroundings, indirectly reflecting the importance of family to the patient's postoperative health, and thus those patients' compliance with calcium supplementation was higher than those with low social support ( $P<0.05$ ), similar to the findings of Teng et al. [21] in the study of medication adherence in elderly renal transplant patients. Patients' perceived need for oral calcium and medication concerns can influence patient adherence to some extent, and the higher the degree of patient belief, the better the adherence [22]. In this investigation, it was found that patients with high belief in the necessity of oral calcium supplementation and low concern about it after gastric cancer surgery had higher adherence ( $P<0.05$ ). Thus, patients should be given moderate health education and psychological support to alleviate their concerns.

In conclusion, oral nutritional adherence of postoperative gastric cancer patients was generally at a low to moderate level, with literacy, average monthly household income, postoperative time, medication beliefs, and social support as the main influencing factors. Nurses need to increase patients' discharge educa-

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**Table 6.** Multivariate analysis of the clinicopathologic characteristics affecting the prognosis of gastric patients

Independent factor	2-year OS Multivariate analysis			2-year DFS Multivariate analysis		
	Hazard ratio	95% CI	P value	Hazard ratio	95% CI	P value
Sex			0.325			0.143
Female	1.000	reference		1.000	reference	
Male	1.423	0.421-1.892		1.243	0.721-1.772	
Age (years)			0.193			0.251
≤50	1.000	reference		1.000	reference	
>50	1.341	0.577-1.899		1.153	0.790-1.553	
TNM stage			0.001			0.003
II	1.000	reference		1.000	reference	
III	5.438	3.231-12.541		5.114	3.234-9.981	
Nutritional supplement compliance			0.002			0.002
Yes	1.000	reference		1.000	reference	
No	3.591	2.248-7.823		3.152	1.569-5.072	
Tumor size (cm)			0.532			0.061
<5.0	1.000	reference		1.000	reference	
≥5.0	1.341	1.125-3.672		1.759	1.352-3.152	
Differentiation			0.011			0.029
Poor	1.000	reference		1.000	reference	
Well	2.431	1.212-4.323		2.496	1.772-4.218	

Note: SII: Systemic Immune-Inflammatory Index; PNI: Prognostic Nutritional Index; FCCs: Free Cancer Cells.

tion and targeted interventions to improve their compliance with oral nutritional supplement calcium to prevent related diseases and complications due to calcium deficiency.

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The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All patients were informed about the adverse effects accompanying therapies, and they all signed informed consent forms. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study design was approved by the Ethics Committee of the Fourth Hospital of Hebei Medical University. The study design was approved by the Ethics Committee of the Fourth Hospital of Hebei Medical University (Approval Number: 2019125).

### Disclosure of conflict of interest

None.

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