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Original Article

Effect of nursing intervention on quality of life of patients with gastric ulcer based on KANO model

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Abstract: Objective: To explore the quality attributes of nursing interventions for improving the quality of life of patients with gastric ulcers using the KANO model, and to design and implement targeted nursing measures and evaluate their effects. Methods: Clinical data from 136 inpatients with gastric ulcers hospitalized between January 2022 and January 2024 were analyzed. Patients were divided into two groups based on the nursing approach: the experimental group (n=68), which received nursing care based on the KANO model, and the control group (n=68), which received routine care. The two groups were compared in terms of general clinical data, symptom improvement, health-promoting lifestyle scores, nursing satisfaction, emotional state, and quality of life assessed using the SF-36 questionnaire. Results: Post-intervention, the experimental group demonstrated significantly lower Hamilton Anxiety and Depression Scale scores compared to the control group (both $P<0.05$). Scores for physical, psychological, social, and material functions in the SF-36 were also significantly higher in the experimental group (all $P<0.05$). Additionally, scores for health responsibility, nutrition, stress management, exercise, interpersonal support, self-actualization, and overall health-promoting lifestyle were significantly higher in the experimental group (all $P<0.05$). The incidence of acid reflux, abdominal pain, and burning sensation was lower in the experimental group than that in the control group after the intervention ($P<0.05$). Conclusions: Nursing interventions based on the KANO model effectively improve clinical symptoms, quality of life, and emotional well-being in patients with gastric ulcers. They also enhance nursing satisfaction, providing a superior approach to routine care.

Keywords: Nursing intervention, quality of life, gastric ulcer, Kano model of customer satisfaction

Introduction

Gastric ulcer is a common digestive system disease with a high incidence in males aged 40-46 years, primarily occurring near the lesser curvature of the stomach. The main pathogenic factors include Helicobacter pylori infection, long-term unhealthy dietary habits, and adverse psychological effects [1]. Gastric ulcers are characterized by a high recurrence rate, significantly impacting patients' psychological state, lifestyle, and emotions. Additionally, gastric ulcer is an independent risk factor for gastric cancer [2]. As the ulcer area enlarges and symptoms such as dull abdominal pain worsen, patients often experience poor sleep quality and a diminished quality of life [3].

Psychological factors have been identified as independent risk factors for gastric ulcers [4]. Currently, no radical cure exists for gastric ulcers. Patients often require long-term treatment, with frequent recurrences even after recovery, severely affecting their mental health and quality of life [5]. Studies suggest that incorporating psychological nursing interventions, tailored to patients' psychological needs, can positively influence treatment outcomes [6]. However, conventional nursing interventions primarily focus on medication and diet while neglecting comprehensive and continuous psychological guidance, limiting their efficacy in disease management.

The KANO demand analysis model, proposed by Noriaki Kano, a Japanese quality management scientist, categorizes quality characteristics into five types: attractive quality, one-dimensional quality, must-be quality, indifferent quality, and reverse quality factors [7]. In

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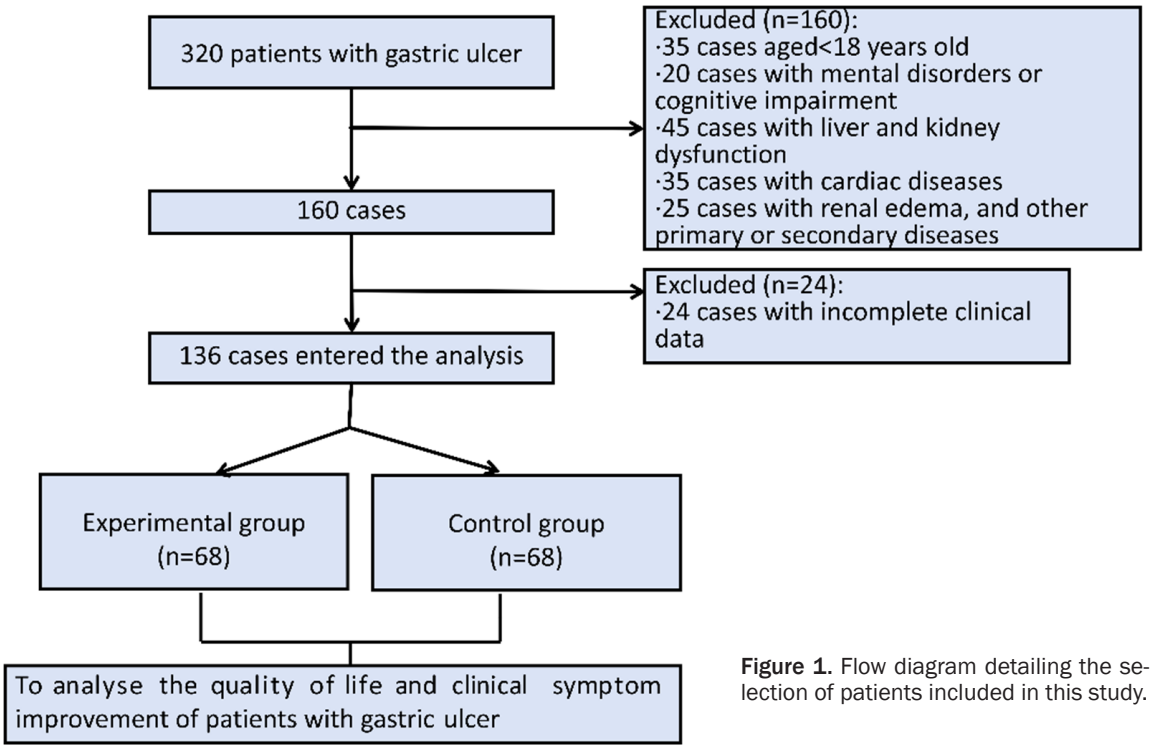

Figure 1. Flow diagram detailing the selection of patients included in this study.

healthcare, the KANO model is used to analyze and classify patient needs, distinguishing basic factors (essential and expected), performance factors (affecting satisfaction based on their degree of fulfillment), and excitement factors (providing unexpected satisfaction). By applying this model, healthcare providers can better understand and prioritize patients' needs, ultimately enhancing the quality of nursing care.

Lin et al. reported that KANO-based nursing interventions for patients with multiple emergency injuries reduced inflammatory responses, minimized the risk of adverse events, improved prognoses, and increased patient satisfaction [8]. However, there has been no systematic study on the application of the KANO model in gastric ulcer management.

This study aims to introduce the KANO model as a novel demand analysis approach for nursing. Using a self-designed questionnaire, we investigated the nursing needs of patients and analyzed the results through the KANO model's fuzzy analysis method. The identified nursing service quality attributes account for the complex psychological needs of patients and provide a robust foundation for designing and implementing tailored nursing interventions in future gastric ulcer management.

Materials and methods

Study design

This study analyzed clinical data from 136 inpatients with gastric ulcers admitted between January 2022 and January 2024. Patients were divided into two groups based on the nursing methods received: the experimental group (n=68), which received nursing care based on the KANO model, and the control group (n=68), which received routine care. The patient selection process is illustrated in **Figure 1**. Ethics committee approval was obtained from Yichun People's Hospital, and informed consent was collected from all participants.

Inclusion and exclusion criteria

Inclusion criteria: (1) Patients diagnosed with gastric ulcer via endoscopic examination [9]. (2) Patients with clear consciousness capable of understanding the questionnaire content and communicating effectively. (3) Age ≥18 years.

Exclusion criteria: (1) Patients with severe cardiopulmonary disorders, suspected severe shock, perforation of the digestive tract, or other critical conditions. (2) Patients with men-

tal symptoms unable to cooperate with endoscopic examinations or those refusing gastroscopy. (3) Pregnant or lactating women. (4) Patients with consciousness or communication disorders. (5) Patients with suspected middle or lower gastrointestinal bleeding. (6) Patients with coagulation disorders, immune deficiencies, or infectious diseases. (7) Patients with a history of gastric surgery.

Interventions

The control group received routine care, including routine health education upon admission, admission guidance, condition monitoring, medication guidance, vital sign monitoring, and telephone follow-up one month after discharge.

The experimental group received nursing care based on the KANO model, which included the following:

Identification of care factors: Nurses identified key factors affecting care, such as pain management, dietary guidance, emotional support, medication compliance, and follow-up care [10].

Pain management: Pain was assessed using the Visual Analogue Scale (VAS) [11]. Nurses assisted patients in maintaining comfortable positions to alleviate pain and administered prescribed painkillers based on the severity, duration, and impact of pain on daily life.

Dietary guidance: Nurses educated patients on appropriate dietary choices to minimize irritation and promote healing [12]. Detailed dietary plans emphasizing balanced nutrition were provided.

Emotional support: Psychological counseling, active listening, and reassurance were offered to help patients manage stress and anxiety commonly associated with gastric ulcers.

Medication compliance: Nurses explained the purpose and dosage of each medication, set up reminder systems to ensure timely administration, monitored for side effects, and addressed any patient concerns [13].

Follow-Up care: Regular check-ups were conducted to monitor ulcer healing, detect recurrence, and adjust treatment plans as necessary.

Observation indicators

The primary observation indicator was the quality of life, assessed using the SF-36 questionnaire [14], developed by the American Medical Outcomes Research Group in 1992. This scale evaluates eight dimensions: physiological function, psychological function, physical pain, emotional function, social function, and mental health. Scores for each dimension were calculated based on weighted items in the subscale and converted to a standardized score ranging from 0 to 100. Higher scores indicate better quality of life.

Secondary observation indicators: The secondary observation indicators included clinical symptoms, negative emotions, health-promoting lifestyle, and nursing satisfaction:

Evaluation of clinical symptoms: The severity of ulcer symptoms was assessed using the total symptom score, which summed scores for burning sensation, epigastric pain, acid reflux, and bloating. Each symptom was rated on a scale of 0 (normal) to 3 (severe) [15]: 0: No symptoms. 1: Mild (occasional symptoms). 2: Moderate (frequent symptoms that do not affect daily life). 3: Severe (frequent symptoms that impact daily life). Symptom improvement was defined as a reduction of ≥2 points or the complete disappearance of symptoms, with the time of improvement recorded.

Evaluation of negative emotions: Anxiety and depression were assessed using the Hamilton Anxiety Scale (HAMA) [16] and the Hamilton Depression Scale (HAMD) [17], respectively. HAMA includes 14 items, with each item scored from 0 to 4. HAMD includes 24 items, with each item scored from 0 to 4. Both scales were administered by two trained nurses through patient interviews and observations, with evaluations completed within 10-15 minutes. The nurses' results were summarized, and higher scores indicated more severe anxiety or depression.

Evaluation of health-promoting lifestyle: The Health-Promoting Lifestyle Profile II (HPLP-II) [18], a revised version of the HPLP introduced in Taiwan, China in 2010, was used. The scale

Table 1. Comparison of clinical characteristics between the two groups

	Experimental group (n=68)	Control group (n=68)	t/χ^2	*P*
Age (years)	52.62±4.90	52.82±7.20	-1.142	0.255
Gender			0.526	0.468
Male (n%)	47 (69.1%)	43 (63.2%)		
Female (n%)	21 (30.9%)	25 (36.8%)		
BMI (kg/m^2)	19.20±1.21	19.16±0.99	0.035	0.852
Smoking	20 (29.4%)	21 (30.9%)	0.197	0.844
Diabetes	21 (30.9%)	20 (29.4%)	0.035	0.852
Hypertension	16 (23.5%)	15 (22.1%)	0.042	0.838
Hyperlipidemia	3 (4.4%)	4 (5.9%)	0.151	0.698
Coronary heart disease	8 (11.8%)	10 (14.7%)	0.256	0.613
Chronic obstructive pulmonary disease	6 (8.8%)	8 (11.8%)	0.319	0.574

comprises six dimensions and 48 items, each scored from 1 to 4, for a total score of 48-192. Higher scores reflect better health-promoting lifestyles.

Score classification: Low level: 1-2 points. Medium level: 2-3 points. High level: 3-4 points.

Dimension scores: Calculated as the total score for a dimension divided by the number of items in that dimension.

Evaluation of nursing satisfaction: Nursing satisfaction was assessed using a self-designed nursing satisfaction scale [19], which includes 22 items with a total score of 110.

Statistical analysis

SPSS 24.0 statistical software was used for data analysis. The Kolmogorov-Smirnov test was performed to assess the normality of all metric data. Normally distributed data were expressed as mean ± standard deviation and analyzed using the independent sample t-test for between-group comparisons. Non-normally distributed data were represented as median (P25, P75) and analyzed using the Mann-Whitney U test. Categorical variables were expressed as counts (%) and analyzed using the chi-square test. A *p*-value of <0.05 was considered statistically significant for all tests.

Results

Comparison of clinical characteristics

There were no significant differences between the two groups in terms of age, gender, BMI, smoking status, hypertension, diabetes, chronic obstructive pulmonary disease, or coronary heart disease (all P>0.05, **Table 1**).

Comparison of quality of life (SF-36 questionnaire)

The experimental group demonstrated significantly higher scores in physical function (87.95±0.58 vs. 69.97±0.88, P<0.001), psychological function (78.96±0.59 vs. 73.90±0.57, P<0.001), social function (85.10±0.59 vs. 67.95±0.61, 67.95±0.61), and material function (75.01±0.62 vs. 64.98±0.57, P<0.001) compared to the control group after the intervention, with significant differences observed (P<0.05) (**Table 2**).

Comparison of negative emotions

Following the intervention, HAMA and HAMD scores decreased in both groups, with the experimental group showing significantly greater improvement than the control group (HAMA: 40.30±5.85 vs. 48.67±5.46, P<0.001; HAMD: 43.17±7.14 vs. 54.28±8.45, P<0.001) (**Table 3**).

Comparison of health-promoting lifestyle

Post-intervention, the experimental group achieved higher scores in health responsibility, nutrition, stress management, exercise, interpersonal support, self-actualization, and the total health-promoting lifestyle score compared to the control group (P<0.05) (**Figure 2**).

Comparison of nursing satisfaction

The nursing satisfaction rate in the experimental group was 95.6%, significantly higher than

Table 2. Comparison of quality of life before and after intervention between the two groups

	Time	Experimental group (n=68)	Control group (n=68)	t	*P*
Physical function	Before intervention	60.99±0.58	60.97±1.34	0.111	0.912
	After intervention	87.95±0.58	69.97±0.88	139.537	0.000
	t	21.194	46.066	-	-
	P	0.000	0.000	-	-
Psychological function	Before intervention	61.00±0.60	60.97±1.55	0.150	0.881
	After intervention	78.96±0.59	73.90±0.57	50.559	0.000
	t	75.435	64.391	-	-
	P	0.000	0.000	-	-
Social function	Before intervention	62.98±0.60	62.72±2.69	0.782	0.436
	After intervention	85.10±0.59	67.95±0.61	16.280	0.000
	t	21.333	15.644	-	-
	P	0.000	0.000	-	-
Material function	Before intervention	65.02±0.59	64.92±0.56	1.052	0.295
	After intervention	75.01±0.62	64.98±0.57	98.137	0.000
	t	96.240	0.631	-	-
	P	0.000	0.529	-	-

Table 3. Comparison of negative emotions before and after intervention between the two groups

	Time	Experimental group (n=68)	Control group (n=68)	t	*P*
HAMA	Before intervention	49.50±5.34	49.95±5.41	0.483	0.630
	After intervention	40.30±5.85	48.67±5.46	8.632	0.000
	t	9.584	1.371	-	-
	P	0.000	0.172	-	-
HAMD	Before intervention	54.17±5.81	53.10±5.75	1.082	0.281
	After intervention	43.17±7.14	54.28±8.45	8.282	0.000
	t	9.859	0.955	-	-
	P	0.000	0.341	-	-

HAMA: Hamilton Anxiety Scale, HAMD: Hamilton Depression Scale.

85.3% observed in the control group (P=0.041) (**Table 4**).

Comparison of blood urea nitrogen and hemoglobin

After the intervention, the experimental group had significantly lower blood urea nitrogen levels (P<0.01) and higher hemoglobin levels (P<0.05) compared to the control group (**Figure 3**).

Comparison of clinical symptom improvement

After the intervention, the acid regurgitation scores in the experimental group were significantly lower than those in the control group (0.79±0.41 vs. 1.77±0.52, P<0.001). Similarly, the epigastric pain scores in the experimental group were lower than those in the control group (0.90±0.35 vs. 1.49±0.43, P<0.001). Furthermore, the burning sensation scores in the experimental group were also lower than those in the control group (0.99±0.32 vs. 1.83±0.34, P<0.001) (**Table 5**).

Discussion

Gastric ulcers result from a combination of factors, including psychological, dietary, and lifestyle influences. Therefore, clinical nursing interventions must adopt a comprehensive approach addressing these aspects [20].

In this study, nursing interventions based on the KANO model were shown to significantly improve clinical symptoms and quality of life for patients with gastric ulcers. They also effec-

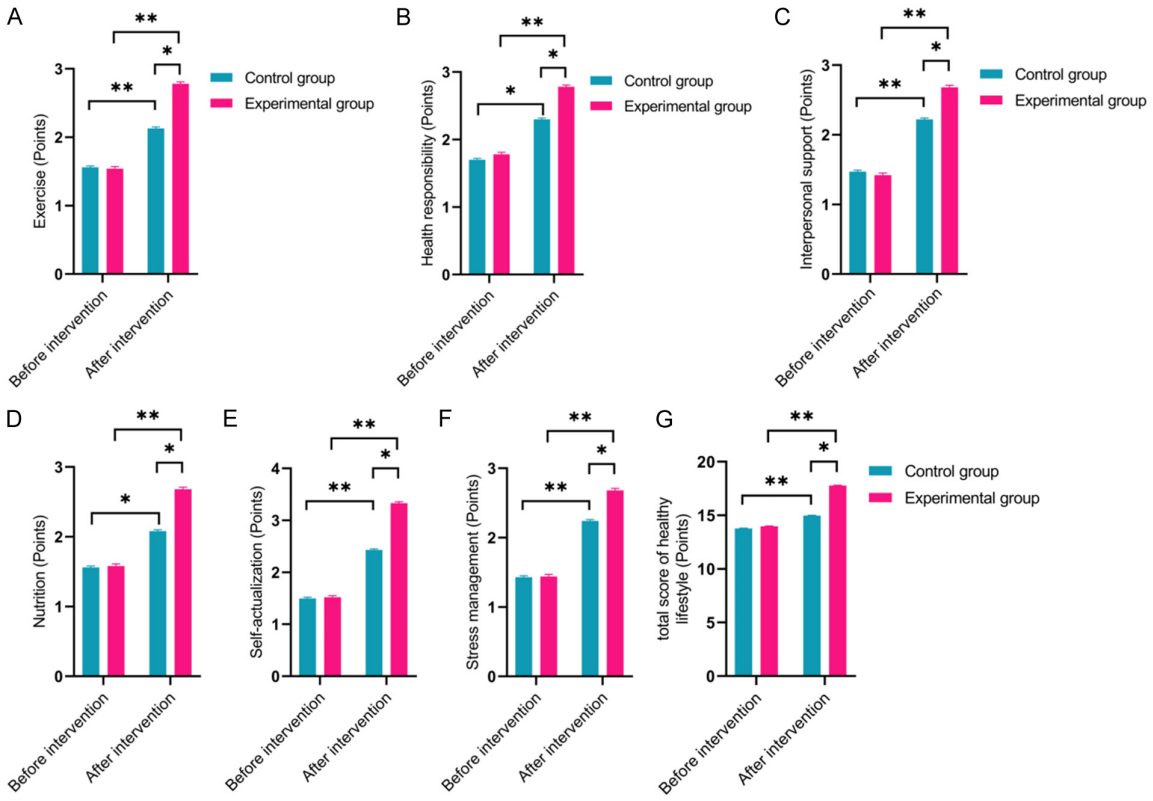

Figure 2. Comparison of health-promoting lifestyle between the two groups. A. Exercise; B. Health responsibility; C. Interpersonal support; D. Nutrition; E. Self-actualization; F. Stress management; G. Total score of healthy lifestyle. Compared to control group, *P<0.05, **P<0.01.

tively alleviated anxiety and depression while enhancing nursing satisfaction.

The observed improvements in quality of life align with findings from previous studies [21, 22]. The KANO model allows for the identification and prioritization of patient needs by categorizing different attributes and expectations. This facilitates the development of targeted nursing measures [23]. For gastric ulcer patients, interventions such as tailored dietary guidance, pain management, and emotional support contribute directly to improved quality of life.

Regular communication and assessment enable timely adjustments to nursing interventions, ensuring alignment with patients' changing needs [24]. This dynamic and patient-centered approach helps to address potential problems promptly, thereby stabilizing and improving the patient's condition [25].

By addressing various aspects of care identified through the KANO model, nursing interventions can reduce symptoms (e.g., pain and discomfort), improve physical functioning (e.g., performing daily activities), enhance mental health (e.g., reducing anxiety and depression), and support better social functioning (e.g., facilitating normal interactions). Together, these improvements lead to a holistic enhancement in patients' quality of life.

Additionally, the positive nurse-patient relationship fostered through this approach contributes significantly to patients' psychological well-being and overall perception of care quality.

The findings of this study demonstrate that nursing interventions based on the KANO model significantly alleviate negative emotions in patients with gastric ulcers, as reflected in reduced HAMA and HAMD scores after the intervention.

Through the KANO model, personalized care plans can be developed to address the unique needs and expectations of each patient [26].

Table 4. Comparison of nursing satisfaction between the two groups

Group	Experimental group (n=68)	Control group (n=68)	χ^2	p
Very satisfied	47 (69.1%)	34 (50.00%)		
Satisfied	18 (26.5%)	24 (35.3%)		
Dissatisfied	3 (4.4%)	10 (14.7%)		
Nursing satisfaction	65 (95.6%)	58 (85.3%)	4.168	0.041

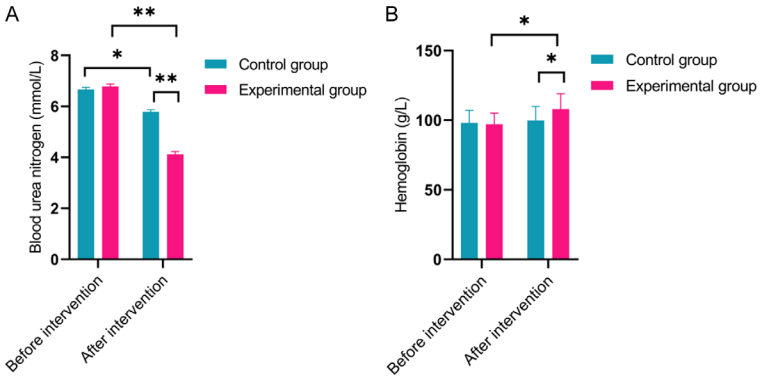

Figure 3. Comparison of blood urea nitrogen and hemoglobin between the two groups. A. Blood urea nitrogen; B. Hemoglobin. Compared to control group, *P<0.05, **P<0.01.

Individualized attention helps patients feel understood and cared for, thereby alleviating anxiety and stress. Additionally, continuous assessment and adjustment of interventions based on patients' responses ensure that care remains dynamic and responsive to their evolving emotional needs.

Effective communication and patient education are also integral components of the KANO model-based nursing approach [27]. Educating patients about their condition, treatment options, and self-care strategies empowers them, reducing uncertainty and enhancing their sense of control and confidence [28]. This empowerment significantly reduces negative emotions.

Interestingly, the study also found that the KANO model-based nursing intervention improved clinical symptoms such as acid reflux, abdominal pain, and burning sensation. For acid reflux, targeted interventions included dietary adjustments (e.g., avoiding foods that trigger acid secretion) and meal timing strategies to regulate gastric acid secretion [29]. Abdominal pain relief involved measures such as heat application and gentle massage to reduce muscle tension. Psychological counseling and emotional support were also emphasized, as stress and anxiety can exacerbate symptoms [30]. For burning sensations, lifestyle modifications (e.g., maintaining an upright posture after meals) and proper medication use to control gastric acid secretion and protect the gastric mucosa were emphasized [31].

This study has some limitations: The relatively small sample size may limit the generalizability of the findings. The study was conducted within a specific geographical or institutional context, which may affect the transferability of results to other settings.

Potential biases in patient selection and data collection could influence the accuracy and reliability of the conclusions. The long-term effects of the KANO model-based nursing interventions on quality of life were not fully captured. External factors, such as changes in the healthcare environment or concurrent treatments, may have impacted the outcomes but were not comprehensively analyzed. Future research should aim to expand the sample size to enhance the representativeness and reliability of the findings. Additionally, exploring the long-term effects of KANO model-based nursing interventions could provide further insights.

In conclusion, nursing interventions based on the KANO model significantly improve clinical symptoms, quality of life, and emotional well-being in patients with gastric ulcers. These interventions also enhance nursing satisfaction, making them a valuable approach for integration into future nursing practices.

Disclosure of conflict of interest

None.

Table 5. Comparison of clinical symptom improvement between the two groups

Group		Experimental group (n=68)	Control group (n=68)	t	p
Acid regurgitation	Before intervention	2.22±0.64	2.06±0.55	1.585	0.115
	After intervention	0.79±0.41	1.77±0.52	12.337	0.000
	t	15.560	3.134	-	-
	P	0.000	0.002	-	-
Celialgia	Before intervention	2.02±0.63	1.99±0.56	0.227	0.821
	After intervention	0.90±0.35	1.49±0.43	8.727	0.000
	t	12.838	5.874	-	-
	P	0.000	0.000	-	-
Burning sensation	Before intervention	2.18±0.59	2.15±0.54	0.331	0.741
	After intervention	0.99±0.32	1.83±0.34	14.941	0.000
	t	14.699	4.055	-	-
	P	0.000	0.000	-	-

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