# Factors affecting preoperative nutritional status of gastric cancer patients at Vietnam National Cancer Hospital

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**Abstract**

**Objective:** Gastric cancer (GC) sometimes presents as asymptomatic or exhibits only nonspecific symptoms in its initial stages, resulting in delayed diagnosis and subsequent starvation. Patients with gastric cancer who had preoperative malnutrition faced a heightened risk of unfavorable clinical outcomes. The nutritional status was affected by various factors, including the disease's location and stage, as well as gastrointestinal symptoms such diminished food intake, abdominal pain, and vomiting. **Materials & Method**: Between January and December 2023, the Vietnam National Cancer Hospital performed cross-sectional descriptive research on 88 stomach cancer patients to elucidate their dietary status and associated factors. **Results:** The preoperative malnutrition rates based on albumin, body mass index (BMI), and scored patient-generated subjective global assessment (PG-SGA) were 34.1%, 29.5%, and 55.7%, respectively. Research has not found a relationship between nutritional status assessed by PG-SGA as well as BMI with factors such as age, gender, clinical symptoms, and disease stage. **Conclusion:** Prior to surgery, GC patients had a very high risk of malnutrition. Research has not found a relationship between nutritional status assessed by PG-SGA as well as BMI with any factors.

***Keywords:*** *preoperative malnutrition, gastric cancer, nutrition status, factors affecting.*

## 1. INTRODUCTION

Gastric cancer constitutes significant public health concern due to the increasing incidence and fatality rates globally [1]. In Vietnam, 17,906 individuals (9.8%) of new gastric cancer cases ranked fourth in both incidence and mortality among all malignancies [2]. Moreover, patients with gastric cancer exhibited a significant prevalence of malnutrition, and preoperative nutritional therapy poses a considerable problem [3]. Prior research indicated that 40-50% of patients with surgical conditions, particularly those undergoing gastrectomy, were malnourished at admission [4].

Stomach cancer affects the ability to digest and absorb food, the tumor secretes substances that reduce appetite... Thereby reducing food intake and nutrient absorption leading to malnutrition. On the other hand, malnutrition affects the body's resistance, reducing the body's ability to fight diseases [4].

Patients with gastric cancer who presented with preoperative malnutrition exhibited a heightened risk of adverse clinical outcomes. In 2010, at St Vincent's Hospital Melbourne, Australia, preoperative malnourished patients had an extended hospital stay averaging 15.8 days and exhibited a higher incidence of complications, more than double that of well-nourished patients [5]. Preoperative nutritional support in gastric cancer has been shown to reduce the incidence of surgical site infections, length of hospital stays, and associated costs [6].

Preoperative nutritional evaluation to identify undernutrition and offer the chance to enhance nutritional status. There are many methods to assess nutritional status such as body mass index (BMI), Patient Generated Subjective Global Assessment (PG-SGA) or assess nutritional status through biochemical indices such as serum albumin or hemoglobin [7]. Weight and height alone did not assess nutritional status, but it must be combined with weight, height and overall size, body structure, energy and protein reserves, through soft tissues surface of carotid circumference, subcutaneous fat layer and muscle, … Among them, BMI was the most used [8]. PG-SGA was a more specific method of assessing nutritional status for cancer patients, such as assessing the presence of symptoms of nausea, vomiting, diarrhea, dry mouth and taste changes, sense. This was a comprehensive subjective assessment performed on all aspects including: weight loss, decreased food digestion, activity and function, increased metabolic demands and physical examination [9]. Albumin was one of the visceral proteins produced by the liver that was used as a

marker of nutritional status [10].

Nutritional status can be influenced by many factors such as age, gender, tumor location, disease stage, gastrointestinal symptoms. Firstly, the rate of malnutrition for digestive disease was higher than that of other sites, accounting for 20 - 85%, of which 14-94% of GC patients were diagnosed with malnutrition [11]. Secondly, gastrointestinal symptoms such as reduced food intake due to mechanical obstruction and cachexia, which occur during tumor progression. These factors might significantly influence appetite, muscle mass, and adipose tissues, leading to weight loss. Besides, most GC patients who had diets before and after surgery do not meet the recommended requirements for energy, energy-producing substances and vitamins as well as some minerals [12, 13].

Evaluating the nutritional status and associated factors of gastric cancer patients is crucial for determining treatment strategies and predicting disease outcomes. This study aims to describe the preoperative nutritional status of gastric cancer patients and associated factors at Vietnam National Cancer Hospital.

### 2. METHOD

**Research subject**

88 patients were diagnosed with gastric cancer at Vietnam National Cancer Hospital from January to December 2023.

**Inclusion criteria**

The research included participants aged 18 and older diagnosed with gastric cancer. Patients exhibited alertness, maintained good contact, and displayed no cognitive disturbances. Patients received comprehensive explanations and participated in the study voluntarily.

**Exclusion criteria**

Patients presented with defects impacting the anthropometric index, including kyphosis, scoliosis, limb loss, and inability to stand. Additionally, some patients were mute, deaf, or unable to provide information and data. Furthermore, patients had incomplete medical records.

**Research design**

Cross-sectional descriptive study

**Sample selection method**

Convenience sampling was purposefully selected for all subjects that met the inclusion and exclusion criteria.

**Research variables/indicators**

Age (age according to solar calendar); gender (male or female); weight (kg); height (cm); BMI (CED, normal, overweight, obesity); clinical symptoms (epigastric abdominal pain, weight loss, hematemesis, melena, pyloric stenosis, palpable abdominal mass), stage disease (I, II, III, IV); blood count test; serum albumin; nutritional status according to PG - SGA (A-B-C).

**Research process**

- Design the research and build questionnaires
- Selecting research subject
- Collecting information
- Data processing, analysis and report writing

**Data collection and analysis**

We collected patients by designing questionnaires. The process of data analysis was done by using SPSS software version 22.0.

Statistics: Description (Mean, standard deviation, max, min, CI 95%); Comparative test (T - Student to compare the mean, comparative test $\chi2$)

- Prepared a set of self-completed questionnaires on paper, distributed to each research subject a set of questionnaires to collect data.

- Collected anthropometric information:

+ Height measurement: Measured standing height with a SECA synthetic plastic ruler. The ruler was placed vertically, perpendicular to the horizontal floor. Height was recorded in centimeters and gave as an odd number after the comma.

+ Weight measurement: Measured weight on the morning of the patient's surgery by TANITA BC-54. The patient wore the neatest clothes, stood in the middle of the table, did not move, eyes looked straight, weight was evenly distributed on both legs. Results were recorded in kg with an odd number.

- Collected test indicators: Collected test indicators from the patient's medical records. Indicators were recorded carefully, accurate to 01 decimal place.

**Some assessment standards**

- Serum albumin [10]: Normal: 35-48 g/L; Mild malnutrition: 28 - < 35 g/L; Moderate malnutrition: 21 - < 28 g/dL; Severe malnutrition: < 21 g/dL.

- Hemoglobin [14]: Anemia < 130 g/l for men and < 120 g/l for women; Anemia < 110 g/l for people over 60 years old.

- Assess disease stage [15]: Based on the TNM classification system of the American Joint Committee on Cancer version 8 for gastric cancer.

- Body Mass Index (BMI) [8]: Chronic energy deficiency (CED): < 18.5; Normal: 18.5 - 22.99; Overweight: 23 - 24.9; Obesity: ≥ 25.

- PG-SGA assessment of the cancer patient's malnutrition risk was classified into 3 levels [9]:

+ PG-SGA A (Wel-nourished): Stable weight or

recent weight gain, no reduction in dietary intake or recently improved, no abnormalities in functions and activities in the past month.

+ PG-SGA B (Moderate or suspected malnutrition): Weight loss < 5% in a month or 10% in 6 months, reduced dietary consumption; presence of symptoms affecting nutrition: moderate functional impairment: loss of subcutaneous layer or moderate muscle mass.

+ PG-SGA C (Severely malnourished): Weight loss > 5% in a month or > 10% in 6 months, severe lack of dietary intake, presence of symptoms affecting eating; severe functional impairment or sudden deterioration with clear signs of malnutrition (loss of subcutaneous layer, muscle atrophy, ...)

**Research ethics**

The subjects would be informed of the purpose of the research, only conducted when they agreed to participate in the research. Subject information would be kept completely confidential. Research results were for research purposes only. Research was only for the purpose of proposing measures to improve the patient's health and had no other purpose. Ensured the truthfulness of information.

## 3. RESULTS

### 3.1. General characteristics and nutritional status

The general features and nutritional condition of the patients are shown in Table 1. With a male to female ratio of 2.26/1, males outnumber females by 69.3%. BMI, albumin, hemoglobin, and PG-SGA preoperative malnutrition rates were 29.5%, 34.1%, 53.4%, and 55.7%, respectively.

**Table 1.** General characteristics and nutritional status

|  |  | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 61 | 69.3 |
|  | Female | 27 | 30.7 |
| **Average age** |  | 60.4 ± 12.0 | |
| **BMI** | **Level (kg/m²)** | **Frequency (n)** | **Percentage (%)** |
| CED | < 18.5 | 26 | 29.5 |
| Normal | 18.5 - 22.9 | 54 | 61.4 |
| Overweight | 23 - 24.9 | 3 | 3.4 |
| Obesity | ≥ 25.0 | 5 | 5.7 |
| **Level** | **Albumin (g/l)** | **Frequency (n)** | **Percentage (%)** |
| Normal | ≥ 35 | 58 | 65.9 |
| Malnutrition | < 35 | 30 | 34.1 |
| **Level** | **Hgb (g/l)** | **Frequency (n)** | **Percentage (%)** |
| No anemia | Male ≥ 130 Female ≥ 120 | 41 | 46.6 |
| Anemia | Male < 130 Female < 120 | 47 | 53.4 |
| **PG-SGA** |  | **Frequency (n)** | **Percentage (%)** |
| PG-SGA A (Wel-nourished) |  | 39 | 44.3 |
| PG-SGA B (Moderate or suspected malnutrition) |  | 35 | 39.8 |
| PG-SGA C (Severely malnourished) |  | 14 | 15.9 |
| **Total** |  | **88** | **100** |

**Table 2.** Some clinical symptoms and stage disease

|  |  | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Epigastric abdominal pain** | Yes | 82 | 93.2 |
|  | No | 6 | 6.8 |

| | | | |
|---|---|---|---|
| **Weight loss** | Yes | 44 | 50.0 |
| | No | 44 | 50.0 |
| **Hematemesis** | Yes | 2 | 2.3 |
| | No | 86 | 97.7 |
| **Melena** | Yes | 12 | 13.6 |
| | No | 76 | 86.4 |
| **Pyloric stenosis** | Yes | 13 | 14.8 |
| | No | 75 | 85.2 |
| **Palpable abdominal mass** | Yes | 3 | 3.4 |
| | No | 85 | 96.6 |
| **Stage disease** | I | 7 | 7.9 |
| | II | 53 | 60.2 |
| | III | 24 | 27.3 |
| | IV | 4 | 4.6 |
| **Total** | | **88** | **100** |

Most patients have epigastric abdominal pain (93.2%). Weight loss occurred in half of the patients studied. The disease stage is mainly stage II (60.2%).

### 3.2. Relationship between nutritional status and some factors

**Table 3.** Relationship between nutritional status according to BMI and gender, age, disease stage

| Information | | No malnutrition | | CED | | p ($\chi^2$ test) |
|---|---|---|---|---|---|---|
| | | N | % | n | % | |
| **Gender** | Male | 43 | 70.5 | 18 | 29.5 | 0.991 |
| | Female | 19 | 70.4 | 8 | 29.6 | |
| **Age** | 18-39 | 4 | 80 | 1 | 20 | 0.136 |
| | 40-59 | 27 | 81.8 | 6 | 18.2 | |
| | ≥ 60 | 31 | 62 | 19 | 38 | |
| **Stage disease** | I | 6 | 85.7 | 1 | 14.3 | 0.669 |
| | II | 35 | 66 | 18 | 34 | |
| | III | 18 | 75 | 6 | 25 | |
| | IV | 3 | 75 | 1 | 25 | |
| **Total** | | **62** | **70.5** | **26** | **29.5** | |

No relationship has been found between nutritional status assessed by BMI and factors such as age, gender, disease stage (p>0.05).

**Table 4.** Relationship between nutritional status according to PG-SGA and some general information

| Information | | Well-nourished | | Malnourished | | Total (n=88) | p |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | | |
| **Age** | 18 - 39 | 4 | 80 | 1 | 20 | 5 | 0.097 [a] |
| | 40 - 59 | 17 | 51.5 | 16 | 48.5 | 33 | |
| | ≥ 60 | 18 | 36 | 32 | 64 | 50 | |
| **Gender** | Male | 25 | 41 | 36 | 59 | 61 | 0.344 [b] |
| | Female | 14 | 51.9 | 13 | 48.1 | 27 | |

| Stage | I | 5 | 71.4 | 2 | 28.6 | 7 | 0.452 [b] |
|-------|-----|------|------|------|------|------|-----------|
|       | II | 21 | 39.6 | 32 | 60.4 | 53 | |
|       | III | 11 | 45.8 | 13 | 54.2 | 24 | |
|       | IV | 2 | 50 | 2 | 50 | 4 | |

|  | Well-nourished | Malnourished | Total (n=88) | p (T-test) |
|--|----------------|--------------|--------------|------------|
| Albumin | 37.3 ± 5.7 | 37.9 ± 5.4 | 37.7 ± 5.5 | 0.597 |
| Hemoglobin | 124 ± 20.6 | 124.1 ± 18.8 | 124 ± 19.5 | 0.984 |

No relationship has been found between nutritional status assessed by PG-SGA and factors such as age, gender, disease stage, albumin and hemoglobin levels (p>0.05).

**Table 5.** Relationship between nutritional status according to PG-SGA and clinical symptoms

| Clinical symptoms | | Well-nourished | | Malnourished | | Total | p |
|-------------------|-----|----------------|------|--------------|------|-------|---|
|                   |     | N | % | n | % | (n=88) | |
| Epigastric abdominal pain | Yes | 36 | 43.9 | 46 | 56.1 | 82 | 0.772 [a] |
|                           | No | 3 | 50 | 3 | 50 | 6 | |
| Weight loss | Yes | 20 | 45.5 | 24 | 54.5 | 44 | 0.840 [b] |
|             | No | 19 | 43.2 | 25 | 56.8 | 44 | |
| Hematemesis | Yes | 1 | 50 | 1 | 50 | 2 | 0.870 [a] |
|             | No | 38 | 44.2 | 48 | 55.8 | 86 | |
| Melena | Yes | 6 | 50 | 6 | 50 | 12 | 0.670 [b] |
|        | No | 33 | 43.4 | 43 | 56.6 | 76 | |
| Pyloric stenosis | Yes | 6 | 46.2 | 7 | 53.8 | 13 | 0.885 [b] |
|                  | No | 33 | 44 | 42 | 56 | 75 | |
| Palpable abdominal mass | Yes | 2 | 66.7 | 1 | 33.3 | 3 | 0.428 [a] |
|                         | No | 37 | 43.5 | 48 | 56.5 | 85 | |

[a] *Fisher's exact,* [b] *χ² test*

No relationship has been found between nutritional status assessed by PG-SGA and clinical symptoms (p>0.05).

## 4. DISCUSSION

### General characteristics and nutritional status

According to the study, which involved 88 GC patients, men made up the majority at 69.3%, 2.26 times greater than women. This outcome is comparable to Phan Thi Dieu Ngoc in 2022, where 60.8% of men were nearly twice as many as women [16]. The average age of the patients was 60.4 ± 12.0 years, with the highest rate (56.8%) occurring in the > 60 age group, which is almost ten times greater than the 18.0-39 age group (5.7%). This is comparable to Phan Thi Dieu Ngoc's 2022 findings, where the highest percentage of people aged 60 and over was 58.3%, with an average age of 61.77 ± 1.007 [16].

Using BMI to determine nutritional status is an easy, affordable, and uncomplicated process. Among hospitalized patients, BMI is a significant predictor of mortality. This approach has the advantage of considering both height and weight, which makes it more suitable for figuring out how much weight is optimal for a particular height. This approach, however, is unable to detect particular or transient nutritional deficits. The study found that 9.1% of patients were overweight or obese, 61.4% of patients had normal nutritional status, and 29.5% of patients had malnutrition based on their BMI prior to surgery. This outcome is better than several other research' findings, as Nguyen Thi Hang's in 2022 (16.7%) [17]. This might be explained by the variety of research sites, especially the Vietnam National Cancer Hospital, which focuses on cancer care. Furthermore, according to BMI, the rates of

malnutrition for men and women were 29.5% and 29.6%, respectively. Furthermore, malnutrition is more common in individuals with advanced cancer and at later ages. Because BMI does not effectively reflect changes in nutritional status over a short period of time, it must be used in conjunction with a variety of other measures to assess nutritional status.

Iron-containing globin makes up the protein known as hemoglobin. Anemia is a condition in which the peripheral blood's hemoglobin content or red blood cell count declines, depriving the blood of oxygen needed to support tissues. Iron deficiency anemia will result from inadequate iron absorption or a diet low in iron. Patients with anemia experience fatigue, lightheadedness, decreased mobility, appetite loss, and an increased risk of complications and mortality. Prior to surgery, 53.5% of patients had anemia, with mild, moderate, and severe anemia accounting for 33%, 18.2%, and 2.3% of the total. This is comparable to Bui Thi Huyen's 51.8% in 2022 [18]. Anemia is common in GC patients. Thus, it is crucial to advise these patient groups to eat a diet rich in iron, particularly absorbable iron like heme iron, which is present in foods derived from animals.

Albumin is a useful metric for evaluating nutritional status and is still regarded as a predictive predictor for surgical risk. According to the data, the preoperative albumin concentration was 37.7 ± 5.5 g/l; the average albumin levels for men and women were 37.7 ± 5.6 and 37.6 ± 5.4 g/l, respectively, and 34.1% of GC patients had malnutrition prior to surgery. In contrast to the findings of Lai Nam Tai's study from 2022, 46% of patients with malnutrition had a score higher than [19]. Therefore, it can be because the study subjects in the studies are different, or that serum albumin levels are associated with factors like cancer kind, disease duration, nutritional status, etc. Consequently, the albumin-based rate of malnutrition varies from study to study.

According to this PG-SGA study of nutritional status assessment, the rate of patients who were malnourished was 55.7%; moderate malnutrition was 39.8%, and severe malnutrition was 15.9%. Men were at a higher risk of malnutrition (59%), compared to women (48.1%). This outcome is comparable to Ngo Thi Linh's 56.8% study result from 2019 [20].

**Relationship between nutritional status and some factors**

Research findings indicate that older age groups are more vulnerable to hunger than younger ones.

In particular, the rates of malnutrition were 64%, 48.5%, and 20% for those aged ≥60, 40–59, and 18-39, respectively. Nutritional status tends to deteriorate as we age since the body's essential processes decline and our immunity deteriorates. Nevertheless, p>0.05 indicates that this difference is not statistically significant. Males are more likely than women to be malnourished (59%) compared to 48.1%. Nevertheless, p>0.05 indicates that this difference is not statistically significant. Malnutrition is more common in patients in stages II and III than in those in stages I and IV, with rates of 60.4% and 54.2%, respectively. Nevertheless, p>0.05 indicates that this difference is not statistically significant.

Research results by Zang in 2014 and Ngo Thi Linh in 2019 show that there is a relationship between some clinical symptoms such as anorexia and nutritional status according to PG-SGA [20, 21]. This could be the result of a mechanical blockage in the stomach, which makes eating difficult because of dry mouth, nausea, vomiting, discomfort, or digestive issues that make the patient less hungry and cause them to eat less, which results in weight loss. Being a persistent ailment results in significant weight loss and malnourishment. However, this study results found no association. Other factors, through research, all showed statistically insignificant results (p>0.05).

**The limitations of the study**

This is a cross-sectional descriptive study with the sample size is not large enough. Moreover, the data collection method is to distribute self-filled forms, which will have many limitations in data quality. Therefore, the study results cannot reflect comprehensively, completely and in detail the nutritional status of gastric cancer patients before surgery as well as related factors.

## 5. CONCLUSION

Prior to surgery, GC patients had a very high risk of malnutrition, according to research. Research has not found a relationship between nutritional status assessed by PG-SGA as well as BMI with factors such as age, gender, clinical symptoms, and disease stage.

**RENFERENCE**

1. Conti CB, Agnesi S, Scaravaglio M, et al. Early Gastric Cancer: Update on Prevention, Diagnosis and Treatment. *Int J Environ Res Public Health*. 2023;20(3). doi:10.3390/ijerph20032149

2. Sung H, Ferlay J, Siegel RL, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries.

*CA Cancer J Clin*. 2021;71(3):209-249. doi:10.3322/caac.21660

3. Venerito R. Nutrition in Patients with Gastric Cancer: An Update. *Gastrointest Tumors*. 2016;2(4):178–187.

4. Barker LA, Gout BS, Crowe TC. Hospital Mailnutrition: Prevalence, Identification and Impact on Patients and the Healthcare System. *Int J Env Res Public Heal*. 2011;8(2):514-527.

5. A. K. Garth, C.M. Newsome, T. C. Crowe. Nutritional status, nutrition practices and post-operative complications in patients with gastrointestinal cancer. *J Hum Nutr Diet*. 2010;23:393-401. doi:doi:10.1111/j.1365-277X.2010.01058.x

6. Deftereos I, Kiss N, Isenring E, Carter VM, Yeung JM. A systematic review of the effect of preoperative nutrition support on nutritional status and treatment outcomes in upper gastrointestinal cancer resection. *Eur J Surg Oncol*. 2020;46(8):1423-1434. doi:10.1016/j.ejso.2020.04.008

7. Trường Đại Học Y Hà Nội. *Thực Hành Dinh Dưỡng Cộng Đồng.* Nhà Xuất Bản Y Học; 2016.

8. Choo V. WHO reassesses appropriate body-mass index for Asians populations. *J Lancet*. 2002;360(235).

9. Balstad TR, Bye A, Jenssen CRS, Solheim TS, Thoresen L, Sand K. Patient interpretation of the patient-generated subjective global assessment (PG-SGA) short form. *Patient Prefer Adherence*. 2019;13:1391-1400. doi:10.2147/PPA.S204188

10. Saito H, Kono Y, Murakami Y, et al. Postoperative Serum Albumin is a Potential Prognostic Factor for Older Patients with Gastric Cancer. Yonago Acta Med. 2018 Mar 28;61(1):72-78.

11. Nguyễn Thị Thúy, Lê Thị Hương, Nguyễn Thị Thanh. Tình trạng dinh dưỡng của người bệnh ung thư dạ dày trong quá trình điều trị hoá chất tại Bệnh viện K năm 2020-2021. *Tạp chí Nghiên cứu Y học*. 2021;146(10):140-149. doi:10.52852/tcncyh.v146i10.460

12. Tisdale MJ. Mechanisms of cancer cachexia. *Physiol Rev*. 2009;89:381-410.

13. Arends J, Bachmann P, Baracos V, et al. ESPEN guidelines on nutrition in cancer patients. *Clin Nutr*. 2017;36:11-48. doi:10.1016/j.clnu.2016.07.015

14. World Health Organization (WHO). Hemoglobin concentrations for the diagnosis of anemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization, 2011 (WHO/NMH/NHD/MNM/11.1).

15. Ji X, Bu ZD, Yan Y, et al. The 8th edition of the American Joint Committee on Cancer tumor-node-metastasis staging system for gastric cancer is superior to the 7th edition: results from a Chinese mono-institutional study of 1663 patients. Gastric Cancer. 2018 Jul;21(4):643-652. doi: 10.1007/s10120-017-0779-5.

16. Phan Thị Diệu Ngọc, Nguyễn Thị Phương, Lê Thị Diệu Linh. Một số yếu tố liên quan đến tình trạng dinh dưỡng ở bệnh nhân sau phẫu thuật cắt dạ dày do ung thư tại bệnh viện Ung bướu Nghệ An năm 2022. *Vietnam Med J*. 2023;524(2):172-176.

17. Nguyễn Thị Hằng, Nguyễn Anh Tuấn, Vũ Ngọc Anh, Đào Thị Hoa. Đánh giá thực trạng dinh dưỡng của người bệnh trước và sau phẫu thuật ung thư dạ dày tại Bệnh viện Trung ương Quân đội 108. *J 108 - Clin Med Pharm*.2022:44-50.

18. Bui Thi Huyen, Tran Thi Ngoc, Dao Thi Thu Hang, Tran Minh Hai, Nguyen Trong Hung. Nutritional Status of Patients Prior to Gastrointestinal Surgery Prepared At Vietnam-Germany Friendship Hospital in 2021-2022. *Tạp chí Dinh dưỡng và Thực phẩm*. 2022;18(2E):54-60. doi:10.56283/1859-0381/106.

19. Lai Nam Tài, Trương Thanh An, Phạm Nhật Tuấn, Đoàn Duy Tân. Tỷ lệ suy dinh dưỡng trước phẫu thuật ở bệnh nhân ung thư dạ dày tại bệnh viện đại học y dược thành phố Hồ Chí Minh năm 2022. *Vietnam Med J*. 2023;6(1):1-6.

20. Ngô Thị Linh (2019). *Tình trạng dinh dưỡng và một số yếu tố liên quan ở bệnh nhân phẫu thuật ung thư đường tiêu hóa tại Bệnh viện Hữu Nghị Việt Đức năm 2019.* Luận văn thạc sĩ dinh dưỡng, Đại học Y Hà Nội.

21. Zhang L, Lu Y và Fang Y. Nutritional status and related factors of patients with advanced gastrointestinal cancer. *British Journal of Nutrition*.2014;111(7), 1239-1244.