

Pancreaticoduodenectomy: Effect of Nursing Instructions and Oral Postoperative Nutritional Supplementation on Patients Outcomes

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Abstract

Background: Adequate dietary oral intake is important to maintain nutritional status for patients after pancreaticoduodenectomy. **Aim:** This study was conducted to evaluate the effect of nursing instructions and oral postoperative nutritional supplementation on outcomes of patients following pancreaticoduodenectomy. **Patients and methods:** Research design: Quasi experimental (non-randomized) design. Sample and setting: Thirty-four adult patients diagnosed with pancreatic cancer and underwent pancreaticoduodenectomy was recruited from November 2021 to November 2022, in addition to 3 month follow-up period ended in February 2023. Patients were assigned non-randomly into 2 groups. Admitted patients during the first six months in hepatobiliary surgical unit at Al-Rajhi Liver and Gastroenterology Assiut University Hospital were included as control group (16 patients), while patients admitted during the next six months were included as study group (18 patients). Tools: Patient assessment sheet, short-form mini nutritional assessment scale, and Clavien-Dindo classification of surgical complications. **Results:** Study finding revealed a statistical significant difference ($p = 0.0001$) with improvement in study group after 3 months postoperatively regarding nutritional status and albumin and protein levels. Reduced length of hospital stay for study group 10 (55.6%) less than 10 days compared to control group 10 (62.5%) from 10-15 days. Complications did not occur in about one-third of study group 6 (33.3%) compared to 3 (18.8%) in control group. **Conclusion:** Nursing instructions and oral postoperative nutritional supplementation reduced hospital stay, improved nutritional status, albumin and protein levels and reduced postoperative complications. **Recommendation:** Nursing instructions (educational booklet) and oral postoperative nutritional supplementation should be utilized in all liver and gastroenterology hospitals as teaching guide for patients undergoing pancreaticoduodenectomy.

Keywords: Nursing instructions; Oral postoperative nutritional supplementation; pancreaticoduodenectomy; Patients outcomes

Introduction

Pancreatic cancer is considered the fourth common cause of cancer death despite advancement in the medical and surgical care. Pancreatoduodenectomy is a surgical procedure for removal of tumors of the pancreatic head and the other periampullary structures. It is also known as the Whipple procedure. This surgical operation poses immense difficulties to surgeons as a result of complex as well as the highly difficult intra-abdominal dissection and repair of digestive system^(1,2).

Pancreaticoduodenectomy is a complex operation that is associated with many potential postoperative complications. Many patients undergoing pancreaticoduodenectomy are malnourished due to their medical condition or difficulty eating in the face of abdominal pain or obstruction from pancreatic disease⁽³⁾.

Most common postoperative complications of pancreaticoduodenectomy include pancreatic leak/fistula, bile leak, intra-abdominal abscess, delayed gastric emptying, pulmonary complications, gastrointestinal complications, or postoperative hemorrhage require blood transfusion or reopening. Other postoperative complications related to surgical site include delayed wound healing, wound infection or dehiscence^(4,5).

Malnutrition is shown to be a risk factor for postoperative complications following pancreatoduodenectomy. In addition, patients undergoing pancreatoduodenectomy, as patients with chronic pancreatitis or pancreatic cancer often are malnourished. The best route for postoperative nutrition following

pancreatoduodenectomy remains unknown⁽⁶⁾.

The nutritional aspect after pancreatoduodenectomy is an essential component of management and therefore nutritional assessment is recommended before and after pancreato-duodenectomy. Early initiation of oral intake with high protein supplement is recommended. However, there is no standardized protocol of nutrition progression after pancreato duodenectomy⁽⁷⁾.

Nurses should provide nutritional requirements essential to neutral balance and not favor metabolic and protein catabolism, it is so relevant in pancreatoduodenectomy. The addition of oral postoperative nutritional supplementation to diet should be considered once intake is tolerated, as it can aid in meeting nutritional needs and avoid use of artificial nutrition^(8,9). Dietary assessment should be the standard of care. Nursing management should directed to proper assessment of patients` nutritional status, weight, and symptoms. Patients should be monitored for nausea, liquid balance and weight loss. Medical and nursing team must ensure proper assessment of dietary status before and after surgery. Nurses should support patients before and after discharge and encourage patients to take active role in their own recovery. Patients education about postoperative nutrition/diet following pancreato-duodenectomy has a vital role in improving postoperative nutritional status. Patients should be informed about recommended and not recommended diet, nutritional supplementations, and necessary

nutritional instructions to improve their recovery⁽¹⁰⁾.

Significance of the study

Patients following pancreaticoduodenectomy is suspected to develop many potential nutritional problems and postoperative complications. However, there is no supporting data for widespread postoperative nutritional supplementation. The current study is conducted in an attempt to provide guide supporting the integration of appropriate oral postoperative nutritional support into overall management of patients following pancreaticoduodenectomy and define how appropriate oral postoperative nutritional support should be prescribed to provide optimal outcome.

Aim of the study

This study aimed to evaluate the effect of nursing instructions and oral postoperative nutritional supplementation on outcomes of patients following pancreaticoduodenectomy.

Research Hypothesis

This study hypothesized that patients undergoing pancreaticoduodenectomy will exhibit improvement in their outcomes post application of nursing instructions concerning proper nutrition and provide nutritional support; oral postoperative nutritional supplementation.

Operational definition

Patients outcomes: complications (Clavien-Dindo Classification), length of hospital stay, nutritional status (short-form mini nutritional assessment scale), weight, protein level and albumin level.

Subjects and Methods

Research design

Quasi-experimental design (non-randomized) was used.

Setting

The study was conducted in hepatobiliary surgical unit at Al-Rajhi Liver and Gastroenterology Assiut University Hospital.

Sample

Thirty-four adult male and female patients diagnosed with pancreatic cancer and underwent pancreaticoduodenectomy was recruited from November 2021 to November 2022, in addition to 3 month follow-up period ended in February 2023. Patients assigned non-randomly into "study and control groups". Admitted patients during the first six months were included as control group (16 patients), while patients admitted during the next six months were included as study group (18 patients).

Inclusion Criteria:

- Patients diagnosed with pancreatic cancer and underwent pancreaticoduodenectomy.
- Aged 18-65 years.
- Able to tolerate oral intake.
- Malnourished or at risk of malnutrition (as defined by score less than 12 on short-form mini nutritional assessment scale).

Exclusion Criteria:

- Protein allergy.
- Dependent on artificial enteral feeding.
- End-stage renal disease undergoing dialysis.
- Pregnancy.

Sample size

G power software was used to calculate the study sample size as thirty patients (fifteen per group). Power 95 percent,

effect size 0.8, and error 0.05 was used to test differences between two independent means two tailed.

Data collection tools:

Tool I. Patient assessment sheet

This tool was developed by the researchers after reviewing relevant literature and used to assess patients' demographic and medical data.

Part 1: Demographic data which included age and gender.

Part 2: Medical data: height, weight, body mass index (BMI), comorbidities, albumin level and protein level, readmission and adjuvant therapy.

Tool II. The short-form mini nutritional assessment scale

It was designed by **Rubenstein et al., (2001)**⁽¹¹⁾ a six-item scale with scores ranging from "0 to 14" points. It used to assess nutritional status. Anthropometric measurements (weight loss and BMI), global assessment (mobility), and dietary questionnaire and subjective assessment (food intake, neuropsychological problems and acute disease). Score (12-14) = normal nutritional status, (8-11) = at risk of malnutrition, (0-7) = malnourished.

Tool III. Clavien-Dindo grading system for the classification of surgical complications:

It was developed by **Clavien et al., (2009)**⁽¹²⁾ then reevaluated and modified by **Dindo et al., (2004)**⁽¹³⁾. It is used to classify postoperative complications rely on its life-threatening conditions, interventions required and disability. It scored as 0 = no complications, I = any deviations from normal postoperative course without pharmacological management, II = require pharmacological management, III a = require surgical, endoscopic or

radiological management without general anesthesia, III b = the same as III a but require general anesthesia, IV a = life threatening complications necessitate admission to intensive care unit (single organ dysfunction), IV b = the same as IV a but with multiple organ dysfunction, V = death. Grade (I-II) is considered low grade while (III-V) considered high grade.

Tools validity

Content of this study reviewed and also approved by five experts (three medical-surgical nursing and two hepatobiliary surgery staff) to ensure validity of the current study content. Minor modifications were performed for the current study content according to the experts' opinion. The experts' opinion was concluded as the study content were valid and can be recommended. It was calculated and found to be very beneficial = (0.36).

Tools reliability

Reliability for (tool II: the short-form mini nutritional assessment scale) using internal consistency (Cronbach's α) was 0.61. Interrater reliability for (tool III: Clavien-Dindo grading system for the classification of surgical complications) was high ranged from "0.88 to 0.91".

Pilot study

It done on (10 percent "6 patients") of the current study sample to test tools "clarity" and "feasibility" and estimate time needed to fill out. Minor modification was done, so pilot study sample (patients) included in present study sample.

Ethical considerations

Official approvals were obtained from faculty of nursing research ethical committee, as well as director of hepatobiliary surgical unit and

outpatients clinic. The studied patients know their right regarding refusing to participate or withdrawing from study at any time. Patients assured of confidentiality of all data and privacy was maintained. Aim of study explained to every patients prior to data collection. Oral consent for participation was taken from every patient after reassurance about confidentiality and privacy.

Fieldwork description

Data collection was carried out through a period of one year from November 2021 to November 2022, in addition to 3 month follow-up period ended in February 2023 in the hepatobiliary surgical unit and outpatients clinic at Al-Rajhi Liver and Gastroenterology Assiut University Hospital.

Procedure

The present study proceeded using the following phases:

Assessment phase

Preoperatively, the researchers met selected eligible patients; control and study groups, each patient in the two groups was informed with aim and nature of current study and patients' agreements were obtained. Assessments of all patients were established to collect baseline data.

The researchers prepared the training place, teaching aids and media (pictures, handouts; educational booklet) according to patients' needs. Also, the researchers arranged the teaching schedule based on the contents of the educational booklet and time availability.

Implementation phase

Each patient in both groups was interviewed by researchers with the attendance of one family member/caregiver who caring for

patients. The time needed for filling out study tools was "25 - 30 minutes" rely on patients' responses.

Patients of control group received the routine hospital care/instructions without oral postoperative nutritional supplementation while patients of study group received the routine hospital care/instructions and the educational booklet developed by the researchers included instructions with illustrated photos and the recommended oral postoperative nutritional supplementation.

The researchers provide the study group patients with brief description to the surgery; pancreaticoduodenectomy and detailed explanation about common gastrointestinal problems following pancreaticoduodenectomy, necessary instructions concerning nutrition following pancreaticoduodenectomy and the recommended oral postoperative nutritional supplementation.

Nursing instructions about proper nutrition for patients following pancreaticoduodenectomy (educational booklet):

It was developed by the researchers in simplified Arabic language with illustrated photos after reviewing available resources, related literature and according to patients' needs. The researchers educate study group patients about necessary instructions concerning proper nutrition following pancreaticoduodenectomy and the recommended oral postoperative nutritional supplementation to improve their conditions. It consisted of information concerning:

Nursing instructions

- Definition of pancreaticoduodenectomy.

- Common gastrointestinal problems following pancreaticoduodenectomy.
 - Instructions concerning proper nutrition following pancreaticoduodenectomy:
 - Recommended oral postoperative nutritional supplementation:
 - High protein supplement (whey protein), 60 gram total protein per day, administered via 3 times daily (20 gram protein per serving) in addition to amino acids, vitamins and minerals.
 - Recommended and not recommended diet during the first 4-6 weeks following pancreaticoduodenectomy.
 - Management of common gastrointestinal problems following pancreaticoduodenectomy.
- The study group patients received "3 sessions daily" through hospitalization; in morning and afternoon shifts:
- The first session: educate patients about definition of pancreaticoduodenectomy and the common gastrointestinal problems and its management following pancreaticoduodenectomy. The time required was 35-40 minutes.
- The second session: educate patients about instructions concerning nutrition following pancreaticoduodenectomy: recommended oral postoperative nutritional supplementation [high protein supplement (whey protein), 60 g total protein per day, administered via 3 times daily (20 g protein per serving) in addition to amino acids, vitamins and minerals]. The time required was 20 - 30 minutes.
- The third session: educate patients about instructions concerning nutrition following pancreaticoduodenectomy: Recommended and not recommended diet during the first 4-6 weeks following

pancreaticoduodenectomy. The time required was 30-40 minutes.

The study group patients were instructed to follow the instructions. They were given the "educational colored booklet" in simplified Arabic language with illustrated photos. Every patient in study group was given a copy of the illustrated booklet.

Oral postoperative nutritional supplementation (nutritional support):

The study group patients administered oral postoperative nutritional supplementation in the form of high protein supplement (whey protein), 60 gram total protein per day, administered via 3 times daily (20 gram protein per serving) in addition to amino acids, vitamins and minerals.

Evaluation phase

Patients were evaluated through a period of 3 months following pancreaticoduodenectomy for length of hospital stay, readmission, and adjuvant therapy (tool: I, part 2) and for postoperative complications (tool III: Clavien-Dindo grading system for the classification of surgical complications). After 3 months, patients were evaluated for weight, BMI, protein and albumin levels (tool: I, part 2) and for nutritional status (tool II: the short-form mini nutritional assessment scale) to evaluate the effect of nursing instructions and oral postoperative nutritional supplementation on patients outcomes.

Statistical analysis

Categorical variables described by [number and percent "N, %"], where continuous variables described by [mean and standard deviation "Mean, SD"]. Chi-square test or Fisher's exact test were used as appropriate to

compare between categorical variables where compare between continuous variables by "independent-samples t-test" or "paired-samples t-test" as appropriate. A two-tailed " $p < 0.05$ " considered statistically significant. Pearson correlation was used to show the association between variables. Analysis of data performed with "IBM SPSS 26.0 software".

Results

Table (1): distribution of demographic and medical data of the studied groups. It shows non-statistically significant difference between the two groups of patients regarding demographic data; age, gender [p.value = 0.980, 1.000 respectively] and medical data; comorbidities, readmission, adjuvant chemotherapy [p.value = 0.663, 0.932, 0.347 respectively]. Study group patients showed less length of hospital stay than control group patients with non-statistically significant difference (p.value = 0.069).

Table (2): comparison between study and control groups as regard height, weight and BMI preoperative and after 3 months postoperatively. It clarifies non-statistically significant difference between patients of study and control groups regarding preoperative weight and BMI (p. value = 0.112, 0.823 respectively) and after 3 months postoperatively (p. value = 0.325, 0.747 respectively). Both groups suffered from postoperative weight loss after 3 months.

Table (3): comparison between study and control groups as regard protein level, albumin level and the short-form mini nutritional assessment scale preoperative and after 3 months postoperatively. It shows non-statistically significant difference

between the study and control groups regarding preoperative protein level (p. value = 0.669), albumin level (p. value = 0.100) and the short-form mini nutritional assessment scale (p. value = 0.360). A statistically significant difference between the study and control groups after 3 months postoperatively regarding protein level (p. value = 0.029) and albumin level (p. value = 0.039). Highly statistically significant difference was found after 3 months postoperatively regarding the short-form mini nutritional assessment scale (p. value <0.001). Protein level, albumin level and the short-form mini nutritional assessment scale scores were increased and showed significant improvement in study group patients than control group patients.

Table (4): comparison between preoperative and after 3 months postoperative regarding weight and BMI for patients of study and control groups. It clarifies that significant reduction in weight and BMI after 3 months postoperatively was found in both study and control groups patients. A highly statistically significant difference (p. value 0.0001) was found between the mean preoperative weight, BMI (63.7 ± 9.2 , 24.78 ± 2.67 respectively) and the mean weight, BMI after 3 months postoperatively (59.02 ± 9.8 , 22.92 ± 3.2) for study group patients. A statistically significant difference (p. value 0.0001) was found between the mean preoperative weight, BMI (71.35 ± 17.29 , 25.06 ± 4.55 respectively) and the mean weight, BMI after 3 months postoperatively (63.85 ± 17.71 , 22.47 ± 4.91) for control group patients.

Table (5): comparison between preoperative and after 3 months

postoperative protein level and albumin level for patients of study and control groups. It clarifies highly statistical significant difference (p. value 0.0001) between the preoperative and after 3 months postoperative mean scores of protein level (71.44 ± 2.38 , 75.91 ± 3 respectively), and albumin level (34.06 ± 2.82 , 8.89 ± 1.32 respectively) for study group patients. A highly significant improvement was obvious in protein level, and albumin level after 3 months postoperatively in patients of study group. Patients of control group showed non-statistically significant difference between the preoperative and after 3 months postoperative mean scores of the protein level (71.88 ± 3.4 , 73.78 ± 2.34 respectively), and albumin level (36.19 ± 4.43 , 35.85 ± 3.06 respectively) for control group patients. Reduction was found in the protein level and albumin level mean scores after 3 months postoperatively.

Figure (1): relationship between preoperative and after 3 months postoperative short-form mini nutritional assessment scale for patients of study and control groups. It illustrates that highly statistically significant difference (P. value = 0.004) was found between preoperative and after 3 months postoperative short-form mini nutritional assessment scale scores for study group patients. More than half of study group patients were malnourished in preoperative assessment while the majority of them were at risk of malnutrition after 3 months postoperatively. Non-statistically significant difference (P. value = 0.156) was found between preoperative and after 3 months postoperative short-form mini nutritional assessment scale scores

for patients of control group; more than half of them were at risk of malnutrition in preoperative assessment while two-third of them were at malnourished after 3 months postoperatively.

Table (6): frequency distribution of the studied patients as regard Clavien-Dindo grading system for the classification of surgical complications. It clarifies that study group patients were having less postoperative complications than control group patients with non-statistically significant difference between both groups of patients (p. value 0.809).

Figure (2): correlation between albumin level and protein level for study group patients. It illustrates that positive correlation was found between albumin level and protein level for study group patients with statistically significant difference ($r = 0.477$, p. value = 0.045). The albumin level increased with increased protein level.

Figure (3): correlation between protein level and the short-form mini nutritional assessment scale for study group patients. It illustrates that positive correlation was found between protein level and the short-form mini nutritional assessment scale for study group patients with statistically significant difference ($r = 0.581$, p. value = 0.012). The short-form mini nutritional assessment scale scores increased with increased protein level.

Figure (4): correlation between albumin level and the short-form mini nutritional assessment scale for study group patients. It illustrates that positive correlation was found between albumin level and the short-form mini nutritional assessment scale for study group patients with statistically significant difference

($r = 0.659$, p . value = 0.003). The short-form mini nutritional assessment scale

scores increased with increased albumin level.

Table (1): Distribution of demographic and medical data of the studied groups

Items	Study group (n=18)		Control group (n=16)		X ²	P. value
	No	%	No	%		
Age						
Less than 50 years	4	22.2	4	25.0	0.040	0.980
From 50 > 60 years	8	44.4	7	43.8		
60 - 65 years	6	33.3	5	31.3		
Mean±SD	54.2±12.4		57.9±9.1		T=0.981	0.334
Gender						
Male	12	66.7	10	62.5	0.064	1.000
Female	6	33.3	6	37.5		
Comorbidities						
None	6	33.3	7	43.8	4.976	0.663
Diabetes mellitus	4	22.2	4	25.0		
Hypertension	4	22.2	2	12.5		
Cardiac disease	1	5.6	0	0.0		
Pulmonary disease	0	0.0	1	6.3		
Diabetes mellitus and hypertension	2	11.1	1	6.3		
Hypertension and pulmonary disease	0	0.0	1	6.3		
Length of hospital stay						
Less than 10 days	10	55.6	3	18.8	5.34	0.069
From 10- 15 days	5	27.8	10	62.5		
More than 15 days	3	16.7	3	18.8		
Readmission						
No	17	94.4	15	93.8	0.01	0.932
Yes	1	5.6	1	6.3		
Did the patient start adjuvant chemotherapy?						
Yes	15	83.3	15	93.8	0.89	0.347
No	3	16.7	1	6.3		

Independent-samples t-test

Chi-square test and Fisher's exact test

Non-significant $p > 0.05$

Table (2): Comparison between study and control groups as regard height, weight and body mass index preoperative and after 3 months postoperatively

Items	Preoperative				After 3 months postoperatively			
	Study group (n=18)	Control group (n=16)	T	P.value	Study group (n=18)	Control group (n=16)	T	P.value
	Mean±SD	Mean±SD			Mean±SD	Mean±SD		
Height	160.3±7.6	167.8±7.7	-2.82	0.008**	160.3±7.6	167.8±7.7	-2.82	0.008**
Weight	63.7±9.2	71.3±17.2	-1.64	0.112	59.0±9.8	63.8±17.7	-1.00	0.325
Body mass index	24.7±2.6	25.0±4.5	-0.23	0.823	22.9±3.2	22.4±4.9	0.33	0.747

Independent-samples t-test

Non-significant $p > 0.05$ Significant $p < 0.01$ **Table (3): Comparison between study and control groups as regard protein level, albumin level and the short-form mini nutritional assessment scale preoperative and after 3 months postoperatively**

Items	Preoperative				After 3 months postoperatively			
	Study group (n=18)	Control group (n=16)	T	P.value	Study group (n=18)	Control group (n=16)	T	P. value
	Mean±SD	Mean±SD			Mean±SD	Mean±SD		
Protein level	71.44±2.38	71.88±3.4	-0.43	0.669	75.91±3	73.78±2.34	2.29	0.029*
Albumin level	34.06±2.82	36.19±4.43	-1.69	0.100	38.01±2.77	35.85±3.06	2.15	0.039*
The short-form mini nutritional assessment scale	7.33±1.19	7.69±1.01	-0.929	0.360	8.89±1.32	6.5±1.75	4.518	<0.001**

Independent-samples t-test

Significant $p < 0.01$

Table (4): Comparison between preoperative and after 3 months postoperative regarding weight and body mass index for patients of study and control groups

Items	Study group (n=18)				Control group (n=16)			
	Preoperative	After 3 months Postoperatively	T	P.value	Preoperative	After 3 months Postoperatively	T	P.value
	Mean±SD	Mean±SD			Mean±SD	Mean±SD		
Weight	63.7±9.2	59.02±9.8	5.65	0.0001**	71.35±17.29	63.85±17.71	8.40	0.0001**
Body mass index	24.78±2.67	22.92±3.2	5.95	0.0001**	25.06±4.55	22.47±4.91	8.49	0.0001**

Paired-samples t-test

Significant p < 0.001

Table (5): Comparison between preoperative and after 3 months postoperative protein level and albumin level for patients of study and control groups

Items	Study group (n=18)				Control group (n=16)			
	Preoperative	After 3 months Postoperatively	T	P.value	Preoperative	After 3 months Postoperatively	T	P.value
	Mean±SD	Mean±SD			Mean±SD	Mean±SD		
Protein level	71.44±2.38	75.91±3	-4.83	0.0001**	71.88±3.4	73.78±2.34	-2.02	0.062
Albumin level	34.06±2.82	38.01±2.77	-6.85	0.0001**	36.19±4.43	35.85±3.06	0.23	0.818

Paired-samples t-test

Significant p < 0.001

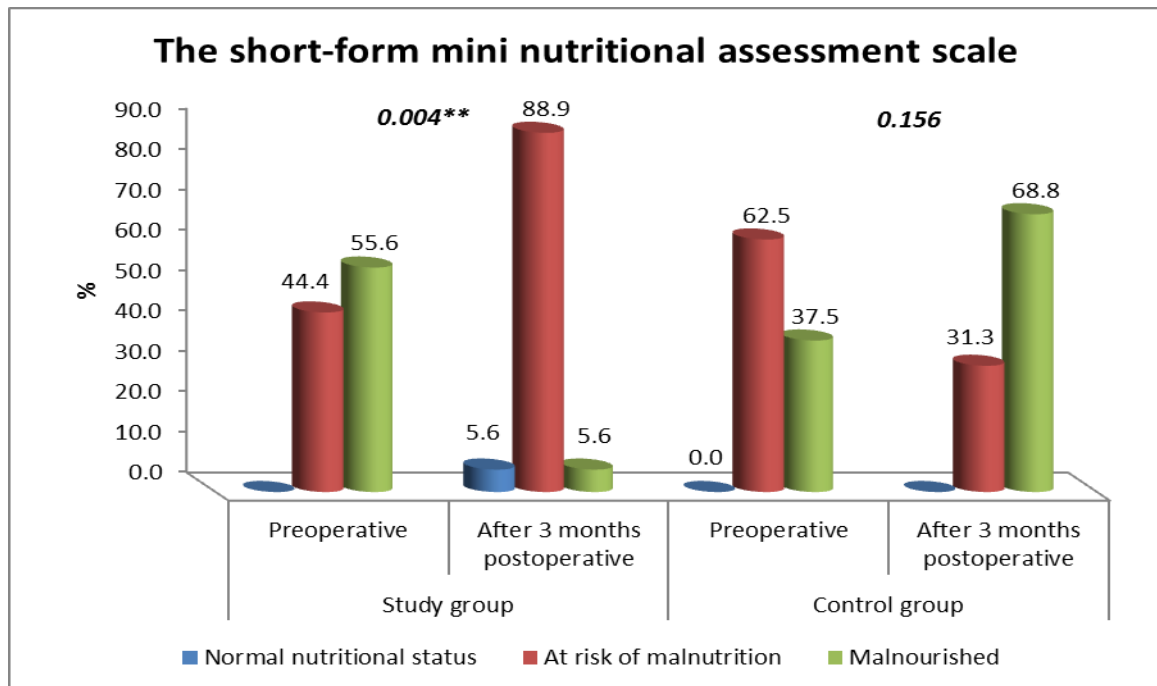


Figure 1. Relationship between preoperative and after 3 months postoperative short-form mini nutritional assessment scale for patients of study and control groups

Table (6): Frequency distribution of the studied patients as regard Clavien-Dindo grading system for the classification of surgical complications

Clavien-Dindo postoperative complications	Study group (n=18)		Control group (n=16)		X ²	P. value
	No	%	No	%		
Pancreatic fistula	1	5.6	1	6.3	3.00	0.809
Biliary fistula	0	0.0	1	6.3		
Chyle leak	3	16.7	1	6.3		
Pulmonary (pneumonia)	2	11.1	2	12.5		
Impaired wound healing	2	11.1	2	12.5		
Gastrojejunostomy leak and Chyle leak	0	0.0	1	6.3		
Chyle leak and gastrointestinal complications	1	5.6	1	6.3		
Grades						
No complications	6	33.3	3	18.8	1.03	0.905
Grade I (low grade)	3	16.7	4	25.0		
Grade II (low grade)	6	33.3	6	37.5		
Grade III a (high grade)	2	11.1	2	12.5		
Grade III b (high grade)	1	5.6	1	6.3		

Chi-square test and Fisher's exact test

Non-significant $p > 0.05$

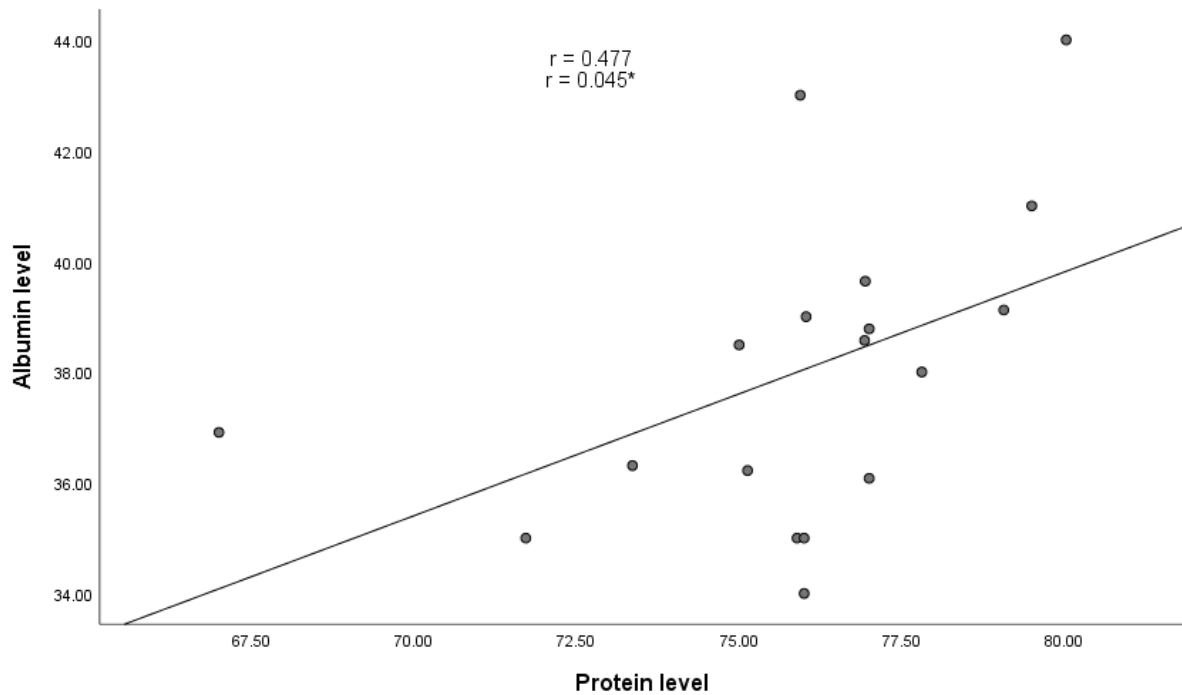


Figure 2. Correlation between albumin level and protein level for study group patients

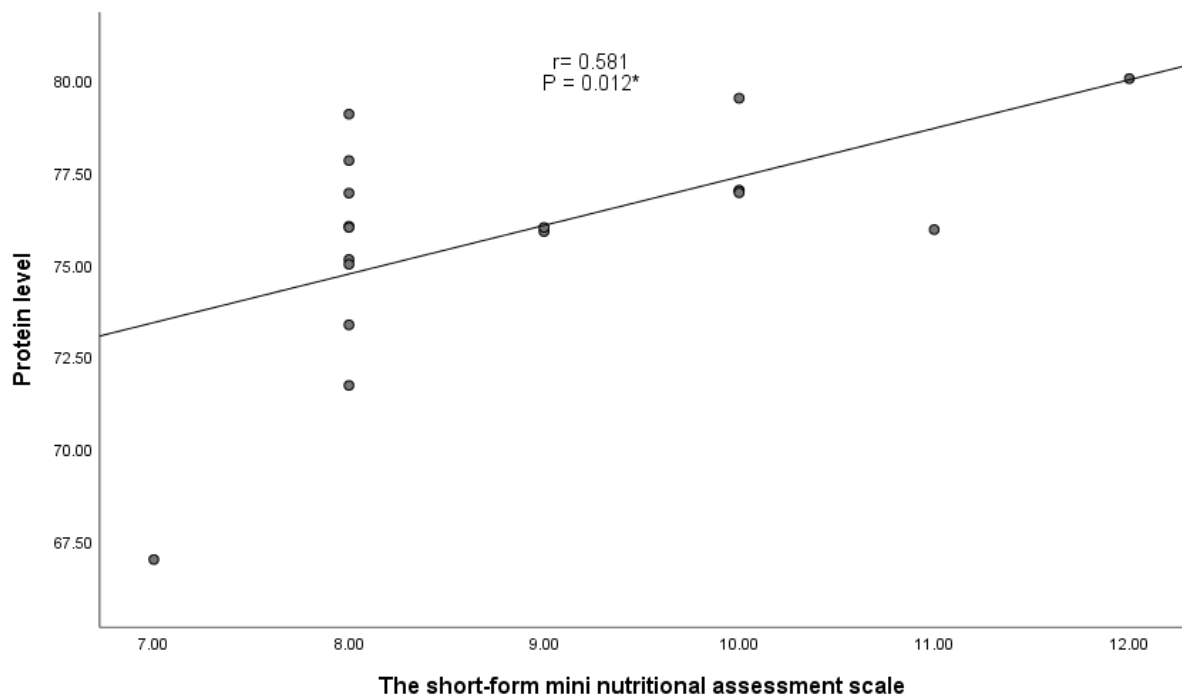


Figure 3. Correlation between protein level and the short-form mini nutritional assessment scale for study group patients

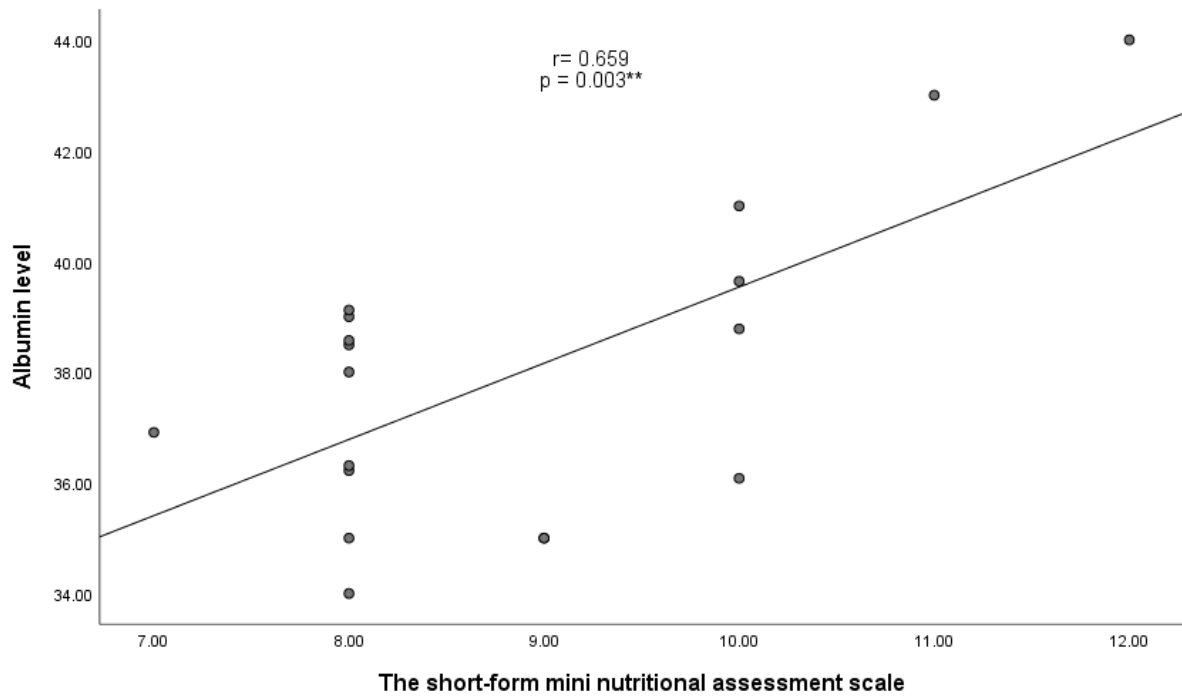


Figure 4. Correlation between albumin level and the short-form mini nutritional assessment scale for study group patients

Discussion

Patients who underwent pancreaticoduodenectomy mainly experience impairment in digestive function which affect nutritional status. Consequences of malnutrition in the preoperative and postoperative periods influence postoperative outcomes of patients including hospital day, complications, and survivals ⁽¹⁴⁾.

Improvement of postoperative outcomes of patients can lead to improving patients` nutritional status, reducing postoperative complications and cost savings for hospital. Advanced practitioners must be aware of the need for prompt and early nutritional consultations for those patients ⁽¹⁵⁾. So, this study aimed to evaluate effect of nursing instructions and oral postoperative nutritional supplementation on outcomes of patients following pancreaticoduodenectomy

In the current study, non-statistically significant difference was found between patients of study and control groups regarding medical data included comorbidities, adjuvant chemotherapy, preoperative weight, BMI, protein level, albumin level and the short-form mini nutritional assessment scale scores. More than half of patients in both groups suffered from preoperative malnutrition. Fewer percent of patients had hypertension, diabetes mellitus, cardiac disease and/or pulmonary diseases. The majority of patients in both groups received adjuvant chemotherapy.

In the same line, **Wang et al., (2022)** ⁽¹⁶⁾ conducted study on three hundred- forty four patients who underwent pancreaticoduodenectomy reported non-statistically significant difference regarding comorbidities, adjuvant chemotherapy and preoperative BMI and albumin level. Some patients were having

hypertension, diabetes mellitus, hyperlipidemia, pulmonary diseases or coronary artery disease, congestive heart failure. Some patients received adjuvant chemotherapy or radiotherapy. Patients suffered from preoperative poor nutritional status, low albumin level and BMI.

From researchers` point of view, preoperative malnutrition considered common health problem in patients with pancreatic cancer and this closely due to immunosuppression and inflammatory activity and the majority of those patients may require adjuvant chemotherapy/radiotherapy after surgery. This opinion was supported by **Song et al., (2019)** ⁽¹⁷⁾ who stated that preoperative malnutrition is common health problem in cancer patients as a result of immunosuppression and inflammatory activity produced by the disease. In addition, study of **Morita et al., (2019)** ⁽¹⁸⁾ reported that postoperative chemotherapy was recommended for many pancreatic cancer patients.

In the current study, study group patients showed less length of hospital stay than patients in control group. More than half of patients in study group (fifty-five percent) hospitalized for less than ten days while more than half of patients in control group (sixty-two percent) hospitalized from ten to fifteen days. Also, non-statistically significance difference was found regarding readmission to hospital.

A study conducted by **Gerritsen et al., (2014)** ⁽¹⁹⁾ on one hundred and two consecutive patients undergoing pancreaticoduodenectomy supported the result of the current study as they stated that introduction of early oral nutrition/feeding after pancreaticoduodenectomy reduced hospital stay.

From researchers' point of view, a shortening of hospital stay through the introduction of nursing instructions and oral postoperative nutritional supplementation reduced the length of hospital stay for study group patients.

In the current study, non-statistically significant difference was found between patients of study and control groups regarding weight and BMI after 3 months postoperatively. Both groups suffered from postoperative weight loss after 3 months postoperatively with statistically significant difference.

The current study supported by the study of **Morita et al., (2019)**⁽¹⁸⁾ who stated that weight loss and low BMI was obvious among patients after pancreaticoduodenectomy and explained that adjuvant chemotherapy after pancreaticoduodenectomy significantly influence patients prognosis led to significant reduction in weight and BMI. Body weight loss ($\geq 10\%$) after pancreaticoduodenectomy is predictive of chemotherapy discontinuation and recommended that adequate nutritional is necessary for patients receiving adjuvant chemotherapy.

The findings of current study demonstrated that protein level, albumin level and the short-form mini nutritional assessment scale scores showed significant improvement in study group patients than control group patients after 3 months. The majority of study group patients were at risk of malnutrition after 3 months postoperatively while two-third of control group patients were malnourished after 3 months postoperatively. Also, the findings illustrated positive correlation between albumin level, protein level, and the short-form mini nutritional assessment scale for study group patients with statistical significant difference.

In this regard, a study of **Rungsakulkij et al., (2019)**⁽²⁰⁾ reported that albumin level is objective indicator of nutritional status which associated with postoperative outcomes for patients with pancreaticoduodenectomy.

Hypoalbuminemia associated with decreased survival in patients underwent pancreaticoduodenectomy.

The current study supported by study of **Ward-Boahen and Wallace-Kazer, (2014)**⁽¹⁵⁾ who stated that nutritional status for patients with pancreatic cancer and underwent pancreaticoduodenectomy should include assessment of weight, diet, protein and albumin levels. Improvement in postoperative outcomes of patients can translate into significant improvement in patients' nutritional status, reducing postoperative complications and cost savings for hospital. Advanced practitioners must be aware of the need for prompt and early nutritional consults for those patients.

From researchers' point of view, the slight increase in the albumin and protein levels, and the short-form mini nutritional assessment scale scores after 3 months postoperatively compared to preoperative assessment for study group patients might be due to the effect of nursing instructions and oral postoperative oral supplementation which provided to the study group patients.

According to the current study finding, study group patients showed less postoperative complications than control group patients with non-statistically significant difference. Postoperative complications did not occur in about one-third of study group patients while less than one-third of control group patients did not have postoperative complications. Postoperative complications included pancreatic fistula, biliary fistula, chyle

leak, pulmonary (pneumonia), Impaired wound healing, gastrojejunostomy leak and/or gastrointestinal complications.

A study of **Gerritsen et al., (2014)**⁽¹⁹⁾ who conducted on one hundred and two consecutive patients underwent pancreaticoduodenectomy supported the finding of present study which stated that introduction of early oral nutrition after pancreaticoduodenectomy reduced length of hospital stay and there was non-statistically difference in the incidence of postoperative complications of Clavien-Dindo between the two groups of patients. The current study finding supported by study of **Karim et al., (2018)**⁽⁴⁾ who stated that pancreaticoduodenectomy has high rate of postoperative complications. Higher rate of postoperative wound infection and bleeding was found. Other complications included pancreatic leak and fistula, pulmonary complications, and intra-abdominal collections.

From the researchers point of view, nutritional status and postoperative complications are key factors that affect recovery of pancreatic cancer patients who underwent pancreaticoduodenectomy. So, oral nutritional support provided to patients of study group helped in improving nutritional status of patients and reducing postoperative complications.

Finally, consequences of malnutrition on patients` postoperative outcomes included higher rate of postoperative complications, increased length of hospital day and poor survivals. So, nutritional intervention for patients with pancreatic cancer and underwent pancreaticoduodenectomy was recommended to lower the impact of malnutrition on patients` outcomes and to offer hope for prolonged survival^(14,21,22).

Study limitations

1. Small sample size.
2. The present study covered a short observation/follow up period.

Conclusions

The study findings implied that nutritional status of patients following pancreaticoduodenectomy was associated with postoperative outcomes. Oral postoperative adequate nutritional supplementation was important to improve postoperative outcome of patients underwent pancreaticoduodenectomy. Nursing instructions and oral postoperative nutritional supplementation improved patients` outcomes; lessen postoperative hospital stay, improve nutritional status, increased albumin and protein levels and fewer postoperative complications.

Recommendations

The current study recommends that:

1. Nursing instructions and oral postoperative nutritional supplementation should be provided for all patients underwent pancreaticoduodenectomy to reduce length of hospital stay, improve nutritional status, albumin and protein levels, and reduce postoperative complications.
2. Nursing instructions and oral postoperative nutritional supplementation should be started as early as possible and encouraged as a routine practice for patients underwent pancreaticoduodenectomy.
3. The educational booklet, which contained detailed nursing instructions with illustrated photos and the recommended oral postoperative nutritional supplementation should disseminating to all patients underwent pancreaticoduodenectomy.
4. For further studies, the researchers recommend conducting future studies to examine whether preoperative/postoperative malnutrition

affects long-term survival for patients underwent pancreaticoduodenectomy.

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