

Effect of Preoperative Feeding with Brown Rice Supplement on the Clinical Outcome in Gastrointestinal Patients

Pooja Thacker¹, Dr. Subhadra Mandalika², Dr. Nilesh Doctor³

¹PhD Scholar of College of Home Science, Nirmala Niketan & Chief Dietician of Bhatia Hospital, Mumbai.

²Associate Professor, College of Home Science, Nirmala Niketan, Affiliated to Mumbai University,

³Consulting Hepatobiliary Surgeon at Bhatia Hospital, Mumbai, India

Corresponding Author: Pooja Thacker

ABSTRACT

Background- Preoperative feeding with nutritious food has been reported to reduce postoperative nausea, vomiting and length of hospital stay in hospitalized patients. The aim of the present study was to investigate the influence of preoperative feeding with brown rice based supplement rich in maltodextrin, gamma butyric acid and B-complex vitamins on the post-operative complications and length of hospital stay in gastrointestinal patients undergoing surgery.

Method- Sixty patients (n=60) who were suggested gastrointestinal surgeries like hepaticojejunostomy, pancreatectomy, Whipple's and gastrojejunostomy were purposively selected and divided into two groups i.e. Control (n=30) and intervention group (n=30). The control group (n=30) received 1200 kcal hospital diet and was NBM for 16 hours prior to surgery and intervention group was provided with 1200 kcal hospital diet along with a CHO supplement made of brown rice (20gms of carbohydrate x 3times) providing 300 Kcal on the previous day of the surgery and was NBM for 8 hours. Preoperative parameters including Nutritional status (MUST), anthropometry, selected biochemical markers (CBC, albumin, electrolytes), dietary nutrient intake (24 hour diet recall), and post surgery parameters including clinical symptoms (nausea and vomiting), biochemical parameters (CBC and electrolyte), nutritional intake and length of stay of all the participants were recorded. Data were statistically analysed using SPSS version 16.0.

Results- As per the screening 23.3% patients was severely malnourished and 61.6% were moderately malnourished. All the patients had significantly low MUAC (p=0.03). Overall, females (55.00 ± 6.84yrs) undergoing surgery were younger than males (61.67 ± 4.27yrs) and had significantly greater length of hospital stay as compared to males by 4 days (p=0.03). The total energy intake prior to surgery was significantly higher (p=0.032) in the intervention group (1750 Kcal) than that of control group (1200 Kcal). There was significant drop in serum potassium status (p=0.012) in control as well as intervention group post surgery. White blood cell count was higher than reference values in both groups post surgery due to inflammation but it was higher in control group (mean=15209cells/cumm) than in the intervention group (mean=14700cells/cumm). The length of hospital stay was lower in the intervention group (mean =9.13days) than the control group (mean =9.93days) (p=0.3) also a significant decline in symptoms of nausea and vomiting was observed post surgery in the intervention group (4/30, p=0.005).

Conclusion - Brown rice supplement improved the post surgery complications and LOS among patients undergoing GI surgeries and hence could be considered as an effective pre surgical feeding strategy.

Key words: Preoperative feeding, Brown rice supplement, Gastrointestinal patient, GI surgery.

INTRODUCTION

Gastrointestinal disease affects esophagus, stomach, small and large intestine along with liver, pancreas and gallbladder. Gastrointestinal cancer is responsible for more number of organ cancers due to metastasis and more number of deaths. Further there has been a rise in cancer of different organs due to H. pylori, hygiene issues, lifestyle, smoking, alcohol, and high intake of salted and sugary food. [1, 2]

Globally stomach cancer is the second most prevalent cause of death being sixth common reason among males and seventh common reason among females in South India. However, stomach cancer is under reported in India. The reason for stomach cancer is pyloric carcinogenesis which occurs due to poor food hygiene and sanitation. A study also stated that due to high consumption of chilies and pickles there is a rise in stomach cancer but the affected part of stomach varies e.g. smoking affects the pylorus, and chilies and spices affect the antrum and the body. Due to the increased inflammation and metastasis it is often diagnosed in the advanced stage where the need for gastrojejunostomy surgery rises. [3]

Incidence of Gallbladder cancer increased among women in North India. Many studies have stated that obesity, smoking and high carbohydrate diet are responsible for gallbladder stone formation. [4] Hepatocellular carcinomas (HCC) are more common in males due to alcoholism, hepatitis, and nonalcoholic fatty liver diseases. Each year in India about 1.6% of cirrhotic liver leading to HCC have been recorded. A study in 2014 stated that male female ratio of 4:1 was diagnosed in HCC in the age group of 40-60 years. Hepatectomy is the mostly conducted surgery for better prognosis at an early stage but life expectancy of such patients is often poor. [5] Global cancer statistics of 2002 stated that pancreatic cancer is 13th most common cancer worldwide and about 50% of the patients are diagnosed in the advanced

stage. [6,7] Pancreatic head is the common origin for pancreatic cancer in which Pancreatectomy is preferred. Patients with pancreatic cancer and involving hepatic duct obstruction undergo major surgery like the Whipple's surgery. Obstruction of hepatic duct is the main reason for Whipple's surgery in the patients. [8,9]

Malnutrition due to anorexia and vomiting results in poor food intake which leads to approximately more than 10% weight loss over a period of 6 months in patients undergoing major gastrointestinal surgery. Therefore weight stabilization is an important component for such patients especially before and after surgery. [12,13]

Moreover, due to the removal of various organs, the risk of major nutritional complications such as delayed gastric emptying, pancreatic exocrine insufficiency and diabetes increases. [6] Other complications like leakage at the anastomosis site, abscess, and biliary reflux cause increase in length of hospital stay. Towards prevention of malnutrition and complications such as nausea and vomiting post surgery, various feeding techniques prior to surgeries have been recommended rather than keeping the patient fasting. [14]

Traditionally overnight fasting was followed as a regime prior to surgery. But various studies have shown that prolonged fasting does not reduce gastric contents, rather increases discomfort. Various international guidelines like ESPEN, ESA, and Enhanced Recovery after Surgery (ERAS) have recommended shortening the duration of preoperative fasting to enhance the surgery. [12,15] Carbohydrate ingestion (loading) prior to surgery was recommended to maximize glycogen storage in the body as a source of energy and reduce degradation of tissues and insulin resistance thereby combat surgery induced inflammation. [15] The present study was conducted to evaluate the effect of preoperative feeding of patients undergoing gastrointestinal surgery with brown rice supplement on postoperative outcome and length of hospital stay.

MATERIALS & METHODS

1. Study population -A total of sixty patients (N=60) in the age group of 40 to 65 years undergoing gastrointestinal surgeries such as Whipple's, pancreatectomy, hepaticojejunostomy and gastrojejunostomy were selected from Bhatia Hospital, Mumbai, India using purposive sampling technique.

2. Ethics clearance: The study was approved by the institutional ethics committee of Bhatia hospital. A written informed consent was obtained from all subjects and they were allowed of voluntarily withdrawal. Three patients were excluded due to severe complications. The patients in each surgery category were further divided into control and intervention groups. Data on various parameters were collected prior to and post surgery and was analysed.

3. Data collection prior to surgery of control and intervention groups

Following data were collected from all the participants (N=60) pre surgery using standardized methods.

Anthropometry

Height and weight

Standing height and weight was measured to the nearest 0.1 cm and 0.5 kg using wall mounted stadiometer and automated balance respectively.

Body Mass Index (BMI) was calculated using the formula- weight (kg)/height² (meter)

Mid Upper Arm Circumference (MUAC) was measured using measuring tape placed around the mid-point of arm without compressing the skin

Biochemical parameters:

Blood samples were collected by venepuncture in EDTA tubes .Plasma was subsequently separated and frozen to -20degree Celsius within 1 hour of collection of sample in the laboratory. Various parameters like CBC, albumin, electrolyte and fasting blood sugar were assessed using automated well calibrated machines

Medical history and other details:

Data on the patients' past medical history, weight loss, and lifestyle, present visible clinical symptoms have been recorded.

Dietary Nutrient intake:

Nutritional assessment of the participants was carried out pre surgery using Malnutrition universal screening tool (MUST). This tool includes information on history of weight loss, gastrointestinal disturbances like frequency of vomiting and diarrhoea, and changes made in consistency of diet (if any) and 24 hour diet recall. According to the data collected patients were graded

4. Intervention Trial

Control group:

The control group was provided with standard hospital diet supplying 1200 kcals and was kept NBM for 16 hours prior to surgery.

Intervention group:

A food supplement was prepared using brown rice (rich source of antioxidants like oryzanol, gamma amino butyric acid and B-complex vitamins), vitamin-mineral mix (vitamin A, C, zinc and B-complex) and green tea. Sixty grams of the supplement consisting of 98% maltodextrin and providing 300 calories (100calories x 3) was administered to the experimental group thrice a day i.e. 20 grams in lunch, 20gms at midevening and 20 grams 3hrs post dinner which was 8 hours prior to surgery followed by NBM. Hospital diet and supplement together contributed a total of 1500kcal and 50gm of protein for the intervention group.

5. Data collection Post surgery from both control and intervention group

Following data was collected from all the participants

Biochemical parameters

Blood samples were collected by venepuncture in EDTA tubes .Plasma was subsequently separated and frozen to -20degree Celsius within 1 hour of collection of sample in lab. Various parameters like CBC, electrolyte and fasting blood sugar were also assessed using automated well calibrated machines

Clinical symptoms

Using assessment sheet, data on frequency of nausea, vomiting and aspiration were recorded as informed by patient or care taker.

Dietary protocol:

Post operation day (POD)-1 all the patients were kept NBM and on Total parental nutrition (TPN). On POD -2 to POD-

5 Jejunostomy feeds of 500kcal were initiated for the patients that were stepped up to 1500kcal. On POD-5 to POD-6 clear liquid was started in small volumes of 30cc, 60cc, 100cc, and 150cc and finally on POD-7 soft diet was started. Average nutritional intake was calculated on POD-6, POD-7 to POD-12 in terms of calories and protein.

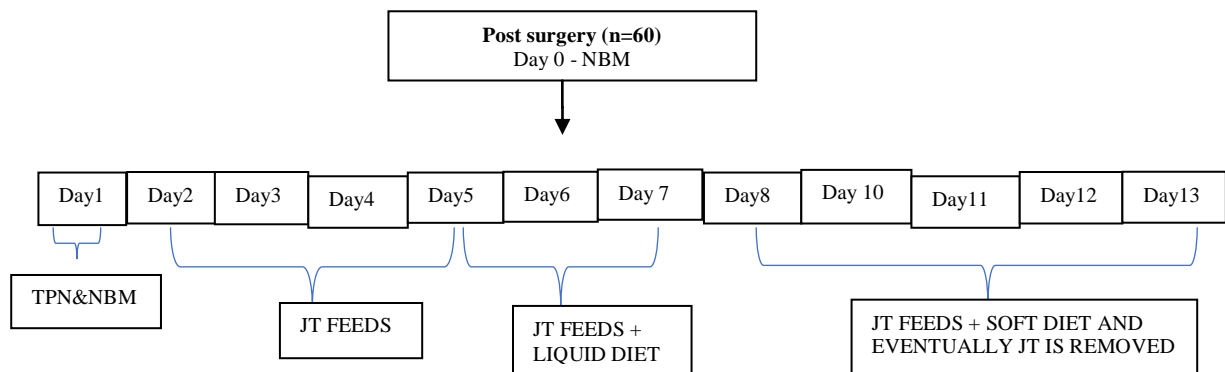


Figure -1: Post surgery Diet transition protocol for the participants

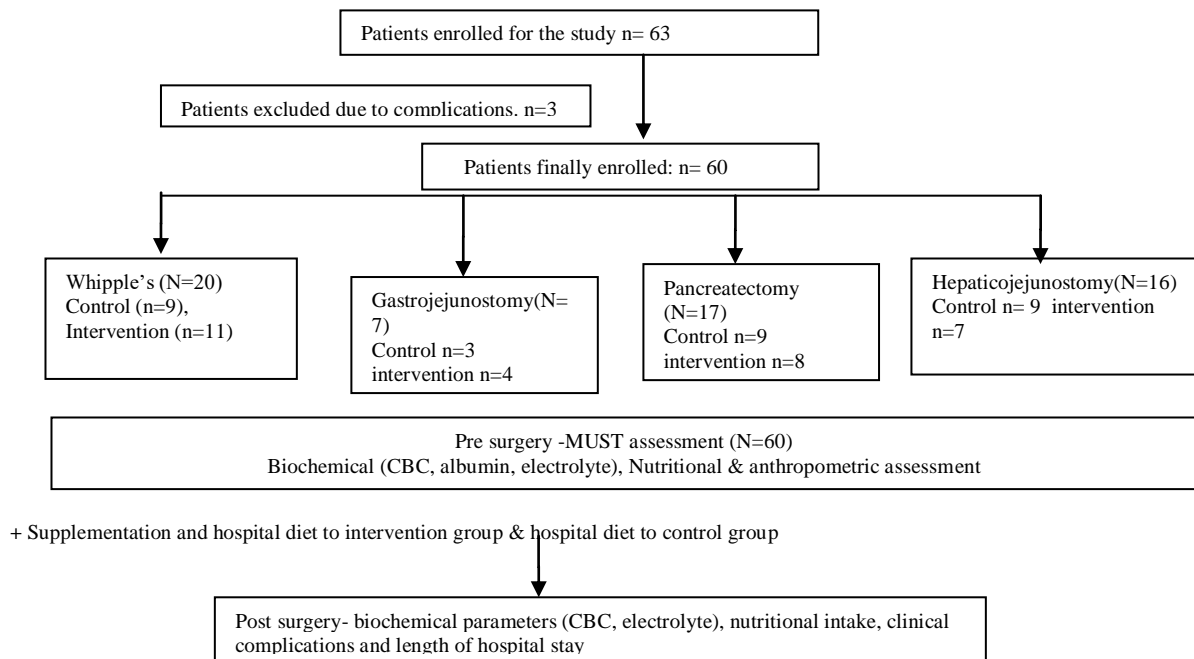


Figure-2: Study design

8. Statistical analysis

Data were analyzed using SPSS version 16.0 and presented as mean and standard deviation. Student t test was applied to analyze the difference in the pre and post surgery biochemical parameters of inflammatory stress response, nutritional intake and anthropometry of the two groups.

Level of significance was established at 5% level.

RESULTS

Demographic profile of the participants:

The sample comprised of males (41%) and females (56%) in the age of 40 -65 years who were undergoing 4 categories of

surgery namely Whipple’s surgery (33%), pancreatectomy (28%), and hepaticojejunostomy (26%) gastrojejunostomy (11%). They were assessed for nutritional, biochemical and clinical status.

Nutritional status of the participants:

Table No-1 shows distribution of the participants (n=60) as per their risk of malnutrition assessed using Malnutrition universal screening tool (MUST). Patients who had lost 10% of their body weight in past 6 months with poor food intake,

multiple incidences of vomiting or nausea and adopted to change of consistency of diet (liquid or soft) that is less in calories, were classified as malnourished, while if the incidences had repeated more frequently leading to 20% weight loss or more, had extremely poor appetite and on liquid diet or unable to tolerate it were classified as severely malnourished. Accordingly, in the present study majority of the patients were malnourished and/or severely malnourished indicating a strong need to address the same.

Table -1: Incidence of Malnutrition among the participants as per MUST (n=60)

Nutritional status of the participants	Control group (n=30)	Intervention group (n=30)	Total. N=60)
Normal	2 (3.3%)	6 (10.6%)	13.3%
Malnourished	17 (28.7%)	20 (33.5%)	61.6%
Severely malnourished	6 (10.6%)	8 (13.3%)	23.3%

Anthropometry:

All the patients were malnourished with a mean BMI <18.5 kgm² when they were posted for surgery. They had history of weight loss i.e.10% to 20% and poor MUAC.

Females undergoing surgery were younger compared to males (Table-2).Interesting gender differences were noticed in the anthropometry of the patients.

Table-2: Anthropometric parameters of patients pre surgery (N=60)

Parameters	Males (n=25)	Reference value	Females (n=34)	Reference value	P value
Total Body Weight (kgs)	59.86 ± 6.34	60	56.10 ± 18.15	55	0.6
Age yrs.	61.67 ± 4.27	18 above	55.00 ± 6.84	18 above	0.027*
BMI (kg/m2)	20.3±3.32	18.5-23	19.7±4.25	18.5-23	1.05
MUAC (Inches)	9.2±5.6	13	10.2±6.3	13	0.02*
Previous weight loss (kgs)	7.28	-	8.56	-	0.07

*Significant at 0.05 level

2- Biochemical Assessment of patients pre surgery (Hemoglobin and albumin) (N=60)

Hemoglobin was significantly lower (p>0.05) in majority of the participants and hence they required blood transfusion pre surgery. The intervention group had slightly lower status as compared to control group (Figure-3). In this study the rate of blood transfusion was higher among females compared to males (Figure-4)

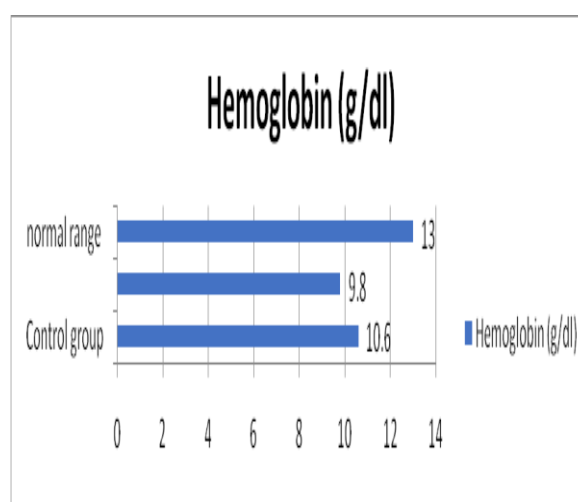


Figure-3: Haemoglobin status of the patients' pre surgery

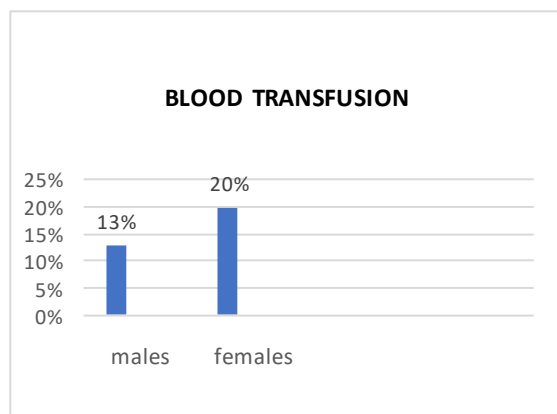


Figure-4: Gender difference in the need for blood transfusion among the participants (N=60)

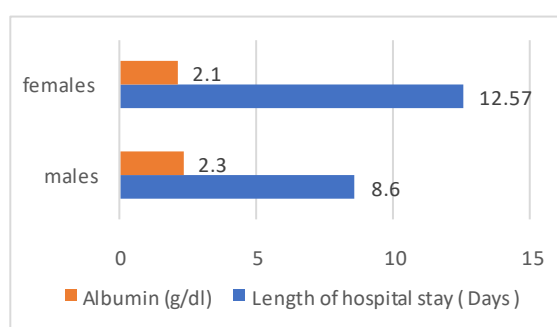


Figure-5: Serum albumin level and LOS of the participants

Serum albumin status was also poor in both the groups and all the patients required intravenous albumin correction post surgery to facilitate wound healing. There was also significantly longer hospital stay among females who had lower albumin status compared to males (Figure-5).

Biochemical Assessment of the Patients Post Surgery (Platelet, Potassium, WBC)

It was observed that platelet count was higher in control group as compared to intervention group ($p < 0.05$) (Table no-3). Studies have shown that high platelet count leads to increase in complications and rate of mortality. [11] There was also a non-significant decline in serum sodium level post surgery in both groups whereas the reduction in serum potassium level was significant ($p = 0.005$) as shown in Table no-3.

Table No-3: Biochemical parameters pre and post-surgery (n=60)

Parameters	Pre surgery		P value	Post-surgery		P value
	Control group MEAN \pm SD	Intervention group MEAN \pm SD		Control group MEAN \pm SD	Intervention group MEAN \pm SD	
Heamoglobin (gm/dl)	10.63 \pm 1.98	9.887 \pm 1.17	0.79	10.07 \pm 1.18	9.930 \pm 0.79	0.86
Platelets ($\times 10^9$ per liter)	325.53 \pm 93.75	318.97 \pm 73.83	0.5	384.47 \pm 6.53	370.84 \pm 4.18	0.041**
Sodium (mEq)	139.93 \pm 4.18	137.97 \pm 6.53	0.54	137.20 \pm 3.90	136.40 \pm 4.88	0.098
Potassium (mEq)	4.337 \pm 0.55	3.883 \pm 0.718	0.03**	3.113 \pm 0.53	3.513 \pm 0.63	0.05**

*Data was interpreted at 0.05significance level

It was observed that WBC count was higher post-surgery in both the groups due to inflammation. But there was faster but a non-significant decline in the count of intervention group compared to control group. CBC test was conducted thrice i.e. pre surgery, post-operative day 2 and post-operative day 4, and it was observed that higher the count longer was the hospital stay as shown in Table no-4.

Table No 4 – Assessment of WBC pre and post surgery (N=60)

WBC COUNT	GROUPS	MEAN \pm SD	P value
WBC pre surgery ($\times 10^9$ per liter)	control(n=30)	9988.57 \pm 3316.83	0.9
	intervention(n=30)	9952.63 \pm 2527.35	
WBC Post surgery day 2 ($\times 10^9$ per liter)	control(n=30)	21550.40 \pm 6391.85	0.3
	intervention(n=30)	19942.63 \pm 2527.35	
WBC Post surgery day 4 ($\times 10^9$ per liter)	control(n=30)	15209.74 \pm 2836.34	0.5
	intervention(n=30)	14700.43 \pm 2747.45	
Length Of Hospital Stay (Days)	control(n=30)	9.93 \pm 0.6	0.3
	intervention(n=30)	9.13 \pm 0.3	

*Data was interpreted at 0.05significance level

3- Dietary nutrient intake of Patients (N=60)

24 hour diet recall with questions on diet preferences and frequency were used for calculating patients' nutritional intake. It was found that about 95% of the patients were vegetarian by preference and 5 % were non vegetarians. Patients in both groups had poor food intake due to nausea and vomiting. Hence frequency of non

vegetarian food intake was almost nil and milk and dairy product intake was poor in vegetarians leading to high intake of carbohydrate due to its easy digestibility. Control group was provided hospital diet and intervention group was provided supplement along with the hospital diet pre surgery and the difference in their dietary energy intake is given below in table no-5

Table No-5–Dietary energy and macronutrient nutrient intake of patients (n=60)

Parameters	Pre surgery			Post surgery		
	Control group Mean ±SD	Intervention group Mean ±SD	P value	Control group Mean ±SD	Intervention group Mean ±SD	P value
Energy (kcal)	527±50.55	932±35.7	0.032**	952±25.5	1111±75.2	0.05**
Protein (gms)	12.5±2.5	19±2.3	0.51	40±5.2	45±3.3	0.6
Carbohydrate (gms)	112±12	190±10	0.05*	185±5	192±7	<0.07
Fat (gms)	4.9±0.5	10.5±0.3	0.57	8±2.5	14.5±3.5	0.074

*Data was interpreted at 0.05significance level

There was a significant rise in energy intake in the intervention group (p=0.032) by 300 kcals compared to control group. Even post surgery, the calorie intake of the intervention group was significantly higher than pre surgery.

4- Episodes of nausea and vomiting Post-surgery

Episodes of nausea and vomiting were higher in control group compared to intervention group (Figure6).

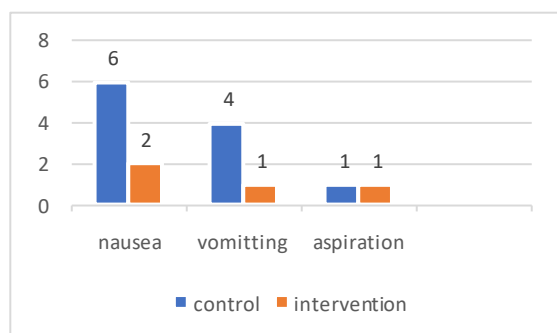


Figure 6- post surgery nausea, vomiting and aspiration in the patients

It was seen that the patients in control group had higher chances of nausea and vomiting.

DISCUSSION

Canto MI et al (2013) reported a sudden rise in pancreatitis, pancreatic cancer, tumor adenoma, and hepatic diseases in patients below 65 years of age. [17-19]

Also in this study similar observations were noted, where females (55.00 ± 6.84 yrs) had significantly lower age compared to male patients (61.67 ± 4.27yrs) (p=0.027)

Malnutrition in gastrointestinal surgeries leads to poor quality of life and mortality at very early age. [6] Pausch et al (2012) studied 408 patients undergoing Whipple's surgery and reported that patients with low BMI of 18kg/m², experienced unintentional weight loss, cachexia and had longer hospital stay, higher complications and mortality within 90 days than patients with higher BMI of 30kg/m² with many comorbidities. [8]

Another study by Magnini EV et al (2018) on impact of major surgery on patients with respect to biochemical parameters and nutritional assessment showed that old age and female gender were independent risk factors. [21] Both the gender patients were half malnourished and about 15 % were at the risk of malnourishments

assessed by Subjective global assessment tool (SGA). Female patients were more than half malnourished compared to males and also had inflammatory stress higher in them. Similarly in the present study cachexia was observed both in females and males. About 61.6% patients were malnourished as per MUST tool (Table-2). And also had lower BMI i.e. $19.7 \pm 4.25 \text{ kg/m}^2$, $20.3 \pm 3.32 \text{ kg/m}^2$ respectively, low MUAC, previous weight loss, low hemoglobin and albumin; and longer hospital stay (Figures-3,4 and 5 & Table-1)

Studies have proven that changes in biochemical parameters in patients and a drop in hemoglobin is observed post-operative day 1 and also some patients require blood transfusion of 1 liter (2 pint) which is usually given preoperatively. [20] Similarly in the present study 13% of males and 20% of females received blood transfusion. Moderate Leukocytosis was observed post surgery but not correlated to complications. Hypoalbuminemia was observed in males (mean $2.3 \pm 2.4 \text{ g/dl}$) and females (mean $2.1 \pm 2.2 \text{ g/dl}$) and was corrected post surgery using intravenous albumin on day 1.

Platelet count is an important parameter of concern in major gastrointestinal surgeries especially in pancreatitis. The levels are raised due to organ damage and inflammation due to post surgery thrombocytosis that leads to septic shock, mortality and embolism. Hence they are kept on blood thinners till platelet count is reduced. [16] Likewise control group had slightly higher platelet count than intervention group which might have increased their hospital stay.

Due to intravenous infusion (IV) and TPN, coupled with NBM for 2 days, there is an increased exchange of electrolytes from extracellular fluid to intra cellular fluid leading to hypokalemia and hypocalcaemia in the patients as stated by Wang et al (2018). [23] Similar results were observed in this study i.e. significant hypokalemia ($p=0.05$) and non-significant drop in sodium levels were observed in the participants as

shown in Table-3. Studies have stated that on the post-operative day 1 (POD1) there is rise in WBC count which drops gradually after a week. On the contrary the chances of sepsis and infection increase when the WBC count raises. [22] Hence it is important to keep a check on WBC count post surgery. Higher levels were noted in control group ($15209.74 \text{ cells/cumm}$) as compared to intervention group ($14700.43 \text{ cells/cumm}$) (Figure-4). Three patients were excluded from the study due to sepsis

Impact of oral nutritional supplement on post surgery biochemical, clinical parameters and LOS

Alves and colleagues (2013) conducted a meta-analysis of 22 randomized controlled trials of patients receiving carbohydrate supplement with pea protein preoperatively and observed reduction in length of hospital stay in the intervention group who received 89% of carbohydrate a night before surgery and 3 hours pre surgery but the control group had fasted up to 8 hours. The ratio of inflammatory marker CRP and albumin was lower in the intervention group. [15] Similarly various studies on pancreatic cancer, colorectal cancer, Whipple's surgery have stated importance of supplementation with carbohydrate, whey and micronutrients in increasing calorie intake and reducing length of hospital stay.

In the current study, supplementation was effective in increasing energy and protein intake of patients' pre surgery. The supplement contained maltodextrin (98%) in combination with sucrose and protein from germinated brown rice that was fortified with vitamins and antioxidants, which helped in better intake of calories (Table-5). This is complementary to the study by Dwanna Ward-Boahen (2014) who stated that supplementation of combination of carbohydrate is absorbed faster by the gut lumen in pancreatectomy patients which is similarly suggested by ESPEN guidelines. [10]

Carbohydrate and protein containing oral nutritional supplement given 2 day pre-

operatively in colorectal cancer proved that due to protein there was decline in insulin resistance and CRP level both of which led to decline in hospital stay. [21] Also a study supplementation with glycine, omega 3 and nucleotides in gastrointestinal surgery led to a decline in CRP levels and helped in reducing infections. Thus, immunonutrition prevents infections in patients.

Similarly the supplement developed in the present study is a source of good quality protein, Oryzanol, tocopherol and gamma amino butyric acid from brown rice that has been enriched with vitamins and zinc. When administered to intervention group the supplement helped in lowering WBC counts (inflammatory marker) post surgery and thereby reduced incidence of infection and length of hospital stay of the patients (Table - 4). In addition, it also significantly helped in reducing nausea and vomiting in the intervention group compared to control group. Shirishef et al; (2017) have proven that supplementation of B6 and B12 vitamins lower the episodes of nausea and vomiting in bariatric surgery. [24] As per ESPEN guidelines too, supplementation of pre-operative nutritional drink helps to reduce post surgery nausea and vomiting and leads to faster diet transition.

CONCLUSION

Supplementation of patients undergoing gastrointestinal surgeries prior to surgery with brown rice based product enriched with micronutrients helps in reducing inflammation and complications like nausea and vomiting, improves calorie intake pre and post surgery and reduces length of hospital stay.

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