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Long-term NPO Is a Severe Concern for the Development of Malnutrition in Hospitalized Patients: A Prospective Observational Study

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ABSTRACT

Background: Before elective procedures, patients should be fasted to reduce the risk of pulmonary aspiration due to anesthesia. However, the fasting protocol is sometimes not implemented correctly, and patients are nil per oral (NPO) for an inappropriately long time. For this reason, the authors investigated the NPO duration of hospitalized patients before elective procedures and its relationship with nutritional status, patient outcomes, and 28-day mortality. **Methods:** A prospective observational cohort study was conducted on hospitalized patients who had experienced fasting before elective procedures. Data on demographics, anthropometric index, Mid-upper arm circumference, NRS-2002 questionnaire, length of hospital stay, and 28-day mortality rate were collected. Pearson correlation coefficient test, receiver operating characteristic (ROC) curves, and Kaplan-Meier analysis were also used. **Results:** Among 1135 hospitalized patients in different wards, 251 were included. The mean duration of fasting before elective procedures was 31.76±33.02 hours (mostly before elective surgeries). During the NPO period, patients lost 2769.20±2960.24 Kcal and 116.65±124.01 g protein. Moreover, about 41.9% of patients stayed in the hospital for more than 30 days, and 21.1% of patients died in less than 28 days; most of them suffered from malnutrition. Longer NPO duration was related to the rate of 28-day mortality in malnourished hospitalized patients. **Conclusions:** The results of this study indicated that patients experienced long-term NPO duration before elective procedures, and they lost daily calories and protein requirements, which led to worsening hospital malnutrition and increased length of stay (LOS), ventilator connection, and 28-day mortality.

Introduction

Nil Per Os (NPO), is defined as a medical instruction in which ingestion of food and liquids is withheld and applied before the procedures used in the treatment, evaluation, and diagnosis of diseases (American Society of Anesthesiologists, 2017, Presta *et al.*, 2018). The purpose of fasting before anesthesia is to prepare the patient for elective procedures, and to empty

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the stomach to reduce the risk of pulmonary aspiration of stomach contents during anesthesia (Baril and Portman, 2007). The American Society of Anesthesiologists (ASA) and the European Society of Anaesthesiology (ESAIC) have recommended that the fasting duration for adults and children be as the following: strained liquids for 2 hours, breast milk for 4 hours, infant formula for 6 hours, non-human milk for 6 hours, solid and liquid but light meals for 6 hours, and fatty and fried meals and others slow-digesting foods up to 8 hours of fasting before anesthesia. However, this guideline does not support pregnant women or patients with gastroparesis (such as diabetic patients) and does not ensure that the emptying of the stomach takes place during the fasting period (American Society of Anesthesiologists, 2017, Smith *et al.*, 2011). Despite the recommendation being extensively published, unnecessary restrictive fasting regimens are observed in different countries in perioperative surgeries and other elective procedures. A prospective cohort study showed that among 1192 admitted patients, 262 were given NPO for a mean of 5.2±3.7 days and were kept on a clear liquid diet for a mean of 1.04±1.3 days (Franklin *et al.*, 2011). Being concerned about the risk of aspiration is the main reason for prolonged NPO. However, fasting does not ensure an empty stomach, as gastric acid production continues to be produced during fasting. A gastric volume of 0.8–1.5 ml/kg, which is evaluated by ultrasound, did not increase the risk of aspiration (Van de Putte *et al.*, 2017). In light of the drawbacks of long-term NPO, patient dissatisfaction is of high priority. Long-term fasting can lead to patients' dehydration associated with decreased oxygen delivery. Furthermore, nausea and vomiting may occur due to hypoglycemia and ketosis (Frykholm *et al.*, 2018).

The high prevalence of malnutrition among patients (about 20-50%) is a serious concern in hospitals, which can lead to severe complications such as increased length of stay (LOS), high risk of infection, and increased mortality. The complications can be avoided if special attention is paid to the nutritional care of patients. So, delays in starting nutrition support from every route during the hospitalization cause adverse effects on patients' outcomes (Barker *et al.*, 2011, McClave *et al.*, 2016, Söderström *et al.*, 2017). Malnutrition is considered as one of the major complications of prolonged episodes of NPO. Additional concern should be centered on older adults and patients with previously insufficient protein and calorie intake who are at high risk of protein and energy malnutrition (PEM) (Norman *et al.*, 2021). When patients are continuously NPO for prolonged periods of time or have frequent episodes of NPO during subsequent diagnostic procedures, the risk of PEM can rise. A study in ICU of burn on 41 patients revealed that the average calorie deficit to prescribed calories ratio during the time from NPO to surgical start (9.3±3.1 hr.) was 1154±629/ 3534±851 kcal and NPO to feeding restart (14.2±4.1 hr.) was 1765±928/3534±851 kcal; this means that a preoperative fasting resulted in an average loss of greater than 50% of prescribed calories on the day of surgery (Pham *et al.*, 2018).

Thus, the purpose of this study was to evaluate the duration of NPO before elective procedures in hospitalized patients and to compare it with ASA guidelines. Furthermore, the authors aimed to investigate the relationship between the length and frequency of NPO episodes and patients' nutritional status, including the loss of calories and protein, length of hospital stay, duration of ventilator connection, and 28-day mortality.

Materials and Methods

Study design and patients enrollment

This prospective observational cohort study was designed for hospitalized patients experiencing fasting (NPO) before elective procedures at the Rasoul-Akram Hospital, Tehran, Iran, in December 2022. Over a year, adult patients (above 18 years old) who were admitted to different wards of the hospital and needed anesthesia for elective surgery, endoscopy, colonoscopy, bronchoscopy, tracheostomy, angiography, and tube feeding fixation (placement of the nasogastric tube (NGT), percutaneous endoscopic gastrostomy (PEG), and jejunostomy) were included in the study. The

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patients were excluded if they were NPO due to disease treatments such as gastrointestinal bleeding (esophageal varices or peptic ulcer with visible vessel), high gastric residual volume (NGT output >500 ml/d) or biliary reflux, high output fistula or stoma (output>2000 ml), intra-abdominal hypertension, pancreatitis, and unstable patients with low mean arterial pressure (MAP), who received high dose vasopressor. Also, this study did not include children, pregnant and lactating women, and patients admitted only to the emergency room and released.

Data collection

Demographic data, mid-upper arm circumference (MUAC), anthropometrics indexes [weight, height, and body mass index (BMI)], nutrition risk screening (NRS)-2002 questionnaire to assess malnutrition, the reason for becoming NPO, feeding route (oral, enteral, and parenteral), the duration of NPO from the time of fasting to PO again (in hours), NPOs repetition during hospitalization, type of IV fluid received, lab tests which was routinely assessed in the hospital, duration of connection to the ventilator (in intubated patients), length of hospital stay, and 28-day mortality were collected. Daily calorie and protein requirements were calculated according to formulas by an expert dietitian.

NPO duration and feeding route

The duration of NPO (hours) was recorded from the initiation of fasting until resumption of oral/enteral/parenteral feeding. Repeated NPO episodes during hospitalization were also documented. Moreover, feeding routes (oral, enteral, parenteral) and type of IV fluids administered were noted.

Nutrition screening tools

Anthropometric indexes: Trained dietitians assessed height and weight with a digital scale (Seca 807) (100 g precision) and a stadiometer (0.5 cm precision), respectively; and BMI was calculated for each patient with formula. For complete bedridden patients, an estimated ideal weight was calculated based on the length of the ulna (Gauld *et al.*, 2004).

MAUC: Expert dietitians measured the circumference of the upper arm at the midpoint from the shoulder to the elbow by a flexible tape (0.5 cm precision). The range of MAUC <22.6 and <21.1 was severely underweight, and <23.7 and <23.5 cm was underweight in males and females, respectively (Thorup *et al.*, 2020).

NRS-2002 questionnaire: It is a valid questionnaire that predicts the risk of malnutrition in hospitalized patients. The total score of the two-step questionnaire can range between 0 to 7. The score<3 indicate that the patient's low risk of malnutrition and weekly rescreening is needed. A score≥3 shows the patient is at-risk of malnutrition and a nutritional care plan should be initiated. A score of more than 4 also indicates severe malnutrition (Sahli *et al.*, 2021).

Energy and protein deficit calculation: Daily energy and protein requirements were calculated for each patient using the Harris-Benedict equation, adjusted for each patient according to the clinical conditions, height, weight, and metabolic stress factors. The deficit ("energy loss") was defined as the difference between calculated requirements and actual intake during NPO. Since most patients received only hydration fluids without calories, this deficit represented the cumulative unmet nutritional needs.

Biochemical data

Routine laboratory tests were extracted from hospital records, including serum albumin, total protein, complete blood count (CBC), renal function (BUN, creatinine), liver enzymes (AST, ALT, ALP), electrolytes (Na, K, Ca, P, Mg), and vitamin D.

Ethical considerations

Study protocol including all data collection and analysis procedures were reviewed and approved by the ethics committee of the Iran University of Medical Sciences (IR.IUMS.REC.1399.1216).

Data analysis

Data were analyzed using SPSS 25 for Windows. Descriptive statistics were also reported for qualitative variables using frequencies with numbers and percentages, and for quantitative

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variables using mean and standard deviation (SD). Graphical methods assessed the normality distribution of data; the degree of skewness and normality tests were determined by Kolmogorov–Smirnov and Shapiro-Wilk tests. Moreover, the correlation between the quantitative normal variables was investigated by using Pearson correlation coefficient test. Prediction of NPO duration, malnutrition (by NRS 2002 score), calorie and protein loss for the 28-day mortality outcome was evaluated by using the receiver operating characteristic (ROC) curves and area under the curve (AUC). The AUC values 0.50, >0.70, >0.80, and >0.90 are considered to have the options no better chance, excellent, good, and satisfactory, respectively (Hosmer *et al.*, 2013). The survival curves for 28-day mortality during the NPO were derived using the Kaplan–Meier method in low to high-risk malnutrition patients. The risk factors associated with the 28 day-mortality were evaluated using univariable and multivariable Cox proportional hazards regression. Statistical significance was also considered at P-values <0.05.

Results

Study population and baseline demographics

Among the 1135 hospitalized patients in different wards (ENT, ICU, Internal, Oncology, Orthopedic, and Surgical), 251 patients (156 males and 95 females; age: 52.78±18.64 years; BMI: 23.99±4.93 kg/m^2) were included in the study. The 70.9, 24.7, and 4.4% of patients were fed via oral, enteral, and parenteral routes, respectively. Also, most of the patients were admitted to the ICU (40.6%). Patient characteristics and lab tests are shown in **Table 1**. The patients enrollment and assessment process are shown in **Figure 1**.

NPO duration

The mean duration (hour) of fasting before elective procedures was 31.76±33.02 hours and the highest cause (54.6%) of the patients experienced NPO was related to the procedure used before elective surgeries. Other causes of NPO are depicted in **Table 1**. Among the 251 examined patients, only 8 of them were fasted according to ASA guidelines (NPO for 6-9 hours), and others experienced a long fasting duration (10 to 168 hours). Moreover, some of them were repeatedly NPO during the 30-day follow-up hospitalization. NPO duration and repetition are shown in **Table 1**.

Table 1. Characteristic of study participants.

Variables	Mean± SD
Age (y)	52.78±18.64
Height (cm)	170 ± 9.71
Weight (kg)	69.7 ± 17.07
BMI (kg/m^2)	23.99 ± 4.93
MUAC (cm)	26.58 ± 5.17
Nutrition requirement	
Calorie (kcal/d)	2086.97 ± 351.05
Protein (g/d)	87.7 ± 16.81
Lab Tests	
RBC (10^3/ml)	3.75 ± 0.83
Hb (g/dl)	10.90 ± 2.28
MCV (fl)	86.51 ± 6.15
PLT (10^3/ml)	200.91 ± 90.02
BUN (mg/dl)	20.30 ± 15.53
Creatinine (mg/dl)	1.22 ± 0.91
Na (mEq/l)	138.72 ± 3.88
K (mEq/l)	4.06 ± 0.53
Ca (mg/dl)	8.44 ± 0.92
P (mg/dl)	3.05 ± 1.04
Mg (mg/dl)	1.97 ± 0.40
AST (u/l)	94.66 ± 314.30
ALT (u/l)	64.07 ± 144.99
ALP (u/l)	337.51 ± 621.57
CRP (mg/dl)	63.56 ± 32.37
ESR (mm/h)	51.57 ± 31.47
Vitamin D (ng/ml)	30.65 ± 20.55
Alb (g/dl)	3.05 ± 0.70
Total Protein (g/dl)	4.90 ± 0.68
Sex	**n (%)**
Male	156 (62.2)
Female	95 (37.8)
Ward	
ENT	19 (7.6)
ICU	102 (40.6)
Internal	50 (19.9)
Oncology	9 (3.6)
Orthopedic	45 (17.9)
Surgical	26 (10.4)
Causes of NPO	
Bronchoscopy	17 (6.8)
Colonoscopy	12 (4.8)

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Drainage of ascites	1 (0.4)
Endoscopy	25 (10.0)
Extubating	1 (0.4)
Graphies (MRI, CT	14 (5.6)
scan, Sonography)	1 (0.4)
Intubation	5 (2.0)
Jejunostomy	21 (8.4)
NGT fixation	3 (2.1)
PDT	4 (1.6)
PEG	137 (54.6)
Surgery	10 (4.0)
Tracheostomy	
NPO repetition	
1	167 (66.5)
2	48 (19.1)
3	30 (12)
4	2 (0.8)
5	2 (0.8)
6	2 (0.8)
NRS-2002 score for malnutrition	
No risk	45 (17.9)
Low risk	124 (49.4)
High risk	82 (32.6)
Bed sore	
Yes	60 (23.9)
No	191 (76.1)
Type of serum receiving during fasting	
1/3 2/3	40 (15.9)
D/S	39 (15.5)
D/W 5%	3 (1.2)
H/S	29 (11.6)
N/S	124 (49.4)
R/L	7 (2.8)
PN	5 (2.0)
NONE	4 (1.6)
Feeding rout	
Oral	178 (70.9)
Enteral	62 (24.7)
Parenteral	11 (4.4)
Proteinuria	
Positive	115 (45.8)
Negative	136 (54.2)

***BMI**: Body mass index; **CT scan**: Computerized tomography scan; **D/S**: Dextrose/saline; **D/W**: Dextrose/water; **ENT**: Ear, nose, and throat; **H/S**: Half/saline; **ICU**: Intensive care unit; **MAUC**: Mid-upper arm circumference; **MRI**: Magnetic resonance imaging;; **NGT**: Nasogastric tube; **NPO**: Nil per oral; **N/S**: Normal/saline; **PEG**: Percutaneous endoscopic gastrostomy; **PDT**: Percutaneous dilatational tracheostomy; **PN**: Parenteral nutrition, **R/L**: Ringer/lactate.*

Malnutrition status

Malnutrition based on the NRS-2002 scale is displayed in **Table 1**. According to the assessment, 14.3% were high risk, 18.3% were at risk, 49.4% were low risk, and in 17.9% of cases, no risk of malnutrition was detected. The high rate of mortality, hospital length of stay, and duration of ventilation were seen in patients with a high risk of malnutrition (**Figure 2**). Also, the mean MUAC was evaluated at 26.58±5.17 cm (Min:16-Max:41). The 28.4% of assessed patients had MAUC lower than 24. Furthermore, 14.4% of patients had BMI lower than 18.5, which indicates severe malnutrition in this population. It is noteworthy that most of the high risk of malnutrition were in the ICU ward and had low BMI.

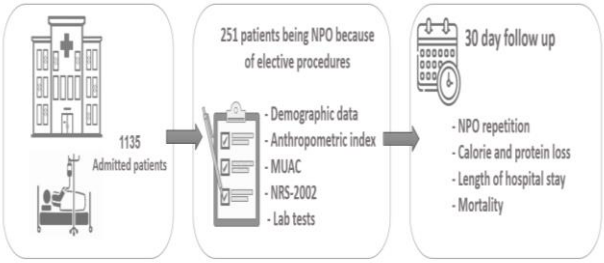


Figure 1. The process of enrolling, evaluating, and 30-day follow-up of patients.

Calorie and protein loss

According to calorie and protein calculation for each patient by an expert dietitian, the mean daily calorie and protein requirements were 2086.97±351.05 Kcal and 87.7±16.81 g, respectively. During the NPO period, the patients lost approximately 2769.20±2960.24 kcal and 116.65±124.01 g protein, i.e. about a minimum loss of 525 kcal and 22.5 g protein in 6 hr. fasting and a maximum of 15000 kcal and 595 g protein in 168 hr. fasting, leading to weight loss and severe malnutrition. The large standard deviation relative to the mean reflects the wide variability in fasting duration among patients. These extreme cases created statistical outliers, which explain why the SD exceeded the mean. A sensitivity analysis excluding patients with NPO>120 hours showed a recalculated mean deficit of 1985.40±1420.12 kcal, confirming that the overall trend of significant

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energy loss remained consistent. On the other hand, 87 patients received IV fluids with the calorie which contained dextrose; most of the patients received IV fluids only for hydration and without any calories.

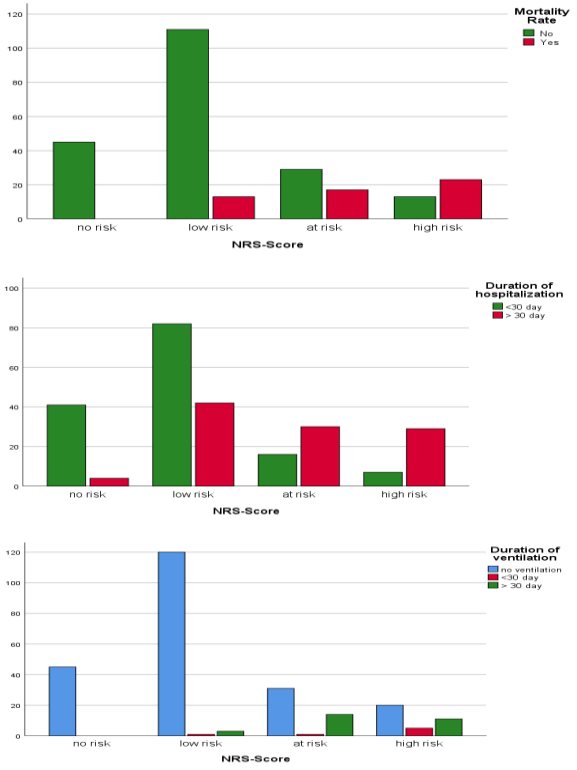


Figure 2. Rate of mortality, duration of hospitalization, and duration of ventilation in patients at no risk, low risk, at risk, and high risk of mannutrition based on NRS-2002 score.

Length of stay and mortality rate

In the follow up, 41.9% of the patients stayed in the hospital for more than 30 days, and 21.1% of patients died in less than 28 days, most of whom suffered from malnutrition. **Figure 3** showed that most of the mortality rate was seen in ICU. The OR and 95% CI for LOS, ventilation duration (>30 days), and mortality was 1.19 (95% CI: 0.81-1.75), 0.35 (95% CI: 0.03-3.66), and 2.68 (95% CI: 1.46-4.96). The scoring systems showed a higher predictive of mortality in patients with malnutrition and longer NPO duration (**Table 2 and Figure 4**). Moreover, longer NPO duration was related to the rate of 28-day mortality in hospitalized patients as shown in Kaplane-Meier accumulative curves (**Table 3 and Figure 5**). A linear correlation was seen between the LOS and severity of malnutrition by NRS-2002 score and length of NPO duration (**Figure 6**).

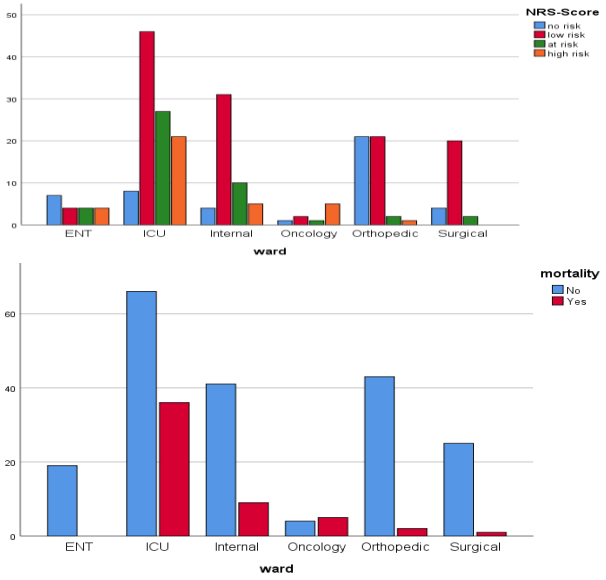


Figure 3. Rate of malnutrition and mortality in different wards of hospital.

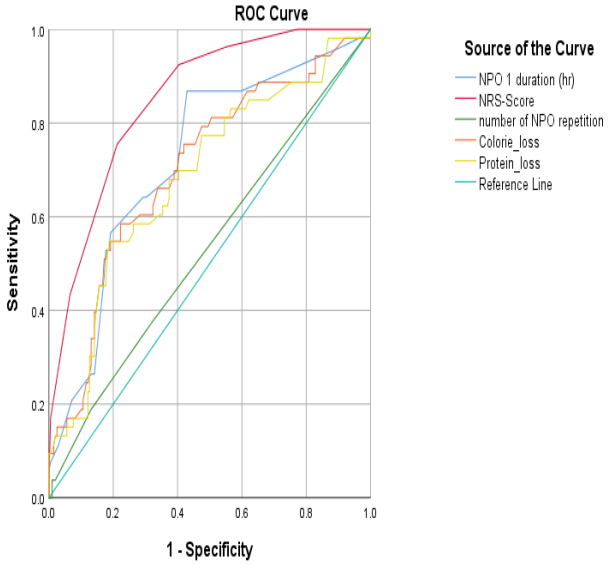


Figure 4. Area under the ROC curve for 28-day mortality predictions.

Discussion

This study demonstrated that most of the hospitalized patients, particularly those in the ICU, experienced prolonged fasting before elective procedures, resulting in significant calorie and

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protein deficits. These deficits contributed to worsening malnutrition and increased risk of adverse outcomes, including longer hospital stays and higher mortality. Hospital malnutrition is already a well-documented problem, with prevalence rates between 20–50%, and the findings confirm that extended NPO periods further aggravate this condition.

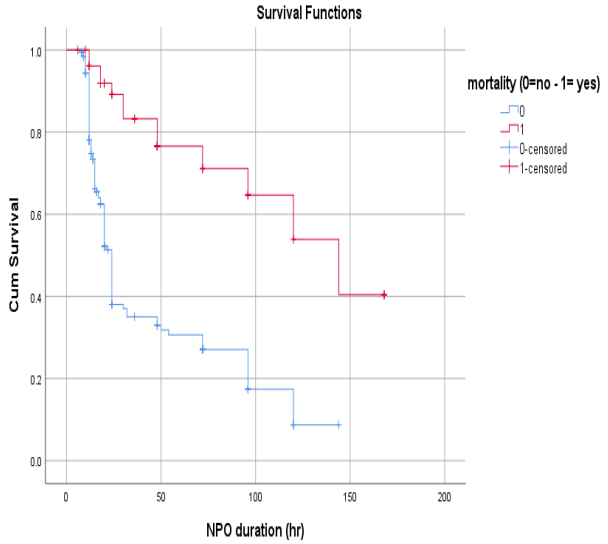


Figure 5. Estimating the survival of patients with different malnutrition statuses during NPO for the elective procedures by the Kaplan-Meier test.

The high prevalence of hospital malnutrition (documented to be between 20% and 50% in the literature) is a major health problem that can increase complications which result in longer hospitalization, longer recovery periods, and higher mortality (Barker *et al.*, 2011). Malnutrition is common in elderly patients and those with chronic and acute diseases. Moreover, hospitalized patients who cannot meet their daily energy, protein, and other nutrient requirements, especially during a catabolic state, face an increased risk of malnutrition or severe complications (Ostrowska *et al.*, 2021). The Malnutrition Risk Screening Tool (NRS-2002) is a concise yet comprehensive instrument that identifies patients at risk of malnutrition by evaluating BMI, recent weight loss, ICU admission, and disease severity (Ostrowska *et al.*, 2021, Sahli *et al.*, 2021). Malnutrition increased the odds of in-hospital death by more than three-fold (Boaz and Kaufman-Shriqui, 2023). A cross-sectional, multi-center study from four university hospitals observed that malnutrition in hospitalized patients prolongs stays, boosts comorbidity, and lowers 30-day survival; under 36% get nutritional support (Ottestad *et al.*, 2024). Furthermore, a large cohort study on 69 934 patients with malnutrition showed that receiving nutritional support decreased hospital mortality and the 30-day readmission rate (Kaegi-Braun *et al.*, 2021). So, it seems that nutritional support for patients at risk of malnutrition is crucial to reduce mortality and length of stay. Prolonged fasting for elective procedures exacerbates malnutrition and its complications by limiting calorie and protein intake.

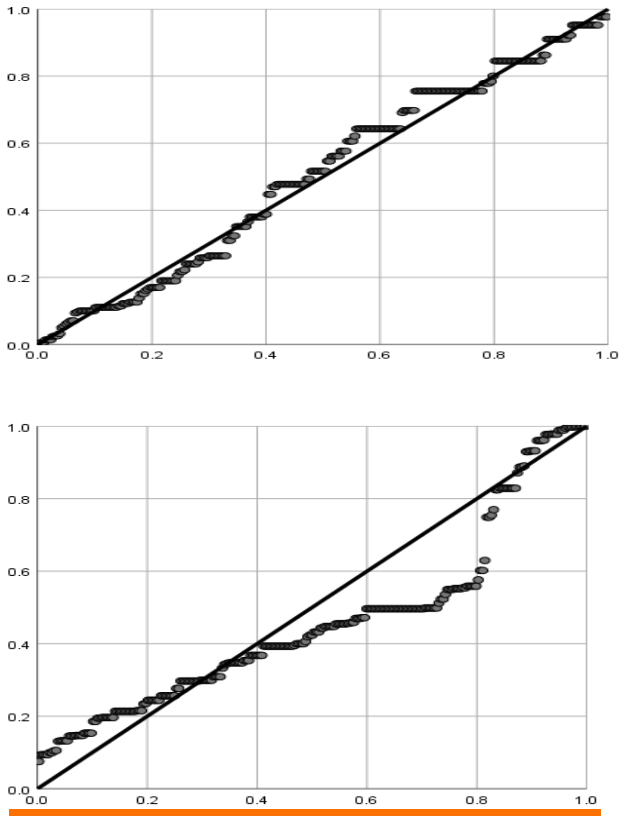


Figure 6. A linear correlation between length of hospital stay and severity of malnutrition by NRS-2002 score (left) and length of NPO duration (right).

NPO before anesthesia is a medical instruction to reduce the risk of aspiration (American Society

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of Anesthesiologists, 2017, Presta *et al.*, 2018). Based on the guidelines, drinking clear fluids (water, pulp-free juice, plain tea) up to 2 hours, light meals (toast and clear fluids), and non-human milk for up to 6 hours, and large oily meals and an 8-hour fast before elective procedures should be required for general anaesthesia, regional anaesthesia, or procedural sedation (American Society of Anesthesiologists, 2017, Smith *et al.*, 2011). Oral intake of clear fluids up to 2 hr. prior to elective procedures appears to be safe and does not increase the gastric fluid content as compared to a longer fast (American Society of Anesthesiologists, 2017, Itou *et al.*, 2012, Smith *et al.*, 2011, Thomas and Engelhardt, 2017). In addition, routine use of proton pump inhibitors (PPIs) in admitted patients in hospital can suppress gastric acid pH and reduce gastric volume, which can lead to a reduced risk of aspiration (Babaei *et al.*, 2009). However, most of the time, NPO duration is not implemented based on guidelines because of physicians' fear of aspiration risk and cancellation or delay in doing procedures, and patients experience long-term fasting, which leads to patient dissatisfaction, hypoglycemia, and dehydration that can reduce recovery (Frykholm *et al.*, 2018).

Table 2. AUC values for the 28-day mortality prediction.

Test Result Variable(s)	Area
NRS-Score	0.850
NPO duration (hr)	0.723
Colorie loss	0.703
Protein_loss	0.685
number of NPO repetition	0.533

ERAS protocol emphasized minimizing fasting time by carbohydrate loading with clear fluids 2 hours before surgery and even nutritional supplementation 7–10 days before surgery; this increases insulin sensitivity, reduces postoperative inflammation, decreases length of hospital admission, and improves patient outcomes (Altman *et al.*, 2019, Kotfis *et al.*, 2020). A study on 168 bariatric surgeries that revised the oral water ad libitum policy until 2 h before surgery showed a decreased 13-15% incidence of extended hospital length of stay and no perioperative pulmonary aspirations of gastric contents (Nossaman *et al.*, 2017).

Table 3. Means[a] for survival time.

Mortality	Estimate	Std. Error	95% Confidence interval	
			Lower bound	Upper bound
No	48.240	4.319	39.774	56.705
Yes	117.213	10.904	95.841	138.586
Overall	65.579	5.066	55.649	75.508

[a]. *Estimation is limited to the largest survival time if it is censored.*

Along with this study, a prospective cohort study showed that among 1192 admitted patients, 262 were given NPO for a mean of 5.2±3.7 days and were kept on a clear liquid diet for a mean of 1.04±1.3 days (Franklin *et al.*, 2011). Also, another study in ICU burn on 41 patients revealed that the average calorie deficit to prescribed calories ratio during the time from NPO to surgical start (9.3±3.1 hr) was 1154±629/3534±851 kcal and NPO to feeding restart (14.2±4.1 hr.) was 1765±928/3534±851 kcal; this means that a preoperative fasting resulted in an average loss of greater than 50% of the prescribed calories on the day of surgery (Pham *et al.*, 2018). A study on training nurses to implement ASA guidelines for NPO patients demonstrated an increase in patient satisfaction and a reduction in postoperative complications (Denton, 2015). In addition, another study showed a tentative NPO status effect on longer treatment duration, greater decline in swallowing ability, and higher mortality rate compared to early oral intake (Maeda *et al.*, 2016). The finding that the standard deviation of energy loss was greater than the mean highlights the heterogeneity of fasting practices in this hospital. Outliers were primarily patients in the ICU who experienced prolonged NPO episodes due to repeated delays in elective procedures. Although these extreme cases inflated the variability, the sensitivity analysis demonstrated that even after excluding outliers, patients still experienced clinically relevant energy and protein deficits. This supports the conclusion that prolonged NPO

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contributes substantially to hospital malnutrition. To minimize unnecessary fasting and prevent malnutrition, stricter adherence to international fasting guidelines (ASA/ESAIC) and enhanced recovery protocols are crucial. Implementing NPO according to the ASA protocol is recommended to ensure patients receive adequate calories and protein, thereby reducing mortality rates.

This study is pioneering in its systematic evaluation of NPO duration across different hospital wards, comparison with international anesthesia guidelines, analysis of its association with malnutrition, length of stay, and mortality. A major strength is the detailed quantification of calorie and protein deficits during prolonged fasting, supported by validated nutritional screening tools and biochemical assessments, which provides strong evidence of the impact of extended NPO on hospital malnutrition. Nevertheless, certain limitations should be acknowledged: the majority of patients were from the ICU, and most fasting episodes were pre-surgical, which may limit generalizability; the sample size was relatively modest; and malnutrition was not reassessed comprehensively at the end of the 30-day follow-up. Future studies with larger, multicenter cohorts - including university and private hospitals - are needed to confirm these findings, alongside longitudinal nutritional assessments and exploration of potential interventions.

Conclusions

The results showed that patients experienced the long-term NPO duration before elective procedures, which was not applied according to the protocols and was related to an increase in the rate of LOS and the 28-day mortality rate. Prevention and modification of malnutrition are major concerns for controlling disease complications and mortality. Observing the rules of fasting for patients, according to international guidelines, before elective procedures can prevent the loss of calories and protein and the exacerbation of hospital malnutrition and its complications, and enhance the recovery of patients after medical procedures. Nutritional assessment of patients at risk of malnutrition by a dietitian and minimal fasting before elective procedures are also recommended to prevent exacerbation of hospital malnutrition.

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Authors' contributions

Khalighi Sikaroudi M and Shidfar F designed the study. Khalighi Sikaroudi M did the sampling. Torabinasab K, Hejazi M, and Mirhosseini SF conducted analysis and interpretation of the data. Khalighi Sikaroudi M, Khoshro S, and Mirhosseini SF wrote the original draft. Khalighi Sikaroudi M, Dehnad A, and Shidfar F reviewed and revised the manuscript. All authors read and approved the final manuscript.

Conflict of interests

The authors declared no conflicts of interest.

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