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ORIGINAL ARTICLE

Preoperative Malnutrition Among Patients Scheduled for Elective Gastrointestinal Surgery at a National Hospital in Tanzania

Collins S. Bowah[a], Ally H. Mwanga[a], Daniel W. Kitua[a*], Nashivai E. Kivuyo,[a] Mungeni M. Misidai,[a] Fransia A. Mushi,[a] Meshack Brighton,[a] Gemenh R. Buway,[b] Zaitun Bokhary,[c] Larry O. Akoko[a]

[a]Department of Surgery, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania; [b]Department of Public Health, Cuttington University, Suacoc, Liberia; [c]Department of Surgery, Muhimbili National Hospital, Dar es Salaam, Tanzania

Correspondence to Daniel W. Kitua (daniel.kitua@muhas.ac.tz)

ABSTRACT

Background: Malnutrition is a critical but under recognized factor contributing to poor surgical outcomes, particularly in low resource settings. In sub-Saharan Africa, data on preoperative malnutrition among patients undergoing gastrointestinal (GI) surgeries are scarce. Therefore, this study aimed to determine the proportion of preoperative malnutrition and its associated factors among adults scheduled for major GI surgeries at the national hospital in Tanzania

Methods: We conducted a cross sectional study involving 143 adult patients who were scheduled to undergo major GI surgeries at Muhimbili National Hospital between August 2023 and January 2024. Nutritional status was assessed using body mass index (BMI) and serum albumin levels. We used the nutritional risk index (NRI) as a proxy estimate of postoperative complications. Sociodemographic and clinical data were analyzed using SPSS version 26. Associations with malnutrition were examined using the chi-square and Fisher's exact tests.

Results: Thirty six percent (n=52) of patients were malnourished based on at least one indicator. Overall, 22.4% (n=32) of patients were undernourished, whereas 14.0% (n=20) were classified as overnourished. Overweight and obesity (BMI > 24.9 kg/m^2) were present in 14% (n=20) of the patients, while 2.1% (n=3) were underweight (BMI < 18.5 kg/m^2). Low serum albumin levels (<35 g/L) were noted in 22.4% (n=32) of the cases. Using the NRI as a proxy measure for postoperative complications, 44.1% (n = 63) of patients were classified as having moderate-to-severe risk. Malnutrition was significantly associated with American Society of Anesthesiology Physiological Status class III (p=.007), illness duration of ≥28 days (P=.042), hypertension (P=.004), and severe anemia (P=.002).

Conclusion: Preoperative malnutrition is common among patients undergoing elective GI surgery, with undernutrition being the most prevalent. Nutritional screening and prehabilitation should be integrated into routine perioperative care to improve surgical outcomes.

BACKGROUND

Adult malnutrition in all its forms; undernutrition, overnutrition, and micronutrient deficiencies remains a major global public health challenge.[1] In 2022, an estimated 2.5 billion adults were overweight, including 890 million with obesity, while 390 million were underweight, reflecting the double burden of malnutrition.[2] Among hospitalized adults in Africa, the prevalence of malnutrition ranges widely from 8% to 85%.[3] In Tanzania, this dual burden is also evident, with 15.2% of adult women and 5.0% of adult men living with obesity, while undernutrition affects up to 23% of the population.[4,5]

Gastrointestinal disorders and malnutrition frequently coexist due to decreased intake, malabsorption, chronic inflammation, and increased metabolic demands.[6] Reflecting this clinical impact on a global scale, digestive disorders account for more than 2.8 billion cases worldwide, many of which require surgical intervention, with an estimated 13.85 million gastrointestinal surgeries performed annually.[7] Beyond surgical volume, the broader societal impact is significant; digestive diseases accounted for approximately 88.99 million disability-adjusted life years (DALYs) in 2019 (3.51% of total DALYs), ranking as the 13th leading cause of disease burden worldwide.[8] This burden disproportionately affects countries within the middle socio-demographic index (SDI) quintile, a trend particularly evident in Sub-Saharan Africa.[8,9] In this region, where many countries fall within low- to middle-SDI categories, the impact of digestive diseases remains high and persistent. [9]

Despite this close and clinically significant interplay, the burden and determinants of malnutrition among patients undergoing gastrointestinal surgery remain poorly characterized, particularly in low-resource settings.

While the association between malnutrition and non-communicable diseases is well established, its implications for surgical outcomes have received comparatively less attention.[10,11] Emerging evidence indicates that malnourished surgical patients are at increased risk of postoperative complications, prolonged hospital stays, intensive care unit admissions, readmissions, and mortality.[12–15] In sub-Saharan Africa, where undernutrition persists alongside rising obesity, this evidence gap is especially pronounced.[15–17] Therefore, this study aimed to determine the proportion of preoperative malnutrition and its associated factors among adults scheduled for major gastrointestinal (GI) surgeries in Tanzania, in order to address the limited local data and inform context-specific strategies to improve perioperative care and outcomes.

METHODOLOGY

Study Design, Area, and Period

This cross-sectional study was conducted in the Department of General Surgery at Muhimbili National Hospital (MNH) between August 2023 and January 2024. The MNH is a quaternary hospital and highest referral level in Tanzania, serving as a national center for specialized care. The Department of General Surgery hosts a dedicated Surgical Gastroenterology Unit that provides comprehensive management of both benign and malignant gastrointestinal diseases, including upper, lower, and hepatobiliary surgeries. The unit is staffed by ten surgical gastroenterologists and supported by a multidisciplinary team. The MNH is also the primary teaching hospital for Muhimbili University of Health and Allied Sciences (MUHAS), with approximately 30 surgical residents undergoing training annually. The facility is equipped with essential perioperative services, including nutritional clinics, anaesthesia, critical care, interventional radiology, and endoscopic support, enabling the management of complex surgical cases.

Participants, Sampling, and Sample Size Determination

The study included adult patients aged ≥ 18 years who were scheduled for elective open GI surgeries during the six-month study period between August 2023 and January 2024. Patients with a history of prior gastrointestinal surgery or with incomplete key information were excluded. Eligible participants were selected using systematic random sampling to ensure representativeness and minimize selection bias, resulting in a total of 143 participants drawn from the sampling frame.

The adequacy of the sample size was assessed using a power-based approach to compare two independent proportions. The required sample size was estimated using the following formula:

$$n = [(Z(1-\alpha/2) * \sqrt{(2P(1-P))} + Z(1-\beta) * \sqrt{(P1(1-P1) + P2(1-P2))})^2] / (P1 - P2)^2$$

where P1 and P2 represent the proportions of malnutrition in the exposed and unexposed groups, respectively, and $P = (P1 + P2)/2$ is the average proportion. For estimation, P1 and P2 were assumed to be 18% and 7%, respectively, reflecting a clinically meaningful difference with an average proportion of P = 0.125, consistent with the anticipated malnutrition prevalence of approximately 11%.[18] $Z(1-\alpha/2)$ corresponds to the standard normal deviation for a two-sided significance level of 5% (1.96), and $Z(1-\beta)$ corresponds to the standard normal deviation for 80% statistical power (0.84). Based on these assumptions and the achieved sample size of 143 participants, the study was considered to have reasonable statistical power to detect moderate differences between groups, although smaller differences may not have been detectable.

Data Collection and Variables

Data were collected using a structured checklist. Sociodemographic and clinical data regarding the presenting illness and comorbidities were retrieved from patient records. Preoperative height and weight were used to calculate body mass index (BMI). Weight and height were measured using a standard stadiometer (Seca GmbH & Co. KG, Hamburg, Germany), accurate to the nearest 0.1 kilograms, with participants wearing light clothing. Usual weight over the previous 6 months was also determined. Biochemical assessments included serum albumin and hemoglobin levels retrieved from the records. Malnutrition was classified into two categories: undernourished (BMI<18.5 kg/m² and/or albumin<35 g/L) and over nourished (BMI>24.9 kg/m²). The Nutritional Risk Index (NRI) was also used as a proxy measure for the likelihood of postoperative complications. This index incorporates serum albumin levels along with current and usual weight. Risk levels were categorized as none, mild, moderate, or severe.[19]

Data Analysis

Data analysis was performed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summaries the demographic and nutritional characteristics of the participants. Continuous variables, such as age and BMI, were reported as means with standard deviations, whereas categorical variables were summarized using frequencies and percentages. The chi-square test was primarily employed to examine associations between nutritional status and other variables. Fisher's exact test was used for analyses involving small sample sizes or five or fewer expected frequencies. The chi-square Monte Carlo analysis was also applied to calculate p-values for selected categorical comparisons. A *P* value of <.05 was considered statistically significant throughout the analysis.

Ethical Consideration

Ethical clearance for this study was obtained from the Institutional Review Board of MUHAS (Ref. No. DA.282/298/01.C/1840), and permission to conduct the study was granted by the Directorate of Research and Training at Muhimbili National Hospital. Written informed consent was obtained from all participants prior to enrolment. Participants were informed of their right to decline participation or withdraw from the study at any time without affecting their care. Confidentiality was strictly maintained by using anonymized data and restricting access to study information to the research team only. This study adhered to the ethical principles outlined in the Declaration of Helsinki and its subsequent amendments.

RESULTS

Nutritional Status Distribution Among Study Participants

Figure 1 shows the nutritional status of the 143 participants included in this study. Nutrition was assessed based on a combination of two indicators: BMI and serum albumin levels. The proportion of malnourished patients was 36.4% (n=52). Of the malnourished, 32/52 (61.5%) were undernourished, while 20/52 (38.5%) were overnourished. Table 1 summarizes the individual nutritional status assessments based on BMI and serum albumin levels. Most participants (n=120 [83.9%]) had a normal BMI, and the median serum albumin level was 38 g/L (interquartile range, IQR: 35–39).

FIGURE 1: Overall Nutritional Status Based on a combination Body Mass Index and Albumin Levels among Participants

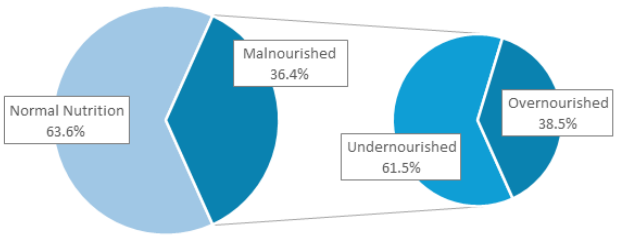

TABLE 1: Preoperative Nutritional Status of Participants

Variable	Frequency (n)	Percent (%)
Body Mass Index		
Underweight	3	2.1
Healthy weight	120	83.9
Overweight/obese	20	14.0
Serum albumin		
Normal	110	77.6
Low	32	22.4
Median serum albumin in g/L (IQR)	38.00 (35.00, 39.00)	

IQR: Interquartile Range

Association Between Clinico-demographic Characteristics and Nutritional Status Among Study Participants

Among the study participants, the mean age was 52 years (±14). Undernutrition was more common among individuals aged over 60 years (n=13 [26.5%]), while overnutrition was more prevalent among those aged 18–34 (n=5 [31.3%]). Malnutrition was slightly more common among females than males (38.3% vs. 33.9%). The highest proportion of malnutrition was observed among widowed participants (n=9 [64.3%]), with undernutrition being the predominant form (n=6 [42.9%]). A similar trend was noted among unemployed individuals, where undernutrition accounted for up to 53.8% (n=7). Malnutrition showed an inverse relationship with education level, with fewer cases reported among participants who had attained higher education (n=9 [30%]). Undernutrition was also more frequent among patients with abdominal tumors (n=26 [25.7%]). However, none of these associations reached statistical significance. Statistically significant ($p<.05$) findings were observed among participants with prolonged illness (lasting more than 28 days) and those with poor physiological status (American Society of Anesthesiologists [ASA] class III), who exhibited significantly higher proportions of undernutrition 42.2% (n=8) and 70% (n=7), respectively (Table 2).

Relationship Between Comorbidities and Nutritional Status in Surgical Patients

The most common comorbidities were hypertension and HIV, accounting for 28.7% (n=41) and 17.5% (n=25) of cases, respectively. Severe anemia accounted for 9.1% of cases and was particularly associated with undernutrition, which was present in eight (61.5%) of these patients (Table 3).

Perioperative nutritional risk assessment using the Nutritional Risk Index

Figure 2 summarizes the findings of the NRI as a proxy measure for malnutrition-related complications, particularly in the surgical context. Approximately 36.4% (n=52) of patients had no nutritional risk. In contrast, 19.6% (n=28) were identified as having a mild risk, 30.8% (n=44) were at moderate risk, and 13.3% (n=19) were classified as having severe nutritional risk.

FIGURE 2: Distribution of Nutritional Risk Index (NRI) Categories Among Participants

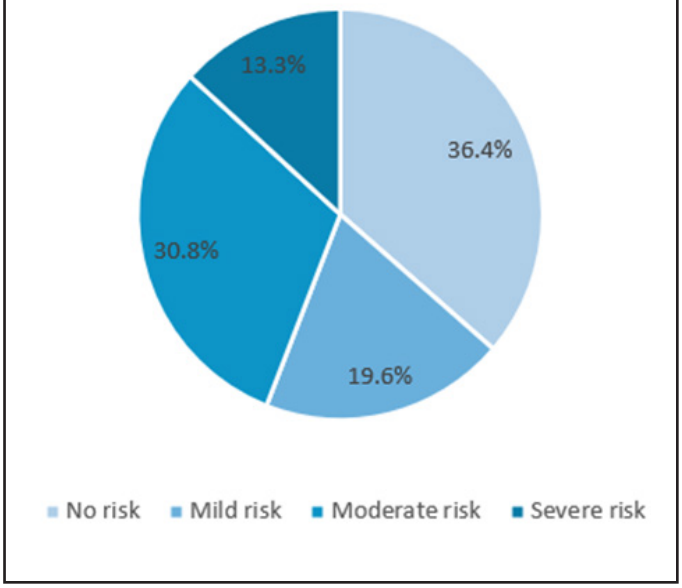

TABLE 2: Association Between Clinicodemographic and Nutritional Status Among Patients Undergoing Elective Gastrointestinal Surgeries

Variable	Normal (%)	Undernourished (%)	Overnourished (%)	*P value*
Mean (years ± SD)		52 (± 14)		
Age (years)				.077
18 – 34	10 (62.5)	1 (6.3)	5 (31.3)	
35 – 59	53 (67.9)	18 (23.1)	7 (9.0)	
>60	20 (57.1)	13 (26.5)	8 (16.3)	
Sex				.692
Male	41 (66.1)	14 (22.6)	7 (11.3)	
Female	50 (61.7)	18 (22.2)	13 (16.0)	
Marital status				.090
Married	65 (67.7)	21 (21.9)	10 (10.4)	
Single	21 (63.6)	5 (15.2)	7 (21.2)	
Widowed	5 (35.7)	6 (42.9)	3 (21.4)	
Occupation				.140
Unemployed	5 (38.5)	7 (53.8)	1 (7.7)	
Employed	52 (65.8)	16 (20.3)	11 (13.9)	
Self-employed	27 (71.1)	7 (18.4)	4 (10.5)	
Other	7 (53.8)	2 (15.4)	4 (30.8)	
Education				.077
No formal education	0 (0.0)	3 (100)	0 (0.0)	
Primary	14 (50.0)	9 (32.1)	5 (17.9)	
Secondary	56 (68.3)	16 (19.5)	10 (12.2)	
Higher	21 (70.0)	4 (13.3)	5 (16.7)	
Duration of sickness				.042
<7 days	48 (69.6)	9 (13.0)	12 (17.4)	
7-28 days	33 (60.0)	15 (27.3)	7 (12.7)	
>28 days	10 (52.6)	8 (42.1)	1 (5.3)	
ASA score				.007
I	33 (73.3)	4 (8.9)	8 (17.8)	
II	56 (63.6)	21 (23.9)	11 (12.5)	
III	2 (20.0)	7 (70.0)	1 (10.0)	
Abdominal tumor				.322
Yes	61 (60.4)	26 (25.7)	14 (13.9)	
No	30 (71.4)	6 (14.3)	6 (14.3)	

ASA: American Society of Anesthesiologists

TABLE 3: Comorbidities Among Study Participants by Nutritional Status

Variable	Normal (%)	Undernourished (%)	Overnourished (%)	*P value*
Hypertension				.004
Yes	23 (56.1)	16 (39.0)	2 (4.9)	
No	68 (66.7)	16 (15.7)	18 (17.6)	
Diabetes Mellitus				.927
Yes	13 (72.2)	3 (16.7)	2 (11.1)	
No	78 (62.4)	29 (23.2)	18 (14.4)	
Renal failure				.133
Yes	11 (100)	0 (0.0)	0 (0.0)	
No	109 (82.6)	3 (2.3)	20 (15.2)	

Continue

TABLE 3: Continued

Variable	Normal (%)	Undernourished (%)	Overnourished (%)	*P value*
Severe anemia				.002
Yes	5 (38.5)	8 (61.5)	0 (0.0)	
No	86 (66.2)	24 (18.5)	20 (15.4)	
HIV				.483
Yes	15 (60.0)	6 (24.0)	4 (16.0)	
No	76 (64.4)	26 (22.0)	16 (13.6)	
Heart failure				.588
Yes	3 (100)	0 (0.0)	0 (0.0)	
No	117 (83.6)	3 (2.1)	20 (14.3)	
Other				.538
Yes	22 (84.6)	1 (3.8)	3 (11.5)	
No	98 (83.8)	2 (1.7	17 (14.5)	

HIV: Human Immunodeficiency Virus

DISCUSSION

In our cohort of 143 adults scheduled for elective gastrointestinal surgery, preoperative malnutrition was significantly prevalent. Over one third of the surgical patients had suboptimal nutritional status. These results are consistent with regional statistics from sub-Saharan Africa and the wider global literature regarding malnutrition among surgical patients. In East Africa, comparable prevalence rates have been observed; for example, a studies from Tanzania and Kenya indicated that approximately 50% of surgical inpatients were malnourished upon admission.[15,20] A study conducted in Malawi on adult laparotomy patients revealed an even greater burden, with approximately 80% identified as malnourished, with 28% classified as severely malnourished.[21] Although the Malawian group comprised numerous emergency surgery and critically ill cases, possibly accounting for the high rates, these findings still highlight that severe malnutrition frequently occurs among surgical patients in sub-Saharan Africa. Interestingly, this prevalence is not confined to Africa; worldwide, studies indicate that around one-third of individuals undergoing major surgeries are malnourished, with rates above 50% in high-risk surgical subgroups.[20] Other studies have reported that approximately 20 to 50% of hospitalized patients (and as many as 50-80% of surgical patients) are malnourished.[22,23] Thus, malnutrition remains a significant concern across various healthcare settings, in both high-income to low-income countries.

In our examination of factors contributing to malnutrition, we found that undernourished patients were often older, unemployed, widowed, or less educated; demographics typically linked to vulnerability in this context. However, these patterns did not reach statistical significance in our sample. Conversely, various clinical variables displayed significant correlations with poor nutritional status. Patients categorized as ASA class III (indicating severe systemic disease) had notably higher rates of malnutrition, implying that individuals in poorer overall health are frequently malnourished. This finding correlates with that from other surgical groups; for instance, a study involving elderly surgical patients identified a high ASA class (III/IV) as an independent risk factor for malnutrition.[24] Our analysis revealed significant associations between malnutrition, comorbid hypertension, and severe anemia. This relationship between malnutrition and hypertension is well-established.[25,26] Furthermore, the coexistence of micro- and macronutrient deficiencies may explain the high prevalence of severe anemia among undernourished patients.[27] These findings indicate that malnutrition is intricately linked to other health issues. Patients exhibiting poorer health, as evidenced by a higher ASA status, chronic illness, and anemia, are more susceptible to nutritional deficiencies, which may exacerbate their surgical risk profile.

A key insight from our study is the dual burden of malnutrition in our settings, which may reflect the situation in similar settings. While undernutrition was more common, we found that 14% of participants were overnourished (overweight or obese). This dual burden (undernutrition and overnutrition) is increasingly observed in many low- and middle-income countries experiencing nutritional and epidemiologic transitions.[28] From a surgical standpoint, it is imperative that clinicians are equipped to address both extremes of nutritional disorders. Overnutrition poses specific perioperative challenges: obesity is associated with difficult airway management and anesthesia, as well as higher rates of cardiovascular comorbidities and increased risks of postoperative complications, such as wound infections and thrombosis.[29] Conversely, undernourished patients are more prone to problems, such as impaired wound healing, sepsis, postoperative catabolic stress, and other shared complications with overweight and obesity.[30] The coexistence of both underweight and overweight/obese individuals within our elective surgery cohort highlights the critical need for comprehensive nutritional assessment and individualized management. Hospitals operating in contexts similar to ours should acknowledge

the dual burden of malnutrition and implement strategies to identify and address both undernourished and overnourished patients prior to surgery. This issue also carries public health implications, underscoring the necessity for expanded nutrition and lifestyle programs within our communities to address all forms of malnutrition.

Approximately 44.1% of our cohort exhibited moderate-to-severe nutritional risk, as assessed by the NRI, indicating that a substantial proportion were vulnerable to nutrition-related adverse outcomes. Although our study did not assess postoperative outcomes, high nutritional risk rates indicate the potential for perioperative morbidity and increased burden on the healthcare system.[31] Malnutrition is, however, a condition that can be addressed, particularly in elective medical settings. Empirical evidence suggests that targeted nutritional interventions can enhance patients' nutritional status and, in certain instances, result in reduced complications and shorter durations of hospitalization.[32] Additionally, prehabilitation programs, including glucose control, weight management, and physical conditioning, can mitigate surgical risks associated with obesity.[33] However, many hospitals in low-resource settings currently lack formal nutritional assessment protocols and prehabilitation programs, which leads to missed opportunities to identify and improve care for at-risk surgical patients. Using feasible screening tools, such as the NRI used in this study, can be a first step toward addressing this issue [34]. Other validated options, such as the Malnutrition Universal Screening Tool (MUST) or Subjective Global Assessment (SGA), are also practical choices, even in busy clinical settings.[35,36] Utilizing these tools will allow clinicians to risk-stratify and tailor perioperative prehabilitation programs.

Limitations

This study has several limitations. First, the relatively small sample size may constrain the generalizability and external validity of the findings. Second, the single-center design may not adequately capture the heterogeneity of surgical populations and practices across diverse settings. Third, the assessment of nutritional status relied on available clinical and anthropometric measures, which may not fully reflect the multifactorial nature of malnutrition, particularly in the absence of more detailed biochemical or functional assessments. Finally, the absence of postoperative outcome data limits the ability to quantify the clinical significance of the observed burden of malnutrition in this context.

CONCLUSION

This study highlights the significant burden of malnutrition among individuals undergoing gastrointestinal surgery, with undernutrition being the most prevalent form. Several factors, including prolonged illness, poor physiological status, hypertension, and anemia, were significantly associated with malnutrition. Notably, nearly half of the patients were identified as being at moderate-to-severe nutritional risk, indicating a substantial proportion of patients who may be susceptible to adverse perioperative outcomes. These findings emphasize the magnitude of malnutrition as a clinically significant yet under-recognized issue in surgical populations within this context.

RECOMMENDATIONS

Routine preoperative nutritional screening should be integrated into standard surgical care to enable early identification of at-risk patients. This should be accompanied by the incorporation of structured nutritional optimization or prehabilitation strategies within perioperative care pathways, particularly for high-risk individuals. There is also a need to develop and implement context-specific protocols that are feasible in low-resource settings. Furthermore, future research should focus on evaluating the effectiveness and practicality of nutritional interventions and their impact on surgical outcomes to support the evidence-based integration of perioperative nutritional prehabilitation into routine clinical practice.

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