



Malnutrition Risk among Hospitalized Patients with Type 2 Diabetes Mellitus and its Association with Hospital Length

Philemon Kwizera^{1*}, Reverien Niyomwungeri², Omar Gatera³, Harriet Gyamfuah Adu-Amoah¹, Jeannine Ahishakiye¹

¹Department of Human Nutrition and Dietetics, University of Rwanda, Rwanda

²Internal Medicine Department, University Teaching Hospital of Kigali, Rwanda

³African Center of Excellence in Internet of Things (ACEIoT), University of Rwanda, Rwanda

ABSTRACT

Background: Estimating malnutrition risk among hospitalized patients is challenging, yet critical due to its association with adverse outcomes such as prolonged hospital stay; increased mortality, impaired wound healing, depression, and increased hospital costs. This research study aims to evaluate the risk of malnutrition among type 2 diabetic hospitalized patients and its impact on the patient's length of stay in two tertiary hospitals based in Kigali.

Method: In this retrospective cross-sectional study, 300 adult hospitalized type 2 diabetic patients from Kigali's tertiary hospitals were enrolled between January 2021 and October 2022. Data collected includes demographics, anthropometrics, serum albumin, and length of hospital stay. The Nutrition Risk Index was used to determine malnutrition risk.

Results: 55.3% of hospitalized type 2 diabetes patients were found to be at risk of malnutrition based on the Nutrition Risk Index. Gender distribution showed no significant difference ($p=0.724$), with 56.6% females and 54.5% males at risk. Significant associations were found with age ($r=0.018$, $p=0.017$), hypertension as comorbidity ($r=0.169$, $p=0.004$), hospital stay duration ($r=0.139$, $p=0.016$), and blood glucose levels ($r=-0.087$, $p=0.001$).

Conclusion: A study finds high malnutrition risk in hospitalized type 2 diabetes patients, linked to longer stays and poor outcomes. Early malnutrition screening, proper nutrition support and a multidisciplinary care team are crucial for improved clinical care and cost-effectiveness.

Keywords: Hospital malnutrition; Diabetes mellitus type 2; length of stay; Nutrition risk index

INTRODUCTION

Malnutrition is a significant issue within hospitals, impacting approximately 20%-50% of patients globally, and it is associated with numerous adverse clinical outcomes such as high morbidity and mortality rates, extended hospital stay, susceptibility to infections, loss of muscle mass, and inadequate wound healing [1,2]. Malnutrition is defined as insufficient, excessive, or disproportionate consumption of energy and/or essential nutrients by an individual [3].

Type 2 diabetes, also known as Diabetes mellitus, is a chronic

metabolic disorder characterized by the body's reduced ability to utilize the hormone insulin efficiently and or inadequate insulin production [4]. This condition represents a remarkable worldwide public health concern, with an estimated prevalence of 10.5% (equivalent to 537 million individuals) in 2021 [5]. Projections indicate that the prevalence is expected to increase to 10.2% (approximately 642.7 million) by 2030 and further to 10.9% (roughly 783.2 million) by 2045 [6].

According to the second Rwanda non-communicable diseases risk factors study, the prevalence of diabetes has remained at 3% over the last 9 years. Especially, Kigali City exhibits the

Received:	16-July-2024	Manuscript No:	ipqpc-24-20799
Editor assigned:	18-July-2024	PreQC No:	ipqpc-24-20799 (PQ)
Reviewed:	01-August-2024	QC No:	ipqpc-24-20799
Revised:	06-August-2024	Manuscript No:	ipqpc-24-20799 (R)
Published:	13-August-2024	DOI:	10.36648/1479-1064.32.4.20

Corresponding author Philemon Kwizera, Department of Human Nutrition and Dietetics, University of Rwanda, Rwanda, E-mail: engineeroffice2010@gmail.com

Citation Kwizera P (2024) Malnutrition Risk among Hospitalized Patients with Type 2 Diabetes Mellitus and its Association with Hospital Length. Qual Prim Care. 32:20.

Copyright © 2024 Kwizera P, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

highest diabetes prevalence, standing at over four times higher than the national average of 9.8% [7]. Ineffective nutritional screening on admission and insufficient food intake among patients who are hospitalized are frequently linked to negative health outcomes [8].

Several factors contribute to insufficient food consumption among hospitalized patients, including the absence of feeding assistance, challenges in delivering regular nutritious meals, and meal omissions due to clinical examinations and procedures [8]. The nutritional status of patients, whether normally nourished or undernourished, can often worsen during hospital admission. This decline can be attributed to various factors, including the physiological and metabolic effects of the illness itself, as well as a decrease in food intake relative to the body's requirements [9].

In Southern Ethiopia, a cross-sectional study carried out in East Africa unveiled an overall hospital prevalence of malnutrition at 25.2%. Among the participants, 49 individuals were classified as mildly malnourished, 19 as moderately malnourished, and 9 as severely malnourished [10].

As far as we know, there hasn't been a study in Rwanda examining the occurrence of malnutrition among diabetic patients admitted to hospitals. Therefore, this study aimed to determine the risk of malnutrition among hospitalized patients diagnosed with type 2 diabetes mellitus and its Association with Hospital Length in tertiary hospitals based in Kigali.

MATERIALS AND METHODS

Study Design and Setting

All the patients with type 2 diabetes mellitus who were hospitalized in the internal medicine department in two Referral Hospitals based in Kigali (University Teaching Hospital of Kigali and King Faysal Hospital) for poor glycemic control (high glucose levels) between January 2021 and October 2022 were recruited.

Study Population and Sample

Secondary data was collected from patients aged above 18 who were hospitalized due to diabetic complications. Patients without measurement of albumin level were excluded from this analysis. We also excluded patients with missing data on follow-up. The sample size of 300 hospitalized patients was calculated using the STEPS sample size calculator of WHO and on the number of yearly hospital admissions with a 95% confidence interval with a margin of error of 0.05 and a 100% expected response rate [11].

Data Collection Methods

Patient demographics, anthropometric and clinical characteristics such as age, gender, admission diagnosis, date of hospital admission and discharge, Weight (present and usual weight), Height, glucose levels, and serum albumin were retrieved from the patient's hospital records. BMI (weight kg/height m²) was calculated and categorized as follows: BMI <18.5 indicates underweight, BMI 18.5-24.9 signifies normal weight, BMI ≥ 25.0 suggests overweight, and BMI ≥ 30.0 denotes obesity [12]. The length of hospital stay was calculated

from the date of admission to the date of discharge, it was categorized as prolonged based on a median of 9 days as the cutoff point [13].

Assessment of Nutrition Risk Index

The calculation for the Nutrition Risk Index was performed using the equation: $NRI = (1.519 \times \text{serum albumin in grams per liter}) + (41.7 \times \text{present weight divided by usual weight})$. Patients with an NRI score higher than 100 were categorized as being in the no-risk group. Scores ranging from 97.5 to 100 were considered mild risk, while scores between 83.5 and 97.5 were classified as moderate risk, and scores below 83.5 were categorized as severe risk groups. However, the mild risk, moderate risk groups, and severe risk groups were combined [14].

Data Analysis

Data obtained were entered and analyzed using the Statistical Package of Social Sciences (SPSS) software version 27. Descriptive data were presented as tables. The categorical variables studied were expressed as proportions and percentages. Associations between categorical variables were analyzed using Chi-square. Spearman's correlation was used to test the association between variables. A p-value less than or equal to 0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by:

- IRB CMHS: 14 November 2022 (Approval notice: CMHS/IRB/500/2022)
- KFH IRB: 30 December 2022 Approval Ref KFH/2022/035/IRB
- CHUK ethics committee: 14th March 2023 (Approval Ref EC/CHUK/046/2023)

The data collectors ensured participants' confidentiality and privacy by not keeping personal identification information; instead, they used a code in place of the name of each participant.

RESULTS

Background and Clinical Characteristics of the Enrolled Patients

Table 1 presents information on 300 patients hospitalized with type 2 diabetes mellitus between January 2021 and October 2022. The patients' ages ranged from 20 years to 90 years, with a mean age of 54.27 years and a standard deviation of 16.3 years. The majority fell above 61 age range of 123 patients (41%), and 87 patients (29%) fell into the age category of less than 45 years. while 90 patients (30%), belong to the age range of 46 years to 60 years. In terms of gender distribution, 113 (37.7%) were female, while 187 (62.3%) were male. Weight data revealed a present weight range of 38.0 kg to 113.0 kg, with a mean of 74.7 kg, and a usual weight range of 35.0 kg to 109.0 kg, with a mean of 74.2 kg. The patients' heights ranged from 1.5 to 1.98 meters, with a mean of 1.67 meters.

Table 1: Background and clinical characteristics of the enrolled chronic patients in the internal medicine department in two referral hospitals based in Kigali, 2022

Variables	N=300 [n (%)]
Age (years)	
Range	20.0-90.0
Mean ± SD	54.27 ± 16.3
<45	87 (29)
46-60	90 (30)
>61	123 (41)
Sex	
Female	113 (37.7)
Male	187 (62.3)
Present Weight (kg)	
Range	38.0-113.0
Mean ± SD	74.7 ± 15.7
Usual Weight (kg)	
Range	35.0-109.0
Mean ± SD	74.2 ± 15.4
Height (m)	
Range	1.5-1.98
Mean ± SD	1.67 ± 0.08
BMI (kg/m²)	
Underweight	28 (9.3)
Normal Weight	102 (34)
Overweight	78 (26)
Obesity	92 (30.7)
Blood sugar level (mg/dl)	
Range	33.5-898.0
Mean ± SD	215.9 ± 137.9
Albumin (g/dl)	
Range	18.0-77.3
Mean ± SD	37.3 ± 6.7
Hypertension	
Yes	183 (61)
No	117 (39)

Hospital stay (days)	
Range	0.0-182.0
Mean ± SD	19.1 ± 23.9
Nonprolonged <9 days	127 (42.3)
Prolonged HS ≥ 9 days	173 (57.7)

Body Mass Index (BMI) analysis classified 9.3% of patients as underweight; the majority was 34% as normal weight, 26% as overweight, and 30.7% as Obesity. Blood sugar levels varied widely, ranging from 33.5 mg/dl to 898.0 mg/dl, with a mean of 215.9 mg/dl. The albumin level ranged from 18.0 g/dl to 77.3 g/dl, with a mean of 37.3 g/dl. Hypertension was prevalent among 61% of patients, while 39% did not have hypertension. Hospital stays ranged from 0 to 182 days, with a mean stay of 21.9 days and a standard deviation of 26.0 days, furthermore, regarding the duration of hospital stays for the patients with type 2 diabetes mellitus. Among the total, 127 patients (42.3%) had non-prolonged hospital stays, defined as less than 9 days, while 173 patients (57.7%) experienced prolonged hospital stays of 9 days or more.

Prevalence of malnutrition risk: Table 2 presents data on the Nutrition Risk Index of 300 patients who were hospitalized with type 2 diabetes mellitus. The results show that we have a prevalence of malnutrition of 55.3% while 44.7% had normal nutritional status.

Table 2: Nutrition Risk Index in the internal medicine department in two referral hospitals based in Kigali, 2022

Variables	Frequency	Percentage
At risk of malnutrition	166	55.3
No risk of malnutrition	134	44.7
Total	300	100

Malnutrition risk and different backgrounds and clinical characteristics: Table 3 indicates associations between malnutrition risk and various variables among hospitalized patients. Gender distribution showed no significant difference between those at high risk of malnutrition and those not at risk ($p=0.724$). Observed numbers revealed 64 females (56.6%) and 102 males (54.5%) at risk, compared to 49 females (43.4%) and 85 males (45.5%) not at risk.

Table 3: Distribution of the enrolled patients by malnutrition risk and different backgrounds and clinical characteristics in the internal medicine department in two referral hospitals based in Kigali, 2022

Variables	At risk of malnutrition [n (%)]		P value
	Yes (N=166)	No (N=134)	
Sex			
Female	64 (56.6)	49 (43.4)	0.724
Male	102 (54.5)	85 (45.5)	
Age			
<45	48 (55.2)	39 (44.8)	0.017
46-60	48 (53.3)	42 (46.7)	
>61	70 (56.9)	53 (43.1)	
Hospital stay			
Nonprolonged <9days	60 (47.2)	67 (52.8)	0.016
Prolonged ≥9 days	106 (61.3)	67 (38.7)	
BMI			
No	No	No	No

Underweight	20 (71.4)	8 (28.6)	0.311
Normal	54 (52.9)	48 (47.1)	
Overweight	44 (56.4)	34 (43.6)	
Obesity	48 (52.2)	44 (47.8)	
Blood sugar level (mg/dl)			
-	215.2 ± 155.6	206.7 ± 112.7	0.001

In contrast, Significant associations with positive correlation as indicated in **Table 4** were found between age and malnutrition risk: <45 years (55.2% at risk), 46 years-60 years (53.3% at risk), and >61 years (56.9% at risk). Individuals aged <45 years exhibited a statistically significant difference in malnutrition risk compared to older age groups ($r=0.018$, $p=0.017$). Hypertension also showed significance with negative correlation ($r=-0.169$, $p=0.004$), with observed numbers indicating 77 (65.8%) and 89 (48.6%) patients at risk with and without hypertension, respectively.

Table 4: Correlations between malnutrition risk as revealed by different background and clinical characteristics in the internal medicine department in two referral hospitals based in Kigali, 2022

Variables	Malnutrition risk	
	r	p
Age		
r	0.018	
p		0.017
Hypertension		
r	-0.169	
p		0.004
Hospital stay		
r	0.139	
p		0.016
Blood sugar level (mg/dl)		
r	-0.087	
p		0.001

Hospital stay duration also showed positive correlation significance ($r=0.139$, $p=0.016$), with high numbers of patients who had prolonged stay (≥ 9 days) in hospital with 106 (61.3%) compared to 60 (47.2%) patients who didn't have prolonged stay (<9 days) both are at risk of experiencing malnutrition. Regarding BMI categories, no significant differences were observed ($p=0.311$), with observed numbers indicating 20 (71.4%), 54 (52.9%), 44 (56.4%), and 48 (52.2%) patients at risk of falling into the respective underweight, normal weight, overweight, and obesity categories. Blood sugar levels, however, exhibited a negatively significant correlation difference ($r=-0.087$, $p=0.001$), with mean levels of 215.2 mg/dl and 206.7 mg/dl for those at high risk and those not at risk, respectively.

DISCUSSION

The main objective of the study was to assess the malnutrition risk prevalence among hospitalized patients with type 2 diabetes mellitus, we employed the documentation approach in a cross-sectional study which included a sample size of 300, representing the population. The study area was Referral Hospitals based in Kigali. The current study revealed that within the Internal Medicine Department, 55.3% of enrolled patients were at risk of malnutrition according to the Nutrition Risk

Index criteria. Factors that were associated with malnutrition risk among the patients included age, extended hospital stays, and the presence of comorbidities (hypertension) and elevated blood glucose levels.

113 (37.7%) were female, while 187 (62.3%) were male. Most of the patients in the study were elderly (41%), and there was a positive correlation between age and malnutrition. The elderly population is vulnerable to malnutrition due to a variety of factors, such as physical weakness due to muscle loss, taking multiple medications, the overall decline in health, cognitive decline, decreased appetite, reliance on others for food intake, difficulty in swallowing and chewing, confusion, and constipation [15]. A study done in Nigeria reported that malnutrition was 7.3% significantly higher among the elderly with T2DM [16].

Patients identified as malnourished according to the nutrition risk index criteria experienced a significantly Longer Length of Stay (LOS) of 9 days and were older. Both LOS and advanced age serve as proxies for a patient's clinical outcomes and Economic hardship [17]. Patients with malnutrition tend to have a longer length of stay in the hospital compared to those who are well-nourished as indicated in this study [15]. Patients who prolonged (≥ 9 days) hospital stay had a high risk of malnutrition of 106 (61.3%) with a significance of ($p=0.016$) and positive Spearman correlation of 0.139. This robust correlation links malnutrition with unforeseen complications and deteriorating clinical conditions, underscoring the urgency of early malnutrition screening and detection during hospitalization.

This is because malnutrition can weaken the immune system, increase the risk of infection, and delay wound healing, which can all contribute to a longer hospital stay [18]. Prolonged hospitalization can lead to decreased appetite, impaired nutrient absorption, and increased nutrient losses, which can result in malnutrition. Conversely, low BMI was the least prevalent criterion in our sample population. More than half of the malnourished patients (54, 52.9%) exhibited a normal BMI, underscoring the imperative of not exclusively depending on BMI for nutrition assessment, a challenge frequently confronted by clinicians [17].

In this study, a significant association was observed between poor glucose control and risk of malnutrition (p -value=0.001, Spearman correlation=-0.087). Patients with diabetes mellitus (DM) who exhibit poor compliance with their glucose-lowering medications are at increased risk of poor glycemic control and the development of chronic DM complications, such as autonomic neuropathy and diabetic kidney disease [19]. These complications may predispose them to malnutrition. This finding aligns with a report by Woo et al., which indicated that elderly individuals with DM experiencing poor glycemic control are at a heightened risk of malnutrition [20].

The limitation of the study is the relatively small sample size.

However, the strength of this study lies in the fact that this is the first study to the best of our knowledge that assessed malnutrition risk in hospitalized patients with diabetes type 2 in in tertiary hospitals based in Kigali.

CONCLUSION

Our study reveals a high prevalence of malnutrition risk among hospitalized patients with type 2 diabetes on admission which is directly associated with prolonged length of stay and worsening clinical outcomes. Recognizing the critical role of early malnutrition screening and assessment of patients with the right nutrition support during admission is a very critical component of clinical care. On top of that, a multidisciplinary care team including registered dietitians and nutritionists' approach to care is highly recommended and remains a practical cost-effective approach in patient care.

DATA AVAILABILITY

The authors can provide the data of this research on reasonable request.

FINANCIAL SUPPORT

The authors did not receive any funding for this research.

ACKNOWLEDGEMENT

PK designed the study protocol, coordinated data collection, analyzed the data, and wrote the manuscript. JA and OG contributed to the design of the study protocol, guided the analysis and the writing of the manuscript, reviewed the manuscript, and approved it for submission. RN coordinated data collection and reviewed the manuscript, and HGA contributed to the review of the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

REFERENCES

1. Roberts S, Marshall AP, Gonzalez R, Chaboyer W (2017) Technology to engage hospitalised patients in their nutrition care: A qualitative study of usability and patient perceptions of an electronic foodservice system. *J Hum Nutr Diet.* 30(5):563-73.
2. Barker LA, Gout BS, Crowe TC (2011) Hospital malnutrition: Prevalence, identification and impact on patients and the healthcare system. *Int J Environ Res Public Health.* 8(2):514-27.
3. WHO (2021) Malnutrition.
4. Nicki S (2019) Wave goodbye to type 2 diabetes. *Holistic Remedy Pub.*
5. Hossain MJ, Al-Mamun M, Islam MR (2024) Diabetes mellitus, the fastest growing global public health concern: Early detection should be focused. *Heal Sci Reports.* 7:5-9.
6. Webber S (2013) International diabetes federation. *Diabetes Res Clin Pract.*
7. Rwanda Biomedical Center (2022) Second Rwanda non-communicable diseases risk factors study dissemination of findings what is NCDs risk factors Kigali.
8. Osman NS, Nor N, Sharif MS, Bariah S, Hamid A, et al. (2021) Hospital food service strategies to improve food intakes among inpatients : A systematic review. 1-26.
9. Naithani S, Whelan K, Thomas J, Gulliford MC, Morgan M (2008) Hospital inpatients' experiences of access to food: A qualitative interview and observational study. *Health Expect.* 11:294-303.
10. Daka DW, Ergiba MS (2020) Prevalence of malnutrition and associated factors among adult patients on antiretroviral therapy follow-up care in Jimma Medical Center, Southwest Ethiopia. *PLoS One.* 15:1-15.
11. Rwanda Ministry of Health (2022) Health sector annual performance report 2020-2021.
12. World Health Organization (WHO) (2021) Malnutrition in women.
13. Rabito EI, Marcadenti A, da-Silva FJ, Figueira LSF (2017) Nutritional risk screening 2002, short nutritional assessment questionnaire, malnutrition screening tool, and malnutrition universal screening tool are good predictors of nutrition risk in an emergency service. *Nutr Clin Pract.* 32(4):526-532
14. Peter KC, Murtaugh M (1999) Perioperative total parenteral nutrition in surgical patients. *N Engl J Med.* 325(8):525-32.
15. Dzinamarira T, Pierre G, Umuhire EJ, Habtu M, Okova R (2020) A hospital based cross sectional study on dietary status and associated factors among people living with HIV/AIDS in Kigali, Rwanda. *J Food Res.* 9:50.
16. Adedeji O, Ayoola O, Ademola O, Mansally F, John K, et al. (2022) Health malnutrition in elderly patients with type 2 diabetes mellitus in a Nigerian tertiary hospital : A cross-sectional study. *Dialogues Health.* 1:100030.
17. Kolotourou M, Radley D, Chadwick P, Smith L, Orfanos S, et al. (2013) Is BMI alone a sufficient outcome to evaluate interventions for child obesity? *Child Obes.* 9(4):350-6.
18. Wei W, Zhang L, Li G, Huang Z, Liu J, et al. (2021) Prevalence and prognostic significance of malnutrition in diabetic patients with coronary artery disease: A cohort study. *Nutr Metab.* 18(1):1-10.
19. Fasil A, Biadgo B, Abebe M (2019) Glycemic control and diabetes complications among diabetes mellitus patients attending at University of Gondar Hospital, Northwest Ethiopia. *Diabetes Metab Syndr Obes.* 12:75-83.
20. Woo MH, Park S, Woo JT, Choue R (2010) A comparative study of diet in good and poor glycemic control groups in elderly patients with type 2 diabetes mellitus. *Korean Diabetes J.* 34:303.