Nutritional Status and Associated Factors among Hospitalised Zambian Adult Patients Receiving Hospital Prepared Total Nasogastric Tube Feeds

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Summary

BACKGROUND

Under-nutrition which attributed by inadequate energy and micronutrient intake, chronic and acute illnesses as well as altered immunological function is linked to nutrition. Identification of factors associated with malnutrition among hospitalized adults is important for policy and practices. In settings similar to sub -Saharan Africa, under-nutrition among hospitalized patients was reported to be higher [5] than the 45% to 70% in developed countries. Several studies have shown significant benefits of NGTF.

AIM

To establish the prevalence of under-nutrition and associated factors among adults on hospital prepared total Nasogastric Tube Feeding (NGTF) in Zambia.

METHODOLOGY

A total of 113 patients on total NGTF admitted in a Zambian referral hospital's intensive care unit (ICU) and four medical wards constituted the study population. A researcher-administered questionnaire was used to collect data on socio-economic and medical characteristics. Mid upper arm circumference (MUAC), subjective global assessment (SGA) and body mass index (BMI) were used to establish nutrition status.

RESULTS

Under-nutrition prevalence rates were 62.0%, 64.6% and 36.3% as determined by MUAC, SGA and BMI respectively. Participants' HIV-reactive status was significantly associated with under-nutrition (MUAC, SGA, and BMI) (Odds ratio [OR]: 301.20; 95% C.I. [8.66 - 466.48] p=0.002), (OR: 34.03; 95% C.I. [0.002 – 0.319], p=0.004), (OR: 100.00; 95% C.I. [0.00 - 112.72], p=0.003) respectively. Participants' energy intake, age, length of hospital stay, monthly income and place of residence were not associated with under-nutrition.

CONCLUSIONS

Malnutrition was regular as HIV positive status was significantly associated with under-nutrition. The hospital administration have consider routine screening for malnutrition in all hospital admissions.

Keywords: Under-nutrition; Nutrition status; Nasogastric tube feeding; Zambia

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Introduction

The prevalence of under-nutrition among hospitalized patients has been reported to range from 45% to 70% in studies conducted in developed countries [1–4]. In settings similar to sub-Saharan Africa, under-nutrition among hospitalized patients is reported to be even higher [5].

This trend has been attributed to inadequate energy and micronutrient intake, chronic and acute illnesses as well as altered immunological function [6,7]. Socio-economic and demographic characteristics such as place of residence, parity, monthly household income have also been associated with under-nutrition especially in low-income countries, particularly in sub-Saharan Africa [8].

The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends tube feeding for long and short term interventions in the provision of nutrients for patients who are unable to feed themselves over a period of more than 5 days but have a functional gut [9]. Several studies have so far shown significant benefits of NGTF in hospitalized patients. In an observational study in North American hospitals, 1174 nasogastric tube -fed patients were observed for survival advantage by comparing the initiation time of nasogastric tube feeds [6].

Early initiation to nasogastric tube feeding gave patients a significant survival advantage compared to delayed feeding. Further, early fed patients were reported to receive adequate nutrient intake that resulted in better nutrition status. Similarly, nasogastric tube feeding resulted in improved nutrition status, nutrient intake and quality of life in hospital malnourished patients in a study conducted in the United Kingdom [10,11]. These studies provide evidence that an optimal supply of nutrients to patients in need of nasogastric tube feeding will result in better nutrition status and favourable hospital outcomes.

Most studies that associate tube feeding to nutrition status, quality of life and improved immunological function in patients were conducted in developed countries. It was expected that in sub-Saharan Africa, adult malnutrition is even higher, considering socio-economic characteristics and levels of disease burden, such as HIV-AIDS and other chronic states [12–14].

There is, however, limited literature to provide conclusive evidence on prevalence and factors associated with adult malnutrition for the region, particularly in Zambia. Further, hospital malnutrition is high among the general population but scarce information still exists on the specific prevalence of malnutrition among patients on total NGTF despite indications of inadequate nutrient intake [15].

Moreover, patients receiving NGTF are in most cases in a critical stage of illness. Knowledge of the current levels of under-nutrition is important, so that preventive, as well as corrective measures, are put in place, to protect these patients.

This study aimed to establish the prevalence of under-nutrition and factors associated with nutrition status among patients on hospital prepared NGTF admitted in a Zambian referral hospital. It is expected that information on the nutrition status of patients and the factors contributing to malnutrition may enhance the practice of total NGTF by responsible stakeholders.

In sub-Saharan Africa, less attention has been given to the treatment of adult malnutrition, as a result of weak policies or the non-existence of relevant policies for the management of adult malnutrition, particularly in clinical settings [12,14,15].

MATERIALS AND METHODS

Study Location and Period

The study was conducted in the intensive care unit (ICU) and the four medical wards of a referral hospital in the Copperbelt Province of Zambia. The institution has a capacity of 850 beds and provided a range of services that catered for in-patients and out-patients. Some of the services offered were medical care, surgical care, obstetrics, and gynaecology care. Data collection activities lasted for approximately 3 months.

Inclusion and Exclusion Criteria

All adults, 20 to 65 years of age on total nasogastric tube feeding in the previous 24hrs, who consented to participate and were admitted to the medical

wards and intensive care unit were included in the study. All participants that were receiving nasogastric tube feeds prepared outside the hospital were excluded from the study. This is because feeds prepared from outside the hospital would confound the findings of the study.

Sample size and Sampling Techniques

For the selection of individual study participants, all adult patients who satisfied the inclusion criteria and consented to participate were included in the study. A total of 129 patients were on NGTF, of which 123 patients were eligible to participate in the study. Of these, 117 consented to participate, out of which 4 had incomplete questionnaires. Data analysis was therefore conducted with 113 complete questionnaires. The referral hospital was purposively sampled among the four main tertiary hospitals in the country because of its speciality in treating adult illnesses. Further, medical wards and the intensive care unit were purposively sampled because they admitted most participants on nasogastric tube feeding.

Study Design

This was a hospital-based cross-sectional study, in which quantitative techniques were used in data collection, analysis and presentation. This paper is part of a larger study [15] in which information on the nutrient intake and nutrition status of all participants, was elicited. The data collection procedures used are explained in the following section.

Data Collection Procedure and Techniques

Voluntary informed consent was first sought from patients or close relatives in cases of advanced illness, thereafter data collection was conducted.

Face to Face Interviews

One-time face to face interviews was conducted at the wards with participants to obtain information on socio-economic and medical characteristics. The interviews were guided by a pretested questionnaire and were conducted by the researchers. The responses were recorded as they were obtained from participants. In cases of advanced illness, close relatives were interviewed on behalf of the patient. All filled questionnaires were checked and cleaned daily, then kept in a locked cupboard.

Review of Patient Medical Records on Nasogastric Tube Feeding

A patients' medical file was reviewed to obtain information on medical characteristics and volumes of feeds from fluid and feed balance charts for determination of the energy intake in the previous 24hrs. On the fluid and feed balance chart, only retained fluids were considered as intake and later used for the calculation of nutrient intake. It is important to note that patients on total nasogastric tube feeding in the study period exclusively received tube feeds.

Subjective Global Assessment of Patients on Nasogastric Tube Feeding

This assessment was conducted by the researchers assisted by the hospital clinician for collection of information on patients' nutrition status by asking the patient or the next of kin on their history on weight, dietary intake, gastrointestinal symptoms, functional capacity, metabolic stress and physical examination. The clinician collected information on gastrointestinal symptoms, stress classification, and physical examination (determining the patients' level of subcutaneous fat and muscles loss, presence of sacral oedema, ankle oedema, and ascites).

The researchers collected information on weight changes (asking changes in weight in the last 6 months) and dietary intake (asking and observing changes in the type of diet) then aggregated all points scored. The procedure was conducted once at the wards on every patient and took an average of 10 minutes. Both the researchers and the clinician had undergone training in the use of the Subjective Global Assessment tool in critically ill patients, before the study.

Anthropometric Measurements of Patients on Nasogastric tube Feeding

Mid-upper arm circumference of patients on nasogastric tube feeding Measurement.

The MUAC was measured twice by the researchers on the non-dominant arm of the participant at

the midpoint between the olecranon and acromial processes to the nearest 0.1cm. In cases of a difference of more than 0.2cm in the two measurements, the results were discarded and the measurement repeated [16].

Height of Patients on Nasogastric Tube feeding Measurement

Height was estimated by the researchers from the two consecutive measurements of the ulna length by the use of the abdominal girth tape. The tape was placed between the elbow (olecranon) and the mid-point of the prominent bone of the wrist (styloid process) to the nearest 0.5cm. In case of a difference of 0.2 cm or more in the two measurements, the results were discarded. The procedure was then repeated until a difference of less than 0.2cm was achieved. Height was estimated from the ulna length using the British Association of Parenteral and Enteral Nutrition (BAPEN) conversion tables [17].

The weight of Patients on Nasogastric Tube Feeding Measurements

Weight was determined on a weighing scale (Seca 813 Robust High-Capacity Digital Floor Scale). The researchers initially calibrated the scale before stepping in the middle of the weighing scale without shoes. The scale was further calibrated whilst standing on it to read zero. The patient was then lifted from bed by the nurse, with both arms and the weight of both the nurse and the patient were recorded to the nearest 0.01kg. The weight of the patient was then determined by calculating the difference between their weights combined and that of the nurse alone. The procedure was done once for every participant and was conducted by the researchers.

Pre-Testing of Instruments

The study instruments were pre -tested at the nearest referral hospital for accuracy and clarity before the main study. The procedures employed in pre-testing the instruments were identical to those used in the main study. The pre-test data collection was conducted twice at an interval of three days with participants of similar characteristics to those in the main study. A total of 10 patients participated in the pre -test. The participants in the pre-test were not included in the main study. After the pre-test, the data collection questionnaires were reviewed and modified.

Validity of Instruments

Validity was ensured by the use of already validated tools such as the SGA, BMI and MUAC tape recommended by the World Health Organization (WHO) [18]. Further, the questions used to determine the socio-economic characteristics were adopted from the Zambia Demographic and Health Survey (ZDHS). Registered medical practitioners were also consulted to make suggestions regarding the instruments before the actual study.

Reliability of Instruments

The test re-test method was used to test the reliability of the data collection tools. Data were collected twice from the same participants at an interval of three days and analyzed. A correlation coefficient of 0.88 (95% C.I; 0.78 – 0.95) was achieved between the two sets of data. A correlation coefficient of above 0.7 is usually considered adequate [19].

Data Analyses

The Statistical Package for Social Sciences (SPSS) version 25.0 was used for data entry, cleaning, and analysis. A total of 113 participants' data was analyzed. A p-value of less than 0.05 was used as the criterion for statistical significance. Descriptive statistics such as frequencies, percentages, means and standard deviations were used to describe the study population in terms of socio-economic and medical characteristics.

The nutrition status of patients was classified according to the subjective global assessment scores as well-nourished (<17 points), moderately malnourished (17 to 22 points) and severely malnourished (> 22 points) [1]. The MUAC was also used to classify patients nutrition status as well-nourished when more than 23cm, moderately malnourished (21-23cm) and severely malnourished (less 21cm) [18]. Ulna length was used to estimate height using the British Association of Parenteral and Enteral Nutrition conversion tables [17].

The estimated height that was derived from the ulna length was used to determine BMI classification of participants' nutrition status into underweight (under-nutrition) (<18.5 kg/m2), normal (18.5 -29.9 kg/m2), overweight (25-29.9 kg/m2) and obese (≥30kg/m2) [20\.

Bivariate analysis was used to establish associations between categorical and continuous variables such as nutrition status, medical and socio-economic characteristics.

Ethical Approval

Ethical clearance was obtained from Kenyatta University Ethics Committee (PKU/415/1384) in Kenya, and the Tropical Diseases Research Centre (TDRC) Ethics Committee (IRB registration number: 00002911) in Zambia. Authority to collect data was then obtained from the referral hospital's administration in Zambia. Written or thumb printed voluntary informed consent was sought from all participants. For those unable to give consent due to advanced illness, their relatives were requested to give informed consent. The participants' privacy and confidentiality were ensured by keeping their filled research questionnaires in a locked cupboard.

Further, their names or national identity numbers were not indicated on their questionnaires as unique codes were used instead. Research findings will be disseminated during clinical meetings at the hospital and other relevant forums to improve patients' nutrition diagnosis and management.

Results

A total of 113 in-patients with 82 admitted from the medical wards and 31 from the intensive care unit had their data fully collected and analysed.

Socio-Economic Characteristics

The mean age of participants was 42.6 ± 11.4 years *(Table 1)*. About a third (34.4%) of the participants were aged 40 to 49 years with the majority (73.5%) under the age of 50 years. More than half (57.5%) of the participants were females with the same percentage being married. Slightly less than a third (30.1%) had no formal education with only 4.4% having tertiary education. Almost half (46.9%) of the participants were casual workers with only 14.2% informal employment. Only 16.8% were self- employed, 6.2% were housewives and while 3.5% were students. A majority (76.1%) of participants had a monthly income of fewer than one thousand Kwacha (K), equivalent to one hundred United States dollars (USD).

Table 1: *Socio-Economic Characteristics of Patients on Total Nasogastric Feed.*

Characteristic	**N=113**	**Mean ± SD**
Age in complete years	n (%)	42.60 ± 11.38
20-29	20 (17.7)	
30-39	24 (21.2)	
40-49	39 (34.4)	
50-59	20 (17.7)	
60-65	10 (8.8)	
Total	**113 (100.0)**	
Sex		
Male	48 (42.5)	
Female	65 (57.5)	
Total	113(100.0)	
Marital status		
Married	65 (57.5)	
Single	21 (18.6)	
Divorced	16 (14.2)	
Widowed	11 (9.7)	
Total	**113(100.0)**	

Characteristic	N=113	Mean ± SD
Level of education		
None	34 (30.1)	
Not completed primary	41 (36.3)	
Completed primary	5 (4.4)	
Not completed secondary	13 (11.5)	
Completed secondary	15 (13.3)	
Attended tertiary	5 (4.4)	
Total	**113(100.0)**	
Occupation		
Casual worker	53 (46.9)	
Housewife	7 (6.2)	
Formal employment	16 (14.2)	
Self-employment	19 (16.8)	
Student	4 (3.5)	
Other	14 (12.4)	
Total	**113 (100.0)**	
Monthly income		
< 1000 Kwacha*	86 (76.1)	
1000 - 2000 Kwacha	14 (12.4)	
2001 - 5000 Kwacha	9 (8.0)	
>5000 Kwacha	4 (3.5)	
Total	**113(100.0)**	

**10 Kwacha* = *1USD*

Medical Characteristics

The provisional admission diagnosis for most patients was a septic shock (37.2%) followed by cardiac and central nervous diseases accounting for 17.7% (*Table 2)*. Other diagnoses were endocrine diseases (15.9%), renal (9.7%) and head injuries representing 7.1%. Few cases consisted of spinal cord injury and burns at 2.6% and 1.8% respectively. All patients did not have their nutrition diagnosis indicated in their medical records. A majority (56.6%) of participants were HIV positive.

The level of consciousness varied among participants, with an overall mean Glasgow coma scale (GCS) score of 10.45±4.8 points. A total of 46 participants (40.7%) were fully conscious of their GCS at 15 points. Further, 23% had their GCS below 5 points with 36.3% in semi-conscious states with GCS from 14 to 5 points. A majority of patients (52.2%) had spent more than 7 days in the hospital since admission, while 21.2% had spent less than 3 days in the hospital at the time of data collection.

Table 2: *Medical Characteristics of Patients on Nasogastric Tube Feeding*

Characteristic	**N= 113**
Provisional admission diagnosis	n (%)
Head injury	8 (7.1)
Spinal cord injury	3 (2.6)
Cardiac/CNS diseases	20 (17.7)
Endocrine diseases	18 (15.9)
Major surgery	9 (8.0)
Sepsis	42 (37.2)
Burns	2 (1.8)
Renal diseases	11 (9.7)
Total	**113 (100.0)**
HIV status	
HIV reactive	64 (56.6)
HIV non-reactive	40 (35.4)
Not indicated	9 (8.0)
Total	113 (100.0)
Glasgow coma scale (GCS)	
GCS mean ± SD	10.45 ± 4.8
< 5	26 (23.0)
5≥x<11	21 (18.6)
12≥x<15	20 (17.7)
15	46 (40.7)
Total	**113 (100.0)**
Length of stay (LOS)	
< 3 days	24 (21.2)
3-7 days	30 (26.5)
>7 days	59 (52.2)
Total	**113 (100.0)**

Nutrition Status (MUAC, SGA and BMI) of Patients on Total Nasogastric Feeds

The nutrition status was determined using MUAC, SGA scores and BMI. The overall mean for MUAC was 24.19 ± 6.06 cm (Table 3). The MUAC was further analyzed in categorical form. Results for MUAC indicated that 48.7% were severely malnourished, 13.3% were moderately malnourished and the well-nourished was 38.1%.

The mean for SGA scores was 21.10 ± 9.38 points

with 40.7% of the malnourished patients being severely malnourished whilst 35.4% were well-nourished *(Table 3)*. The maximum and minimum possible SGA points to attain were 40 points and 0 points respectively. Among the participants, one attained the maximum points of 40 points while the lowest scored 5 points. Almost a quarter (23%) of the patients had experienced diarrhoea in the past 2 days.

Ulna length was used to estimate height using the ulna-height conversion tables (Burr & Phillip, 1984). The estimated height and weight for each individual was then used to determine individual BMI (World Health Organization, 2004). The mean BMI was 21.09 ± 5.49 kg/m2 with 36.3% being under-weight (malnourished), 43.4% being normal, 13.3% overweight and 7.1% obese *(Table 3)*.

Table 3: *Nutrition Status (MUAC, SGA and BMI Categories) for Participants*

Variable	**n (%)**
Weight mean ± SD (kg)	59.38±18.35
Height mean ± SD (cm)	167.04±10.11
MUAC mean ± SD (cm)	24.19±6.06
MUAC categories	
Severely malnourished (<21 cm)	55 (48.7)
Moderately malnourished (21-22.9 cm)	15 (13.3)
Well-nourished (≥ 23 cm)	
Total (N)	43 (38.1)
Total	**113 (100.0)**
SGA scores mean ± SD points	21.10±9.38
SGA categories	
Severely malnourished (> 22 points)	46 (40.7)
Moderately malnourished (17 ≤ 22 points)	27 (23.9)
Well-nourished (< 17 points)	40 (35.4)
Total	**113 (100.0)**
BMI mean ± SD (kg/m2)	21.09±5.49
BMI categories (kg/m2)	
Under-weight (<18.5)	41 (36.3)
Normal (18.5 -24.9)	49 (43.4)
Over-weight (25 – 29.9)	15 (13.3)
Obesity (≥ 30)	8 (7.1)
Total	**113 (100.0)**

Relationship between nutrition status and energy intake of patients on nasogastric tube feeding

Participants' continuous data on nutrition status (MUAC, SGA and BMI) and energy intake were analysed using a linear regression model *(Table 4)*. Mid upper arm circumference, SGA and BMI were not significantly related to participants' energy intake ($p>0.05$).

Table 4: *Relationship Between Nutrition Status (MUAC, SGA and BMI) and Energy Intake of Patients on Nasogastric Tube Feeding*

Models	**R2**	***β***	**p-value**
MUAC model			
Total energy intake	0.00	0.01	0.913
Carbohydrate intake		1848.11	0.026
Protein intake		-2400.14	0.404
Fat intake		-2411.34	0.162
SGA model			
Total energy intake	0.02	-1.44	0.129
Carbohydrate intake		-23215.44	0.105
Protein intake		2727.01	0.338
Fat intake		3414.19	0.044
BMI model			
Total energy intake	0.02	0.15	0.117
Carbohydrate intake		15585.79	0.059
Protein intake		-3693.91	0.193
Fat intake		-2610.15	0.125

β: Standardized coefficient;R2: Regression coefficient.

Factors Associated with Malnutrition among Adults on Total Nasogastric Tube Feeding

Bivariate analysis was conducted to establish socio-economic and medical characteristics associated with nutrition status condensed into a dichotomous variable (undernourished and well-nourished). Participants' HIV status was significantly associated with MUAC.

The HIV-positive patients were 301 times more likely to be under-nourished compared to the HIV-negative (Odd ratio [OR]: 301.20; 95% C.I. [8.66 - 10466.48], p=0.002) *(Table 5*). Participants' age and length of hospital stay were however not associated with under-nutrition as determined by MUAC. Similarly, for participants, HIV status was significantly associated with SGA scores. The HIV-positive patients were 34 times more likely to be under-nourished as determined by SGA scores compared to the HIV-negative (OR: 34.03; 95% C.I. [14.34 – 35.32], p=0.004) *(Table 5)*. Participants' energy intake, age and length of hospital stay in hospital was however not associated with under-nutrition as determined by SGA scores. Participants' HIV status was also significantly associated with BMI. The HIV-positive patients were 100 times more likely to be under-nourished as determined by BMI, compared to the HIV-negative (OR: 100.00; 95% C.I. [0.00 - 112.72], p=0.003) *(Table 5)*. Participants' energy intake, age and length of hospital stay was however not associated with under-nutrition as determined by BMI.

Table 5. *Factors Associated with (MUAC, SGA and BMI) Malnutrition*

Independent Variable	**MUAC**	**p-value**	**SGA OR (CI, 95%)**	**p-value**	**BMI OR (CI, 95%)**	**p-value**
GCS	1.13 (0.93-1.37)	0.230	0.95 (0.84-1.08)	0.462	0.99 (0.88-1.14)	0.884
Age						
20-29years	0.19 (0.09-42.46)	0.161	0.58 (0.04-8.12)	0.688	0.48 (0.06-6.11)	0.281
30-39years	7.29	0.228	0.93	0.952	0.73	0.652
40-49years	3.23	0.451	0.43	0.464	0.37	0.664
50-59years	0.59 (0.03-14.09)	0.755	2.23 (0.24-20.76)	0.481	1.25 (0.39-18.75	0.581
60-65years [b]	1	1	1	1		
Ever attended school						
Yes	3.66 (0.37-36.32)	0.268	1.74 (0.46-6.56)	0.414	1.05	0.944
No [b]	1		1		1	
Place of residence						
Urban formal	2.62 (0.12-58.77)	0.543	0.79 (0.11-5.40)	0.807	0.43 (0.09-2.19)	0.313
Urban informal	0.26 (0.02-3.71)	0.323	1.18	0.872	0.31	0.180
Rural [b]	1		1		1	
HIV status						
Reactive	301.20 (8.67-446.48)	0.002*	34.03 (14.34-35.32)	0.004*	100.00	0.003*
Non-reactive	118.42 (3.92-3574.34)	0.060	0.13	0.119	(0.29-18.76)	
Unknown [b]	1		1		1	(0.06-1.71)

Independent Variable	MUAC	p-value	SGA OR (CI, 95%)	p-value	BMI OR (CI, 95%)	P-value
Length of stay (LOS)						
< 3 days	0.34	0.363	2.15	0.308	(0.05-2.72	
3-7days	1.37 (0.17-11.12)	0.766	3.04 (0.83-11.16)	0.094	3.51 (0.91-13.53)	
>7days [b]	1	.	1		1	
Place of admission						
Female medical wards	3.61 (0.87-9.45)	0.409	2.67	0.675	2.67	0.435
(1.37-6.45)				(0.16-8.61)		
Male medical wards	2.07 (1.09-6.42)	0.345	3.56 (2.03-7.82)	0.554	1.56 (0.23-23.12	0.654
Intensive care unit [b]	1		1		1	

The reference category is: Well-nourished.

[b] This parameter was set to zero because it was redundant.

*Statistically significant at p-values < 0.05.

GCS – Glasgow coma scale (0 to 15).

HIV – Human immunodeficiency virus. OR: Odds ratio.

Discussion

The ESPEN recommends comprehensive screening and assessment of all patients at admission and during their stay at the hospital [21]. Malnutrition screening and assessment tools that ESPEN recommends include the malnutrition universal screening tool (MUST), MUAC, and BMI. The American Society for Parenteral and Enteral Nutrition (ASPEN) further recommends the use of SGA in every hospital admission [22,23]. The use of MUAC, SGA and BMI simultaneously in determining nutrition status has been confirmed as adequate by studies conducted [21].

The fact that MUAC, BMI and SGA revealed significant under-nutrition levels is not unique to this study. Malnutrition among hospitalized patients was been observed frequently in most meta-analysis reviews [24,25]. Similar observations were made in Vietnam where over half of the patients were found to be malnourished using MUAC and BMI [26,27]. Further, other studies conducted by Blaauwet al.,, Sumantra et al., and Miyoba et al., observed significant malnutrition among hospitalised patients [12,14,28]. In a similar study conducted in Ethiopia among tuberculosis patients, prevalence rates of undernutrition were as high as 40% when BMI was used for assessment [13].

Other findings in Brazil detected similarly high prevalence rates of undernutrition among cardiac patients as the current study [29]. The fact that most patients in the current study were malnourished was expected because most patients were critically ill as classified by their GCS, therefore this could have partly influenced the nutrition status through changes in their metabolic system as well as low dietary intake which is common among these patients. In the larger study that this paper is based on, the macro -nutrient and micro-nutrient intakes were significantly less than the patients' requirements [15]. There is limited literature on the prevalence of undernutrition among patients on nasogastric tube feeds in sub-Saharan Africa and particularly in Zambia, therefore this study contributes to the evidence that under-nutrition among hospitalized patients is high in the sub-Saharan Africa region.

Undernutrition among hospitalized individuals implies that their admission medical conditions may worsen during their hospital stay [30]. Undernutrition is independently associated with poor immunological functions which may result in an individual's susceptibility to opportunistic infections [31]. Mortality worsens in hospitalized populations with a high prevalence of HIV and other infectious diseases [31]. Further, admitted undernourished individuals tend to stay longer in hospitals thus directly increasing the cost of medical care, affecting individuals' resources and their productive time. Prioritizing screening of malnutrition and early treatment among hospitalized patients in Zambia has been shown to result in positive hospital outcomes such as short hospital stays due to fast recovery from illness, reduced incidences of malnutrition and cost- saving by health facilities and individuals [12]. This study highlights the gaps in documentation of patients' nutrition status in a hospital setting.

A review conducted in England on 16 articles with emphasis on malnutrition in healthcare institutions found that factors associated with undernutrition were related to pre-admission conditions [11]. One important observation was that disease states were significantly related to undernutrition. In a study in Ethiopia, HIV reactive status, living in a rural area, and intestinal parasitic co-infections were significant factors associated with under-nutrition [32]. The current study also found patients' HIV status as a factor associated with malnutrition. However, the study acknowledges a limitation for not adjusting the effect of antiretroviral therapy (ARVT) on the HIV status of patients. Place of residence was, however, not associated with under-nutrition in the current study, unlike for the Ethiopian study. A similar study in Brazil identified risk factors related to malnutrition among 300 adult hospitalized participants [33].

The findings indicated that malnutrition was significantly associated with recent weight loss, apparent bony stature, diarrhoea, and inadequate energy intake. It was however observed that most of these factors related to malnutrition occurred during hospital admission. Malnutrition determined in hospitals as stated before usually originates from the community (before admission into hospital). It is important to acknowledge the complexity of the pathophysiology of malnutrition in hospitalized patients. In the current study, age, marital status, length of stay, and admission diagnosis were not predictors of malnutrition.

Considering the limited sampling frame, there was a limited sample size which made further inferences not possible. This study highlights the gaps in the documentation of participants' nutrition status at the health facility, which may provide relevant information for future management and diagnosis of patients on NGTF. Further, the study found a non-modifiable factor (HIV- positive status) as being associated with undernutrition among participants' on NGTF. We recommend that health facilities prioritize nutrition screening, assessment and management of all patients during medical care. This will ensure that patients are treated for malnutrition, despite the main contributing factor (HIV-status) being unchangeable. It may also imply that HIV- positive patients should be more keenly observed as the disease characteristics seem to put one at risk for malnutrition.

Conclusions

The prevalence of under-nutrition was high, based on MUAC, BMI and SGA, and was significantly associated with HIV status. Nutrition screening and monitoring for all hospitalized patients on NGTF should be encouraged and adopted as a policy for timely and consistent interventions that address these nutritional inadequacies.

Operational Definitions

- Naso-gastric Feed: Food prepared in the hospital given to patients through the nasogastric tube.
- Nutrition Status: In this study, nutrition status is assessed based on the mid-upper arm circumference (MUAC), subjective global assessment (SGA) scores and body mass index (BMI).
- Total Nasogastric Feeding: Patients being fed exclusively through the nasogastric route in the previous 24 hrs.

Abbreviations and Acronyms

ASPEN	American Society for Parenteral and Enteral Nutrition
ARVT	Antiretrol Viral Therapy
BAPEN	British Association for Parenteral and Enteral Nutrition

ESPEN	European Society for Clinical Nutrition and Metabolism.
ICU	Intensive Care Unit
K	Kwacha
NGTF	Nasogastric tube feeding
USD	United States Dollar
TDRC	Tropical Diseases Research Center
TNGTF	Total Nasogastric Tube Feeding
ZDHS	Zambia Demographic & Health Survey

Authors' contribution

OI: Study design, statistical analyses, data collection and writing.
NM: Study design: statistical analyses, data collection and writing.

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Conflicts of Interest

The authors declare no conflict of interest.

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