

Prevalence of Malnutrition Among Patients with Diabetes Mellitus Type 2 Admitted in a Tertiary Hospital

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Abstract

Introduction: Malnutrition is a state of deficiency of the proper micro and macronutrients to meet daily nutritional requirement. Hospital malnutrition is associated with higher infection, impaired wound healing, and increased morbidity and mortality, especially in patients with type 2 diabetes mellitus (T2DM).

Objectives: To determine the comprehensive baseline nutrition status of hospitalized patients and the prevalence of malnutrition in patients with T2DM in Makati Medical Center (MMC).

Methods: A prospective cross-sectional study involving T2DM patients admitted at MMC from October to December 2014. Malnutrition risk and status were assessed with Subjective Global Assessment (SGA) and clinical parameters.

Results: A total of 150 adults with T2DM were assessed with the Comprehensive Nutrition Assessment Form (CNAF) using SGA. Nutritional risk level showed 37% has moderate risk while 63% has high risk for malnutrition. Nutritional status showed that 55% has mild to moderate

malnutrition and 45% of patients have severe malnutrition. Factors significantly associated with high nutritional risk for malnutrition were SGA C ($P<0.001$), abnormal BMI-underweight and obese class2 ($P<0.001$), lower albumin ($P=0.005$) and lower total lymphocyte count ($P<0.001$). Factors associated to nutritional status were: weight change ($P=0.004$), functional capacity ($P=0.017$), disease and nutritional requirements ($P<0.001$), and presence of edema or ascites ($P=0.012$).

Conclusion: Malnutrition is highly prevalent in the acute hospital setting, 37% has moderate risk while 63% has high risk for malnutrition. While 55% has mild to moderate malnutrition and 45% of patients has severe malnutrition. Significant factors associated with malnutrition were SGA C, abnormal BMI, low albumin and low total lymphocyte count. Factors associated with severity of malnutrition were weight change, functional capacity, disease and nutritional requirements and presence of edema or ascites.

Keywords: Malnutrition, Comprehensive Nutrition Assessment Form, Subjective Global Assessment, Diabetes Mellitus type 2

Introduction

For many individuals with diabetes mellitus type 2 (T2DM), the most challenging part of the treatment plan is determining what to eat. The American Diabetes Association (ADA) Standards of Medical care 2014 and 2015 recognize the integral role of nutrition therapy in overall diabetes management and recommend that each person with diabetes should actively engage in self-management, education, and treatment planning with their health care provider.¹ It is also important that all members of the health care team be knowledgeable about diabetes nutrition therapy and support its implementation. Therefore, nutrition therapy is recommended for all people with T2DM as an effective component of the overall treatment plan.¹

Malnutrition is a broad term that can be used to describe any imbalance in nutrition- from over-nutrition to under-nutrition. World Health Organization (WHO) defines it as a state of deficiency of the proper micro and macronutrients to meet daily nutritional requirement.² It can develop as a consequence of deficiency in dietary intake, increased requirements associated with a disease state, from complications of an underlying illness such as poor absorption and excessive nutrient losses, or from a combination of these factors.² Malnutrition may cause complications and delayed healing process, especially in hospitalized patients.³ Hospital malnutrition is associated with negative outcomes for patients, including higher infection and complication rates, increased muscle loss, impaired wound healing, longer length of hospital stay and increased morbidity and mortality.⁴⁻⁵

Worldwide prevalence of malnutrition in the hospital setting has been widely documented in the literature to range from 38% to 52% (Table I) depending on the patient population, definition and criteria used for diagnosis.⁶⁻⁷ According to the prevalence of malnutrition survey in 2008 done by the Philippine Society of Parenteral and Enteral

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Nutrition (PHILSPEN), 48-53% of hospitalized patients in the country are malnourished (Table II). In another survey, the Philippine General Hospital showed 42% severe malnutrition rate. (Table III)⁸⁻⁹

Table I. Prevalence of Malnutrition Worldwide

Year	Author	Location	Prevalence
1974	Bistrian	US	50%
1977	Hill	England	44%
1979	Weinsier	US	48%
1984	Agradi	Italy	34%
1993	Larsson	Sweden	27%
1994	McWhirter	Scotland	40%
1995	Fernando	Philippines	48%
1997	Waitzberg	Brazil	47%

Table II. Prevalence of Hospital Malnutrition in the Philippines

Hospital	Prevalence
Philippine General Hospital (Manila)	42%
Amang Rodriguez Medical Center (Marikina)	54%
St. Luke's Medical Center (Quezon City)	37-48%
Mary Mediatrix Medical Center (Lipa, Batangas)	38-55%
The Medical City (Pasig City)	50%
Manila Doctors Hospital (Manila)	44%
Our Lady of Lourdes Hospital (Manila)	57%

Table III. Prevalence of Malnutrition State in the Philippines

Hospital	BMI < 18.5	BMI > 30	SGA 'C'
Philippine General Hospital (Manila)	-	-	42%
Amang Rodriguez Medical Center (Marikina)	38%	15%	-
St. Luke's Medical Center (Quezon City)	6%	12%	
Mary Mediatrix Medical Center (Lipa, Batangas)	48%		
The Medical City (Pasig City)	4%	14%	-
Asian Hospital Medical Center (Alabang)	8%	20%	-
Premere Medical Hospital (Cabanatuan City)	15%	9%	-

T2DM is one of the most prevalent endocrine pathologies in the general population being especially prevalent in the adult working and geriatric age groups. A multicenter study in Spanish hospitals (PREDiCES) has been published showing that the prevalence of malnutrition at

admission was 23% composed of 22.6% diabetic patients and 55% were elderly over 64 years old. T2DM diagnosed before admission was associated with a higher probability of being malnourished —with prevalence of 30.1%.¹⁰ Locally, a study by Fernando et. al. showed that the prevalence of malnutrition among hospitalized patients was 48%.⁸ However, currently there is no local report about the prevalence of malnutrition among hospitalized diabetic patients.

The Joint Commission International (JCI) mandates performing nutrition risk screening within 24 hours of admission. It is identifying patients with characteristics commonly associated with nutritional problems that may require comprehensive nutrition assessment as recommended by the ADA.¹¹ Patients identified through screening as 'at risk' are subsequently referred for further nutritional assessment, usually performed by a dietitian. Nutrition assessment is a comprehensive approach to defining nutritional status using medical, nutritional, physical examination, anthropometric measurements and laboratory data.¹²⁻¹³ It is a diagnostic tool to determine one's current nutritional status.

The American Society of Parenteral and Enteral Nutrition (ASPEN) recommends the use of Subjective Global Assessment (SGA) tool because it is simple, valid, noninvasive, applicable, and correlates significantly with some nutritional parameters. It is a clinical technique to assess nutritional status that uses patient's history and physical examination to make the assessment.¹⁴⁻¹⁵ It assesses nutrition status via completion of a questionnaire and allows for malnutrition diagnosis, and classifies patients as either: A well-nourished; B mildly/moderately malnourished; or C severely malnourished.¹⁵

Patient's nutritional status is an important indicator of quality care in the institution especially the hospital. The need for systems that will improve patient care through inclusion of an effective nutritional management program has become an issue in the Philippine hospital care set up where efficient utilization of resources is recognized to be a key in maintaining hospital operations together with achieving optimum outcomes in patient care.⁸

Objectives

To determine the comprehensive baseline nutrition status and the prevalence of malnutrition in hospitalized T2DM patients in Makati Medical Center (MMC).

Methodology

This is a prospective cross-sectional study involving Filipino patients with T2DM aged 19 years old and above who was admitted at Makati Medical Center from October to December 2014.

A. Study Subjects

Total number of patients was done by recruitment of study subjects that was initially screened by the admitting nurse then referred for nutritional assessment.

Inclusion Criteria:

1. Patients 19 years old and above hospitalized within the last 24-72 hours.
2. Diagnosed as T2DM based on the American Diabetes Association (ADA) Criteria for the diagnosis of diabetes before admission.

Exclusion Criteria:

1. Newly diagnosed T2DM during admission.
2. History of long term intake of drugs that can affect glucose metabolism such as steroids and beta adrenergic agonists
3. Initial presentation of diabetic ketoacidosis.
4. History of long term/medical/surgical conditions that may affect glucose metabolism, such as acromegaly, cushing's syndrome and post pancreatectomy.
5. Patients admitted for executive check up with T2DM.

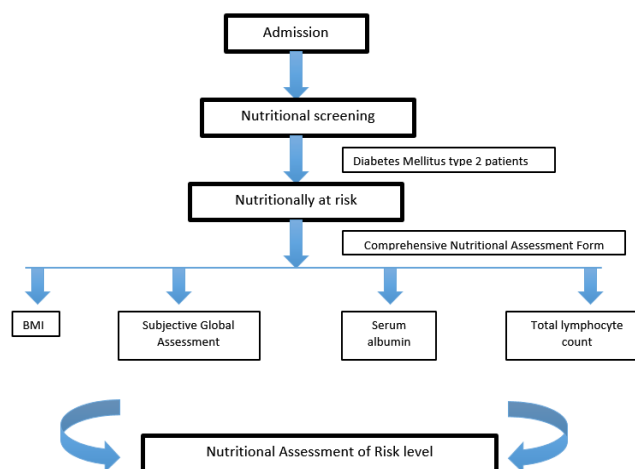
Patients admitted with T2DM were recruited in the study after nutritional screening done (Appendix 1) by the admitting nurse in each hospital unit and is referred to the Nutrition support team. Upon recruitment, control number is randomly assigned then informed consent is given and signed by patients. The clinical profile: age, gender, duration of T2DM, past medical history (hypertension, cardiovascular disease, stroke, foot ulcer, chronic kidney disease, dyslipidemia), smoking in pack years, family history of diabetes mellitus, DM medications (insulin or oral hypoglycemic agents), HbA1c level, and diabetic complications were all recorded in a data collection tool (Appendix 2).

The nutritional evaluation was carried out with the use of the Comprehensive Nutrition Assessment Form (CNAF) (Appendix 3) done by a licensed and trained nutritionist within 24-72 hours of hospital admission. This is validated tool used by Makati Medical Center since 2012 for evaluation of malnutrition. It is a clinical technique to assess nutritional status that used patient's history and physical examination to make the assessment.¹⁴⁻¹⁵ The following criteria were evaluated: any weight change over the past six months, oral nutrition intake in the last one to two weeks, gastrointestinal symptoms - if with nausea, vomiting, diarrhea and anorexia daily for at least two weeks, changes in functional capacity - if with impairment of strength or loss of usual activity, disease and its relation to disease requirements - presence of comorbidities, assessment of fat and muscle stores by examining areas with (1) loss of subcutaneous fat below the eye, triceps skinfold and biceps skinfold or (2) muscle wasting in the scapula, temple, clavicle, shoulder, knee,

calf, quadriceps and interosseous muscle and presence of edema and ascites.¹⁶ This tool classified patient according to Subjective Global Assessment (SGA) and the overall scoring of A (well-nourished), B (mild or moderately-malnourished), and C (severely-malnourished) were decided depending on the most predominant score (A, B, or C) in the different parts of the SGA.

The nutritional risk for malnutrition was also evaluated by the following parameters - SGA, body mass index (BMI), level of albumin and total lymphocyte level. With this parameters patients were classified to low, moderate or high risk for malnutrition. All the anthropometric and clinical parameters and SGA grades were obtained by a qualified clinical dietitian licensed and trained in answering the CNAF to minimize errors of measurement.

Figure 1. Method of Data Collection



Definition of Terms

- Malnutrition -using the Subjective Global Assessment (SGA) tool by identifying data on weight change, dietary intake change, gastrointestinal symptoms, changes in functional capacity, assessment of fat and muscle stores and the presence of edema and ascites, and with score of SGA B or C.
- Comprehensive Nutrition Assessment Form (CNAF) - clinical technique to assess nutritional status that used patient's history and physical examination to make the assessment.¹⁴⁻¹⁵
- Nutritional risk for Malnutrition - patients were classified to low, moderate or high risk for malnutrition using clinical parameters of SGA, BMI, level of albumin and total lymphocyte count.
- Total lymphocyte count - a measurement of malnutrition computed by $WBC \times \% \text{ lymphocytes}$.

Statistical Analysis

Clinical characteristics of the patients were described using frequency and percentage, mean and standard deviation, median and range. Independent *t* test was used to analyze age and HbA1c across BMI ranges. Chi square analysis was applied to gender, oral hypoglycemic medications, smoking history, family history of T2DM, comorbidities, complications of diabetes, nutritional risk level, and malnutrition status. Duration of having diabetes was treated with Mann Whitney U test. Post hoc analyses were performed to compare BMI categories against one another, and clinical profiles by nutritional risk level and malnutrition severity. Null hypotheses were rejected at 0.05 α -level of significance. STATA v12.0 was used for data analyses.

Results

A total of 150 adults with T2DM were included in the study (Table IV). The study population had a mean age of 63 years old and composed of 55% males (*n* = 82) and 45% females (*n* = 68). All the 150 patients that were assessed with the CNAF used the SGA have either moderate or high risk and mild/moderate or severe malnutrition. Nutritional risk level showed 37% has moderate risk while 63% has high risk for malnutrition. Nutritional status showed 55% has mild to moderate malnutrition and 45% of patients have severe malnutrition.

Majority of both male and female patient groups were obese class 1, at 61% (36 of 59) and 39% (23 of 59), respectively (Table V). Mean age was significantly different across BMI ranges (*P* = <0.001), with normal weight subjects having the oldest population (71.5 years) and the obese class 3 having the youngest (51.3 years). Highest percent of males were found in underweight (67%) and for females were obese class 3 (67%). Normal and obese class 1 groups were similar at having the longest median duration since a diagnosis of diabetes, at 10 (range: 1–40) years. Those on insulin ranged from 33% in the underweight group to 67% in obese class 3. Six to seven out of 10 patients were on oral hypoglycemic agents across all BMI classes, except in obese class 3 where its use was 100%. Overweight subjects had the highest mean HbA1c (8.5%), while those in both extremes of BMI range had the lowest values (both 7.2%).

On investigation of past medical and personal social histories, the highest percent of smokers were in the underweight (50%) and overweight (31%) groups (Table VI). Underweight patients were recorded to have the greatest pack-years of smoking (median:56, range:10–100). Hypertension consistently ranked first as the most common comorbidity across all BMI categories, followed in frequency by past medical history of cerebrovascular and chronic kidney diseases. The overweight group had the highest

Table IV. Baseline characteristics of the study population.

	Frequency (%); Mean $\pm$ SD; Median (Range)
Age	63.07 $\pm$ 14.13
Height	161.3 $\pm$ 8.87
Weight	68.82 $\pm$ 14.94
BMI	26.38 $\pm$ 5.2
Sex	
Male	82 (55)
Female	68 (45)
DM duration in years	10 (1-40)
Past Medical History	
Hypertension	112 (75)
Cardiovascular Disease	50 (33)
Stroke	17 (11)
Foot ulcer	9 (6)
Chronic Kidney Disease	37 (25)
Dyslipidemia	22 (15)
Smoking history (Pack years)	14.5 (1-120)
DM Medications	
Insulin	73 (49)
Oral hypoglycemic	95 (63)
HbA1c	8.14 (207)
DM Complications	
Nephropathy	62 (41)
Coronary Artery Disease	40 (27)
Cerebrovascular Disease	26 (17)
Peripheral vascular disease	10 (7)
Nutritional risk level	
Low Risk	0 (0)
Moderate Risk	55 (37)
High Risk	95 (63)
Nutritional Status	
Normal	0 (0)
Mild/ Moderate malnutrition	82 (55)
Severe malnutrition	68 (45)
Family history of DM	75 (50)

proportion of patients with diabetic complications of nephropathy (54%), coronary artery (38%), and cerebrovascular (27%) diseases. Peripheral vascular disease and family history of diabetes mellitus were found in highest percentages in obese class 3 (33%) and normal BMI (58%) patients, respectively.

Nutritional risk level varied significantly by patient BMI (*P* = <0.001). Moderate risk was highest in proportion in the overweight group (58%), while all subjects in both extremes of BMI range were assessed with high nutritional risk (Table VII). On the other hand, significant differences in malnutrition were at borderline (*P* = 0.050). Moderate malnutrition was found highest in the obese class 3 (100%), followed by overweight (62%) and obese class 1 (61%). Severe malnutrition was highest among underweight patients (83%) and obese class 2 patients (64%).

Table V. Clinical Profile of Adult Type 2 Diabetes Patients Seen in a Private

	Body Mass Index						<i>P</i>
	Underweight <18.5 (<i>n</i> = 6)	Normal <18.5 (<i>n</i> = 6)	Overweight 23–24.99 (<i>n</i> = 26)	Obese Class1 25–29.99 (<i>n</i> = 59)	Obese Class2 30–39.99 (<i>n</i> = 25)	Obese Class3 >40 (<i>n</i> = 3)	
	Mean $\pm$ SD; Frequency (%); Median (Range)						
Age ^a (years)	69.8 $\pm$ 13.0	71.5 $\pm$ 13.0*§	66.77 $\pm$ 12.8¶	60.1 $\pm$ 13.0*	55.7 $\pm$ 12.4§¶	51.3 $\pm$ 23.7	<0.001
Gender ^b							0.68
Male, <i>n</i> = 82	4 (67)	16 (52)	14 (54)	36 (61)	11 (44)	1 (33)	
Female, <i>n</i> = 68	2 (33)	15 (48)	12 (46)	23 (39)	14 (56)	2 (67)	
Duration of diabetes ^c (years)	8 (1-20)	10 (1-40)	6.5 (1-24)	10 (1-40)	7 (1-40)	2 (2-25)	0.95
Anti-diabetic medications ^b							
Insulin, <i>n</i> = 75	2 (33)	16 (52)	13 (50)	30 (51)	12 (48)	2 (67)	0.96
Oral hypoglycemic, <i>n</i> = 95	4 (67)	19 (61)	17 (65)	36 (61)	16 (64)	3 (100)	0.85
HbA1c ^a (%)	7.2 $\pm$ 0.9	7.8 $\pm$ 1.8	8.5 $\pm$ 2.4	8.3 $\pm$ 2.3	8.2 $\pm$ 1.7	7.2 $\pm$ 0.9	0.60

Values with the same superscripted marks (* § ¶) are statistically different.

Statistical methods used were: ^a---independent t test; ^b---chi square analysis; ^c---Mann-Whitney U test. *P*-value in boldface is significant at .05 α -level of significance.

Results of post hoc analyses for mean age between BMI categories revealed that the normal BMI group differed significantly from each of the obese class 1 (*P* = 0.002) and obese class 2 (*P* = 0.000) groups (Table VIII). Statistically significant difference was likewise revealed between overweight and obese class 2 subjects (*P* = 0.043).

Using the Comprehensive Nutritional Assessment Form (CNAF), the nutritional risk level and status of the patients were further evaluated. The results showed that all of the clinical parameters significantly differed between the groups and all has significant association to malnutrition (Table IX). The moderate risk group had higher proportions of better health states than the high nutritional risk group: SGA B (100% vs. 36%, respectively); normal BMI (51% vs. 28%, respectively); albumin of >3.40 g/dL (98% vs. 79%, respectively); and total lymphocyte count of above 1500/ μ L (84% vs. 54%, respectively). While patients with high nutritional risk showed has SGA C (64%), abnormal BMI (underweight 35% and overweight 37%), lower albumin levels and low total lymphocyte count.

The clinical profile of diabetic patients with malnutrition were different between the mild/moderate and severe malnutrition groups. The results showed the significant factors associated to nutritional status were patterns in weight loss, functional capacity, disease and nutritional requirements, and presence of edema or ascites (Table X). The moderately malnourished group (*N* = 82) had a higher percentage with no weight loss when compared to the severely malnourished group (*N* = 68) (91 % vs. 76%). The former group also had more with no reported functional impairment than the latter (16% vs. 6%), and less bedridden members (0% vs. 6%). Moderate stress was most common in the moderately malnourished (94%), while the severely malnourished mostly had severe stress (78%). The moderately malnourished patients also had a higher percentage of no edema or ascites than the severely malnourished (95% vs. 82%).

Discussion

Malnutrition is prevalent around the world and is a burden on patients and health care facilities.¹⁵ Despite numerous advances in medicine and clinical care, the simple correction of a patient's nutritional status appears to be overlooked or not considered as a sufficient medical priority. A nutritional evaluation on admission in hospitalized patients has a great impact on patient's outcome and healthcare costs, this is supported by several studies and societies recommendations.^{10,13} A higher risk of malnutrition has been seen in diabetic patients compared with non-diabetics⁹ however the prevalence of malnutrition and its clinical profile in diabetic patients admitted to acute care facilities is still unknown.

In the study, mean age was significantly different across BMI ranges (*P* < 0.001), with normal weight subjects having the oldest population (71.5 years) and the obese class III having the youngest (51.3 years). In a study by lvarez et al, on hospitalized elderly patients, the mean BMI was 24.3 kg/m² however, the prevalence of diabetes in the studied subjects was not described.¹⁰ Type 2 diabetes is associated with being overweight and obese, and then it is expected to find our diabetic patients, though suffering some level of malnutrition, with higher BMI than those without diabetes.

Patients on insulin ranged from 33% in the underweight group to 67% in obese class 3. Overweight subjects had the highest mean HbA1c (8.5%), while those in both extremes of BMI range had the lowest values (both 7.2%). Hypertension consistently ranked first as the most common comorbidity across all BMI categories, while the overweight group had the highest proportion of patients with diabetic complications of nephropathy (54%), and coronary artery (38%), and cerebrovascular (27%) diseases.

In our study, all the 150 admitted diabetic patients that were assessed with the CNAF that used the SGA as recommended by The American Society of Parenteral and Enteral Nutrition (ASPEN)¹⁴

Table VI. Medical and Personal Social Histories of Adult Type 2 Diabetes Patients, by Body Mass Index (N = 150)

	Body Mass Index						<i>P</i> *
	Underweight <18.5 (<i>n</i> = 6)	Normal <18.5-22.99 (<i>n</i> = 31)	Overweight 23–24.99 (<i>n</i> = 26)	Obese Class1 25–29.99 (<i>n</i> = 59)	Obese Class2 30–39.99 (<i>n</i> = 25)	Obese Class3 >40 (<i>n</i> = 3)	
	Frequency (%) or Median (Range)						
Smoking history, <i>n</i> = 46	3 (50)	8 (26)	10 (38)	18 (31)	6 (24)	1 (33)	0.75
Pack-years	56 (10 100)	15 (5 40)	35 (5 70)	12 (1 120)	7.5 (1 40)	4 (4 4)	0.23
Comorbidities							
Hypertension, <i>n</i> = 112	3 (50)	23 (74)	22 (85)	39 (66)	23 (92)	2 (67)	0.09
Cerebrovascular disease, <i>n</i> = 50	1 (17)	12 (39)	10 (38)	22 (37)	4 (16)	1 (33)	0.39
Stroke, <i>n</i> = 17	0 (0)	4 (13)	4 (15)	8 (14)	1 (4)	0 (0)	0.66
Foot ulcer, <i>n</i> = 37	0 (0)	1 (3)	0 (0)	4 (7)	3 (12)	1 (33)	0.15
Chronic kidney disease, <i>n</i> = 37	0 (0)	12 (39)	5 (19)	14 (24)	6 (24)	0 (0)	0.25
Dyslipidemia, <i>n</i> = 22	1 (17)	4 (13)	3 (12)	9 (15)	4 (16)	1 (33)	0.95
DM Complications							
Nephropathy, <i>n</i> = 62	0 (0)	14 (45)	14 (54)	23 (39)	11 (44)	0 (0)	0.14
Coronary artery disease, <i>n</i> = 40	0 (0)	8 (26)	10 (38)	18 (31)	4 (16)	0 (0)	0.22
Cerebrovascular disease, <i>n</i> = 26	0 (0)	6 (19)	7 (27)	10 (17)	3 (12)	0 (0)	0.53
Peripheral vascular disease, <i>n</i> = 10	0 (0)	2 (6)	1 (4)	3 (5)	3 (12)	1 (33)	0.35
Family history of diabetes, <i>n</i> = 75	3 (50)	18 (58)	12 (46)	29 (49)	13 (52)	0 (0)	0.55

*Chi square analysis was used for all variables except for pack-years, which was treated by Mann-Whitney U test.

§The % values are proportions of the total per BMI range.

Table VII. Nutritional Risk and Malnutrition Status of Adult Type 2 Diabetes Patients, by BMI (N = 150)

Body Mass Index							P *
	Underweight <18.5 (n = 6)	Normal <18.5-22.99 (n = 31)	Overweight 23–24.99 (n = 26)	Obese Class1 25–29.99 (n = 59)	Obese Class2 30–39.99 (n = 25)	Obese Class3 >40 (n = 3)	
Frequency (%) or Median (Range)							
Nutritional risk	0 (0)	13 (42)	15 (58)	26 (44)	1 (4)	0 (0)	<0.001
Moderate, n = 55	6 (100)	18 (58)	11 (42)	33 (56)	24 (96)	3 (100)	
High , n = 95							
Malnutrition	1 (17)	17 (55)	16 (62)	36 (61)	9 (36)	3 (100)	0.050
Mild/Moderate, n = 82	5 (83)	14 (45)	10 (38)	23 (39)	16 (64)	0 (0)	
Severe, n = 68							

*Comparisons were made by chi square analysis.

P-values in boldface are significant at .05 α -level of significance.

Table VIII. Post-Hoc Analyses Between BMI Categories (N = 150)

	Mean Difference	P *
<18.5 (underweight)	1.683	1.00
18.5 to 22.99	to 3.064	1.00
23 to 24.99	-9.782	1.00
25 to 29.99	-14.153	0.28
30 to 29.99	-18.500	0.71
>40		
18.5 to 22.99 (normal)	-4.747	1.00
23 to 24.99	-11.465	0.002
25 to 29.99	-15.836	0.000
30 to 29.99	-20.183	0.17
>40		
23 to 24.99 (overweight)	-6.718	0.46
25 to 29.99	-11.089	0.043
30 to 29.99	-15.436	0.82
>40		
25 to 29.99 (obese class I)	-4.371	1.00
30 to 29.99	-8.718	1.00
>40		
30 to 29.99 (obese class II)	-4.347	1.00
>40		

*P-values in boldface are significant at .05 α -level of significance.
 BMI of >40 kg/m² is under WHO category of obese class III.

Table IX. Clinical Profiles By Nutritional Risk Levels (N = 150)

	Moderate Nutritional Risk (N = 55)	High Nutritional Risk (N = 95)	P *
	Frequency (%)		
SGA^a			
B	55 (100)	34 (36)	<0.001
C	0 (0)	61 (64)	
Body mass index^b			
<18.5 (underweight)	0 (0)	33 (35)	<0.001
18.5 to 24.9 (normal)	28 (51)	27 (28)	
25.0 to 29.9 (overweight)	27 (49)	35 (37)	
Albumin^b (g/dL)			
>3.40	54 (98)	75 (79)	0.005
2.50 to 3.40	1 (2)	15 (16)	
<2.50	0 (0)	5 (5)	
Total lymphocyte count^b (per μL)			
<900	0 (0.0)	18 (19)	<0.001
900 to <1500	9 (16)	26 (27)	
>1500	46 (84)	51 (54)	

Statistical methods used were: a---Fisher's exact test; b---chi square analysis.
 P-values in boldface are significant at .05 α -level of significance.

Table X. Clinical Profiles By Malnutrition Severity (N = 150)

	Moderate Malnutrition (N = 82)	Severe Malnutrition (N = 82)	P *
	Frequency (%)		
Weight loss^b			
None	75 (91)	52 (76)	0.004
10% or less	7 (9)	8 (12)	
More than 10%	0 (0)	8 (12)	
Oral nutrition^b			
Little or no change	57 (70)	38 (56)	0.148
Sub-optimal	25 (30)	29 (43)	
Starvation of >5 days	0 (0)	1 (1)	
Gastrointestinal symptoms^b			
None	77 (94)	61 (90)	0.123
Nausea	2 (2)	0 (0)	
Vomiting	3 (4)	7 (10)	
Functional capacity^b			
No change	13 (16)	4 (6)	0.017
With dysfunction	69 (84)	60 (88)	
Bedridden	0 (0)	4 (6)	
Disease and nutritional requirements^b			
None	5 (6)	2 (3)	<0.001
Moderate stress	77 (94)	13 (19)	
Severe stress	0 (0)	53 (78)	
Physical examination^a			
Little or no depletion in most	79 (96)	61 (90)	0.186
Mild to moderate	3 (4)	7 (10)	
Edema or ascites^a			
None	78 (95)	56 (82)	0.012
Mild	4 (5)	12 (18)	

Statistical methods used were: a---Fisher's exact test; b---chi square analysis.
 P-values in boldface are significant at .05 α -level of significance.

have either moderate or high risk and mild/moderate or severe malnutrition. Nutritional risk level showed 37% has moderate risk while 63% has high risk for malnutrition. Nutritional status showed 55% has mild to moderate malnutrition and 45% of patients have severe malnutrition. Recently, a Spanish nationwide, multicenter study in hospitals (PREDeCES) has been published. The prevalence of malnutrition at admission was 23%, composed of 22.6% diabetics patients, and 55% elders over 64 years were included. Unlike ours, the Nutritional Risk Screening 2002 (NRS 2002) tool -proposed by ESPEN as a screening tool in hospitals was used to assess nutritional status.¹⁰

The results showed that the factors significantly associated with high nutritional risk for malnutrition were SGA C (P<0.001), abnormal body mass index- underweight and obese class 2 (P<0.001), lower albumin (P=0.005) and lower total lymphocyte count (P<0.001). As expected, the mean plasma albumin level was greater in patients with moderate risk nutrition status (more than 3.4 g/dl) than in high

risk (less than 2.5 g/dl). Therefore, patients with high nutrition risk level also had a higher level of visceral protein depletion. This component of protein malnutrition may be related to the effect of the acute disease that led to hospitalization. A significant correlation between malnutrition and serum albumin has also been described in other studies.¹⁶ Patients with high nutritional risk also have a low total lymphocyte count that was also seen in a study by Gunarsa et al, where there is an association between malnutrition and total lymphocyte count less than 1200.¹⁷ Also, factors associated with nutritional status or severity of malnutrition were the following: weight change ($P=0.004$), functional capacity ($P=0.017$), disease and nutritional requirements ($P<0.001$), and presence of edema or ascites ($P=0.012$).

Conclusion

Malnutrition is highly prevalent in the acute hospital setting, 63% of T2DM hospitalized patients has high risk for malnutrition and 45% has severe malnutrition. Significant factors associated with malnutrition were SGA C, abnormal BMI, low albumin and low total lymphocyte count. Factors associated with severity of malnutrition were weight change, functional capacity, disease and nutritional requirements and presence of edema or ascites.

Therefore, this study emphasized the importance of evaluating the nutritional status in admitted T2DM patients because this simple evaluation will estimate the severity of the problem and may help develop more strategies on nutrition intervention and have good patient outcome.

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Appendix 1. Nutrition Screening (Questionnaire upon admission of patients on the chart)

NUTRITION SCREENING		
Instruction: Please answer all of the following questions: Reference: World health Organization		
	YES	NO
1. Is the BMI < 18.5 or > 30?	☐	☐
2. Has the patient lost weight within last three (3) months?	☐	☐
3. Did the patient have reduced dietary intake in the last week?	☐	☐
4. Is the patient severely ill? (e.g. with diabetes mellitus, hip fracture, chronic disease with acute Complications, cancer, major surgery, bone marrow transplant, head injury, ICU patients)	☐	☐
NOTE: One "yes" answer is enough to categorize the patient as "Nutritionally at Risk"		
☐ Nutritionally at risk, kindly notify the Clinical Dietician for further assessment.		

Appendix 2. Data collection tool for baseline characteristics of study populationPatient Control No: **INFORMED CONSENT**

Has the subject freely given written informed consent?

NO

☐

YES

☐**DEMOGRAPHIC DATA**

Age (yrs):

Sex:

Male

Female

☐☐

Height (cm):

BMI:

Weight (kg):

SMOKING HABITS

Does the subject smoke or use tobacco products?

NO

☐

YES

☐

How many cigarettes do they smoke in pack years:

Other, please specify

PAST MEDICAL HISTORY

	Past Medical History	YES	NO
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1	Hypertension		
2	Cardiovascular Disease		
3	Stroke/Cerebrovascular Disease		
4	Foot ulcer		
5	Chronic Kidney Disease		
6	Dyslipidemia		

Prevalence of Malnutrition among patients with Diabetes Mellitus type 2 Admitted in a Tertiary hospital

Myl R. Cabangon, Carolyn Narvacan-Montano, Maria Leonora Del Rosario-Capellan,
Ma. Luisa Campos-Cagingin

Patient Control No:

DIABETES MELLITUS HISTORY

Duration of DM in yrs:

Oral Hypoglycemics ☐

DM Medications: Insulin ☐

HBa1C:

DIABETES MELLITUS FAMILY HISTORY

Family History: NO ☐ YES ☐

DIABETES MELLITUS COMPLICATIONS

	DM Complications	YES	NO
1	Nephropathy		
2	Coronary Artery Disease		
3	Cerebrovascular Disease		
4	Peripheral Vascular Disease		

NUTRITIONAL RISK LEVEL

	Nutritional Risk Level	YES	NO
1	Low Risk		
2	Moderate Risk		
3	High Risk		

NUTRITIONAL RISK LEVEL

	Nutritional Status	YES	NO
1	SGA A Normal		
2	SGA B Mild/Moderate Malnutrition		
3	SGA C Severe Malnutrition		

Appendix 3. Comprehensive Nutritional Assessment Form (CNAF).



MAKATI MEDICAL CENTER

(To Clinical Dietitian involved in patient's care: Enter information / findings as elicited from patient. Indicate with a % mark on the tick boxes if item applies. Write "N/A" if item does not apply.)

Patient's Name (Last, First, Middle)

☐ ASSESSMENT

☐ REASSESSMENT

Room Number

Age

Sex

Date of Birth

Hospital Number

☐ M ☐ F

Attending Physician

Date of Admission

Height (cm)

Usual Weight(kg)

Current Weight(kg)

Body Mass Index (kg/m²)

Diet Prescription:

Clinical Diagnosis:

CRITERIA		NORMAL		MILD/MODERATE		SEVERE
Weight Change	☐	None	☐	10% or less Weight loss	☐	More than 10% Weight loss
Oral Nutrition Intake (last 1-2 weeks)	☐	Little or No change	☐	Sub-optimal	☐	Starvation more than 5 days
Gastrointestinal Symptoms (more than 2 weeks)	☐	None	☐	Nausea	☐	Vomiting(daily) Diarrhea (more than 5 times daily), Anorexia
Functional Capacity	☐	No change	☐	Dysfunction more than 3 weeks, sub-optimal work, Bedridden less than 2 weeks	☐	Bedridden more than 2 weeks
Disease and its relation to nutritional requirements	☐	None	☐	Moderate stress	☐	Severe stress
Physical Examination	☐	Little or no depletion in most or all areas	☐	Mild to moderate depletion in some areas	☐	Severe depletion in most or all areas
Edema/Ascites	☐	None	☐	Mild to moderate	☐	Severe

Subjective Global Assessment Grade	0 ☐	A	1 ☐	B	3 ☐	C
Body Mass Index (kg/m ²)	0 ☐	18.5 – 24.9	1 ☐	25-29.9	2 ☐	Less than 18.5 or more than 30
Albumin (g/dL)	0 ☐	More than 3.4	1 ☐	2.5-3.4	2 ☐	Less than 2.5
Total Lymphocyte Count	0 ☐	More than 1500	1 ☐	Equal to 900 to Less than 1500	2 ☐	Less than 900
Total Score						

NUTRITION RISK LEVEL

0 ☐ (Level 1) LOW RISK
 1-2 ☐ (Level 2) MODERATE RISK
 Equal or greater than 3 ☐ (Level 3) HIGH RISK

NUTRITIONAL STATUS

SGA A ☐ Normal
 SGA B ☐ Moderate Malnutrition
 SGA C ☐ Severe Malnutrition

Printed Name of RND/Clinical Dietitian:

Signature:

Date: _____

Time: _____