

# Disease-related adult malnutrition in tertiary health care settings in Sri Lanka

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## Abstract

**Background:** Despite availability of high end medical advances in tertiary care settings, diseases related malnutrition (DRM) have emerged worldwide. Published studies revealed prevalence of malnutrition in Sri Lanka ranged from 24-74%. This study aimed at screening for malnutrition using anthropometry to determine the prevalence in patients admitted to the tertiary care settings.

**Methods:** A cross-sectional cluster study was conducted in randomly selected 6 tertiary care settings among 774 adults patients admitted from 25<sup>th</sup> October to 28<sup>th</sup> November 2016. DRM was defined as body mass index (BMI) less than 18.5kg/m<sup>2</sup> and mid upper arm circumference (MUAC) less than 22cm in women and 23cm in men.

**Results:** Mean age was 52.5 (SD=15.5) years and 51.6% were male. Mean BMI and MUAC was 22.1 (SD=5.2)kg/m<sup>2</sup> and 26.1 (SD=4.5)cm. The prevalence of severe malnutrition and overweight/obesity was 9.2% and 28.1% respectively. The prevalence of DRM was 25.9% (BMI definition) and 21.0% (MUAC definition). Significantly high level of DRM was observed in men and ≥70 years. Malnutrition was most common among patients with pulmonary diseases. MUAC and BMI correlated significantly ( $r=0.87$ ;  $p=0.000$ ) and malnutrition by the two methods showed good agreement ( $k=0.69$ ;  $p=0.000$ )

**Conclusions:** One fourth of patients are admitted to tertiary care hospitals had DRM. MUAC can be utilized as a screening tool to identify the patients after admission. Nutrition screening and assessment should be integrated in the routing care plan of patients to prevent further deterioration.

## Introduction

Disease-related malnutrition (DRM) is a specific type of malnutrition caused by a coexisting disease. European Society of Parenteral and Enteral Nutrition (ESPEN) identify DRM as two categories; disease-specific inflammatory and non-inflammatory [1]. Even though the DRM in hospitalized patients was recognized as early as in 1974, it is still remain as a public health issue in both developed and developing countries [2,3]. Several studies show the worldwide prevalence of malnutrition and at risk of malnutrition in hospitals are between 40-70% [2,4-8]. Prevalence of disease-related malnutrition varied between countries; Philippines (73%), Canada (51%), Brazil (48%), Vietnam (33%), Singapore (29%) and Netherland (14%) [2-4,7-9].

DRM is divided into DRM with inflammation, which is a catabolic condition triggered by a disease-specific inflammatory response and DRM without inflammation linked mainly to non-inflammatory etiological mechanism. Sub types of DRM with inflammation are chronic DRM with a milder inflammatory response (cancer cachexia and other disease-specific cachexia) and acute disease or injury-related malnutrition with a strong inflammatory response [1]. The effect of malnutrition on disease prognosis is well established. Malnourished patients develop more complications, have a higher mortality rate, longer length of hospital stay and have a higher rate of readmission [10-

14]. Early identification of DRM in hospitalized patients will enable effective management for better disease outcome as well as reduce health care cost [15]. Therefore, nutrition screening and identifying patients with malnutrition or at risk of malnutrition should be an integral part of disease management [8].

Limited studies conducted in Sri Lanka have reported prevalence figures between 24-71.4%, with a higher prevalence in the older adults with bronchial asthma (71.4%), chronic obstructive pulmonary disease (66.6%), heart disease (5-25%) and chronic kidney disease (24%) [16-18]. However, DRM is frequently under-recognised and under-treated. Therefore, the aim of the present study was to determine the prevalence of DRM in tertiary care settings and to identify a simple screening tool to be used by the busy health professionals.

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## Methods

This was a hospital based descriptive cross sectional study. Patients who were pregnant, below 18 years, with psychiatric illnesses, unconscious, on dialysis, critically ill, who had physical impairments which makes getting anthropometric measurement impossible and patients discharged within 24 hours were excluded from the study.

Sample size was calculated considering the prevalence of malnutrition is 50% and 95% confidence interval with 5% error. Design effect was taken as 1.8. Total sample size was 836; 140 participants from each hospital. Six out of 20 tertiary care hospitals were randomly selected; one ward was selected randomly from each hospital. All patients within the inclusion criteria who were admitted to the selected wards were included after informed written consent was obtained. Ethical clearance was obtained from the faculty of medicine, University of Kelaniya. Data was collected until fulfil the sample size in each hospital.

Data was collected by the medical officers of nutrition who have been trained and standardized for anthropometric measurements. Selected wards were visited daily by the data collectors and the eligible patients were recruited from 25<sup>th</sup> of October to 28<sup>th</sup> of November 2016. Demographic data and type of the disease was gathered and weight, height and mid upper arm circumference was measured.

Weight and height was measured using an electronic weighing scale (seca 813) with a precision of 100g and a stadiometer (seca 217) with a precision of 1mm respectively. Mid-upper arm circumference (MUAC) was measured using non stretchable measuring tapes to the nearest 0.5 cm (Seca). All the equipment were calibrated and standardized prior to the study.

## Data analysis

Body-mass-index (BMI) was calculated based on weight in kilogram divided by height in meters squared ( $\text{kg}/\text{m}^2$ ). DRM of adult is defined when  $\text{BMI} < 18.5 \text{ kg}/\text{m}^2$  according to ESPEN guidelines [19]. When MUAC  $< 23 \text{ cm}$  in men and  $< 22 \text{ cm}$  in women is considered as malnutrition [20]. Type of illness was categorized as surgical (trauma, minor and major surgery, burn, fracture etc); medical (acute renal failure, dengue, viral fever, diabetes, hypertension, hepatitis etc.); oncology (all cancers); pulmonary (asthma, tuberculosis, chronic obstructive pulmonary disease etc.) and cardiovascular (angina, ischaemic heart disease, cardiomyopathy, myocardial infarction, valvular disease etc.). All analysis was performed using IBM SPSS statistics 23.0. Differences were tested using Chi square test and  $p < 0.05$  considered as statistically significant. Agreement between malnutrition described as ESPEN and MUAC was measured by kappa statistics and correlation between the two methods was assessed by Pearson's correlation coefficient.

## Results

Total number of patient recruited was 774, which is 93% of the calculated sample size. Patient's characteristics are presented in Table 1. Age of the patients ranged from 18-89 years and half was belonged to 50-69 years. The mean age was 52.5 (SD=15.5) years. There were 51.6% males. Patients were classified according to the type of illness as shown in Table 1; surgical (24.8%), medical (27.0%), oncology (31.3%), pulmonary (8.5%) and cardiovascular (8.4%). According to the WHO criteria for BMI classifications, 9.2%, 6.1% and 10.5% were severely, moderately and mildly malnourished respectively and 26.5% were overweight or obese [21]. Mean BMI and MUAC of the study population was 22.1 (SD=5.2)  $\text{kg}/\text{m}^2$  and 26.1 (SD=4.5) cm respectively.

**Table 1.** Characteristics of patients

Characteristics	n	%
<b>Age (Years)</b>		
18 – 49	292	37.7
50 – 69	387	50.0
$\geq 70$	95	12.3
<b>Gender</b>		
Male	399	51.6
Female	375	48.4
<b>BMI groups (WHO criteria)</b>		
<16.0 (severe malnutrition)	71	9.2
16.0-16.9 (moderate malnutrition)	47	6.1
17.0-18.49 (mild malnutrition)	82	10.5
18.5-24.9 (normal)	373	47.9
25.0-29.9 (overweight)	150	19.3
30.0-34.9 (obesity)	39	7.2
$\geq 35.0$ (morbid obesity)	12	1.6
<b>Type of illness</b>		
Surgical	192	24.8
Medical	209	27.0
Oncology	242	31.3
Pulmonary	66	8.5
Cardiovascular	65	8.4
<b>Total</b>	<b>774</b>	<b>100.0</b>
	<b>Mean</b>	<b>SD</b>
Age in years	52.5	15.5
BMI ( $\text{kg}/\text{m}^2$ )	22.1	5.2
MUAC (cm)	26.1	4.5

## Disease-related malnutrition

Table 2 shows the prevalence of malnutrition defined by ESPEN and MUAC was 25.9% and 21.0% respectively. The prevalence of malnutrition was significantly higher in men than female according to both classifications and patients  $>70$  years of age group than other age groups. There were statistically significant differences in the prevalence of malnutrition by the type of illness by ESPEN and MUAC definitions (surgical 15.1% vs 11.0%, medical 20.1% vs 15.5%, oncology 31.8% vs 25.6%, pulmonary 67.7% vs 63.6% and cardiovascular 12.3% vs 4.6%) respectively.

## Agreement and correlation between methods

Table 3 shows good agreement between ESPEN cut-off and MUAC criteria for classifying malnutrition with  $k=0.69$  (SE=0.03) and 90.9% observed agreement. BMI and MUAC had a significantly positive correlation ( $r=0.87$ ;  $P=0.000$ ).

## Discussion

This study was conducted using ESPEN and MUAC cut-off levels to identify the easy tool for screening purposes. Many studies have used combination of BMI and intention weight loss as screening tools to identify diseases related malnutrition [16,22], some used BMI alone [23,24] and others both criteria were used [2,25,26]. This study revealed that the prevalence of DRM was 25.9% and 21.0% at tertiary care settings respectively. Similar prevalence are observed in previous studied conducted in Sri Lanka. A German hospital study has shown only 4.1% [25] while in Vietnam it was 33.3% [27]. Severe malnutrition was 9.7% in our study which is higher than in Vietnam (8%) study [27]. Overweight and obesity was 25.4% in this study. In German it was very high, 51.9% while in Vietnam it was only 6.6% [25,27].

This study shows that DRM varies significantly with the gender as well as with the type of disease and age. Naderi, *et al.* [14] also found

**Table 2.** Malnutrition in relation to basic characteristics and type of illness

Characteristics	Malnutrition% (95% Confidence Interval)			
	WHO	N	MUAC	N
<b>Age (Years)</b>				
18-49	25.3 (22.1 – 28.4)	292	15.3 (12.7 – 17.9)	274
50-69	24.3 (21.3 – 27.3)	387	22.1 (19.1 – 25.1)	384
≥ 70	33.7 (30.4 – 37.0)	95	32.6 (28.3 – 34.9)	95
	<i>P=0.1</i>		<i>P=0.001</i>	
<b>Gender</b>				
Male	32.6 (29.3 – 35.9)	399	25.3 (22.2 – 28.4)	395
Female	18.7 (15.9 – 27.5)	375	16.2 (13.3 – 18.5)	358
	<i>P=0.000</i>		<i>P=0.001</i>	
<b>Type of illness</b>				
Surgical	15.1 (11.9 – 16.9)	192	11.0 (8.2 – 12.6)	173
Medical	20.1 (17.5 – 23.1)	209	15.5 (13.2 – 18.4)	207
Oncology	31.8 (28.5 – 35.1)	242	25.6 (22.5 – 28.7)	242
Pulmonary	67.7 (66.5 – 72.9)	66	63.6 (61.8 – 68.6)	66
Cardiovascular	12.3 (9.6 – 14.2)	65	4.6 (1.8 – 4.2)	65
	<i>P=0.000</i>		<i>P=0.000</i>	
<b>Total</b>	<b>25.9</b> <b>(22.8 - 29.1)</b>	<b>774</b>	<b>21.0</b> <b>(18.0 - 23.9)</b>	<b>753</b>

**Table 3.** Agreement between identification of disease-related malnutrition using ESPEN, WHO and MUAC definitions

ESPEN	MUAC		k (SE)	P
	Malnutrition	No malnutrition		
Malnutrition	135	63	0.69 (0.03)	0.000
No malnutrition	22	533		
Observed agreement = 90.9%				
Person correlation coefficient (r) MUAC vs BMI = 0.87; P=0.000				

more male patients with malnutrition than females similar to findings of our study. However, gender had no association with the prevalence of malnutrition in one study [2]. This study shows the older patients (> 70 years) having the highest prevalence of malnutrition (33%). This may be due to low sample size in this age group and need more representative study to confirm it. Dominguez [2] also found that older patients (above 60 years) were more malnourished and it was supported by Chakravarty, *et al.* [22] and Kruiuzenga, *et al.* [7] also. But Naderi, *et al.* [14] found younger patients (18–29 year) to be more malnourished.

Prevalence of malnutrition was different according to the type of illness. It was highest in pulmonary which was 67.7% while lowest 12.3% was seen in cardiovascular patients. Similar findings were observed in a study conducted among elderly medical ward patients in Sri Lanka. It showed the highest prevalence among chronic obstructive lung disease patients which was 66.6% by the nutrition screening tool Mini Nutritional Assessment [16]. A study in Vietnam found the highest prevalence of malnutrition (51.3%) among patients in surgery wards but respiratory ward patients also had a high prevalence of 40.9% in a tertiary care hospital [27]. Dominguez [2] and Kruiuzenga, *et al.* [7] noted that patients with malignancies were more malnourished but in another study in Tehran it was highest in patients with gastrointestinal diseases [14].

When we used MUAC to define malnutrition, it showed MUAC and BMI had good agreement with almost 90% correctly classified malnutrition. A similar agreement of these two indices has been found by other authors [28]. It highlights the use of both BMI and MUAC can be acceptable for screening in our settings as they are simple and less resource driven. MUAC can be used even with severely ill patients and patients who cannot be weighed or measure their heights. Most of patients are unaware about their original weight in our setting. Hence it is difficult to determine the unintentional weight loss to apply validated screening tools such as NRS-2002. MUAC will provide opportunity for busy nursing staff to easily carry out the screening which can be followed by the comprehensive assessment by the nutrition staff.

Limitation of our study was severely ill patients were not included to determine the prevalence of DRM, who may be the most malnourished. Biochemical indices were not collected to classify the types of DRM. It should be cautious in interpreting the prevalence of malnutrition in pulmonary and cardiovascular diseases and among patients ≥70 years due to small sample sizes.

## Conclusion

This study has shown one fourth of adult patients admitted to tertiary health care settings in Sri Lanka had DRM. One out of ten were severely malnourished. Highest prevalence was observed with patients with pulmonary diseases. MUAC can be used as a screening tool to identify DRM in our settings to integrate the comprehensive medical nutrition therapy.

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## Author contributions

Renuka Jayatissa (RJ) and WMSK Weerasekara (SW) were responsible for the study concept, study design, data analysis and critical revision of the manuscript for important scientific content. Other 9 investigators supported with acquisition of data and performing interviews. All 11 authors equally contributed to preparation of manuscript.

## Conflict of interest

The authors declare no conflict of interest.

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