NUTRITIONAL STATUS OF CHILDREN WITH WILMS' TUMOUR ON ADMISSION TO A SOUTH AFRICAN HOSPITAL AND ITS INFLUENCE ON OUTCOME

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Abbreviations table:

Abbreviation	**Full term/phrase**
WT	Wilms Tumour
IALCH	Inkosi Albert Luthuli Central Hospital
MUAC	Mid Upper Arm Circumference
TSFT	Triceps Skinfold Thickness
BMI	Body Mass Index
KZN	Kwa-Zulu Natal
WFA	Weight for Age
HFA	Height for Age
LFA	Length for Age
WFH	Weight for Height
WFL	Weight for Length
AHOPCA	Asociacion de Hemato-Oncologia Pediatrica de Centro America
NG	Nasogastric

ABSTRACT

Background: In developing countries up to 69% of children with cancer have been shown to be malnourished on admission. High rates of malnutrition occur due to factors such as poverty and advanced disease. Weight can be an inaccurate parameter for nutritional assessment of children with solid tumours as it is influenced by tumour mass. This study aimed to assess the prevalence of malnutrition amongst children with Wilms Tumour (WT), the level of nutritional support received on admission, as well as the influence of nutritional status on outcome.

Methods: Seventy six children diagnosed with WT and admitted to Inkosi Albert Luthuli Central Hospital (IALCH) between 2004 and 2012 were studied prospectively. Nutritional assessment was conducted using weight, height, Mid Upper Arm Circumference (MUAC) and Triceps Skinfold Thickness (TSFT) prior to initiating treatment. Outcome was determined two years after admission. Time until commencement of nutritional resuscitation, and nature thereof, were recorded.

Results: Stunting and wasting was evident in 12 and 15% of patients respectively. The prevalence of malnutrition was 66% when MUAC, TSFT and albumin were used. Malnutrition was not a predictor of poor outcome and did not predict advanced disease. The majority of patients (84%) received nutritional resuscitation within two weeks of admission.

Conclusions: When classifying nutritional status in children with Wilms Tumour, the utilisation of weight and height in isolation can lead to an underestimation of the prevalence of malnutrition. Nutritional assessment of children with Wilms Tumour should also include MUAC and TSFT. Early aggressive nutritional resuscitation is recommended.

INTRODUCTION

Wilms Tumour (WT), also known as Nephroblastoma, contributes to approximately five percent of all childhood cancer cases in developed countries [1,2] and more than 10% of childhood cancers in many African countries.[3] In South Africa, WT is the fourth most common childhood cancer according to hospital based registries.[4]

There is a paucity of information regarding the incidence of cancer amongst children in developing countries. This is due to under-diagnosis of paediatric cancers in these countries, and a lack of simple measures for recording and capturing patient-related data, such as cancer registries.[5] As in most developing countries, South African children with WT face many challenges that can affect prognosis. These include delayed presentation, high rates of treatment abandonment and poverty.[6-8] The strongest prognostic indicators amongst this population are considered to be disease stage and histology.[9]

Studies have shown that 45-77% of children with cancer in developing countries are malnourished on admission to hospital.[10-12] Malnutrition amongst this population can lead to higher mortality and treatment abandonment rates,[10] and increased complication risks.[13] Some risk factors for a poor outcome amongst children with cancer, such as age, are not modifiable. Yet, malnutrition is a risk factor that can be modified if appropriate steps are taken.[14]

The assessment of nutritional status of children with cancer needs to be standardised amongst centres treating these patients.[15] When weight and height are used in isolation, malnutrition in children with WT can be masked [12,16,17] due to tumour mass and fluid shifts.[18] In addition, utilisation of serum albumin in isolation as an indicator of nutritional status can lead to underestimation of malnutrition, as albumin levels can be affected by several disease-related factors.[17] Many studies have used weight, height and Body Mass Index (BMI), or albumin levels, in isolation to classify nutritional status.[19] It can therefore be posited that malnutrition rates amongst WT patients could have been under-reported, leading to a significant underestimation of the actual prevalence of malnutrition amongst this population to date.

A growing body of research has emphasised the importance of including arm anthropometry measurements, specifically MUAC and TSFT, as part of the classification criteria [10,12,17,20] as these measurements are independent of tumour size.[21,22] Utilisation of biochemistry (namely albumin) and anthropometry measurements *in combination* has been shown to improve the sensitivity of classification of nutritional status.[10]

When assessing the influence of nutritional status at the time of admission on outcome, there is a paucity of data relating to children with cancer, particularly WT. Although some studies have found a significant correlation between malnutrition on admission and poorer outcome,[10,23,24] others have failed to show any significant link.[25-27] Of concern regarding previous studies assessing this relationship is that many children may have been incorrectly classified as being well-nourished when in fact they were malnourished.[12,16,17]

The purpose of this study was to determine the prevalence of malnutrition amongst children with WT on admission to IALCH. Furthermore, it aimed to determine the relationship between nutritional status on admission and outcome, and determine the level of nutritional intervention that the subjects received within the first two weeks of admission.

METHODS

This prospective observational study utilised a cohort study design amongst children with WT at IALCH between 2004 and 2012. The study design was approved by the Biomedical Research Committee of the University of Kwa-Zulu Natal. IALCH is classified as a National Central Hospital and services a large catchment area spanning two of South Africa's nine provinces (Kwa-Zulu Natal [KZN] and Eastern Cape). It is a referral hospital for all tertiary and district hospitals in the KZN province [28] and has a catchment area of over ten million people.[29]

The study population included 88 children aged 6 months to 13 years diagnosed with WT and admitted to the paediatric surgical ward. The files of twelve children had to be excluded (anthropometric data of two children were collected after the initiation of nutritional intervention, while the medical files of ten children could not be located, leading to incomplete data), therefore 76 children made up the final sample for analysis.

Anthropometry and Biochemistry

Between 2004 and 2012, subjects were assessed by the ward Dietitian after admission. Anthropometric measurements were taken before any interventions in the form of nutritional supplementation or chemo/radiotherapy.

Nutritional status was assessed using weight, height, MUAC and TSFT measurements. Body weight and height were measured while subjects wore light clothing and no shoes, using a Nagata electronic weight and height measurement scale (Model BW-1122H). Weight was recorded to the nearest 100g and height and length to the nearest 1cm. Height measurements were taken while subjects stood straight on the electronic scale with their back against the height-meter, looking forward. Infants were weighed on a Nagata electronic baby scale (Model BW-20) and their length measured with a measuring tape while supine. These scales are calibrated annually by the manufacturer in order to maintain accuracy. Excised tumour weight was recorded by the paediatric surgeon post-operatively and the corrected weight was utilised for statistical analysis.

In order to measure MUAC, the midpoint between the acromion process of the scapula and olecranon process of the ulna was determined while the left forearm was bent at a right angle. A non-stretchable measuring tape was used to measure the circumference at the midpoint while the arm hung straight down, to the nearest 0.1cm. TSFT was measured on the same midpoint using a Harpenden skinfold caliper and recorded to the nearest 0.1cm. To ensure accuracy, measurements were performed in triplicate and the average recorded.

Weight and height measurements were utilised to determine weight for age (WFA), length for age (LFA)/height for age (HFA), weight for length (WFL)/ weight for height (WFH) and BMI depending on the subject's age. These were classified according to age and gender matched norms utilising the STAT GrowthCharts app,[30] which classifies subjects according to Z-scores using the WHO growth charts. MUAC and TSFT measurements were compared with age and gender matched norms and interpreted using the Frisancho percentile charts.[31] Albumin levels were routinely assessed on admission to hospital.

Classification of nutritional status

A combination of arm anthropometry and albumin were used to classify subjects. Subjects who met at least one of these criteria were classified as malnourished:

MUAC and TSFT between the fifth and tenth percentiles

MUAC or TSFT below the fifth percentile

Albumin less than 35g/L

Those with a MUAC and/or TSFT below the 5th centile, or albumin levels below 32g/L, were classified as being severely malnourished. This combination of criteria, which have been modified and utilised in previous studies,[17,32] was adapted from the guidelines developed at the Asociacion de Hemato-Oncologia Pediatrica de Centro America (AHOPCA) congress in 2004.[33]

Level of nutritional support

At the time of intervention the Dietitian recorded any nutritional support that subjects received in their electronic files. Early intervention was considered as dietary intervention that took place within two weeks of admission. Data relating to both the assessment and nutritional intervention type (oral, enteral or parenteral) were documented.

Data analysis

To ensure confidentiality, anthropometric measurements were only accessible to the Dietetics Department at IALCH. Outcome data were obtained using electronic patient records recorded by the doctor. The data were analysed using the Statistical Package for Social Sciences version 21. Descriptive tests as well as the Chi-Squared test of independence were conducted. A p-value <0.05 was considered significant.

RESULTS

The male and female distribution amongst the sample of 76 children with WT was exactly half (50%; n = 38). Most consisted of Black Africans (97.3%; n = 74), while 2.6% (n = 2) comprised White and Coloured children. The mean age of the subjects was four years, eight months (SD ± 2.89) and the median age was three years, ten months (IQR = 37.32 months). Anthropometric characteristics are presented in Table 1. Median height for males and females was 0.98 (IQR = 0.23) metres, while on average females weighed slightly more than males (16.99kg versus 16.56kg). Consequently, the mean female BMI [16.17kg/m^2 (SD ± 2.69)] was higher than the males [15.30kg/m^2 (SD ± 1.83)]. The mean albumin level was 38.61g/L (SD ± 5.87)

Table 2 shows malnutrition prevalence according to various anthropometric measurements. According to WFA, HFA and BMI results, most of the sample was classified as well-nourished. However, according to arm anthropometry measurements, the malnutrition prevalence was much higher.

Fig. 1 shows a comparison between different combinations of measurements when classifying nutritional status. When albumin was utilised to classify nutritional status in isolation, 70% (n = 53) of subjects were well-nourished. In this study, a combination of MUAC, TSFT and albumin was used to classify overall nutritional status. The results showed that two thirds (66.67%; n = 48) of the sample (n = 72) were malnourished on admission to hospital.

Stage of disease and nutritional status

Neoadjuvant chemotherapy was offered to all patients. Patients without metastatic disease received four weeks of actinomycin and vincristine, while those with metastases received additional epi-adriamycin over six weeks. Post-operative chemotherapy was determined by the operative staging and histology using SIOP guidelines, with radiotherapy offered to patients with Stage III and Stage IV disease. While most of the patients presented in stages three to five (71%; n = 54), 29% presented in stage one or two (n = 22). The influence of stage of disease on nutritional status was analysed using the chi-square test of independence. This analysis showed a trend towards increased malnutrition prevalence amongst those in stages two to four (Table 3). Those in stage five had a lower malnutrition prevalence compared to stages two to four. Overall, the influence of stage of disease on nutritional status was not significant.

Nutritional status and outcome

The influence of nutritional status upon admission and outcome after two years is presented in Tables 4 and 5. Overall nutritional status could not be classified for five subjects as their TSFT measurement was not recorded. Outcome was defined as the subject surviving or dying. It should be noted that the outcome of 14 of the subjects could not be described as they were lost to follow up or did not return for scheduled follow up visits two years post admission. The rate of treatment abandonment was 2.6%.

Two thirds (n = 41) of the 62 subjects were classified as being malnourished according to their MUAC, TSFT and albumin results. Seventeen (27.42%) of the 62 subjects died during the two year follow up period. Of those who died 13 (76.47%) were malnourished on admission. Of the 45 subjects who survived, 28 (62.22%) were malnourished on admission. There was no significant relationship between nutritional status on admission and outcome after two years.

No significant relationship was found between malnutrition severity and outcome. Table 5 shows that on admission both well-nourished and severely malnourished subjects were equally prevalent in the group who survived.

Binary logistic regression analysis was conducted to account for confounding variables known to have a significant influence of prognosis (stage and histology). No significant relationship between nutritional status and outcome was found, despite correcting for these variables (p = 0.711).

Level of nutritional support received

Most of the sample (84.2%; n = 64) received nutritional supplementation within two weeks of admission. Just over 10% (n = 8) received supplements more than two weeks after admission and were not included. Only 5.3% (n = 4) of the sample did not receive any nutritional supplementation. Of those who received supplementation, 87.5% (n = 56) received oral supplementation which refers to a nutritional supplement, a nutritious snack (for example yoghurt or a sandwich), or a combination of the two. Of the remaining subjects, 9.4% (n = 6) received nasogastric (NG) feeds, whereas 3.1% (n = 2) received a combination of oral and NG supplementation. There was no significant relationship between malnutrition severity and whether or not the subjects received supplements (p=0.768). Furthermore, there was no significant relationship between malnutrition severity and type of nutritional support received (p=0.620).

DISCUSSION

To date there is no published research assessing the prevalence of malnutrition amongst South African children with WT utilising arm anthropometry measurements.

This study found the prevalence of malnutrition to be just over 66%. Previous studies in developing countries have found malnutrition prevalence amongst children with cancer to range from 45 to 77%.[10-12,20] Sala *et al* (2012) conducted a large study which included 1787 children with cancer from seven developing countries in Central America. The authors used similar categories to classify nutritional status to those in this study. Malnutrition was found to be present in 63.8 % of the sample while 72.4% of those with solid tumours were malnourished.

A comprehensive search of the literature found four studies assessing the prevalence of malnutrition amongst South African children with WT.[26,34,35,36] Wessels *et al* (1999) found that 35% of their sample was malnourished, while Davidson *et al* (2006) and Visser *et al* (2014) found the prevalence of malnutrition to be 20.7% and 10.3% respectively. Holzinger *et al* (2007), who conducted their study at IALCH, found a prevalence of 45%. This study was performed from 2002 to 2005 and did not include the same patient population as the present study. Unfortunately, these studies were limited by the fact that they used weight and height in isolation and did not include arm anthropometry in their classification. Wessels *et al* (1999) did, however, try to compensate for this limitation by classifying any subject with a weight for height less than 90% of the expected value as poorly nourished. A final limitation of the studies by Wessels *et al* (1999) and Holzinger *et al* (2007) was that they utilised relatively small sample sizes (59 and 37 respectively).

Assessment of the nutritional status of children with solid tumours is problematic due to the effect of tumour weight on body weight measurements.[18] Although corrected weight was used in this sample (admission weight minus excised tumour weight), tumour weight would have shrunk from the time of admission due to neoadjuvant treatment. When comparing the prevalence of malnutrition according to WFA, HFA and BMI to MUAC and TSFT measurements in this study, the lack of correlation between these different types of anthropometric measurements was striking. It is concerning that the prevalence of severe malnutrition remained below 6% when arm anthropometry was not utilised, even after correcting for excised tumour weight, and increased to over 43% and 32% when MUAC and TSFT were assessed respectively. The results of this study are in agreement with several other studies which showed that utilising body weight measurements for classification of nutritional status amongst children with cancer, without including arm anthropometry measurements, often leads to an underestimation of the prevalence of malnutrition.[12,17,20]

The AHOPCA algorithm incorporates arm anthropometry, albumin, weight loss and percentage of ideal body weight measurements. Initially, the algorithm stated that both MUAC *and* TSFT had to be below a certain value for a subject to be classified as malnourished. However, to increase the sensitivity of the algorithm and to encourage interventions amongst a larger proportion of subjects these criteria have since changed, stipulating that all subjects with either MUAC *or* TSFT below a certain level be classified as malnourished.[10] Due to many studies in the past having assessed the prevalence of malnutrition amongst children with solid tumours using weight and height measurements in isolation,[19,25,26] it is possible that the prevalence of malnutrition amongst this population has been grossly underestimated.

The results from this study showed that, in isolation, albumin considerably underestimated the prevalence of malnutrition (30%). This is in agreement with previous research by Tazi *et al* (2008), which showed that malnutrition prevalence according to albumin was 28%. However, when the authors classified nutritional status according to arm anthropometry, the prevalence of malnutrition increased to 39% and 50% using MUAC and TSFT respectively. When including albumin in combination with MUAC and TSFT in the current study, the prevalence of malnutrition increased by almost 10%. Due to its low specificity, albumin is considered to be a poor indicator of nutritional status when assessed in isolation.[37] However, previous research has shown the inclusion of albumin as one of a combination of criteria when classifying nutritional status does add considerable value to the accuracy and sensitivity of the classification methodology.[10]

Nutritional status was not shown to be significantly related to outcome, although there was a trend towards poorer outcome amongst malnourished children. The correlation between nutritional status on admission and outcome has not been conclusively established in previous studies.

Most research has focused on analysing this relationship amongst children with haematological malignancies, with few studies focusing on children with solid tumours. A large study by Hoffmeister *et al* (2013) analysed 733 American children with haematological malignancies who had undergone a haematopoietic stem cell transplant. They found those with an arm muscle area below the 5th percentile had significantly worse event free survival at 100 days and three years post-transplant. Hoffmeister's study was strong as it had a large sample size and utilised arm anthropometry when classifying nutritional status. In contrast, a United Kingdom study with a large sample of 1025 children with haematological malignancies found no evidence that nutritional status on admission was a prognostic indicator of outcome. While this sample size was substantial, arm anthropometry was not used when classifying nutritional status.[27]

Results from previous studies amongst children with solid tumours are similarly inconclusive. The strengths of the aforementioned study conducted by Sala *et al* (2012) included its large sample size, accurate classification of nutritional status and multiple locations from which children were sampled. The authors found a significant relationship between malnutrition and higher mortality rates amongst children with solid tumours, but not haematological malignancies.[10] Similar studies found no significant relationship between these variables; however, none of these studies took arm anthropometry into account.[19,25,26]

Late presentation and advanced disease stage on admission can have extensive consequences, as children with larger tumours on admission have been shown to be more severely malnourished than those with smaller tumours.[11] This in turn can negatively affect their outcome [10] and can contribute to poorer prognosis.[9]

In this study, nutritional interventions within two weeks of admission were implemented for more than 80% of the study sample. This included an initial assessment of nutritional status and implementation of oral and/or NG supplements.

Children with cancer often struggle to meet their nutritional requirements,[39] making nutritional intervention extremely important. Nutritional intervention has been shown to lead to effective weight gain amongst children with cancer.[32,35,39-41] Wessels *et al* (1999) emphasised the importance of utilising clinical judgement in addition to anthropometric assessment in order to determine which patients are in need of nutritional intervention. When treating these patients, the challenge faced by the Dietitian is to prevent further deterioration of nutritional status, and to attempt to reverse any deterioration in nutritional status that may have already occurred. Children with solid tumours in particular are often in need of nutritional interventions as they practice food restrictions more often and may experience significantly worse eating problems including nausea, vomiting and loss of appetite.[21]

An international study that assessed the nutrition-related practices amongst 125 institutions found inconsistent practices related to nutritional interventions.[42] Similar results were demonstrated by a survey of several South African hospitals.[43] It is unfortunate that there are no standardised guidelines related to nutritional intervention which can be implemented throughout centres that treat children with cancer, as the efficacy of nutritional intervention is well documented.[32,39-41] The fact that there was no significant relationship between severity of malnutrition and type of support received suggests that both oral nutritional supplements as well as NG feeds have a role in the nutritional management of malnourished children with cancer.

The greatest weight changes amongst children with cancer have been shown to occur within three months of diagnosis,[44] thus emphasising the importance of early and aggressive nutritional intervention. A study by Antillon *et al* (2013) looking at children with leukaemia showed that multidisciplinary management, in the form of a combination of nutritional intervention as well as chemotherapy treatment contributed to improved nutritional status after six months. Furthermore, of those who were classified as being severely depleted on admission, the nutritional status of almost two thirds of the subjects improved. For the subjects who were severely malnourished but for whom an improvement in nutritional status was seen by six months, the overall survival probability at five years was similar to those whose nutritional status was adequate on admission.[32]

A similar study by Orgel *et al* (2014) found that children with leukaemia who were underweight for more than 50% of their treatment period had significantly worse outcomes. Those who were initially underweight but who gained weight and maintained their normal weight for more than 50% of treatment had a similar risk for recurrence as those who maintained a normal weight throughout. Therefore, nutritional monitoring is imperative amongst this population, and nutritional intervention should be implemented as early as possible. By reducing the time that children are classified as being malnourished during their treatment, the potential negative effects of poor nutritional status on admission can be significantly reduced.[14]

Study limitations

A limitation of this study was the sample size, which was relatively small compared to other international studies. This study may be subject to selection bias due to the fact that it was conducted at a government hospital. However, IALCH serves a catchment area spanning two provinces in South Africa and is therefore representative of a wide spectrum of the South African population. The use of the Frisancho charts to classify nutritional status in this study may have introduced some bias as these charts are based on a population made up of only Caucasian subjects.

CONCLUSION

Nutritional status should be assessed as early as possible in order to improve nutritional status or prevent malnutrition in children with WT. Utilisation of a combination of arm anthropometry and albumin provide accurate criteria for assessing nutritional status amongst children with WT.

Malnutrition on admission did not contribute to significantly poorer outcomes. Aggressive early nutritional assessment, intervention and management of these children may help to reduce the negative impact that malnutrition on admission may have on outcome.

Conflict of interest: nothing to declare

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Figure 1 legend:

Title: Prevalence of malnutrition using biochemical and anthropometric measurements.

Y axis: Number of subjects

X axis: Well nourished (first three bars) Malnourished (second three bars)

Key: Blue bar represents TSFT + MUAC + Albumin (n=72)

Yellow bar represents TSFT + MUAC (n=72)

Green bar represents Albumin (n=76)

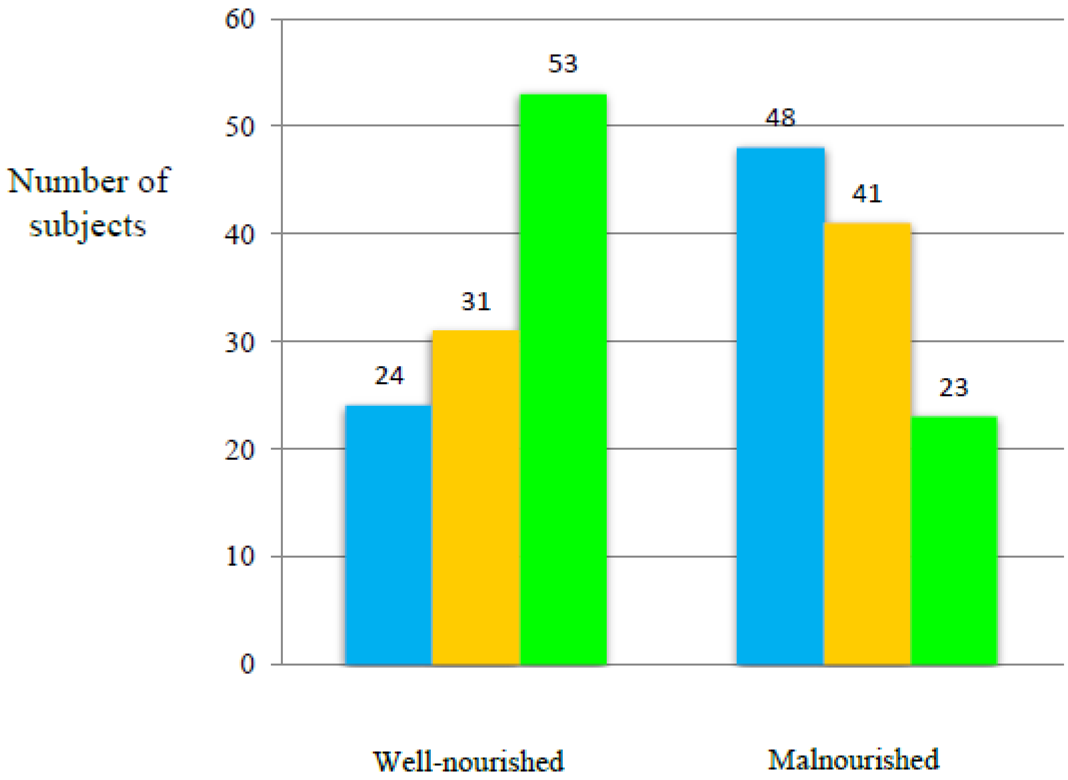

Table 1. Age and anthropometric characteristics of the study population

	Mean	Median	IQR	Min	Max	SD
Age (months)						
Combined (n = 76)	55.77	46.50	37.32	11.04	149.04	34.68
Males (n = 38)	56.58	46.98	31.74	11.04	149.04	35.16
Females (n = 38)	54.95	45.54	48.72	14.04	147.00	34.66
Weight (kg)						
Combined (n = 76)	16.77	15.25	5.73	7.50	43.18	6.99
Males (n = 38)	16.56	15.53	4.62	8.54	34.58	6.04
Females (n = 38)	16.99	14.56	7.88	7.50	43.18	7.91
Height (m)						
Combined (n = 75)	1.02	0.98	0.23	0.64	1.58	0.19
Males (n = 37*)	1.01	0.98	0.22	0.64	1.50	0.19
Females (n = 38)	1.03	0.98	0.29	0.72	1.58	0.20
BMI (kg/m^2)						
Combined (n = 75)	15.73	15.94	3.14	10.31	23.85	2.32
Males (n = 37*)	15.30	15.29	3.63	12.71	20.07	1.83
Females (n = 38)	16.17	16.68	2.49	10.31	23.85	2.69

* Height was not available for one of the subjects; SD=Standard deviation

Table 2. Anthropometric classification of study population

	Female		Male		Combined		
	n	**%**	**n**	**%**	**n**	**%**	**Total %**
WFA (n = 71*)							NW
Normal	25	54.35	21	45.65	46	64.79	64.79
Underweight, mild (<-1 SD)	9	56.25	7	43.75	16	22.53	UW
Underweight, moderate (<-2 SD)	3	37.50	5	62.50	8	11.27	35.21
Underweight, severe (<-3 SD)	0	0.00	1	100.00	1	1.41	
HFA (n = 75**)							NW
Normal	28	60.87	18	39.13	46	61.33	61.33
Underweight, mild (<-1 SD)	9	45.00	11	55.00	20	26.67	UW
Underweight, moderate (<-2 SD)	1	16.67	5	83.33	6	8.00	38.67
Underweight, severe (<-3 SD)	0	0.00	3	100.00	3	4.00	
BMI (n = 75**)							NW
Normal	25	47.17	28	52.83	53	70.67	70.67
Underweight, mild (<-1 SD)	10	76.92	3	23.08	13	17.33	UW
Underweight, moderate (<-2 SD)	2	40.00	3	60.00	5	6.67	29.33
Underweight, severe (<-3 SD)	1	25.00	3	75.00	4	5.33	
MUAC (n = 74[#])							NW
Normal	10	66.67	5	33.33	15	21.13	21.16
Underweight, mild (<-1 SD)	8	44.44	10	55.55	18	24.32	UW
Underweight, moderate (<-2 SD)	5	55.55	4	44.44	9	12.16	79.72
Underweight, severe (<-3 SD)	15	46.87	17	53.12	32	43.24	
TSFT (n = 71[##])							NW
Normal	12	60.00	8	40.00	20	28.17	28.17
Underweight, mild (<-1 SD)	4	28.57	10	71.43	14	19.72	UW
Underweight, moderate (<-2 SD)	8	57.14	6	42.86	14	19.72	71.83
Underweight, severe (<-3 SD)	12	52.17	11	47.82	23	32.39	

* Five subjects could not be classified due to insufficient age specific growth charts – WHO WFA growth charts not available for children over the age of ten years.

** Height information not available for one subject

[#] MUAC not available for two subjects

[##] TSFT not available for five subjects

NW = Normal Weight; UW = Underweight

Table 3. The association between stage of disease and nutritional status

Malnourished	Stage 1 (n = 5)	Stage 2 (n = 13)	Stage 3 (n = 19)	Stage 4 (n = 29)	Stage 5 (n = 6)	Total (n = 72)	p-value
Yes, n, (%)	1 (20)	9 (69.23)	13 (68.42)	22 (75.86)	3 (50)	48 (66.67)	p=0.152
No, n (%)	4 (80)	4 (30.77)	6 (31.58)	7 (24.14)	3 (50)	24 (33.33)	

* Four subjects did not have TSFT therefore their overall nutritional status could not be classified

Table 4. The association between malnutrition on admission and outcome; 2 years

		Outcome				Total	
		Dead		Alive			
		n	%	n	%	n	%
Malnourished	**Yes**	13	31.71	28	68.30	41	100.00
	No	4	19.05	17	80.95	21	100.00
Total		17	27.42	45	72.58	62	100.00

*Chi-squared test, p=0.443

Table 5. The association between severity of malnutrition and outcome

		Degree of malnutrition						Total	
		Normal		Malnourished		Severely malnourished			
		n	%	n	%	n	%	n	%
Outcome	**Dead**	4	25.00	6	37.50	6	37.50	16	100.00
	Alive	17	36.96	12	26.09	17	36.96	46	100.00
Total		21	33.87	18	29.03	23	37.10	62	100.00

*Chi-squared test, p=0.163