

**The adaptation of an appropriate screening tool for
the early detection of malnutrition in individuals
with intellectual disability (ID) in a psychiatric
hospital in North West Province (South Africa)**

**by
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DECLARATION OF AUTHENTICITY

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ABSTRACT

Background: Considering the myriad of risk factors causing nutritional deficiency, as well as the prevalence of malnutrition and feeding problems experienced by individuals with intellectual disability (ID), early detection and diagnosis of malnutrition in this population group is essential.

Objectives: The main aim and objectives of the study were to determine the degree of malnutrition and body composition in individuals with ID living in a psychiatric hospital (North West Province, South Africa), to determine which degree of ID was more prone to malnutrition, to investigate the different risk factors for malnutrition in this group of individuals, and to use this data to adapt an existing screening tool used to facilitate the easier identification of malnutrition.

Methodology: An observational descriptive cross-sectional study, with an analytical component, was conducted. The study consisted of two phases. During the first phase, measurements were taken of individuals with ID to determine body composition and nutritional status. During the second phase, said data, as well as other factors influencing the nutritional status of individuals with ID, were used to adapt an existing screening tool to allow for easier identification of malnutrition in the study population. The adapted screening tool was tested by nursing staff.

Results: The anthropometric measurements of 244 individuals with ID were determined. The overall anthropometrical status indicated that half of the study population (52,1%, n=127) had a normal nutritional status, that 38,1% (n=93) was undernourished or at risk of becoming undernourished, and that 10,0% (n=24) was either at risk of becoming or was overnourished . Men were more prone to being undernourished or at risk of becoming undernourished

(48,0%, n=73), compared to women (21,7%, n=20). Although no significant difference was found in anthropometrical status across the four severities of ID (Pearson Chi-square test ($p=0,15$)), individuals with mild ID were more likely to become obese (19,4%, n=6), and individuals with profound ID were more prone to being underweight (57,1%, n=8). It was found that 41,8% (n=102) of the total study population had a waist circumference (WC) above the normal values. A significant difference was found between increased WC and severity of ID (Pearson Chi-square test ($p=0,00$)). Other risk factors that can influence nutritional status in said population included medical conditions such as hypertension (13,0%, n=32) and epilepsy (EP) (46,0%, n=112), as well as polypharmacy (71,7%, n=175). An existing malnutrition screening tool for the population with ID was adapted by means of the addition of prevalent factors (WC measurements, presence of EP and use of medications), as well as through adaptation of the scoring system.

Conclusion: Using anthropometric measurements and indices for body composition, a high prevalence of malnutrition was identified in the study population of individuals with ID. The adapted screening tool was more sensitive than the original tool in identifying individuals who were at risk of malnutrition, or who were already malnourished in this study population. The research undertaken in this respect can help health care professionals to be more aware of the interaction between the severity of ID and malnutrition.

OPSOMMING

Agtergrond: Wanneer daar gelet word op die magdom faktore wat voedingstekorte veroorsaak en op die voorkoms van wanvoeding en voedingsprobleme onder individue met intellektuele gestremdheid (IG), is dit duidelik dat vroegtydige waarneming en diagnose van wanvoeding noodsaaklik is.

Doelwitte: Die hoofdoel en doelwitte van die studie was om die graad van wanvoeding sowel as die liggaamsamestelling van individue met IG te bepaal wat in 'n psigiatriese hospitaal (Noordwes Provinsie, Suid-Afrika) inwoon. Daar is bepaal watter graad van IG individue is meer geneig tot wanvoeding. Verskillende risiko faktore van wanvoeding in hierdie groep individue is ondersoek en die data is gebruik om 'n bestaande siftingshulpmiddel aan te pas om wanvoeding makliker te kan identifiseer.

Metodologie: Die studie-ontwerp was 'n dwarsnitwaarnemingstudie met 'n analitiese komponent. Die studie het uit twee fases bestaan. Gedurende die eerste fase is antropometriese metings van individue met IG geneem om liggaamsamestelling en voedingstatus te bereken. Gedurende die tweede fase is hierdie data, sowel as ander risiko faktore wat die voedingstatus van individue beïnvloed, gebruik om 'n bestaande siftingshulpmiddel aan te pas wat die identifisering van wanvoeding in hierdie populasie kan vergemaklik. Verpleegpersoneel het die aangepaste siftingshulpmiddel uitgetoets.

Resultate: Die antropometriese metings van 244 individue met IG is bepaal. Hulle algemene antropometriese status het aangedui dat die helfte van die studiepopulasie (52,1%, n=127) 'n normale voedingstatus gehad het; 38,1% (n=93) was ondervoed of het 'n risiko gehad vir ondervoeding en 10,0% (n=24) was reeds oorvoed of het 'n risiko gehad vir oorvoeding. Mans (48,0%, n=73) was meer geneig om ondervoed te wees of het 'n groter risiko tot

ondervoeding as vroue (21,7%, n=20). Daar was geen beduidende statistiese verskille in antropometriese status tussen die vier grade van IG nie (Pearson Chi-square-toets, $p=0,15$), alhoewel individue met matige IG 'n groter neiging het tot obesiteit (19,35%, n=6), terwyl uitgesproke IG 'n groter neiging tot ondergewig gehad het (57,1%, n=8). Daar is bevind dat 41,8% (n=102) van die totale studiepopulasie 'n verhoogde middelomtrek gehad het. Daar was 'n beduidende statistiese verskil tussen verhoogde middelomtrek en graad van IG (Pearson Chi-square-toets, $p=0,00$). Ander risiko faktore wat die voedingstatus van hierdie populasie kan beïnvloed sluit in mediese toestande soos hipertensie (13,0%, n=32) en epilepsie (46,0%, n=112), asook die gebruik van veelvuldige medikasie (71,7%, n=175). 'n Bestaande wanvoedingsiftingshulpmiddel vir die IG populasie is aangepas deur algemene faktore (middelomtrek, voorkoms van epilepsie en gebruik van veelvuldige medikasie) in te sluit en die puntstelsel aan te pas.

Gevolgtrekking: Met behulp van antropometriese metings en liggaamsmassa indekse is 'n hoë voorkoms van wanvoeding in die studiepopulasie van individue met IG waargeneem. Die aangepaste siftingshulpmiddel was meer sensitief as die oorspronklike hulpmiddel om individue wat 'n risiko loop vir wanvoeding of wat reeds wangevoed is, te identifiseer in hierdie studie populasie. Hierdie navorsing kan help om gesondheidswerkers meer bewus te maak van die interaksie tussen die graad van IG en wanvoeding.

CONTRIBUTIONS BY PRINCIPAL RESEARCHER AND FELLOW RESEARCHERS

The principal researcher (Maretha Nel) developed the idea and the protocol for the current study. The principal researcher planned the study, undertook data collection, captured the data for analysis, analysed the data with the assistance of a statistician (Prof DG Nel), interpreted the data, and drafted the thesis. Mrs Maritha Marais and Mrs Sunita Potgieter (supervisors) provided input at all stages and revised the protocol and thesis.

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TABLE OF CONTENTS

	Page
Declaration of authenticity	ii
Abstract	iii
Opsomming	v
Contributions by principal researcher and fellow researchers	vii
List of figures	xi
List of tables	xii
List of abbreviations	xiv
List of definitions	xv
List of appendices	xvi
1 CHAPTER 1: LITERATURE REVIEW	1
1.1 INTRODUCTION	1
1.2 NUTRITIONAL STATUS OF THE POPULATION WITH ID	3
1.3 RISK FACTORS FOR MALNUTRITION	8
1.4 ASSESSMENT OF FEEDING AND MEALTIME BEHAVIOUR PROBLEMS	13
1.5 MOTIVATION	16
1.6 PROBLEM STATEMENT	16
2 CHAPTER 2: RESEARCH DESIGN AND METHODOLOGY	18
2.1 AIM	18
2.2 OBJECTIVES	18
2.2.1 Primary objectives	18
2.2.2 Secondary objectives	19
2.3 STUDY DESIGN	19
2.4 STUDY FRAME	19
2.5 SAMPLE SIZE	20
2.5.1 Phase 1	20
2.5.2 Phase 2	20
2.6 SAMPLE SELECTION	21

2.6.1	Inclusion criteria	21
2.6.2	Exclusion criteria	21
2.7	METHODS OF DATA COLLECTION	23
2.7.1	Phase 1: Anthropometric measurements	23
2.7.1.1	Determination of the body composition of individuals with ID through anthropometrical measurements, namely weight, height, waist circumference, mid-upper arm circumference, skinfold measurement at the TSF site and elbow width	24
2.7.1.2	Investigation of the different risk factors for malnutrition in the group of in-patients with ID	28
2.7.2	Phase 2: Development of a screening tool that could be used by nursing staff for the early detection of malnutrition	29
2.7.3	Pilot study	30
2.7.3.1	Phase 1: Anthropometric measurements	30
2.8	DATA ANALYSIS	31
2.8.1	Preparation and analysis of data	31
2.8.1.1	Determination of which degree of ID was more prone to malnutrition	31
2.8.1.2	Indices of fat-free mass (FFM)	32
2.8.1.3	Indices of fat mass (FM)	32
2.8.2	Statistical methods	33
2.9	ETHICS AND LEGAL ASPECTS	34
2.9.1	Informed consent	34
2.9.2	Confidentiality	35
3	CHAPTER 3: RESULTS	36
	<i>PHASE 1</i>	36
3.1	DEMOGRAPHIC INFORMATION OF THE STUDY POPULATION WITH ID	36
3.2	PREVALENT MEDICAL CONDITIONS FOR DETERMINING POSSIBLE RISK FACTORS FOR MALNUTRITION IN THE STUDY POPULATION WITH ID	37

3.3	BODY MASS INDEX AND WAIST CIRCUMFERENCE OF THE STUDY POPULATION WITH ID	38
3.4	BODY COMPOSITION OF THE STUDY POPULATION WITH ID	40
3.4.1	Calculation of fat-free mass (FFM)	42
3.4.2	Indices of fat mass (FM)	46
3.5	ANTHROPOMETRICAL STATUS OF THE STUDY POPULATION WITH ID	48
3.6	RISK FACTORS FOR MALNUTRITION IN THE STUDY POPULATION WITH ID	52
	<i>PHASE 2</i>	54
3.7	THE ADAPTATION OF AN APPROPRIATE SCREENING TOOL	54
3.7.1	Existing screening tool	54
3.7.2	Sensitivity and specificity	58
4	CHAPTER 4: DISCUSSION	60
4.1	INTRODUCTION	60
4.2	BODY COMPOSITION OF THE STUDY POPULATION WITH ID	62
4.3	USE OF THE NUTRITIONAL STATUS OF THE STUDY POPULATION WITH ID TO DETERMINE DEGREE OF MALNUTRITION	65
4.4	RISK FACTORS FOR MALNUTRITION IN THE STUDY POPULATION WITH ID	69
4.5	ADAPTATION OF A SCREENING TOOL FOR USE BY NURSING STAFF FOR THE EARLY DETECTION OF MALNUTRITION	72
4.5.1	Existing screening tools	72
4.5.2	Adjusted screening tool	72
5	CHAPTER 5: SUMMARY	75
5.1	LIMITATIONS OF THE STUDY	75
5.2	RECOMMENDATIONS	76
5.3	CONCLUSION	77
6	CHAPTER 6: REFERENCES	79
7	CHAPTER 7: APPENDICES	88

LIST OF FIGURES

Figure 2.1:	Diagram illustrating the methodology of the study	22
Figure 3.1:	BMI distribution across severities of ID amongst study population	39
Figure 3.2:	High-risk WC, according to all severities of ID found in the study population	40
Figure 3.3:	BF-AMA measurements, according to gender distribution of the study population with ID	42
Figure 3.4:	AMC measurements, according to severity of ID of study population	44
Figure 3.5:	AMC measurements, according to gender distribution of the study population with ID	45
Figure 3.6:	AMA measurements, according to severity of ID among total population	46
Figure 3.7:	AFA measurements, according to severity of ID among total population	47
Figure 3.8:	Overall anthropometrical status of the total study population	48
Figure 3.9:	Nutritional status, according to severity of ID of the total population	49
Figure 3.10:	Medication, according to different severities of ID amongst the total population	53

LIST OF TABLES

Table 1.1:	Mean IQ and percentage distribution within the population with ID	1
Table 1.2:	BMI amongst different severities of ID in individuals from the West Coast of Norway	5
Table 1.3:	Central nervous system medication, its use and nutritional side effects	11
Table 1.4:	Most relevant feeding difficulties within different severities of ID	13
Table 2.1:	Number of in-patients with ID at the psychiatric hospital surveyed, according to severity of ID, gender and race	20
Table 2.2:	Cut-offs used for classification of anthropometrical status of study participants	27
Table 3.1:	Demographic information, according to the severity of ID of study participants	36
Table 3.2:	Distribution of individuals across the different severities of ID of study participants	37
Table 3.3:	Prevalence of EP amongst study participants with different severities of ID	38
Table 3.4:	Comparison of severity of ID and average MUAC measurements across gender	41
Table 3.5:	Comparison of severity of ID and average TSF measurements across gender	41
Table 3.6:	Comparison of overall anthropometrical status and BMI in the study population with ID, in percentage	50
Table 3.7:	Summary of the classification of nutritional status, according to various anthropometrical measurements in the study population with ID, in percentage	51
Table 3.8:	Most prevalent medications used in the study population with ID, according to gender, in percentage	53
Table 3.9:	Differences between the current and adjusted screening tool	56

Table 3.10:	Action that should be taken, according to scoring of adapted screening tool	57
Table 3.11:	Comparison of the nutritional status of the participants, according to the anthropometrical measurements (overall anthropometrical status) (Phase 1) and the adapted screening tool (Phase 2), in percentage	59
Table 4.1:	Comparison of BMI classification between the population with ID and the general South African population, in percentage	66

LIST OF ABBREVIATIONS

Abbreviation	Term
AFA	arm fat area
AMA	arm muscle area
AMC	arm muscle circumference
ANOVA	analysis of variance
BF-AMA	bone-free arm muscle area
BMI	body mass index
CDL	chronic disease of lifestyle
EP	epilepsy
FFM	fat-free mass
FM	fat mass
GERD	gastroesophageal reflux disease
HIV	human immunodeficiency virus
ID	intellectual disability
IQ	intelligence quotient
LD	learning disability
MS	metabolic syndrome
MUAC	mid-upper arm circumference
SD	standard deviation
STEP	Screening Tool of fEeding Problems
TB	tuberculosis
TSF	triceps skinfold
WC	waist circumference

LIST OF DEFINITIONS

- Intellectual disability (ID): Individuals with below-average intellectual functioning, in combination with the limitation of certain skills that are necessary for everyday living.¹
- Z score: The deviation of the value for an individual from the median value of the reference population, divided by the standard deviation (SD) for the reference population.²
- Anatomical position: The body is assumed to be in the standing position, feet together, arms at the sides, the head, eyes and palms of hand facing forward.³
- Pearson Chi-square test: Used to assess two types of comparison: tests of goodness of fit and tests of independence, determining to what extent two variables are proportional to each other.⁴
- Mann-Whitney U test: Used to compare differences between two independent groups.⁴
- Kruskal-Wallis test: Used to compare three or more samples.⁴

LIST OF APPENDICES

Appendix A:	<i>Nutritional Screening Tool for Adults with Learning Disabilities</i> (Original version)
Appendix B:	Consent and assent forms: participants, guardian or hospital superintendent (English and Afrikaans)
Appendix C:	Patient anthropometric information and additional risk factors
Appendix D:	Demographic information
Appendices E1–E5:	Tables and formulae for anthropometric measurements
Appendix E1:	Body mass index
Appendix E2:	Waist circumference
Appendix E3:	Mid-upper arm circumference and upper-arm muscle circumference
Appendix E4:	TSF and BF-AMA (small, medium and large frames)
Appendix E5:	Frame size
Appendix E6:	Formulae for calculating AMA
Appendix F:	Formulae to calculate upper AFA
Appendix G:	Adapted Screening Tool for Adults with ID
Appendix H:	Consent forms: nursing staff (English and Afrikaans)
Appendix I:	Face validity questionnaire: nursing staff (English and Afrikaans)
Appendix J:	Content validity questionnaire: dietitians (English and Afrikaans)
Appendix K:	Letter for approval: Hospital
Appendix L:	Patient information sheet (English and Afrikaans)

CHAPTER 1

LITERATURE OVERVIEW

1.1 INTRODUCTION

Intellectual disability (ID) is a term that is used to describe individuals with below-average intellectual functioning, in combination with the limitation of certain skills that are necessary for everyday living.¹ The skills refer to daily living skills, communication skills, functional academics, and health, safety and social skills.^{5,6} Individuals with ID experience markedly more ailments and health risks than does the general population.⁷ Some of the health risks that occur in individuals with ID include growth alterations, metabolic disorders, poor feeding skills, prolonged use of medication and poor health habits.⁸ ID is classified according to the severity of intellectual impairment. There are four degrees of severity, with the severity referring to the number of SDs below the mean intelligence quotient (IQ) of the general population (Table 1.1).⁹ The average IQ score of the general population is 100.⁵

Table 1.1: Mean IQ and percentage distribution within the population with ID: ^{1,6,9,10}

Degree of ID	SD below normal IQ	IQ	Average percentage distribution within the population with ID (%)
Mild	-2	55–70	85,0
Moderate	-3	40–54	10,0
Severe	-4	25–39	3,0–4,0
Profound	-5	0–24	1,0–2,0

Individuals with mild ID can become fairly self-sufficient and are able to acquire some academic skills. Those with moderate ID can carry out work and self-care tasks with

moderate supervision, and they are able to develop communication skills in childhood. Individuals with severe ID can carry out very basic self-care skills, and have some communication skills. The most extreme form of ID is found among those with profound ID, who require a high level of structure and supervision.^{6,10}

ID affects 1–3% of the population globally. The prevalence of ID varies between different countries. In low-income countries, ID affects about 16,4/1000 individuals; in middle-income countries, it affects about 15,9/1000 individuals; and high-income countries are the least affected, with only 9,2/1000 of their individuals being affected. Gender distribution is skewed more towards men, with the prevalence ranging between 52,0% and 59,3% and for women between 40,7% and 48,0%.^{10–13}

Despite the above-mentioned percentages being only an average, the percentage distribution amongst the different severities does vary. Even though the size of the study populations varied, the distribution variation is clearly seen in several studies, with the prevalence of mild ID ranging from 1,7% to 47,0%, moderate ID ranging from 32,4% to 48,0%, severe ID ranging from 14,2% to 53,0%, and profound ID affecting up to 72,0%.^{11,13,14}

Although ID occurs independently of ethnicity/race, within the population with ID in the United States, Caucasian individuals are mostly affected, with a prevalence of 73,0% to 77,0%, and secondly, the African or African-American individuals, with a prevalence of 12,5% to 23,0%. Hispanic or other races are least affected, with a prevalence of 3,3% to 9,1%.^{12,13,15}

1.2 NUTRITIONAL STATUS OF THE POPULATION WITH ID

Individuals with ID are nutritionally vulnerable, as they have an increased risk of developing nutritional deficiencies and malnutrition, due to various reasons. These reasons include restricted food choices, being dependent on others for food, physical abnormalities, and poor feeding techniques, as well as additional feeding problems, such as pica, binge eating, anorexia nervosa, food refusal and self-induced vomiting, which affects one out of three individuals.^{16–18} Therefore, adequate nutrition should be a major component of the rehabilitation process in long-term care facilities or hospitals.

Malnutrition goes hand-in-hand with suboptimal patient care, and can negatively impact on the management of disease conditions. Malnutrition can be classified as either undernutrition or overnutrition, having measurable adverse effects on tissue, body form and function, as well as on clinical outcome, for example an increased morbidity and mortality, wound-healing problems, reduced gut function, and an increased risk of infection, due to poor immune function, of which all contribute to an increased length of hospital stay and to increased cost.^{19,20} Overweight or obesity specifically leads to an increase in the development of chronic diseases of lifestyle (CDL), such as diabetes mellitus, hypertension and cardiovascular disease.⁸ The prevalence of malnutrition among the population with ID in the United Kingdom, Ireland, Finland and Australia ranges from underweight (5,0–43,0%) to overweight (2,0–35,0%).²¹

Whether individuals with ID are free-living or not plays a role in their nutritional status. Individuals living in institutions have the lowest prevalence of obesity whereas individuals with severe and profound ID living with family are more likely to be obese,

compared to those living in an institution.^{12,22} In a study that was undertaken on the semi-institutionalised^a population with ID of Santa Catarina in Brazil, it was noted that 60,0% of the adults were malnourished (with 7,0% being underweight, 24,0% overweight and 29,0% obese). Possible causes of the overweight and obesity in this Brazilian population included living a sedentary lifestyle, lack of nutritional education, inadequate diet, behaviour factors, and personality disorders. The prevalence of obesity in the general population of Brazil is known to be 8,3%, which is at least 3.5 times less than the prevalence among the population with ID.²³ There appears to be a paucity of data in South African literature about the nutritional status of individuals with ID, precluding the drawing of any direct comparisons.

Anthropometry is defined as the measurement of body size, weight and proportions.³ It can be used to evaluate the nutritional status of individuals. The SD, or z score, is used to interpret anthropometrical measurements.² Anthropometrical measurements that can be used to describe nutritional status include: weight; height; waist circumference (WC); various skinfold measurements; and mid-upper arm circumference (MUAC). To distinguish between indices of fat mass (FM) and fat-free mass (FFM) is fundamental to the diagnosis and treatment of malnutrition.³ Anthropometry on its own cannot completely assess the overall nutritional status of individuals. Anthropometrical measurements should be used in combination with a thorough clinical examination, evaluation of dietary intake and biochemical investigations to determine the nutritional status of an individual.³

A study done by Hogan *et al.* (1994) has shown that almost 62,0% of individuals

^a ID individuals that stay with family members during the evening, but at an institution during the day

(33 men and 33 women) with severe developmental disabilities living in Southern Ontario had weight-for-height z scores of ≤ -2 SD, indicating that undernutrition was more prevalent than overnutrition in the population with ID concerned.¹⁶

ID has been linked to body mass index (BMI) status. Obesity is twice as high in the population with ID compared to the general population. Men with ID overall are significantly less obese than their females counterparts, with a prevalence of 13,0% versus 24,0% respectively.^{12,22,24–26} In a study done on individuals with ID from the West Coast of Norway, 61,7% of the population had weights outside the desirable ranges (7,8% underweight, 34,8% overweight, and 19,1% obese), compared to 44,5% of the general population (7,5% underweight, 30,5% overweight and 6,5% obese). The BMI distribution amongst the different severities of ID within said population is indicated in Table 1.2 below.²⁵

Table 1.2: BMI amongst different severities of ID in individuals from the West Coast of Norway:²⁵

Severity of ID	BMI <18.5 (underweight) (%)	BMI 18.5–24.9 (normal weight) (%)	BMI 25–29.9 (overweight) (%)	BMI >30 (obese) (%)
Mild	7,3	25,7	40,4	26,6
Moderate	5,1	43,6	36,8	14,5
Severe	14,9	53,2	21,3	10,6

Table 1.2 clearly shows that the population with mild and moderate ID tend to be more at risk of being overweight and obese, whereas the population with severe ID is more likely to being underweight compared to the other two severities.²⁵

An anthropometrical measurement that can be used to determine body fat distribution and the risk of developing CDL is WC. Fat placement or distribution within the body may be more important than is the quantity of body fat overall. General adiposity and abdominal adiposity are associated with an increase in morbidity and mortality, and support the use of WC, in addition to BMI, in assessing risk of developing CDL. Excess abdominal fat is associated with an increased risk of developing CDL.²⁷ The conditions/diseases include hyperglycaemia (impaired fasting glucose, impaired glucose tolerance and diabetes mellitus), hypertension, dyslipidaemia, metabolic syndrome (MS), coronary heart disease, and cardiovascular disease.^{21,28} WC cut-off values that indicate a high risk of developing CDL have been identified for both men and women. A WC measurement of above 102 cm for men, and of above 88 cm for females, indicates an increased risk of developing CDL.^{3,28} Studies have shown an increased WC in 20,0–48,4% of the total population with ID, and indicate that there is an overall prevalence of increased WC in the population with ID compared to the general population.^{11,14,29} Similar results were found in a Taiwanese disability welfare institution that cared for individuals with ID, where the prevalence of increased WC in men and women was 21,0% and 59,4%, respectively.¹⁴ To illustrate the fact that using WC in isolation is not the best indicator of nutritional status, a study that was undertaken by Waning *et al.* (2010) found that 10,0% of women with ID, and 0,0% of men with ID were obese according to the BMI classification, yet 39,0% of the females and 7,0% of the males were obese according to the WC measurement.²⁷

Skinfold measurements indirectly estimate the percentage of body fat, and should be used in combination with other measurements.³ In a study conducted on a population of

Saudi men (with a mean age of $39,7 \pm 1,6$), 17,9% of the adults with ID had a skinfold thickness measured at the triceps skinfold (TSF) site above the recommended range (4–25 mm) for the normal population, indicating that some of the individuals might be overweight.¹⁸

Bone-free arm muscle area (BF-AMA) is a good indication of lean body mass, and is valuable in evaluating the possible existence of protein energy malnutrition. BF-AMA is interpreted by taking into account elbow width as an indication of frame size and by using a formula including the TSF measurement and MUAC.³ MUAC can be used in equations for calculating arm muscle area (AMA) and for estimating body weight. As much as 41,0% of the population of Saudi men with ID had a MUAC below the desirable range (22,3–30,6 cm) for the normal population, and could be seen to be at risk of malnutrition, or already malnourished.¹⁸

Hogan *et al.* (1994) showed that 46,0% of individuals (men and women) in Southern Ontario with severe developmental disabilities, aged 6 to 31 years, had a z score of ≤ -2 SD for AMA, and that 38,0% had a z score of ≤ -2 SD for upper arm fat area (AFA).¹⁶ It was also found that the percentage FM of the population with ID was higher than that of the general population, and that the FFM percentage was lower.^{14,29} The findings indicated that individuals with severe ID were more prone to having lower AMA, when compared to them having AFA, and that they tended to have an overall lower muscle mass.

1.3 RISK FACTORS FOR MALNUTRITION

The population with ID is prone to the same risk factors for malnutrition as is the general population, but in the population with ID the number and the effect of risk factors is increased due to various reasons.³⁰ Feeding problems, such as poor feeding technique, swallowing difficulty, regurgitation, dysphagia, gastroesophageal reflux disease (GERD), limited appetite, food refusal and choking or vomiting during eating are some of the risk factors for malnutrition, and are potentially life-threatening in the population under survey.³⁰ The prevalence of feeding problems among the population with ID has been estimated at rates greater than 30,0%.^{13,31}

The prevalence of feeding problems in the population with severe and profound ID is the highest, with rates up to 80,0%.¹³ GERD affects only 5,0–7,0% of the general population, but up to 33,0–50,0% of the population with ID: the more severe the ID, the higher the incidence of dysphagia/GERD. Dysphagia, with or without GERD, places individuals at a high risk of aspiration of food or liquids into their lungs, which often results in any of a number of lung infections, including pneumonia. BMI is the best indicator of the severity of dysphagia, with individuals with a relatively low BMI being more likely to be dysphagic.^{32,33}

MS is one of the conditions that might occur due to excess abdominal fat and having the condition increases the risk of coronary heart disease and other health problems, such as diabetes mellitus and stroke.¹⁴ MS occurs in 11,6% of the population with ID of Taiwan, with women being more affected than men (17,2% and 8,0%, respectively), yet it has a lower prevalence than amongst the general population (women 20,4% and men

25,7%). Such rates of prevalence correlate with women with ID having a higher WC than do men with ID.¹⁴

Hypertension is a common condition in South Africa, affecting 29,0–55,0% of the general population. The prevalence is highest in the African community (59,0%), whereas it is 50,0% for the Caucasian community. Hypertension is a risk factor for heart attacks, stroke, renal disease and blindness. It is frequently referred to as the ‘silent killer’, seeing that hypertension is universally under-diagnosed and/or inadequately treated.³⁴ Hypertension also frequently co-exists with other risk factors for CDL. In two studies undertaken on individuals with ID in Taiwan and New York, hypertension was found to affect 17,9–30,0% of individuals, with a higher percentage occurring among men than women (30,3% and 25,4% respectively). A correlation was found between having an increased WC and hypertension of 36,6%. The co-existence of overweight and hypertension in individuals with ID was found to be 35,4% and of obesity and hypertension 39,3%.^{11,24}

Epilepsy (EP) is the most common neurological condition in the general population. About 1 in every 100 individuals in the general population (globally) suffers from EP. EP occurs together with seizures, and is usually diagnosed after a person has had at least two seizures that were not caused by some known medical condition.³⁵ A seizure can be caused by hunger, hypoglycaemia, hypocalcaemia and nutritional imbalances.³⁶ EP is the second most common co-morbid condition in adults with ID, and in a south east London population, it was found to affect between 20,0–30,0% of the population. More men than women have EP, affecting 55,8% of men and 44,2% of women in the population with ID.^{35,37} EP amongst the different severities of ID also varies, affecting

43,6% of the mild, 23,1% of the moderate and 33,3% of the population with severe ID in south east London.³⁵ Epilepsy can play a role in malnutrition through various mechanisms which include sociocultural aspects such as a restricted lifestyle, limited food intake due to food prohibitions and social rejection. Drug-resistant epilepsy can also lead to frequent seizures, and longer periods of reduced alertness. This may in turn lead to a decreased energy intake. Anti-epileptic treatment may also lead to malnutrition due to weight loss being a side-effect of the medication.³⁸

Other aspects also influence the nutritional status of individuals with ID, including type and number of medications, pica, and underlying medical conditions, such as constipation, pressure sores, human immunodeficiency virus (HIV) and tuberculosis (TB).³⁹

- Medication: Individuals with ID receive numerous medications (polypharmacy) and are known to be the most overmedicated group in society.⁴⁰ Even though it is known that the population with ID is more susceptible to experiencing side effects, 20,0–40,0% of the population with ID requires psychotropic medication. Additionally, most central nervous system medications have nutrient interactions, as well as both short- and long-term nutritional side effects (Table 1.3).^{8,40,41} Some of the general side effects include: dry mouth; weight gain; increased/decreased appetite; constipation; and metabolic changes. It is, therefore, of utmost importance that the medical personnel are aware of the drug-nutrient interactions and side effects, in order to limit possible negative impact on the nutritional status of the population with ID.⁴⁰

Table 1.3: Central nervous system medication, its use and nutritional side effects:⁴¹

Central nervous system medications	Common nutritional side effects
Analgesics Group of drugs used to relieve pain	<ul style="list-style-type: none"> • Nausea/Vomiting • Constipation • Slow gastric emptying • Dry mouth • Gastric irritation – abdominal pain
Antiepileptic Used for a wide variety of seizures	<ul style="list-style-type: none"> • Folic acid deficiency • Megaloblastic anaemia • Vitamin D deficiency • Nausea/Vomiting • Gastrointestinal disturbances (Anorexia, diarrhoea, epigastric pain) • Dry mouth • Constipation • Increased appetite • Weight gain
Antiparkinsonian agents Symptoms associated with Parkinson's disease result from an imbalance between two neurotransmitters. Drug therapy focuses on restoring the balance between the two neurotransmitters.	<ul style="list-style-type: none"> • Dry mouth • Nausea/Vomiting • Constipation • Anorexia • Peptic ulceration • Gastrointestinal bleeding • Oedema
Psycholeptics Medication that produces a calming effect upon the patient	<ul style="list-style-type: none"> • Nausea/Vomiting • Jaundice • Anorexia • Constipation • Diarrhoea • Weight gain • Dry mouth • Hypertriglyceridaemia
Psychoanaleptics Medication that produces an arousing effect upon the patient.	<ul style="list-style-type: none"> • Dry mouth • Constipation • Nausea/Vomiting • Diarrhoea • Anorexia/Increase in appetite • Weight loss/gain • Oedema • Bitter taste

- Pica is considered to be a compulsive eating disorder, and is defined as *‘the desire for something unusual, either in terms of the substance itself, or the*

quantity', with the object of such desire including dirt, clay, plaster, cigarette butts, faeces, ice, hair, paper, sand, soap and toothpaste.⁴² Pica is common in ID, with a global prevalence of 4,3% and occurring in 9,0–25,8% of institutionalised individuals with ID.⁴³ The more severe the ID is, the higher is the risk of developing pica. Pica is also less frequent in men with ID than in women with ID and the incidence of pica decreases with age.^{13,43} It is known that pica has been associated with malnutrition, poor sanitation, personal injury, and a number of health risks. Other complications that pose health risks include chemical poisoning, iron and zinc deficiency, organ problems, due to the ingestion of abnormal substances, damage to the gums and teeth, and the invasion of unwanted organisms into the body, which can affect the absorption of certain nutrients.^{39,44} It is, therefore, of utmost importance that the presence of pica should be included in all clinical assessments.

- Constipation refers to bowel movements that are infrequent or hard to pass. It is a common condition, and the incidence in the general population is about 12,0%. Constipation in the general population with ID varies from 7,6–69,0%, depending on various factors.⁴⁵ A study undertaken by Morad *et al.* (2007) in Israel found that, within the different severities of ID, those with mild and moderate ID had the highest incidence of constipation (3,9%), and those with severe (1,8%) and profound ID (1,9%) had a lower incidence of constipation.⁴⁵ Possible causes for constipation in said population with ID included immobility, neurological impairment, inadequate fluid intake, poor dietary fibre, pica and physical disabilities.^{33,45}

Considering the overall risk factors, it is clear that some of the population with ID are at risk of developing malnutrition or has an increased risk of developing nutrition related complications, especially when risk factors persist, and require alternative feeding practices.⁴⁶ In the following section, feeding and mealtime behaviour problems and the motivation for the adjustment of an appropriate screening tool will be discussed.

1.4 ASSESSMENT OF FEEDING AND MEALTIME BEHAVIOUR PROBLEMS

Timeous assessment of feeding and mealtime behaviour problems in the population with ID is of utmost importance, seeing that individuals diagnosed with severe and profound ID are more likely to suffer from behaviour problems, with a prevalence of almost 80,0%.^{13,39} These behaviour problems include; self-injury, rumination disorders, pica, depression and food selectivity.^{13,39} Matson *et al.* (2001) found that 1 out of 3 individuals with ID had feeding difficulty. The most relevant difficulties within the different severities are summarised in Table 1.4 below.¹³

Table 1.4: Most relevant feeding difficulties within different severities of ID:¹³

Severity of ID	Cannot feed self independently (%)	Lack the ability to chew (%)	Only eat selected foods (%)	Need special equipment for feeding (%)
Mild	8,0	3,4	3,4	11,4
Moderate				
Severe				
Profound	31,5	13,2	12,1	43,4

Although there are currently different behaviour rating scales developed by various researchers, scant attention has, as yet, been given to problems related to feeding and mealtime behaviour.³⁰ Different behaviour scales are briefly mentioned below:

- *The Reiss Screen*

Consisting of 38 items, the Reiss Screen is a questionnaire that is used to screen for symptoms of psychopathology and other maladaptive behaviours. Only one item focuses on feeding and mealtime behaviour, and is related to weight gain/loss.³⁰

- *The Diagnostic Assessment for Severely Handicapped-II:*

This diagnostic tool, which consists of 84 items, is used to screen for symptoms of psychopathology in individuals with severe and profound ID. Six of the items address feeding problems.³⁰

- *The Assessment of Dual Diagnosis*

This diagnostic tool, which consists of 79 items, is a screening instrument that is used to identify psychopathology among individuals with mild to moderate ID. Six of the items are related to eating.³⁰

- *The Screening Tool of fEeding Problems (STEP)*

This tool consists of 23 items that are aimed at identifying feeding problems in individuals with ID. Such feeding problems include food-type selectivity, food-texture selectivity, pushing food away, vomiting, and eating too quickly. This tool contains the following five categories: aspiration risk; feeding skills; selectivity; behaviour problems; and some nutrition aspects.³⁰

- *Nutritional Screening Tool for Adults with Learning Disabilities*

This tool, which focuses on the nutritional status of individuals, includes anthropometrical measurements, feeding abilities, learning disabilities and the overall health status of the patient.⁴⁷

The above mentioned screening tools are not comprehensive enough to assess and monitor the risk of malnutrition. The *Reiss Screen*, *The Diagnostic Assessment for Severely Handicapped-II*, as well as *The Assessment of Dual Diagnosis* were not regarded as ideal for screening the nutritional status of individuals with ID, seeing that there was little attention given to the nutritional aspects.³⁰ *STEP* focuses mainly on feeding problems, and not on overall nutritional status. The tool contained no anthropometrical measurements and therefore was not deemed suitable as a screening tool for malnutrition in patients with ID.³⁰

The *Nutritional Screening Tool for Adults with Learning Disabilities* (Appendix A) can be considered as an appropriate screening tool for individuals with ID as it focuses on the overall nutritional status of the individual and incorporates different aspects that affect nutrition (appetite and dietary intake e.g. reduced intake and diabetic diet, psychological state e.g. regurgitation and eats inedible foods, skin type (skin condition) e.g. dry and flaky and pressure sores, symptoms e.g. vomiting and diarrhoea). It also includes anthropometry (bodyweight for height) and feeding ability. This tool was developed by the The Leicestershire Nutrition and Dietetic Service in 2004 for use in the Learning Disabilities Service, and it was never tested for sensitivity or specificity. Although this tool can be regarded as an appropriate screening tool in this population, other factors

(such as co-morbidities and other anthropometrical measurements), emanating from the literature review should be investigated and added to the tool in order to improve the tool as a screening tool for malnutrition in a population with ID.⁴⁷

1.5 MOTIVATION

Considering the myriad of risk factors causing nutritional deficiency, as well as the high prevalence of malnutrition and feeding problems experienced by individuals with ID, there was a clear need for a comprehensive screening tool to assess the risk of malnutrition in the population with ID. The development of a more sensitive and reliable screening tool, which includes all the mentioned risk factors, as well as anthropometrical indicators that are aimed at screening for malnutrition, should enable nursing professionals to identify individuals with ID at risk of malnutrition and to refer them to the dietitian for timeous intervention. Doing so should ultimately improve the quality of life of individuals with ID, as well as decrease the use of unwarranted medication and improve their general health.

1.6 PROBLEM STATEMENT

After careful evaluation of the relevant literature, it was evident that there was a need to establish whether the current screening tool (the *Nutritional Screening Tool for Adults with Learning Disabilities*) used for the early detection of malnutrition in individuals with ID was applicable. It was also necessary to establish what adjustments were needed to make the screening tool more accurate in identifying malnutrition in this cohort.

Thereafter, it was important to assess whether or not the adjusted screening tool was easy to complete by nursing staff without prior training, and, if not, what adjustments were needed to make it easier for the staff to use.

CHAPTER 2

RESEARCH DESIGN AND METHODOLOGY

2.1 AIM

The main aim of the current study was to determine the degree of malnutrition and body composition in individuals with ID, in a psychiatric hospital in North West Province (South Africa), and to adapt an existing screening tool (*Nutritional Screening Tool for Adults with Learning Disabilities*) accordingly.

2.2 OBJECTIVES

2.2.1 Primary objectives

The primary objectives of the current study were the following:

- to determine the body composition of individuals with ID through anthropometrical measurements and to calculate indices of FM and FFM;
- to determine which degree of ID was more prone to malnutrition;
- to investigate the different risk factors for malnutrition in the group of patients with ID; and
- to adapt a screening tool that could be used by nursing staff for early detection of malnutrition, including determination of the relevant anthropometrical measurements and risk factors.

2.2.2 Secondary objectives

The secondary objective of the current study was to determine the sensitivity and specificity of the screening tool devised.

2.3 STUDY DESIGN

An observational descriptive cross-sectional study, with an analytical component, was conducted.

2.4 STUDY FRAME

The study frame consisted of 719 in-patients at a psychiatric hospital in the North West Province (Table 2.1). This psychiatric hospital was chosen through convenience sampling.

Table 2.1: Number of in-patients with ID at the psychiatric hospital surveyed, according to severity of ID, gender and race (n=719)

Total number of patients per severity of ID	Number
• Mild ID	35
• Moderate ID	60
• Severe ID	147
• Profound ID	26
Gender and race	Number
Total number of men:	391
• Caucasian men	290
• Black/Coloured and Indian men	101
Total number of women:	328
• Caucasian women	267
• Black/Coloured and Indian women	61
Total number of patients with ID	719

2.5 SAMPLE SIZE

2.5.1 Phase 1

After considering the diagnosis and age of all the individuals within the study frame (719 patients), all the individuals whose characteristics complied with the inclusion criteria were assessed. Anthropometric measurements of 244 in-patients with ID (comprising 34,0% of the total population with ID) were assessed during phase 1 of the study.

2.5.2 Phase 2

During the second phase, the existing screening tool was adapted and the sensitivity and specificity of the screening tool was determined. This phase of the study was

performed on 48 of the 244 in-patients (19,7% of the study population). Twelve participants were chosen through quota sampling to represent each severity of ID.

2.6 SAMPLE SELECTION

2.6.1 Inclusion criteria

The inclusion criteria for a patient to be included in the study were the following:

- an in-patient of a psychiatric hospital in the North West Province who had been classified with ID;
- a male/female in-patient with ID;
- an in-patient with ID who was between the ages of 18 and 75 years;
- a member of any race present in the hospital; and
- a speaker of any language

2.6.2 Exclusion criteria

The exclusion criteria for a patient to be excluded from the study were the following:

- an in-patient with ID who had another neurological disorder that affected their body composition and possibly their nutritional requirements, such as cerebral palsy, Down syndrome, Joubert syndrome, Machado-Joseph Disease, multiple system atrophy, neuroacanthocytosis, neurodegeneration with brain iron

accumulation, Sydenham chorea, ataxias and cerebellar/spinocerebellar degeneration;

- an in-patient who was unable to stand without support; and
- an in-patient with ID who did not give written informed consent, or whose guardian refused consent for their participation in the study.
- patients who participated in the pilot study.

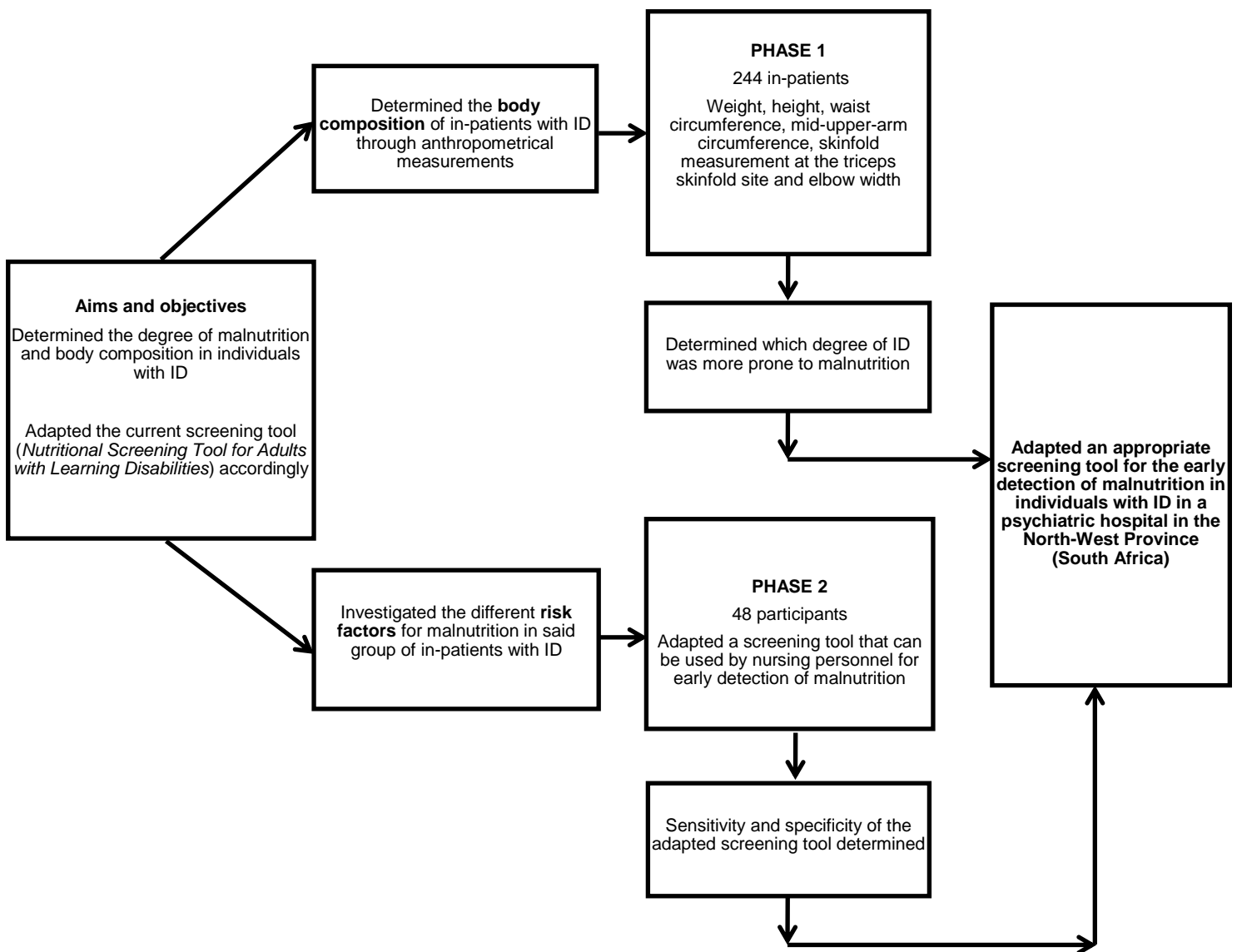


Figure 2.1: Diagram illustrating the methodology of the study

2.7 METHODS OF DATA COLLECTION

The study consisted of two phases. During the first phase, the anthropometric measurements of the participants were obtained and used to determine their nutritional status, and during the second phase, a screening tool for early detection of malnutrition was adapted and the relevant risk factors were added and tested.

2.7.1 Phase 1: Anthropometric measurements

The first phase of the study was performed 5 days a week for 7 weeks by the investigator. Participants were assessed per ward and the anthropometric measurements of 7 participants were obtained per day. Written informed consent (Appendix B) to participate in the study was obtained from the participant, the guardian or the hospital medical superintendent.

For each participant, there was a set of data sheets, consisting of an information form (Appendix C), on which all the anthropometrical measurements and additional risk factors were noted, a demographic information form (Appendix D) and the existing screening tool (Appendix A). Said forms were completed by the researcher and all the information was obtained from either the patient's file or through discussions with nursing staff. The degree of disability was obtained from the diagnosis documented in the patient's file. A unique participant code was indicated on the top right corner of each form and was used as a reference number for purposes of data analysis and determination of sensitivity and specificity.

2.7.1.1 Determination of the body composition of individuals with ID through anthropometrical measurements, namely weight, height, waist circumference, mid-upper arm circumference, skinfold measurement at the TSF site and elbow width.

All the anthropometrical measurements were measured by the investigator, who is a registered dietitian, trained and standardised to take anthropometrical measurements, who was assisted by the nursing staff. All the measurements were performed in a private area. An average of two measurements was taken for all the anthropometrical measurements. None of the measurements differed enough to warrant a third measurement, in which case the median would have been used. The above was done in order to ensure standardisation, and in order to increase the strength of reliability of the results obtained and to avoid any variability. To ensure the accuracy of measurements taken, the participants wore lightweight clothing and were required to remove any unnecessary clothing items, such as shoes or hats.

The following anthropometric measurements were required to classify the nutritional status of each participant: weight; height; BMI; WC; MUAC; triceps skinfold thickness and elbow width. The overall anthropometrical status of the participants was then calculated. All measurements taken are described below.

Weight was measured using a SECA electronic scales (no. 2750156075169) with a capacity of 150 kg × 50 g. Measurements were taken to the nearest gram. The participant stood in the middle of the scale in the anatomical position without external support.³ Zero calibration was done between each measurement and calibration using a

2 kg weight was done every day before starting with data collection and, in the case of the scale not being calibrated, it would have been sent to the company for calibration, but such action proved to be unnecessary.

Height was measured to the nearest cm using a SECA stadiometer (no. 2131721009). The participant stood barefoot in the middle of the platform of the instrument, in the anatomical position, with his/her back against the pole and the head in the Frankfurt plane. Measurements were taken during inspiration.³

BMI was calculated from the above-mentioned weight and height measurements, the participants' weight-for-height ratio. The ratio was used to classify the participants' nutritional status, using the recognised cut-off values.³ (Appendix E1)

WC was measured, using a non-stretch, flexible tape measure, to the nearest 0.1 cm. The participant removed any outer clothing obstructing the taking of the measurement and stood in the anatomical position. The measurement was taken in a horizontal plane, parallel to the floor, and around the abdomen. The point of the measurement was in the middle, between the iliac crest and the last rib. The measurement was taken on the right-hand side of the participant. The WC was used to determine the individual's risk of developing CDL.³ (Appendix E2)

MUAC was measured on the right-hand side of the body, using a non-stretch, flexible tape measure, to the nearest 0.1 cm. Before the MUAC could be taken, the midpoint of the arm first needed to be located. The participant's arm was flexed, with the hand of the participant facing upwards. Taking into consideration that the middle point is between the tip of the acromion process and the olecranon process, in taking the

MUAC, the arm needed to be in a relaxed position, hanging next to the participant's side, with the palm facing the thigh. The tape measure was placed around the arm, perpendicular to the long axis of the arm, at the level of the TSF site.³ The MAUC was used to determine indices of FM and FFM. (Appendix E3)

Skinfold thickness at the TSF site was measured using a SAEHAN skinfold calliper (no. 03090105). The TSF site was located at the midpoint of the arm. The measurement was taken on the right-hand side of the participant, with the participant's arm hanging loosely at his/her side, with the palm of the hand facing anteriorly. The skinfold measurement was measured by grasping the skinfold with the thumb and index finger about 1 cm proximal to the skinfold site. The calliper was placed in the middle of the skinfold. The measurement was read 4 seconds after the pressure from the measurer's hand was released. Readings was recorded to the nearest 1 mm.³ The average of two measurements was used. Assumptions about skinfolds were taken into account during the measurements, which included that body fat is normally distributed, the proportion of internal fat to external fat is constant, and the thickness of subcutaneous adipose tissue is constant or predictable within and between individuals.³ This was important to ensure the accuracy of the measurements taken. TSF was used to determine the indices of FM and FFM. Appendix E4 was used for the interpretation of TSF.

Elbow width was measured to determine the participant's frame size (Appendix E5). The participant stood with the elbow flexed 90°, with his/her palm facing towards him/her. The calliper blade measured the widest part of the elbow. The calliper blades were placed between the medial and lateral epicondyles of the humerus. The measurement was read to the nearest 0.1 cm. The elbow-width measurement was used

to identify the frame size of the participants, which was needed to interpret the BF-AMA (Appendix E4). Frame size was determined using elbow width and height.³

The overall anthropometrical status was determined by combining the results of different anthropometrical measurements, namely the BMI, the BF-AMA, the arm muscle circumference (AMC), the AMA and the AFA. This was the researchers' way of getting a better idea of their overall anthropometrical status. Although this is still a subjective assessment, it is important to combine findings from the indices of fat mass and fat free mass to get the overall picture. The data of all said measurements were then captured into an Excel[®] (2010) spreadsheet and, according to the relevant cut-off values (Table 2.2), the overall anthropometrical status of the individuals was determined. These indices are included in the appendices; E1, E4, E3, E6 and F respectively. The determination was done by assessing the distribution amongst the five different measurements, for example if the individual had 3 normal measurements; he/she was classified as having a normal overall anthropometrical status.

Table 2.2: Cut-off values used for classification of anthropometrical status of study participants:

Body composition	Under-nourished	At risk of under-nutrition	Normal	At risk of over-nutrition	Over-nourished
BMI ⁴⁸	<18,5	NA	18,5 – 24,9	25,0– 29,9	>30,0
BF-AMA ⁴⁹	≤5,0	>5,0<15,0	15,0-85,0	>85,0<95,0	≥95,0
AMC ⁴⁹	≤5,0	>5,0<10,0	25,0-75,0	>75,0<95,0	≥95,0
AMA ⁴⁹	≤5,0	>5,0<15,0	15,0-85,0	>85,0<95,0	≥95,0
AFA ⁴⁹	≤5,0	>5,0<15,0	15,0-85,0	>85,0<95,0	≥95,0

2.7.1.2 Investigation of the different risk factors for malnutrition in the group of in-patients with ID.

To identify possible risk factors for malnutrition in the study population of in-patients with ID, an existing screening tool, *Nutritional Screening Tool for Adults with Learning Disabilities* (Appendix A), was used. Any additional risk factors that were not included in the screening tool were recorded separately.

The *Nutritional Screening Tool for Adults with Learning Disabilities* included the following information:

- anthropometrical measurements: weight, height and BMI;
- the dietary intake of the individual: normal or reduced intake;
- the psychological state of the individual during mealtimes: enjoyment of mealtimes; disruptive behaviour at mealtimes; regurgitation/self-induction; eating of inedible matter; the eating of only a limited range of foods; and hyperactivity/athetosis;
- the individual's skin condition (skin type), which was used as a parameter of nutritional status and nutritional deficiencies;
- the degree of learning disability (LD): mild, moderate, severe and profound;
- the feeding ability/inability of the individual;
- gastrointestinal problems, such as vomiting, diarrhoea or constipation; and
- the age of the individual.

The information that was needed for the existing screening tool, other than the anthropometry, was either observed by the investigator during mealtimes or obtained from participant's files or through discussion with the nursing staff.

2.7.2 Phase 2: Development of a screening tool that could be used by nursing staff for the early detection of malnutrition.

The existing screening tool was adapted (Appendix G) by incorporating the different aspects that might influence the nutritional status of the participants, as well as the most prevalent risk factors. Additionally, the sensitivity and specificity of the screening tool was determined.

Nine nursing staff whom was selected through convenience sampling, and who gave their written informed consent (Appendix H) to participate in the study used the adapted screening tool for one week to identify participants with ID who were at risk of malnutrition, or who were malnourished. Each nurse had to complete the adapted screening tool for 5 to 6 participants. As the nursing staff used the tool without the assistance of a dietitian, no training on the completion of the screening tool was given prior to implementation. Afterwards, the nursing staff completed the face validity questionnaire (Appendix I).

Forty-eight participants from among the 244 participants in Phase 1 were selected by means of randomisation tables. Twelve participants were selected from amongst those with each severity of ID through quota sampling, seeing that the researcher needed an equal number of participants from each severity of ID. Phase 2 was single-blinded, as

only the investigator knew the nutritional classification of each participant concerned. Using the participant code, the classification of malnutrition made by the investigator (Phase 1) using all the anthropometrical measurements, was compared to the classification made by the nursing staff (Phase 2) according to the adjusted screening tool, to assess the sensitivity and specificity of the screening tool employed.

2.7.3 Pilot study

2.7.3.1 Phase 1: Anthropometric measurements

After ethics approval was obtained for the study, a pilot study was performed during October 2011 in a psychiatric hospital in the North West Province on 10 in-patients who complied with the inclusion criteria. Said participants were excluded from the main study. The pilot study was done to assess the logistical arrangements made and the amount of time required to complete the anthropometrical measurements, to collect other information, such as additional risk factors for malnutrition and demographic information, and to improve the quality of the data sheets used.

The content validity of the screening tool was assessed by two dietitians with experience in consulting psychiatric patients. They provided feedback by completing the content validity questionnaire (Appendix J) together with the adapted screening tool. The average time taken to complete the adapted screening tool was 4 minutes. The dietitians concerned recommended that the questions in each subsection should be placed in the scoring order of 0 to 5, in order to make the layout more uniform. The scoring order initially was random, with scores ranging from example 2 to 4 to 1, which

caused confusion when completing the screening tool, and which necessitated the introduction of changes. A comment that it should be made possible for other neurological conditions to be added under 'other diseases' was not implemented, because patients who suffered from such conditions were excluded from the study. The expert panel expressed their concern as to whether nursing staff possessed sufficient skill to calculate the BMI. However, the measurement concerned could not be excluded from the screening tool; instead, the training that was regarded as being necessary for the nursing staff had to form part of their prior training and work responsibilities. The reason for not training the nursing staff prior to data collection was to simulate the habitual use of the tool because the screening tool would be used in the hospital setting, without the assistance of a dietitian.

2.8 DATA ANALYSIS

2.8.1 Preparation and analysis of data

2.8.1.1 Determination of which degree of ID was more prone to malnutrition

All anthropometrical data were captured in an Excel[®] (2010) document. The different severities of participants with ID and their anthropometrical and body composition measurements were statistically analysed to determine which degree of individuals with ID was more susceptible to malnutrition.

By using the skinfold thickness measurement at the TSF site and the MUAC measurements, the indices described below were determined.

2.8.1.2 Indices of fat-free mass (FFM)

BF-AMA (Appendix E4) was used to determine the lean body mass.⁴⁹ The formula used for the calculation of FFM was as follows:

$$\text{BFAMA} = \frac{[\text{MUAC (cm)} - (3.14 \times \text{TSF (cm)})]^2}{4\pi} - 10 \text{ (males) or } - 6.5 \text{ (females)}$$

AMC (Appendix E3):⁴⁹

The formula used for the calculation of AMC was as follows:

$$\text{AMC} = \text{MUAC (cm)} - [\pi \times \text{TSF (cm)}]$$

AMA (Appendix E6):⁴⁹

The formula used for the calculation of AMA was as follows:

$$\text{AMA (cm}^2\text{)} = \frac{[\text{MUAC (cm)} - \pi \times \text{TSF}]^2}{4\pi}$$

2.8.1.3 Indices of fat mass (FM)

The **AFA** (cm²) was determined by using the following formula (Appendix F):⁴⁹

$$\text{AFA} = \frac{\text{MUAC (cm)} \times \text{TSF (cm)}}{2} - \frac{\pi \times \text{TSF (cm)}^2}{4}$$

The above measurements were captured and formulas were entered into an Excel[®] (2010) spreadsheet. The values that were obtained were compared to the relevant standard cut-off values to determine the degree of malnutrition of each participant.

2.8.2 Statistical methods

MS Excel[®] (2010) was used for capturing the data and STATISTICA version 9 was used to analyse the data. Data were analysed and interpreted with the assistance of a statistician at the Centre for Statistical Consultation at Stellenbosch University.

Summary statistics was used to describe the variables. Distributions of variables were presented with histograms. Medians or means were used as the measures of central location for ordinal and continuous responses, and SDs as indicators of spread.

Relationships between two continuous variables were analysed using regression analysis, and the strength of the relationship was measured with the Pearson correlation if the continuous variables were not normally distributed. If one continuous response variable was related to several other continuous input variables, multiple regression analysis was used and the strength of the relationship was measured with multiple correlations.

The relationships between continuous response variables and nominal input variables were analysed using the appropriate analysis of variance (ANOVA). When ordinal response variables were compared versus a nominal input variable, nonparametric ANOVA methods, such as the Kruskal-Wallis test or the Mann-Whitney test, were used. The relationship between two nominal variables was investigated with contingency tables and likelihood ratio chi-square tests.

A p value of $p < 0.05$ represented statistical significance, and 95% confidence intervals were used to describe the estimation of unknown parameters.

2.9 ETHICS AND LEGAL ASPECTS

Ethics approval was obtained from the Health Research Ethics Committee of Stellenbosch University (N11/03/062), as well as from the Research Ethics Committee, Department of Health, North West Province. Permission to conduct the study was also requested and granted by the medical superintendent of the psychiatric hospital in the North West Province (Appendix K). The study was conducted according to the Declaration of Helsinki and Medical Research Council and ICH guidelines.

2.9.1 Informed consent

Written informed consent was obtained from the patient, guardian or hospital medical superintendent. In the case of mild or moderate ID, the patient was responsible for informed consent. All relevant information was read by the patient. If the patient was unable to read, the form was read to the patient, ensuring that all information was understood and agreed upon. The investigator ensured that each patient, where applicable, signed the consent form when they voluntarily agreed to participate in the study. In the case of a patient with severe or profound ID, either the patient's guardian or the medical superintendent were requested to give informed consent. Through consultation with social workers, it was determined that, if there was any family contact, and in the absence of family contact, the medical superintendent was requested to give informed consent. The consent form was kept separately from other data sheets. Each of the participants received a copy of the consent form as well as an information sheet, explaining the study and their part in it (Appendix L). During the second phase of the

study, written informed consent was also obtained from the nursing staff, who then completed the adapted screening tool (Appendix G). Appendix L was made available in English and Afrikaans only. According to the demographics of the hospital, patients were mainly Afrikaans speaking. In the event of a participant not understanding Afrikaans or English I would have asked one of the nursing staff to act as a translator, however this was never required.

2.9.2 Confidentiality

The confidentiality of the patient was respected by observing the following protocol:

- Confidential information was only accessible to the investigator and was destroyed after data collection and analysis.
- A unique participant code was used as reference number. The participant code was linked to the patient file number, which was kept in a password-protected file. Participant codes were known only to the investigator, so that the necessary comparisons and analysis of data could be performed.
- Personal information was not included in the reporting of results and was destroyed after data collection and analysis.
- Consent forms were separated from the screening tool prior to data capture.

CHAPTER 3

RESULTS

PHASE 1

3.1 DEMOGRAPHIC INFORMATION OF THE STUDY POPULATION WITH ID

The mean age for the total population (n=244) was 45 ($\pm 12,8$) years (range 18–72 years). Most participants studied were Caucasians (78,7%, n=192). There were 62,3% (n=152) male and 37,7% (n=92) female participants (Table 3.1). The distribution across the different severities is also shown below (Table 3.2). Over half of the participants (52,5%, n=128) had severe ID.

Table 3.1: Demographic information, according to the severity of ID of study participants (n=244)

Severity of ID	Age mean ($\pm 12,8$)	Gender		Race		
		Men % (n=152)	Women % (n=92)	African % (n=51)	Caucasia n % (n=192)	Coloured/ Indian % (n=1)
Mild (n=31)	49 years ($\pm 13,2$)	45,0 (n=14)	54,8 (n=17)	16,1 (n=5)	83,9 (n=26)	0,0 (n=0)
Moderate (n=71)	47 years ($\pm 12,8$)	60,6 (n=43)	39,4 (n=28)	12,7 (n=9)	87,3 (n=62)	0,0 (n=0)
Severe (n=128)	44 years ($\pm 12,6$)	66,4 (n=85)	33,6 (n=43)	25,0 (n=32)	74,2 (n=95)	0,8 (n=1)
Profound (n=14)	33 years ($\pm 12,6$)	71,4 (n=10)	28,6 (n=4)	35,7 (n=5)	64,3 (n=9)	0,0 (n=0)

Table 3.2: Distribution of individuals across the different severities of ID of study participants (n=244)

Severity of ID	Number of individuals (n=244)	Percentage of study population
Mild ID	n=31	12,7
Moderate ID	n=71	29,1
Severe ID	n=128	52,5
Profound ID	n=14	5,7

3.2 PREVALENT MEDICAL CONDITIONS FOR DETERMINING POSSIBLE RISK FACTORS FOR MALNUTRITION IN THE STUDY POPULATION WITH ID

Prevalent medical conditions were identified through consulting patients' files and were noted on Appendix C, under '*underlying medical conditions*'. Only 1,2% (n=3) of the study population was found to have diabetes mellitus. According to the information recorded in patients' files, none of the participants had TB, cancer or HIV/AIDS. However it is possible that this information was not disclosed in the files. The two most prevalent medical conditions that were found in the study population were EP (46,0%, n=112) and hypertension (13,1%, n=32).

EP was more prevalent in men (62,5%, n=70) than in women (37,5%, n=42), and was most prevalent in the group with severe ID and least prevalent within the group with mild ID (Table 3.3).

Table 3.3: Prevalence of EP amongst study participants with different severities of ID (n=244)

Severity of ID	Number of participants with EP	Percentage of participants with EP
Mild	n=10	8,9
Moderate	n=29	25,8
Severe	n=62	55,5
Profound	n=11	9,8

Hypertension was diagnosed in 10,5% (n=16) of the male and in 17,4% (n=16) of the female participants in the population with ID concerned. A statistically significant correlation was found between increased BMI and the prevalence of hypertension, seeing that 12,0% (n=9) of the overweight participants were found to suffer from hypertension ($p=0,00$), and 23,6% (n=13) of the obese participants were found to suffer from hypertension ($p=0,00$). There was also a positive correlation, according to Pearson Chi-square, between BMI and hypertension. No statistically significant correlation was found between an increased WC and hypertension.

3.3 BODY MASS INDEX AND WAIST CIRCUMFERENCE OF THE STUDY POPULATION WITH ID

The BMI distribution, according to the severity of ID, is shown below (Figure 3.1). The population with mild ID was more prone to obesity (35,4%, n=11) than was the population with any other severity, whereas the population with profound ID was more prone to being underweight (28,6%, n=4) than was the latter population. There was a significant difference between BMI and gender ($p = 0,00$) when the Pearson Chi-square test was used. Women with ID were found to be more obese (35,9%, n=33) than were

men with ID (14,5%, n=22), and a higher percentage of men with ID (48,7%, n=74) were classified as having a normal BMI compared to the percentage of women with ID (28,3%, n=26).

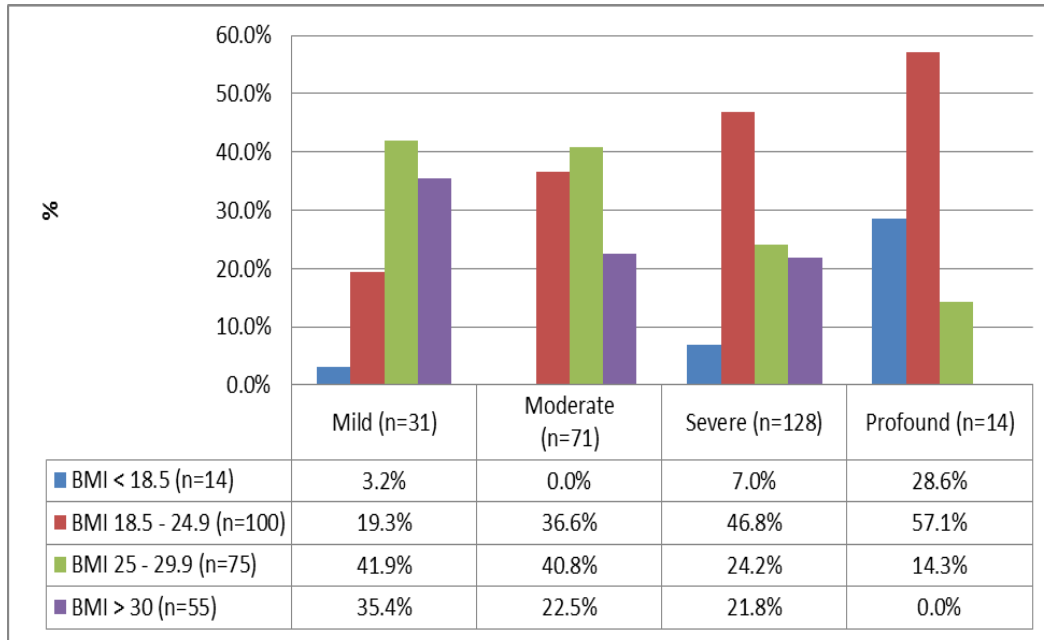


Figure 3.1: BMI distribution across severities of ID amongst study population (n=244)

WC was used to determine the risk of developing CDL, including diabetes mellitus, cardiovascular disease and hypertension. A measurement of >102 cm for men, and >88 cm for women indicated an increased risk of developing CDL.^{3,28} Of the total study population (n=244), 41,8% (n=102) were found to have a WC above the normal values. The female participants were found to have a 4 times higher risk of developing CDL according to WC, seeing that 80,4% (n=74) of women with ID and only 18,4% (n=28) of men with ID had an increased WC ($\rho=0,00$). The population with mild and moderate ID was more prone to having a high-risk WC compared to the populations with the other

two severities (Figure 3.2). A significant difference was found between increased WC and severity of ID ($p = 0,00$) when the Pearson Chi-square test was used.

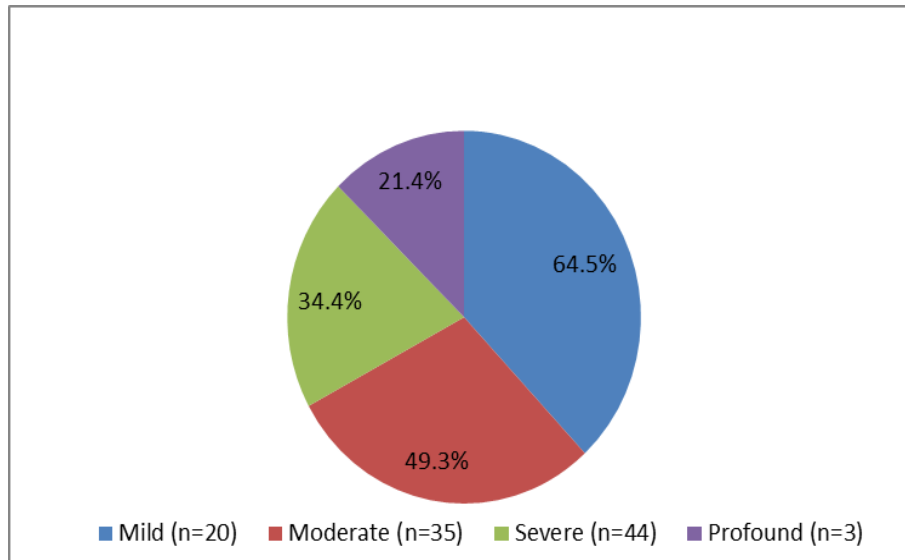


Figure 3.2: High-risk WC (>102 cm males, >88 cm females), according to all severities of ID found in the study population (n=244) (Pearson Chi-square, $p=0,00$)

When comparing BMI and WC, the majority of individuals (85,3%, n=87) with an increased WC were clearly also classified as overweight/obese according to the BMI.

3.4 BODY COMPOSITION OF THE STUDY POPULATION WITH ID

The body composition of the study population was determined by means of the collection of various anthropometrical measurements, namely MUAC and TSF. Indices of FFM, as well as of FM, were determined for each participant by use of the relevant formula (Refer to Section 2.8.1).

The average MUAC measurement for the total study population (n=244) was 29,1cm; 28,4cm for the men and 30,4cm for the women. There was a negative relationship between the average MUAC measurements and the severity of ID (Table 3.4).

Table 3.4: Comparison of severity of ID and average MUAC measurements across gender (n=244)

Severity of ID (number of participants)	Average MUAC measurement (cm)	
	Males (n=152):	Females (n=92):
Mild (n=31)	29,5	34,8
Moderate (n=71)	30,3	30,7
Severe (n=128)	27,7	28,7
Profound (n=14)	23,7	27,0

TSF measurements were also taken and the average for the study population was 1,9cm. Across the genders, men had an average TSF measurement of 1,5cm compared to 2,5cm of the women. There was a negative relationship between the average TSF measurements and the severity of ID (Table 3.5).

Table 3.5: Comparison of severity of ID and average TSF measurements across gender (n=244)

Severity of ID (number of participants)	Average TSF measurement (cm)	
	Males (n=152):	Females (n=92):
Mild (n=31)	1,9	2,6
Moderate (n=71)	1,6	2,4
Severe (n=128)	1,5	2,5
Profound (n=14)	0,8	2,4

3.4.1 Calculation of fat-free mass (FFM)

The calculation of FFM requires measurements of BF-AMA, AMC and AMA, and is indicative of the body’s muscle stores. The indices for BF-AMA across all the severities of ID shows that the largest proportion of participants (39,8%, n=97) fell within the ≤5 percentile, meaning that the participants had depleted muscle stores. A BF-AMA of >5th and <15th percentile indicated that 25,0% (n=61) of the participants were at risk of having depleted muscle stores. Less than a third of all participants in all severities of ID fell within the normal range (15–85 percentiles) (Figure 3.3). BF-AMA measurements between the different severities of ID did not differ significantly. However, the same trend was seen, with all of the severities having mostly BF-AMA measurements <5th percentile.

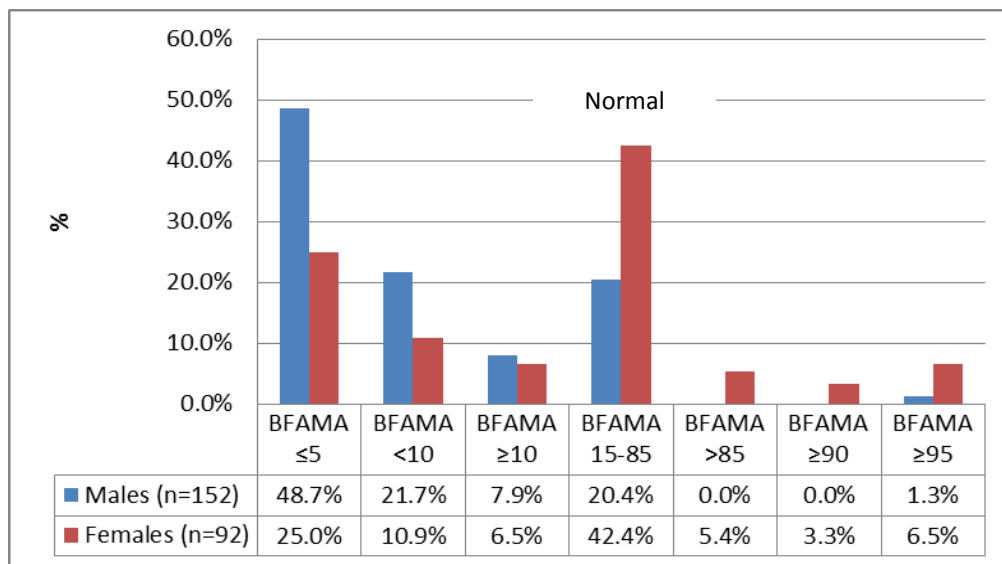


Figure 3.3: BF-AMA measurements, according to gender distribution of the study population with ID (n=244) (Mann–Whitney U, p=0,00)

Using the Mann-Whitney U test to compare the BF-AMA measurements between genders, a significant difference was found ($p=0,00$). According to the BF-AMA measurements 48,7% ($n=74$) of the men and 25,0% ($n=23$) of the women in the total population ($n=244$) fell under the 5th percentile (Figure 3.4). Thus, in the population with ID, the men had lower muscle stores compared to the women.

Similarly to the situation as regards to BF-AMA, nearly half (47,1%, $n=115$) of the participants were found to have an AMC that fell ≤ 5 percentile across all four severities of ID, indicating that the participants might have had depleted muscle stores (Figure 3.3). In terms of the AMC cut-off values of $<25^{\text{th}}$ percentile classification, high numbers of the population with ID (68,0%, $n=166$) were found to have depleted muscle stores and to be at risk of having depleted muscle stores. The normal range of percentiles (25–75) represented only 22,7% ($n=53$) of the total study population ($n=244$). AMC measurements between the different severities of ID differed significantly ($p=0,00$) when the Kruskal-Wallis test was used, meaning that the severity of occurrence influenced the AMC measurements. The more severe the ID, the lower were the AMC measurements, meaning that more individuals with severe ID had lower muscle stores.

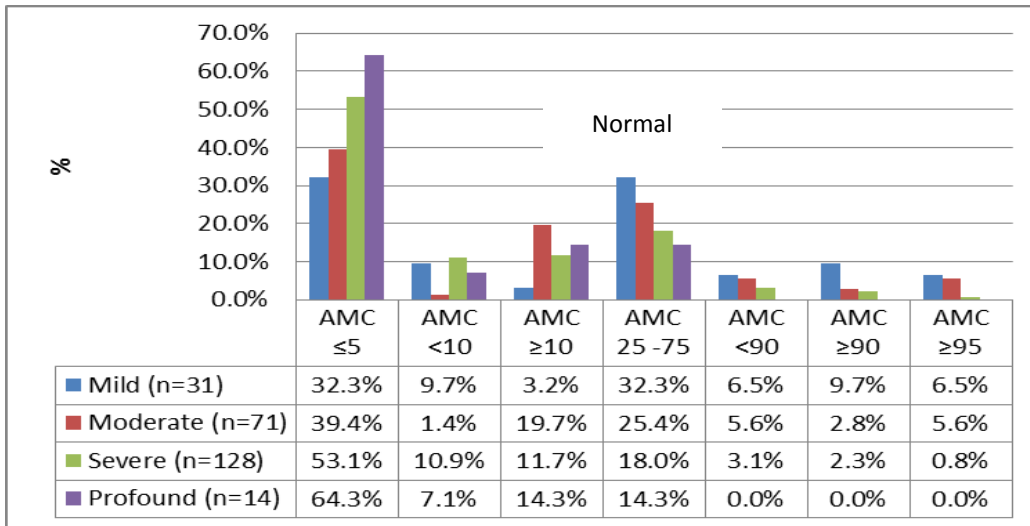


Figure 3.4: AMC measurements, according to severity of ID of study population (n=244) (Kruskal-Wallis, $p=0,00$)

When comparing the AMC measurements between genders, the researcher found that 65,1% (n=99) of the men, compared to 17,4% (n=16) of the women in the total population (n=244) fell under the 5th percentile (Figure 3.5). There was a significant difference with regard to AMC measurements between men and women ($p=0,00$) when the Mann-Whitney U test was used, meaning that gender does have an influence on AMC measurements, where men tend to have a lower AMC measurement, and females a higher AMC measurement.

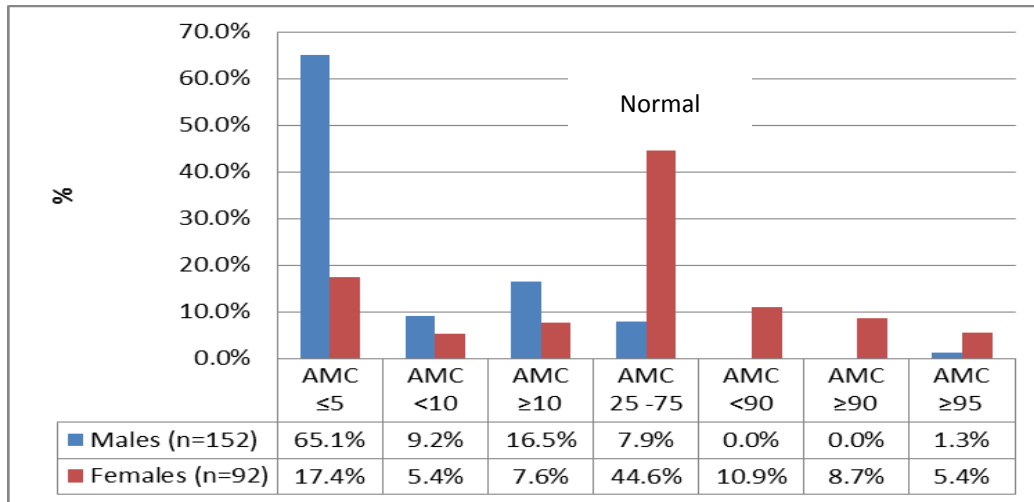


Figure 3.5: AMC measurements, according to gender distribution of the study population with ID (n=244) (Mann-Whitney U, $\rho=0,00$)

The largest proportion of the total study population fell within the normal range (15–85 percentiles) for AMA (56,2%, n=137) (Figure 3.6). AMA measurements between those with different severity of ID differed significantly when the Kruskal-Wallis test was used ($\rho=0,03$) meaning that the FFM measurement was affected by the severity of ID, with individuals with more severe ID having lower muscle stores compared to individuals with milder ID. A significant difference was found between men and women in regard to the AMA measurements ($\rho=0,00$) when the Mann-Whitney U test was used. The male participants in the study were found to have a higher percentage normal AMA measurements (61,2%, n=93) in comparison to the female participants (47,8%, n=44). The women (33,7%, n=31) had a significantly higher percentage of individuals with an AMA measurement of >85, in comparison to the male measurement (2,0%, n=3).

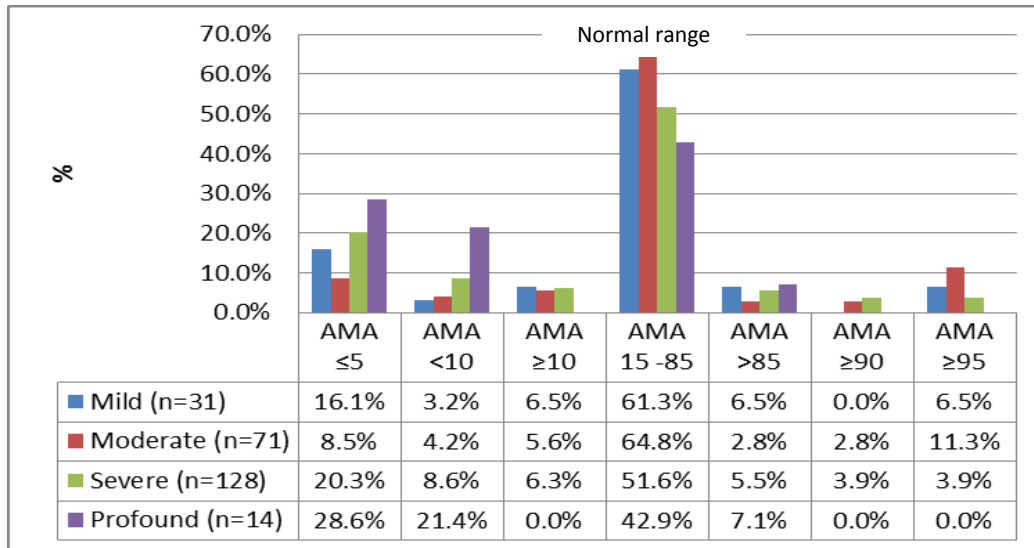


Figure 3.6: AMA measurements, according to severity among ID of total population (n=244) (Kruskal-Wallis, $p=0,03$)

To summarise the above, two of the three indices for FFM (BF-AMA and AMC) indicated that the majority of the population with ID had depleted muscle stores, or were at risk of having depleted muscle stores, and the men of the population with ID had a lower muscle store in comparison to the women. Only AMA measurements showed that the majority of the population fell within the normal range.

3.4.2 Indices of fat mass (FM)

Indices of FM, including AFA, were used as indices of underweight or overweight among the participants in the study. The largest proportion of the total study population fell within the normal range (15–85 percentiles) for AFA (58,2%, n=142) (Figure 3.7), meaning that, according to FM measurements, more than half of the population with ID had a normal fat store. AFA measurements between the participants with different

severity of ID differed significantly when the Kruskal-Wallis test was used ($p=0,02$), meaning that the FM measurement was affected by the severity of ID. The individuals with more severe ID were found to have a lower fat store in comparison to the fat store of individuals with milder ID.

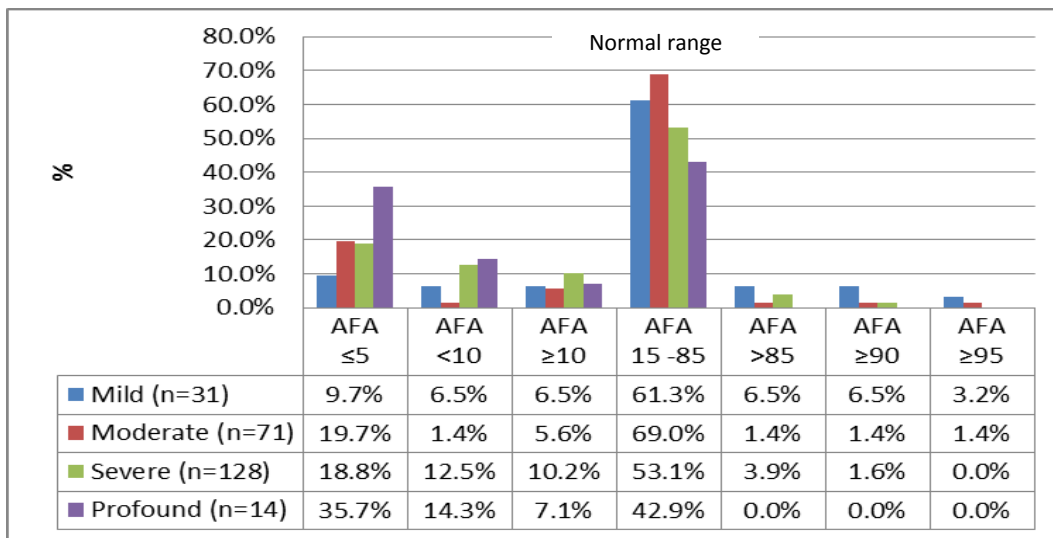


Figure 3.7: AFA measurements, according to severity of ID among total population (n=244) (Kruskal-Wallis, $p=0,02$)

Comparing BMI to the indices of FM (AFA), the classification of the nutritional status of the individuals differed. According to the BMI classification, the majority of the individuals were overweight/obese (53,3%, n=130), whereas according to the indices of FM, the majority (58,2%, n=142) of individuals fell within the normal range. According to BMI, 5,7% (n=14) were underweight and 30,7% (n=75) and 22,5% (n=55) were classified as overweight/obese respectively. This was contradicting to results reported for FM, where 18,9% (n=46) had depleted and 6,2% (n=15) had increased fat stores.

According to the FM indices, 58,2% (n=142) of the population with ID were classified as having normal fat stores and 18,9% (n=46) had depleted fat stores.

3.5 ANTHROPOMETRICAL STATUS OF THE STUDY POPULATION WITH ID

To obtain an overall idea of the anthropometrical status of the study population (n=244) with ID, the results of different anthropometrical measurements were combined, namely of the BMI, the BF-AMA, the AMC, the AMA and the AFA. Although the majority (52,1%, n=127) of participants had a normal anthropometrical status, 38,1% (n=93) were classified as being undernourished, or at risk of undernutrition (Figure 3.8).

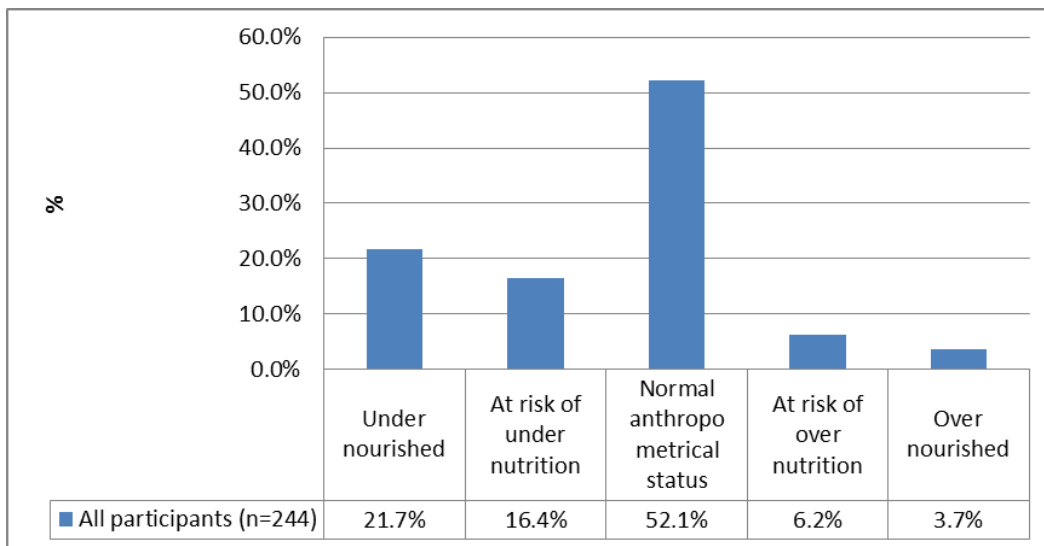


Figure 3.8: Overall anthropometrical status of the total study population (n=244)

The anthropometrical status amongst genders indicated that the men were more prone to be undernourished, or at risk of undernutrition (48,0%, n=73), compared to the women (21,7%, n=20). No significant difference was found in anthropometrical status

across the four severities of ID when the Pearson Chi-square test was used (Figure 3.9). None of the participants with profound ID was found to be at risk of overnutrition or overnourished, while the majority of participants at risk of overnutrition or of being overnourished were in the group with mild ID (19,4%, n=6). The anthropometrical status amongst genders indicated that women with ID (21,7%, n=20) were more prone to be overnourished or at risk of overnutrition than were men with ID (2,6%, n=4).

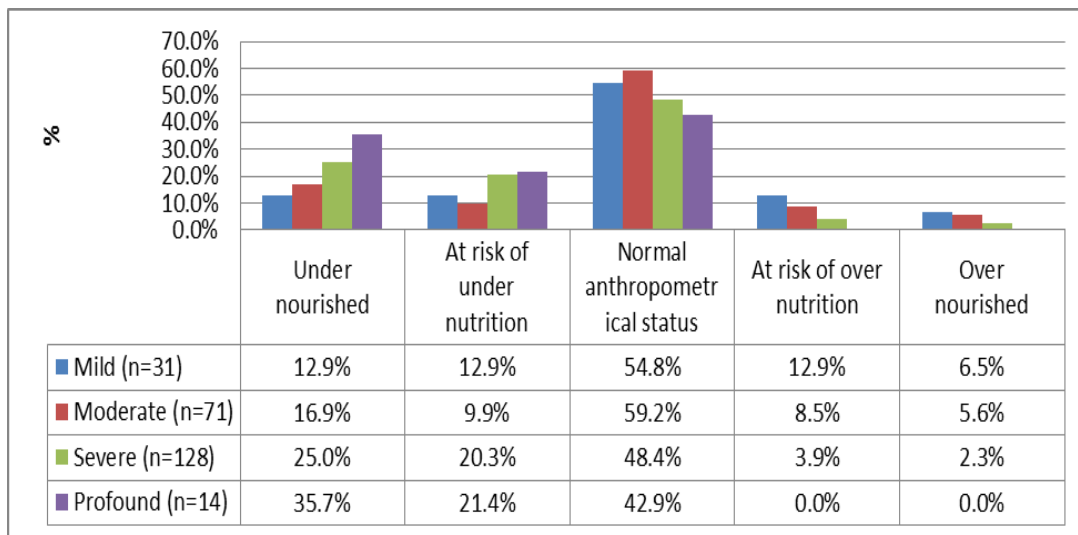


Figure 3.9: Anthropometrical status, according to severity of ID of the total population (n=244)(Pearson Chi-square, $\rho=0,15$)

The BMI forms part of the measurement of the overall anthropometrical status. There was a significant difference between BMI and overall anthropometrical status ($\rho=0,00$) when the Pearson Chi-square test was used (Table 3.6).

Table 3.6: Comparison of overall anthropometrical status and BMI in the study population with ID (n=244), in percentage

Gender	Overall anthropometrical status*			BMI (%)		
	Under-nourished / At risk of under-nutrition	Normal anthropometrical status	Over-nourished / At risk of over-nutrition	Under-weight	Normal weight	Overweight/ Obese
Male (n=152)	48,0 (n=73)	49,3 (n=75)	2,6 (n=4)	6,6 (n=10)	48,7 (n=74)	44,7 (n=68)
Female (n=92)	21,7 (n=20)	56,5 (n=52)	21,7 (n=20)	4,4 (n=4)	28,3 (n=26)	67,4 (n=62)
Total (n=244)	38,1 (n=93)	52,1 (n=127)	9,3 (*n=24)	5,7 (n=14)	41,0 (n=100)	53,3 (n=130)

*Pearson Chi-square test, $\rho=0,00$

Generally, it is important to consider all the different anthropometrical measurements in assessing the overall anthropometrical status of individuals with ID, rather than to use such measurements in isolation. When comparing all the measurements (Table 3.7), it is clear that most of the individuals fell either in the undernourished group, or in the normal nutrition status group.

Table 3.7: Summary of the classification of nutritional status, according to various anthropometrical measurements in the study population with ID (n=244), in percentage

Body composition	ID Population	Under-nourished	At risk of under-nutrition	Normal	At risk of over-nutrition	Over-nourished
BMI	Males (n=152)	6,6 (n=10)	N/A	48,7 (n=74)	44,8 (n=68)	
	Females (n=92)	4,3 (n=4)	N/A	28,3 (n=26)	67,4 (n=62)	
	Total (n=244)	5,7 (n=14)	N/A	41,0 (n=100)	53,3 (n=130)	
BF-AMA	Males (n=152)	48,7 (n=74)	29,6 (n=45)	20,4 (n=31)	0,0 (n=0)	1,3 (n=2)
	Females (n=92)	25,0 (n=23)	17,4 (n=16)	42,4 (n=39)	8,7 (n=8)	6,5 (n=6)
	Total (n=244)	39,8 (n=97)	25,0 (n=61)	28,7 (n=70)	3,3 (n=8)	3,3 (n=8)
AMC	Males (n=152)	65,1 (n=99)	25,7 (n=39)	7,9 (n=12)	0,0 (n=0)	1,3 (n=2)
	Females (n=92)	17,4 (n=16)	13,0 (n=12)	44,6 (n=41)	19,6 (n=18)	5,4 (n=5)
	Total (n=244)	47,1 (n=115)	20,9 (n=51)	21,7 (n=53)	7,4 (n=18)	2,9 (n=7)
AMA	Males (n=152)	20,4 (n=31)	16,5 (n=25)	61,2 (n=93)	0,7 (n=1)	1,3 (n=2)
	Females (n=92)	10,9 (n=10)	7,6 (n=7)	47,8 (n=44)	19,6 (n=18)	14,1 (n=13)
	Total (n=244)	16,8 (n=41)	13,1 (n=32)	56,2 (n=137)	7,8 (n=19)	6,2 (n=15)
AFA	Males (n=152)	19,7 (n=30)	17,8 (n=27)	55,9 (n=85)	5,9 (n=9)	0,7 (n=1)
	Females (n=92)	17,4 (n=16)	15,2 (n=14)	62,0 (n=57)	4,4 (n=4)	1,1 (n=1)
	Total (n=244)	18,9 (n=46)	16,8 (n=41)	58,2 (n=142)	5,3 (n=13)	0,8 (n=2)
Overall anthropometrical status	Males (n=152)	27,0 (n=41)	21,1 (n=32)	49,3 (n=75)	1,3 (n=2)	1,3 (n=2)
	Females (n=92)	13,0 (n=12)	8,7 (n=8)	56,5 (n=52)	25,0 (n=13)	7,6 (n=7)
	Total (n=244)	21,7 (n=53)	16,4 (n=40)	52,1 (n=127)	6,2 (n=15)	3,7 (n=9)

3.6 RISK FACTORS FOR MALNUTRITION IN THE STUDY POPULATION WITH ID

Risk factors that were noted in the study population with ID using the current screening tool included diabetes mellitus (1,2%, n=3), regurgitation (1,2%, n=3), and pressure sores (1,2%, n=3). Eight (3,3%) individuals required assisted feeding (severe ID: 2,3%, n=3; profound ID: 35,7%, n=5). No gastrointestinal problems (vomiting, diarrhoea or constipation), as well as no additional underlying medical conditions (TB, HIV/AIDS or cancer) were noted in said group of individuals with ID.

Pica was only diagnosed in 2,9% (n=7) of the total population, of which 1,6% (n=2) had severe ID and 35,7% (n=5) had profound ID. No significant difference was found between the genders (female 2,2%, n=2; male 3,3%, n=5).

The only additional risk factor identified in the current study was the use of multiple medications. The medication that was most often used by men was Risperidone, which is a psycholeptic medication that produces a calming effect upon the participant,⁴¹ whereas the medication that was most often used by women was Depo Provera which is a progesterone-only injectable contraceptive⁴¹ (Table 3.8). Overall, a bigger proportion of women (80,4%, n=74) was prescribed psychotropic medication compared to men (74,3%, n=113) in the population studied. The other two prevalent medications that were used in this study population were Carbamazepine which is an anticonvulsant used to control seizures and Sodium Valproate used to treat epilepsy.⁴¹

Table 3.8: Most prevalent medications used in the study population with ID, according to gender (n=244), in percentage

	Carbamazepine	Risperidone	Depo Provera	Sodium Valproate
Male	20,4 (n=31)	48,0 (n=73)	0,0 (n=0)	38,2 (n=58)
Female	26,1 (n=24)	37,0 (n=34)	44,6 (n=41)	31,5 (n=29)
Total	22,5 (n=55)	43,9 (n=107)	16,8 (n=41)	35,7 (n=87)

The medication that was most prevalent in the study population was Risperidone. According to the different severities of ID, it was found that the use of Risperidone was highest in the group with profound ID; however, 71,7% (n=175) of the population with ID was prescribed all of the psychotropic medication concerned (Figure 3.10). The most common nutrition-related side effects of the medications were found to be weight gain, increased appetite and anorexia.

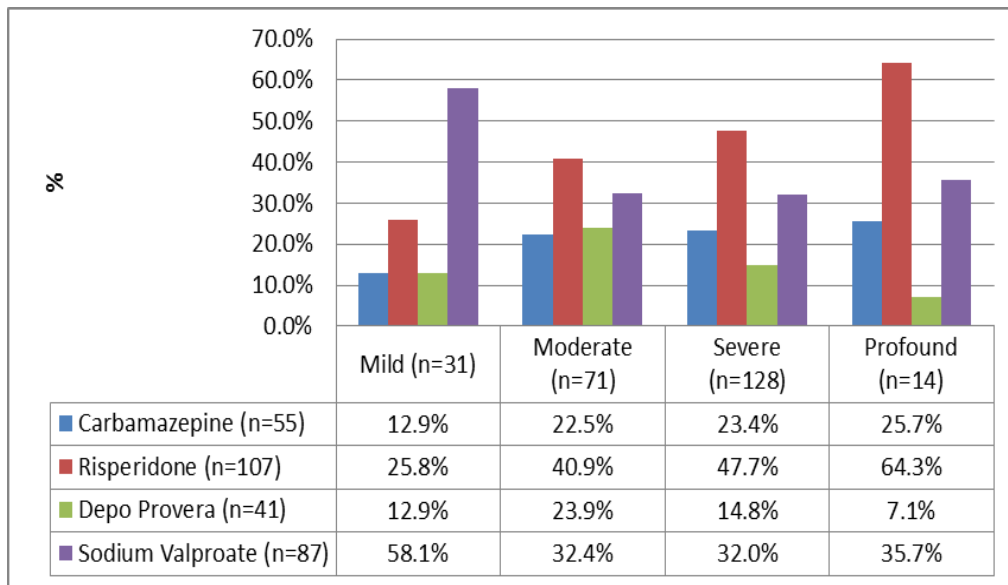


Figure 3.10: Medication, according to different severities of ID amongst total population (n=244)

Thus, the most prevalent risk factors found in this population with ID were the use of medications, the inability to self-feed and pica. The above-mentioned information was then used to adapt the existing screening tool.

PHASE 2

3.7 THE ADAPTATION OF AN APPROPRIATE SCREENING TOOL

The adaptation of a screening tool which can be used by nursing staff, to include all relevant anthropometrical measurements and risk factors found in this study population during Phase 1, was deemed to be essential for early detection of malnutrition in individuals with ID within this specific psychiatric hospital.

3.7.1 Existing screening tool

The existing screening tool, namely *Nutritional Screening Tool for Adults with Learning Disabilities*, was completed during phase 1 of the current study for the total study population (n=244), and included all the information mentioned earlier. The screening tool was completed by the primary investigator.

The existing screening tool was adjusted after all the relevant risk factors and anthropometrical measurements were analysed and scored according to prevalence in this population with ID. Additional information included in the adapted screening tool is indicated below in *italics**,

- anthropometrical measurements: weight, height and BMI; **waist circumference*;
- nutritional status of patients: underweight, normal weight, overweight and unexplained weight loss;
- appetite and dietary intake of the patient: normal or reduced intake and special diets;
- psychological state of the patient during mealtimes: enjoys mealtimes; engages in disruptive behaviour at mealtimes; eats inedible matter (pica); and regurgitates;
- patients' skin type or condition (healthy; dry and flaky; oedematous and leg ulcer/pressure sore), which is used as a parameter of nutritional status and nutritional deficiencies;
- **Other diseases: epilepsy*;
- degree of LD: mild, moderate, severe or profound;
- feeding ability/inability of the patient: eats independently; needs to be fed; chewing/swallowing problems;
- gastrointestinal problems: vomiting, diarrhoea and constipation;
- **Medication: Depo Provera; Carbamazepine; Sodium Valproate; and Risperidone*; and
- age of the patient in years.

Table 3.9 indicates the differences between the current screening tool and the adjusted screening tool, and reasons why additional information was added.

Table 3.9: Differences between the current and adjusted screening tool

Current screening tool:	Adjusted screening tool:	Reasons for change:
Bodyweight for height	Nutritional status	Changed the heading; however the adjusted screening tool still uses BMI at this section.
	Waist circumference	Added WC as a second anthropometrical measurement to increase reliability.
Appetite and dietary intake	Appetite and dietary intake	
Psychological state	Psychological state	
Skin type	Skin type	
	Other diseases	Only added EP under 'other diseases' seeing that it was the most prevalent condition in this study population and the presence of EP can negatively affect the nutritional status of individuals.
Degree of learning disability	Degree of learning disability	
Feeding ability	Feeding ability	
Symptoms	Symptoms	
	Medications	Added the most relevant medications used in this study population, which can also have nutrition-related side effects.
Age	Age	

Scoring of the screening tool, which helps in the decision-making regarding the action that needs to be taken after the completion of the adapted screening tool, was adjusted to make the referral process more effective than it would otherwise have been (Table 3.10). This was done by giving each of the added sections a score based on the possible effect it could have had on the nutritional status of the participants, and then by calculating what was the maximum total that could have been scored by any particular participant, the scores that indicated the action that needed to be taken was calculated.

The maximum score that could have been achieved according to the current screening tool was 31, where the adapted screening tool's maximum is 38. These scores were calculated in an arbitrary manner by the researcher. The above was done, seeing that more sections were added into the screening tool (Table 3.9) during the current study, making the current scoring system ineffective for the referral process.

Table 3.10: Action that should be taken, according to scoring of adapted screening tool

Nutritional score: Original tool	Nutritional score: Adapted tool	Nutritional status of participant	Action
0-9	0-7	Normal	None
10-15	8-14	At risk of malnutrition/over-nutrition	Reassess after one month; if no improvement, refer to dietitian
>15	>14	Malnourished/Overnourished	Immediate referral to dietitian

The nursing staff completed the adapted screening tool without any help from the primary investigator, to simulate the habitual use of the tool because the screening tool would be used in the hospital setting, without the assistance of a dietitian. Overall, there was no difficulty with the completion of the screening tool. Mistakes were, however, made when the BMI had to be calculated, which could have caused skewed results, seeing that the commission of such errors would have influenced the score. Regarding the content of the screening tool, one nurse responded negatively to the question regarding whether she had understood the questions asked in the survey. The score system on the screening tool regarding gastrointestinal problems was unclear, seeing

that no option was provided to indicate if a participant had no symptoms. The necessary changes were made.

3.7.2 Sensitivity and specificity

To determine the sensitivity and specificity of the adapted screening tool, it was used on 48 participants (19,7%) who were randomly selected from the total study population (n=244). Using the participant code, the classification of malnutrition made by the investigator (Phase 1), using all the anthropometrical measurements (overall anthropometrical status), was compared to the classification made by the nursing staff (Phase 2) according to the adjusted screening tool, to assess the sensitivity and specificity of the screening tool (Table 3.11). Even though the classification that was made by the nursing staff was used according to the completion of the adjusted screening tool, the researcher did recalculate the BMI for data capturing to ensure that the correct measurements was used.

The adapted screening tool misdiagnosed 16 participants as not being malnourished, whereas they were diagnosed as malnourished according to their anthropometrical measurements. The result showed that the specificity was still very low.

Table 3.11: Comparison of the nutritional status of the participants (n=48), according to the anthropometrical measurements (overall anthropometrical status) (Phase 1) and the adapted screening tool (Phase 2), in percentage

Nutritional status	Anthropometrical measurements (Phase 1)	Adapted screening tool (Phase 2)
At risk of malnutrition (undernourished/overnourished)	18,8 (n=9)	58,0 (n=28)
Normal nutritional status	45,8 (n=22)	39,5 (n=19)
Malnourished (undernourished/overnourished)	35,4 (n=17)	2,0 (n=1)

The sensitivity of the adapted screening tool was 0,9, and the specificity was 0,1. A test with a high sensitivity is used to screen for disease (malnutrition), whereas a test with a high specificity are used to confirm the results.⁴ The above indicated that the adapted screening tool was sensitive enough to identify individuals who were at risk of malnutrition or who were already malnourished. However, the specificity was not high, indicating that the individuals who were not malnourished were not correctly identified.

CHAPTER 4

DISCUSSION

4.1 INTRODUCTION

In the light of the apparent paucity of data in South African literature about the nutritional status of individuals with ID, the aim of the current study was to determine the degree of malnutrition and body composition in individuals with ID. An existing screening tool for the detection of malnutrition was adjusted to include more risk factors for malnutrition relevant to individuals with ID than it already had.

No data could be found regarding the current prevalence of ID in South Africa. The distribution amongst the severities of ID within said institutionalised South African population with ID was different from other studies. More than half of the study population fell within the group with severe ID, compared to the 15,9% reported in the USA.¹² However, data from the current study should be interpreted with caution, as it was not a representative sample of the South African population.

Similarly to other studies conducted in the same field, EP and hypertension were the most prevalent medical conditions found within said population with ID, though the prevalence of EP within the population with ID in this study was nearly double the prevalence found in a study done on individuals with ID living in institutions in south east London (20,0–30,0%).³⁵ Within the current population, those with severe ID were affected the most (55,5%), in contrast with the participants in the south east London study, which found the highest prevalence of EP in the group with mild ID (43,6%).³⁵

The above could have been due to the current study sample involved not being a

representative sample, and due to the fact that more than half of the population with ID fell in the group with severe ID. EP can impact negatively on the nutritional status of individuals with ID, seeing that the use of some of the medications, and, in the current study specifically, the use of Sodium Valproate and Carbamazepine, can lead to weight gain.⁴¹ The use of anticonvulsants can also interfere with the ability to use certain nutrients in the body, which can lead to some deficiencies. Nutrients that are often affected by the use of anticonvulsants include Vitamin D and K, calcium, magnesium, manganese and folic acid.⁴¹

Hypertension is a common condition in SA, affecting the black community (59,0%) more than the white community (50,0%).³⁴ The occurrence of such a condition among said communities differs from its occurrence in the study population with ID, where only 9,8% of black individuals, and 14,1% of white individuals, with ID were diagnosed with hypertension. The prevalence of hypertension within the study population with ID was found to be half the prevalence found in research done on adults with disabilities living in east Taiwan, where hypertension was found to affect 27,4% of individuals.¹¹ The east Taiwan population showed a higher risk of developing hypertension than did the participants in the current study, as the former were older and had a higher WC (mean age, 61,2 [\pm 16,6]; increased WC, 48,4%) than the latter population (mean age, 45 [\pm 12,8]; increased WC, 41,8%). To the contrary of the Taiwanese findings, the current study found a much lower prevalence of hypertension across genders in the population with ID compared to the prevalence found in the study done in Taiwan (men 10,5% and 26,1%; women 17,4% and 29,2%, respectively).¹¹

A co-existence was detected between hypertension and overweight and obesity (12,0% and 23,6% respectively), which was lower in comparison to research that was undertaken in east Taiwan. In the latter research, 35,4% of overweight individuals with ID and 39,3% of obese individuals with ID were diagnosed with hypertension.¹¹

4.2 BODY COMPOSITION OF THE STUDY POPULATION WITH ID

The body composition of the participants with ID was determined through the taking of anthropometrical measurements (MUAC and TSF) and through calculations of indices of FM and FFM to determine their nutritional status. In a study conducted on a population of Saudi men with ID, as much as 41,0% of the population had a MUAC below the desirable range for the normal population,¹⁸ compared to only 9,2% in this ID population. Regarding the TSF measurements, 17,9% of the men had measurements above the recommended range for the normal population,¹⁸ which corresponds to the 15,1% in the current ID population.

When using FFM in isolation, more than half of the population with ID had an already depleted muscle store, or were at risk of developing a depleted muscle store. The above finding corresponded with findings by Bertoli *et al.* (2006) in Milan, which determined that the population with ID had a lower FFM percentage than the normal population.²⁹

BF-AMA measurements among the different severities of the ID did not differ significantly, meaning that the severity of ID did not influence the measurement, and could thus be used on its own on the population with ID. AMC measurements among

the different severities of the population with ID differed significantly, which indicated that the severity could possibly have an effect on the AMC measurement and should not be used on its own, since it may not be as sensitive for identifying malnutrition as another measurement that isn't affected by the severity of ID. The inverse relationship between severity of ID and AMC measurements can possibly be ascribed to the fact that those with more severe ID tend to be inactive with resultant decreased levels of muscle mass. This corresponds with the study done on semi-institutionalised population with ID of Santa Catarina, where a sedentary lifestyle also impacted on the nutritional status.²³

AMA measurements differed significantly between the severities of ID, however it showed the same trend. AMA indicated that the population with mild ID was less underweight (16,1%) compared to the population with profound ID (28,6%). Findings for at risk AMA measurements (29,8%) within the total population with ID differed slightly from Hogan *et al.* (1994) (Southern Ontario) who reported higher percentages of at risk measurements (46,0%) in a group of individuals' with severe physical and developmental disability.¹⁶ A possible reason can be that the population with ID had individuals with profound ID, whereas the individuals from Southern Ontario had only severe ID and this could have affected the results.

Similarly, individuals who are more severely affected by ID have a lower FFM measurement, and the current study indicated that men were more prone to having a depleted muscle store than women. According to BF-AMA, AMC and AMA measurements more men (48,7%, 65,1% and 20,4%, respectively) compared to women

(25,0%, 17,4% and 10,9%, respectively) had a depleted muscle store; however, such measurements cannot be interpreted in isolation. A concerted effort to minimise the impact of the multiple factors contributing to malnutrition is essential. An additional aspect that needs to be considered in such regard is the menu composition, the protein quality, the nutrient adequacy and the food acceptability, making provision for the different nutritional requirements between the genders.⁵⁰

The FM for the population with ID indicated that over half of said population had normal fat stores. Though AFA measurements between the different severities of ID differed significantly, they showed the same trend. The AFA indicated that the population with mild ID was less underweight (9,7%) compared to the population with profound ID (35,7%). These percentages meant that this FM measurement was affected by the severity of ID involved. Findings for AFA indicated that the majority of individuals with severe ID was at risk of having decreased and increased fat stores (28,2%) within the total population with ID, which differ from the findings made by Hogan *et al.* (1994) (Southern Ontario) who reported the existence of higher percentages of at risk measurements (decreased and increased) (38,0%) amongst the members of a group with severe physical and developmental disability.¹⁶

When both the FFM and the FM measurements were analysed in the current population with ID, it was clear that the population concerned lost more muscle mass than FM. The study population resided in an institution that provided care for those with decreased physical activity, which is a known cause of loss in muscle mass.⁵¹ As a result, many

participants (41,8%) had a WC above the recommended limit, which, in turn, increased the risk of them developing CDL.

According to the overall body composition, more than 20,0% of the institutionalised population with ID was classified as being underweight, in contrast to only 7,0% of the normal population that was reported on in a Brazilian study.²³ The fact that the Brazilian participants were semi-institutionalised brought into play other factors that might affect nutritional status. For instance, the participants only stayed in an institution during the day, and with family members during the evening, which could have led to more personalised nutritional care. Any institution taking care of individuals is obliged to provide for their nutritional requirements. With the availability of an appropriate screening tool, it might be possible to reduce the risk of patients developing malnutrition by facilitating the early detection of malnutrition, timely referral to dietitians and individualised nutrition intervention.

4.3 USE OF THE NUTRITIONAL STATUS OF THE STUDY POPULATION WITH ID TO DETERMINE DEGREE OF MALNUTRITION

The anthropometrical measurements of the population with ID were analysed to determine to what extent the degree of ID and which gender were more prone to malnutrition. Considering the general South African population, using BMI classification, the population with ID showed the same trend, namely the women tended to be overweight/obese in comparison to the men, and that the men tended to more underweight in comparison with the women (Table 4.1).⁵²

Table 4.1: Comparison of BMI classification between the population with ID and the general South African population, in percentage: ⁵²

Gender	ID population			South African population		
	BMI <18,5	BMI 18,5–24,9	BMI ≥25	BMI <18,5	BMI 18,5–24,9	BMI ≥25
Male	6,6	48,7	44,7	12,2	58,6	29,2
Female	4,4	28,3	67,4	5,6	37,8	56,6
Total	5,5	38,5	56,1	8,9	48,2	42,9

The BMI of the study population with ID indicated that more than half of the participants had a weight outside the normal range, being underweight, overweight or obese. In another South African study of individuals with ID (n=30) residing in an institution, the prevalence of obesity was much lower, although the same trend persisted between genders (with the percentage of women who were either overweight or obese being 17,0%, and the percentage of men with the same classification being 6,0%). In this South African study, data should be interpreted with caution, due to the much smaller study population (n=30).⁵³ In this study population with ID, individuals with mild ID were found to be more obese, and those with severe/profound ID were found to be more underweight, according to BMI classification. Similarly, using the BMI, Hove (2004), in a Norwegian-based study, indicated that 26,6% of those with mild ID were obese and 14,9% of those with severe ID were underweight in a population with ID.²⁵ Even though the BMI, used on its own, seems to be less reliable than when it is used in combination with other measurements, as was evident when comparing the BMI classification with the overall anthropometrical status (using five different measurements combined), the BMI still provides some information about the nutritional status of individuals, and can be considered as a relatively simple option in the assessment of nutritional status, with

limited resources. According to the BMI classification, only 14 participants were underweight, yet, compared to the overall anthropometrical status, 93 participants were seen as undernourished/at risk of becoming undernourished. The finding meant that large numbers of individuals could be misdiagnosed if the BMI were to be used on its own. Due to the good correlation that was found between BMI and increased WC, WC must be used in combination with BMI to give a clearer picture than might otherwise be obtained and to detect malnutrition more effectively.

These contradicting anthropometrical findings are of concern. Reasons why these measurements differ can be due to inaccuracy of skinfold measurements taken. There are various assumptions that need to be taken into consideration when using skinfold measurements and prediction equation, as used in the present study. Skinfold measurements assume that the body fat is normally distributed, the proportion of internal fat to external fat is constant, and the thickness of subcutaneous adipose tissue is constant or predictable within and between individuals.³ There is a higher risk of skinfold measurements being taken incorrectly in comparison with BMI. The measurement of skinfold thickness also has a very high inter- and intra-observer variability. Another possible reason for the difference can be that BMI correlates well with FM measurements when BMI is within the normal ranges, however when the BMI is abnormal (<18.5 / >24.9) or at extremes of BMI, the correlation between BMI and FM decreases and the relationship cannot be seen as accurate.⁵⁴ In this study population 14 participants were underweight (BMI <18.5) and 75 and 55 participants were overweight (BMI >24.9) and obese (BMI >30) respectively. Nursing staff are also not trained to take skinfold measurements and it could thus not be included as a separate

anthropometric measurement. However, there is no clear explanation why these measurements differed significantly in this study population, and this warrants further research.

WC was used to determine individual risk of developing CDL. Almost half of the participants in said population with ID had an increased WC. Compared to the general South African population, the number of women at risk of CDL was double that of the general South African population (42,0%), whereas the number of men at risk of CDL was half that of the South African population (9,2%).⁵²

Despite a small percentage of the population with ID being diagnosed with CDL, both indices, BMI and WC, indicated a major health risk for individuals with ID, in view of the fact that a variety of co-morbidities are associated with being overweight and with having an increased WC (e.g. coronary heart disease, cardiovascular disease, MS and hypertension).^{8,11,14,27} Therefore, the population with ID required careful monitoring. Being underweight poses other health risks, as it increases individual vulnerability to the development of infection, anaemia, osteoporosis, delayed wound healing and nutrient deficiencies.⁵⁵

In view of the findings in the current study, urgent attention needed to be given to combat malnutrition in the population with ID concerned, as most participants had abnormal anthropometrical values, placing them at an increased risk of malnutrition. One reason for the current study was to improve the process of identifying individuals who were malnourished or who are at risk of malnutrition by investigating the use of a screening tool. Application of the improved method should lead to the improved

nutritional status of individuals with ID, by means of the early detection of malnutrition by the nursing staff, which would allow for timely referral to dietitians. The timeliness of such referral would be likely to result in fewer co-morbidities, and thereby the existence of a healthier population with ID.

4.4 RISK FACTORS FOR MALNUTRITION IN THE STUDY POPULATION WITH ID

Risk factors included in the existing screening tool for malnutrition were investigated, and additional risk factors were recorded as present in the group of participants and to be included in the existing screening tool.

A very low prevalence of some risk factors (including diabetes mellitus, regurgitation and pressure sores) for the development of malnutrition was noted in the current population with ID, making a small contribution to the high prevalence of malnutrition in the study's population with ID. The prevalence of diabetes mellitus was much lower than that which has, in the past, been found in the general South African population (9,1%).⁵⁶ In other studies, the prevalence of diabetes mellitus in individuals with ID ranged between 11,2% and 19,4%.^{57,58} A review article reported that the prevalence of regurgitation in institutionalised individuals with ID ranged between 5,0% and 10,0%.⁵⁹ McDermott-Scales *et al.* (2009) found that 33,5% of individuals with ID in Ireland who made use of ID services had pressure sores.⁶⁰ However, bed-ridden patients were not included in the study population, which could be a possible explanation for the major difference in findings. MS was not observed in the study's population with ID, which

differs from the observations made in a study done on a population with ID in Taiwan, amongst whom MS was found to occur in 11,6% of the cases.¹⁴

In this population with ID, fewer than 4,0% of the individuals required feeding, no additional feeding problems was noted. This finding differed from other studies that indicated that a third of individuals with ID had feeding problems, including GERD.^{1,8,11,13,40} Feeding problems could thus be noted as not contributing to malnutrition in the group of individuals with ID under survey.

There wasn't any prevalence of TB in the current ID population. This differed slightly from research done on patients with ID from a hospital in eastern Taiwan, which found that the prevalence of TB, was 0,9%.⁶¹ Regarding the prevalence of HIV/AIDS in the ID population, a South African study (2010) indicated that the prevalence in people with ID was estimated to be 14,0%, compared to no cases reported in the current ID study population.⁶² Based on a review article done in 2008 by Hogg *et al.* (2008) the incidence of deaths due to cancer in the ID population was 12,1%.⁶³ This differed from the current study, where no cancer was reported.

The prevalence of pica, which was another risk factor within the population with ID, was found to be very similar to that revealed in the study by Matson *et al.* (2011) in the USA on individuals with developmental disabilities (4,3%).⁴³ The risk of developing pica has, in the past, been found to increase with the degree of severity of ID,⁴³ which was also evident within the current population with ID, seeing that only the population with severe and profound ID was diagnosed with pica. Pica can lead to major health problems such as malnutrition, iron and zinc deficiency, damage to the gums and teeth, and the

invasion of unwanted organisms into the body, which can affect the absorption of certain nutrients.^{39,44} Pica was not a common problem within the population with ID surveyed, which made a minor contribution to the poor nutritional status found in the current study.

Individuals with ID are known as the most overmedicated group in society. The most concerning additional risk factor identified in the population with ID referred to polypharmacy. Nearly three-quarters of the population with ID used prescribed psychotropic medication, which was almost double the finding made by Matson *et al.* (2010) in connection with individuals with ID (20,0–40,0%).⁴⁰ That the current study did not use a representative sample of the South African population with ID must be stressed. A possible reason why the participants in the current study were seemingly overmedicated could be due to the large percentage of the population with severe and profound ID, requiring polypharmaceutical intervention. Of grave concern were the side effects and drug-nutrient interaction of the medications concerned. Most common nutrition-related side effects of polypharmacy include weight gain and increased/decreased appetite,⁴¹ which possibly contributed to the high prevalence of malnutrition within the population with ID. Other side effects included dry mouth, constipation, metabolic changes, vomiting and diarrhoea, and, even though it was not noted in this population with ID, there was a need for awareness of the potential impact of polypharmacy on the nutritional status of individuals. The conservative use and frequent revision of medication in a population with ID is, hence, strongly advised.

4.5 ADAPTATION OF A SCREENING TOOL FOR USE BY NURSING STAFF FOR THE EARLY DETECTION OF MALNUTRITION

In the current study, an existing screening tool was adapted, which included relevant anthropometrical measurements, and most of the known risk factors. The tool can be used in future by nursing staff for the early detection of malnutrition in the population with ID.

4.5.1 Existing screening tools

Various screening tools are currently available that focus mainly on the behaviour of individuals, with little attention being given to feeding, to mealtime behaviour or to the nutritional status of individuals. For said reason, the *Reiss Screen*, *The Diagnostic Assessment for Severely Handicapped-II*, as well as *The Assessment of Dual Diagnosis* were not regarded as ideal for screening the nutritional status of individuals with ID. As *STEP* focuses mainly on feeding problems, and not on overall nutritional status, it was also not deemed suitable as a screening tool.³⁰ The *Nutritional Screening Tool for Adults with Learning Disabilities* focuses on the overall nutritional status of the individual and incorporates different aspects of nutrition, including anthropometry and feeding ability.⁴⁷ As said nutrition screening tool was found to be the most appropriate for individuals with ID, it was chosen for use in the current research.

4.5.2 Adjusted screening tool

The existing screening tool was adjusted according to the identified risk factors. For this screening tool to be effective in predicting malnutrition, both sensitivity and specificity

needed to be high. The adapted screening tool has a high sensitivity, which indicates that it is a sensitive tool for identifying individuals who are at risk of malnutrition, or who are already malnourished. However, the specificity was not high, indicating that the individuals who were not malnourished were not correctly identified. One reason for the low specificity could be that different categories of health care professionals, namely a qualified dietitian and nursing staff, completed the screening tool. Also, different methods were used to classify the degree of malnutrition present. The primary investigator used a combination of anthropometrical measurements, which are regarded as the golden standard,³ and the nursing staff tested the screening tool as an easy and user friendly instrument. Lastly, the nursing staff concerned received no training on the completion of the screening tool, in order to simulate the habitual use of the tool, since, in practice, nursing staff would use the tool without the assistance of a dietitian. The lack of training might have resulted in the adjusted screening tool being completed incorrectly, since one main concern with the study was the calculation of BMI, which was done incorrectly by some of the nursing staff, for 7 participants (15,0%). Ideally, the continuous training of nursing staff by a qualified dietitian would be beneficial to ensure the correct completion of the adjusted screening tool. The tool needed to be simplified to ensure accurate measurement with minimal training.

Although it was previously mentioned that using BMI on its own could result in the misdiagnosis of individuals who are at risk of becoming malnourished or who are already malnourished, such use, nevertheless, provides some information about the nutritional status of individuals, and, with the addition of WC to BMI, the reliability of the measurements is increased. The use of a screening tool to help the nursing staff in

identifying individuals who are already malnourished, or who are at risk of becoming malnourished, and to help them identify possible risk factors, should facilitate referral to a dietitian for further investigation and nutritional assessment. As a screening tool needs to be easy to complete and should not require the use of specialised equipment, the use of the BMI and WC was found to be acceptable. As nursing staff are also not trained to take skinfold measurements, such measurements were not included in the adjusted screening tool.

To summarise, the adjusted screening tool was improved by adding more risk factors for the development of malnutrition. Accurate completion of the adjusted screening tool should lead to the early identification of malnutrition and, subsequently, the timeous referral of individuals who are at risk of developing malnutrition.

CHAPTER 5

SUMMARY

5.1 LIMITATIONS OF THE STUDY

One of the limitations of the study was that the exclusion criteria included in-patients who were not able to stand on their own, which led to a large percentage of patients being excluded.

Another limitation of the study was the completion of the screening tool that was done without any training of the nursing staff concerned. Although the study provides information about the current situation regarding the practices of nursing staff, the results might have been skewed, especially in terms of the specificity.

The use of skinfolds can be seen as a limitation, due to the high inter- and intra-observer variability which might have influenced the results.

The overall anthropometrical status was determined through a subjective manner, which might have influenced the correlations, since it was bias and showed a large variation between measurements.

The current screening tool was specifically adapted according to the prevalence study, and therefore the adapted screening tool can only be used in this psychiatric hospital and is not applicable to all individuals with ID.

5.2 RECOMMENDATIONS

The recommendations for future research would be to include individuals who are unable to stand on their own, for whom knee-height measurements should be used. Thus, the formula for calculating height using knee height should be included in the screening tool. A knee-height calliper is required to perform the measurements concerned.

The addition of more risk factors, specifically other diseases (e.g. hypertension, HIV/AIDS etc.) should be added to the screening tool, should the tool be used in other settings. The reason being, it is clear that there is a high prevalence within the general ID population, however through this prevalence study it was not noted.

The use of medication in the population with ID was higher than that used in other populations with ID, which should encourage the health care professionals of South Africa to undertake more research in future to investigate the reasons for, and the consequences of polypharmacy.

It would be helpful if both the existing and the adapted screening tool were both first completed by the investigator in order to determine sensitivity and specificity before the nursing staff tested the tool.

The screening tool can, in future, be considered for use for individuals with other neurological disorders that affect body composition, and probably their nutritional requirements as well, such as cerebral palsy, Down syndrome, Joubert syndrome, Machado-Joseph disease, multiple system atrophy, neuroacanthocytosis, neu/herrodegeneration with brain iron accumulation, Sydenham chorea, ataxias and

cerebellar/spinocerebellar degeneration. In such cases, each individual then becomes his/her own frame of reference for follow-up purposes, which would help in identifying individuals who are at risk of malnutrition. There are currently no reference standards regarding the nutritional status and anthropometrical measurements of such individuals.

5.3 CONCLUSION

Throughout the current research, the degree of malnutrition (undernutrition and overnutrition) and the body composition of the population with ID concerned were determined. The correlation between the nutritional status, as well as the susceptibility of the subjects of the study to malnutrition and severities of ID was determined by means of the taking of anthropometrical measurements. Their overall anthropometrical status indicated that more than a third were undernourished/at risk of becoming undernourished, with more than half of the population with ID having a normal nutritional status and one out of ten being at risk of becoming overnourished/already being overnourished. The results of BMI classification differed from the overall anthropometrical status, with a large number of individuals, who were diagnosed as being malnourished according to the overall anthropometrical status, being misdiagnosed. Men were more prone to be undernourished and at risk of becoming undernourished compared to women. According to the BMI classification, individuals with mild ID were more likely to be obese, and individuals with profound ID were more prone to being underweight. The population with mild and moderate ID was more susceptible to having a high-risk WC compared to those with the other two severities.

The information to which the current study gave rise could help health care professionals to be more aware of the interaction between the severity of ID and

malnutrition. Within a population with ID, many risk factors have to be taken into consideration, with the most prevalent risk factors that were identified being polypharmacy and existing co-diseases. Possible side effects of medications include: a dry mouth; weight gain; and increased/decreased appetite. Pica has been associated with malnutrition, iron and zinc deficiency and the invasion of unwanted organisms into the body, which can affect the absorption of certain nutrients

Taking into account all the different aspects involved in the nutritional care of the population with ID, it is important to have appropriate tools to help with the prevention and management of nutritional problems such as malnutrition. Through the current research, an existing screening tool was adapted to help health care professionals with early detection of malnutrition.

CHAPTER 6

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CHAPTER 7

7.1 APPENDIX A

NUTRITIONAL SCREENING TOOL FOR ADULTS WITH LEARNING DISABILITIES⁴⁷

Guidelines for use:

Date: _____

* Recheck monthly

Weight (kg) = _____

* Score more than one criteria per section if applicable

Height (m) = _____ BMI (kg/m²) = _____

Ideal weight range for height = _____

BODYWEIGHT FOR HEIGHT:		DEGREE OF LEARNING DISABILITY:	
Looks underweight (BMI below 19)	4	Mild	0
Looks overweight (BMI above 25)	2	Moderate	1
An acceptable weight (BMI 19-25)	0	Severe	3
* Looks severely undernourished	5	Profound	4
Has recently lost more than 3kg	3		
APPETITE AND DIETARY INTAKE:		FEEDING ABILITY:	
Normal intake	0	Eats independently	0
Reduced intake	3	Needs to be fed	3
*Very poor intake most days	5	Poor definition/chewing problems	2
Goes through phases – refusing food	2	Swallowing problems	5
Special diets e.g. : Puree, Diabetic	2		
PSYCHOLOGICAL STATE:		SYMPTOMS:	
Enjoys mealtimes	0	Vomiting	2
Disruptive behavior at mealtimes	3	Diarrhoea	2
Regurgitates/self induces	3	Constipation	2
Eats inedible matter	2		
Will only eat limited range of foods	3		
Hyperactive/Athetosis	2		
SKIN TYPE:		AGE	
Healthy	0	If over 65 years add 2 to score	
Dry and flaky	3		
Oedematous	3		
*Leg ulcer/pressure sore (all grades)	5	TOTAL:	

AUTOMATIC REFERRAL TO DIETITIAN

There are three instances which trigger an automatic referral to a Dietitian. These have been marked with an ASTERISK.

ACTION:

Nutritional score 0-9 → Encourage a well balanced varied diet

Nutritional score 10-15 → At risk of malnutrition. Try the following action points:

Keep an accurate record of food intake for a few days e.g.: 4-5 days. This may highlight problem areas in the diet.

To improve nutritional intake, try the following:

- Encourage milky drinks / milky puddings
- Encourage small snacks between meals

Consider the need for dietary supplementation

If in any doubt, discuss with the Dietitian

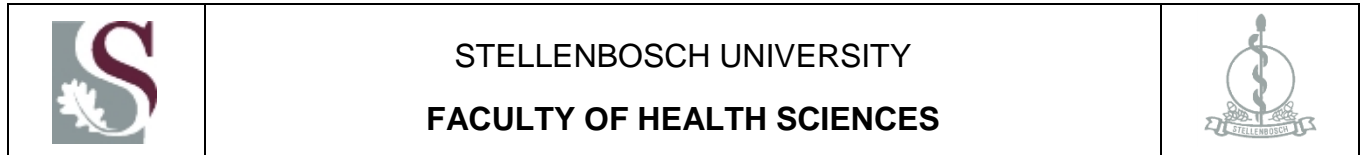
Reassess monthly, and if no improvement in nutritional score, refer to Dietitian

Nutritional score >15 → **REFER CLIENT TO DIETITIAN**

Remember this is only a screening tool, therefore if in any doubt about the score, look at your client and use your professional judgment

DATE	NUTRITIONAL SCORE	WEIGHT (kg)	DIETETIC REFERRAL		NURSE SIGNATURE
			SCORE	DATE	

7.2 APPENDIX B



PARTICIPANT INFORMATION LEAFLET AND ASSENT FORM

TITLE OF THE RESEARCH PROJECT:

The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

RESEARCHERS NAME:

Maretha Nel

ADDRESS:

Stellenbosch University

Department of Human Nutrition

3rd Floor

Clinical Building

CONTACT NUMBER:

082 541 1363

What is RESEARCH?

Research is something we do to find new knowledge about the way things (and people) work. We use research projects or studies to help us find out more about disease or illness. Research also helps us to find better ways of helping, or treating patients who are sick.

What is this research project all about?

The study will be done at The Psychiatric Hospital. A total of 250 patients will be used in the study. The main aim of the study is to determine the degree of malnutrition and body composition in patients with intellectual disability (ID), and to and to change the screening tool as needed. This will help dietitians to treat malnutrition from an early stage.

Why have I been invited to take part in this research project?

You have been invited to take part in this study because you stay in the Hospital.

Who is doing the research?

My name is Maretha Nel and I will be doing the research. I'm a dietitian and busy developing a screening tool to help other patients like you.

What will happen to me in this study?

You will have to help the investigator when she is taking your measurements. The following measurements will be taken; you will be weighed on a scale, your height will

be measured, waist circumference will be taken using a measurement tape, skinfold measurement as well as the elbow width will be measured using a caliper. None of these measurements will hurt.

Can anything bad happen to me?

Nothing bad can happen to you if you take part in the study.

Can anything good happen to me?

If you are malnourished, something good will happen to you, because you will be identified and dietitians can help you. In future, something good can also happen to other patients, because of the early identification of malnutrition through the use of this screening tool.

Will anyone know I am in the study?

Yes, the investigators will know you are in the study. If information is to be used in a book, your name will not be mentioned. The information will be handled in a nameless and private manner.

Who can I talk to about the study?

- Study leader, Maritha Marais Tel: 021-938 9136
- Committee for Human Research Tel: 021-938 9207



What if I do not want to do this?

Participation in the study is completely up to you, and you don't have to take part in the study if you don't want to. You can stop being in the study at any time, even after you said yes.

Do you understand this research study and are you willing to take part in it?

 YES NO

Has the researcher answered all your questions?

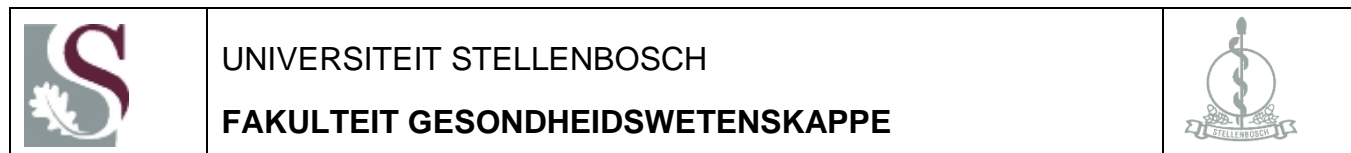
 YES NO

Do you understand that you can pull out of the study at any time?

 YES NO

Signature of participant

Date



INLIGTINGSTUK EN TOESTEMMINGSVORM VIR DEELNEMERS

TITEL VAN NAVORSINGSPROJEK:

Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde (IG) pasiënte in die Psigiatrisiese Hospitaal, Noordwes Provinsie (Suid Afrika).

The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

NAVORSER:

Maretha Nel

ADRES:

Universiteit van Stellenbosch

Departement Menslike Voeding

3^{de} Vloer

Kliniese gebou

KONTAKNOMMER:

082 541 1363

Wat is NAVORSING?

Deur navorsing leer ons hoe dinge (en mense) werk. Ons gebruik navorsingsprojekte of -studies om meer oor siektes uit te vind. Navorsing leer ons ook hoe om siek pasiënte beter te help of te behandel.

Waaroor gaan hierdie navorsingsprojek?

Die studie sal uitgevoer word in die Hospitaal. In totaal sal 250 pasiënte ingesluit word in die studie. Die hoofdoel van die studie is om te bepaal wat is die graad van wanvoeding en liggaamsamestelling in pasiënte wat intellektueel gestremd is en om aanpassings te maak soos nodig. Hierdie siftingshulpmiddel kan deur dieetkundiges gebruik word om wanvoeding reeds in 'n vroeë stadium te behandel.

Die siftingshulpmiddel sal ontwikkel word deur verskeie parameters in te sluit, wat metings sowel as inligting vanaf u mediese rekord insluit.

Hoekom vra julle my om aan hierdie navorsingsprojek deel te neem?

Jy is genooi om deel te neem aan die studie omdat jy in die Hospitaal bly.

Wie doen die navorsing?

My naam is Maretha Nel en ek gaan die navorsing doen. Ek is 'n dieetkundige en is besig om 'n siftingshulpmiddel te ontwikkel om ander pasiënte soos jy te help.

Wat sal in hierdie studie met my gebeur?

Jy sal die navorser moet help wanneer sy jou mates neem. Die volgende metings sal geneem word; jy sal geweeg word op 'n skaal, jou lengte sal gemeet word, middel omtrek sal gemeet word met 'n maatband, 'n velvoumeting en elmboog wydte sal geneem word met 'n kalliper. Nie een van die metings sal jou seermaak nie.

Kan enigiets fout gaan?

Niks kan fout gaan as jy besluit om deel te neem nie.

Watter goeie dinge kan in die studie met my gebeur?

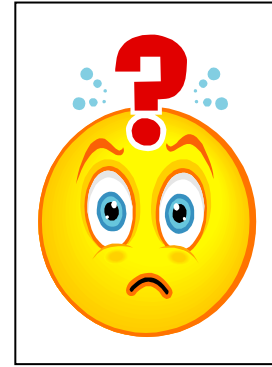
As jy wangevoed is, sal daar iets goed met jou gebeur, want jy sal raakgesien word en dieetkundiges kan jou help. In die toekoms kan daar ook iets goed met ander pasiënte gebeur, deurdat wanvoeding vroeër raakgesien sal word deur middel van die siftingshulpmiddel.

Sal enigiemand weet ek neem deel?

Ja, die navorser gaan weet jy neem deel. As enige inligting in 'n boek gebruik sal word, sal jou naam nie genoem word nie. Die inligting sal op 'n naamlose en vertroulike wyse hanteer word.

Met wie kan ek oor die studie praat?

- Studie leier, Maritha Marais; Tel: 021-938 9136
- Komitee oor Gesondheidsnavorsing; Tel: 021-938 9207



Wat gebeur as ek nie wil deelneem nie?

Deelname aan die studie is jou besluit, en jy hoef nie deel te neem as jy nie wil nie. Jy kan ook onttrek uit die studie, nadat jy ja gesê het.

Verstaan jy hierdie navorsingstudie, en wil jy daaraan deelneem?

 JA NEE

Het die navorser ál jou vrae beantwoord?

 JA NEE

Verstaan jy dat jy kan ophou deelneem net wanneer jy wil?

 JA NEE

Handtekening van deelnemer

Datum

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR USE BY PARENTS/LEGAL GUARDIANS

TITLE OF THE RESEARCH PROJECT:

The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

REFERENCE NUMBER:

N11/03/062

PRINCIPAL INVESTIGATOR:

Maretha Nel

ADDRESS:

Stellenbosch University

Department of Human Nutrition

3rd Floor

Clinical Building

CONTACT NUMBER:

082 541 1363

Your child / The Hospital are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how your child could be involved. Also, your child's participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you or your child negatively in any way whatsoever. You are also free to withdraw him/her from the study at any point, even if you do initially agree to let him/her take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

The study will be conducted at The Psychiatric Hospital on patients with mental retardation. A total of 250 patients will be included in the study. The main aim of the study is to determine the degree of malnutrition and body composition in patients with intellectual disability (ID), in The Psychiatric Hospital, Potchefstroom (North West Province), and to adjust the current screening tool (Nutritional Screening Tool for Adults with Learning Disabilities) accordingly. This will help dietitians to treat malnutrition from an early stage. The screening tool will be developed using different parameters, which include measurements as well as information taken from your child's medical records.

If you agree to let your child participate in the study the following measurements will be taken; he/she will be weighed on a scale, his/her height will be measured, waist circumference will be taken using a measurement tape, skinfold measurement as well as the elbow width will be measured using a caliper. None of these measurements will hurt.

Why has your child been invited to participate?

Your child has been invited to participate in this study because he/she is an in-patient at The Hospital.

What will your responsibilities be?

Your child will have to cooperate with the investigator when she is taking his/her measurements.

Will your child benefit from taking part in this research?

If your child is malnourished, he/she will benefit immediately. In future, other patients will also benefit from early identification of malnutrition through the use of this screening tool.

Are there any risks involved in your child taking part in this research?

There are no risks involved in your child's participation in the research study.

If you do not agree to allow your child to take part, what alternatives does your child have?

Participation in the study is completely voluntary. As this is a descriptive study and not an intervention study, no alternatives will be provided if you chose not to let your child participate.

Who will have access to your child's medical records?

The investigator will have access to your child's medical records. If information is to be used in a publication, their identity will remain undisclosed at all times. The information will be handled in an anonymous and confidential manner. Their name won't be used, as they will receive a reference number.

What will happen in the unlikely event of your child getting injured in any way, as a direct result of taking part in this research study?

There are no risks for injury as a result of participation in this study.

Will you or your child be paid to take part in this study and are there any costs involved?

You or your child will not be paid to take part in the study. There will be no costs involved for you if your child does take part.

Is there anything else that you should know or do?

You can contact the study leader, Maritha Marais at tel. 021-938 9136, if you have any further queries or encounter any problems. You can also contact the Committee for

Human Research at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your principal investigator. You will receive a copy of this information and consent form for your own records.

Declaration by parent/legal guardian

By signing below, I (*name of parent/legal guardian*)
agree to allow my child (*name of child*) who is
years old, to take part in a research study entitled “The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).”

I declare that:

- I have read or had read to me this information and consent form and that it is written in a language with which I am fluent and comfortable.
- If my child is older than 7 years, he/she must agree to take part in the study and his/her ASSENT must be recorded on this form.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to let my child take part.
- I may choose to withdraw my child from the study at any time and my child will not be penalised or prejudiced in any way.

Signed at (*place*) on (*date*)2012

.....

Signature of parent/legal guardian

.....

Signature of witness

Declaration by investigator

I (*name*) declare that:

- I explained the information in this document to
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understand all aspects of the research, as discussed above
- I did/did not use a interpreter

Signed at (*place*) on (*date*) 2012.

.....

Signature of investigator

Declaration by interpreter

I (*name*) declare that:

- I assisted the investigator (*name*) to explain the information in this document to (*name of parent/legal guardian*) using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the parent/legal guardian fully understands the content of this informed consent document and has had all his/her questions satisfactorily answered.

Signed at (*place*) on (*date*)2012

.....
Signature of interpreter

.....
Signature of witness

DEELNEMERINLIGTINGSBLAD EN -TOESTEMMINGSVORM VIR GEBRUIK DEUR OUERS/WETTIGE VOOGDE

TITEL VAN DIE NAVORSINGSPROJEK:

Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde (IG) pasiënte in die Psigiatriese Hospitaal, Noordwes Provinsie (Suid Afrika).

The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

VERWYSINGSNOMMER:

N11/03/062

HOOFNAVORSER:

Maretha Nel

ADRES:

Stellenbosch University

Departement Menslike Voeding

3^{de} Vloer

Kliniese Gebou

KONTAKNOMMER:

082 541 1363

U kind / die Hospitaal word genooi om deel te neem aan 'n navorsingsprojek. Lees asseblief hierdie inligtingsblad op u tyd deur aangesien die detail van die projek daarin verduidelik word. Indien daar enige deel van die projek is wat u nie ten volle verstaan nie, is u welkom om die navorsingspersoneel daaroor uit te vra. Dit is baie belangrik dat u ten volle moet verstaan wat die navorsing behels en hoe u kind daarby betrokke kan wees. U kind se deelname is ook **volkome vrywillig** en dit staan u vry om deelname te weier. U kind sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om hom/haar te laat deelneem nie. U mag u kind ook te eniger tyd aan die studie onttrek, selfs al het u ingestem om hom/haar te laat deelneem.

Hierdie studie is deur die **Etië Komitee oor Gesondheidsnavorsing van die Universiteit Stellenbosch** goedgekeur en sal uitgevoer word volgens die etiese riglyne en beginsels van die Internasionale Verklaring van Helsinki en die Etiese Riglyne vir Navorsing van die Mediese Navorsingsraad (MNR).

Wat behels hierdie navorsingsprojek?

Die studie sal uitgevoer word in die Hospitaal op pasiënte wat verstandelik gestremd is. In totaal sal 250 pasiënte ingesluit word in die studie. Die hoofdoel van die studie is om te bepaal wat is die graad van wanvoeding en liggaamskomposisie in pasiënte wat intellektueel gestremd is in die Psigiatrisiese Hospitaal, Noordwes Provinsie (Suid Afrika),

en om die huidige siftingshulpmiddel toepaslik aan te pas. Hierdie siftingshulpmiddel kan deur dieetkundiges gebruik word om wanvoeding reeds in 'n vroeë stadium te behandel. Die siftingshulpmiddel sal ontwikkel word deur verskeie parameters in te sluit, wat metings sowel as inligting vanaf u kind mediese rekord insluit.

Indien u instem dat u kind kan deelneem aan die studie sal die volgende metings geneem word; hy/sy sal geweeg word op 'n skaal, sy/haar lengte sal gemeet word, middel omtrek sal gemeet word met 'n maatband, 'n velvoumeting en elmboog wydte sal geneem word met 'n kalliper. Nie een van die metings sal u kind seermaak nie.

Waarom is u kind genooi om deel te neem?

U kind is genooi om deel te neem aan die studie omdat hy/sy 'n binne pasiënt is by die Hospitaal.

Wat sal u verantwoordelikhede wees?

U kind sal moet samewerking gee wanneer die navorser sy/haar mates neem.

Sal u kind voordeel trek deur deel te neem aan hierdie navorsing?

Indien u kind wangevoed is, sal hy/sy dadelik voordele geniet. Toekomstige pasiënte sal ook voordeel geniet deurdat wanvoeding vroeër raakgesien sal word deur middel van die siftingshulpmiddel.

Is daar enige risiko's verbonde aan u kind se deelname aan hierdie navorsing?

Daar is geen risiko's verbonde met die deelname van u kind aan die navorsingsprojek nie.

Watter alternatiewe is daar vir u kind indien u nie instem om hom/haar te laat deelneem nie?

Deelname aan die studie is volkome vrywillig. Aangesien dit 'n beskrywende studie is en geen intervensies plaasvind nie, sal geen alternatiewe verskaf word indien u kies dat u kind nie kan deelneem aan die studie nie.

Wie sal toegang hê tot u kind se mediese rekords?

Die navorser sal toegang hê tot u kind se mediese rekords. Indien inligting vir 'n publikasie in 'n joernaal gebruik word sal u kind se identiteit as 'n deelnemer glad nie bekend gemaak word nie. Die inligting sal op 'n anonieme en vertroulike wyse hanteer word. U kind se naam sal nie gebruik word nie, aangesien hy/sy 'n verwysingsnommer ontvang.

Wat sal gebeur in die onwaarskynlike geval van 'n besering wat mag voorkom as gevolg van my kind se deelname aan hierdie navorsingsprojek?

Deelname aan die studie hou geen risiko vir beserings in nie.

Sal u of u kind betaal word vir deelname aan die projek en is daar enige koste verbonde aan deelname?

Nee, u of u kind sal nie betaal word vir deelname aan die projek nie. Deelname aan die projek sal u niks kos nie.

Is daar enigiets anders wat u moet weet of doen?

U kan die studie leier, Maritha Marais kontak by tel. 021-938 9136 indien u enige verdere vrae het of enige probleme ondervind. U kan ook die Etiek Komitee oor Gesondheidsnavorsing kontak by 021-938 9207 indien u enige bekommernis of klagte het wat nie bevredigend deur die navorsers hanteer is nie. U sal 'n afskrif van hierdie inligtings- en toestemmingsvorm ontvang vir u eie rekords.

Verklaring deur ouer/wettig voog

Met die ondertekening van hierdie dokument onderneem ek, (*naam van ouer/wettige voog*), om my kind (*naam van kind*), wat jaar oud is, te laat deelneem aan 'n navorsingsprojek getiteld "Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde pasiënte in die Psigiatrisiese Hospitaal, Noordwes Provinsie (Suid Afrika)"

Ek verklaar dat:

- Ek hierdie inligtings- en toestemmingsvorm gelees het of aan my laat voorlees het en dat dit in 'n taal geskryf is waarin ek vaardig en gemaklik mee is.
- My kind moet instem om aan die navorsingsprojek deel te neem as hy/sy ouer as 7 jaar is, en dat sy/haar **INSTEMMING** op hierdie vorm aangeteken sal word.
- Ek geleentheid gehad het om vrae te stel en dat al my vrae bevredigend beantwoord is.
- Ek verstaan dat deelname aan hierdie projek **vrywillig** is en dat daar geen druk op my geplaas is om my kind te laat deelneem nie.
- My kind te enige tyd aan die projek mag onttrek en dat hy/sy nie op enige wyse daardeur benadeel sal word nie.

Geteken te (*plek*) op (*datum*) 2012.

.....
Handtekening van ouer/wettige voog

.....
Handtekening van getuie

Verklaring deur navorser

Ek (naam) verklaar dat:

- Ek die inligting in hierdie dokument verduidelik het aan
.....
- Ek hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek tevrede is dat hy/sy al die aspekte van die navorsingsprojek soos hierbo bespreek, voldoende verstaan.
- Ek 'n tolk gebruik het/nie 'n tolk gebruik het nie.

Geteken te (*plek*) op (*datum*) 2012.

.....

Handtekening van navorser

.....

Handtekening van getuie

Verklaring deur tolk

Ek (*naam*) verklaar dat:

- Ek die navorser (*naam*) bygestaan het om die inligting in hierdie dokument in Afrikaans/Xhosa aan (*naam van ouer/wettige voog*) te verduidelik.
- Ons hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek 'n feitelik korrekte weergawe oorgedra het van wat aan my vertel is.
- Ek tevrede is dat die ouer/wettige voog die inhoud van hierdie dokument ten volle verstaan en dat al sy/haar vrae bevredigend beantwoord is.

Geteken te (*plek*) op (*datum*) 2012.

.....
Handtekening van tolk

.....
Handtekening van getuie

7.3 APPENDIX C

Patient Anthropometric Information and Additional Risk Factors:

Reference number: _____

Anthropometrical measurements:

Weight (1) _____
(2) _____

Height (1) _____
(2) _____

Waist circumference (1) _____
(2) _____

Mid-upper-arm circumference (1) _____
(2) _____

Skinfold measurement (1) _____
(2) _____

Elbow width (1) _____
(2) _____

Additional risk factors:

Medication:

Pica:

Yes, specify

No

Underlying medical conditions:

HIV/AIDS

TB

Cancer

Pressure sores

Other

Other:

7.4 APPENDIX D

Patient Demographic Information:

Reference number: _____

Age / Date of Birth: _____

Date of evaluation: _____

Gender:

Male

Female

Race:

White

Coloured

Black

Indian

Other _____

Degree of intellectual disability:

Mild

Moderate

Severe

Profound

Informed Consent:

Yes

No

7.5 APPENDICES E

Appendix E1: Body Mass Index.⁴⁸

The International Classification of adult underweight, overweight and obesity according to BMI

Classification	BMI(kg/m ²)	
	Principal cut-off points	Additional cut-off points
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	18.50 - 24.99	18.50 - 22.99
		23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

Source: Adapted from WHO, 1995, WHO, 2000 and WHO 2004.

Appendix E2: Waist circumference:³

<u>High-Risk Waist Circumference for Adult Males and Females</u>	
Males	>102 cm
Females	>80 cm

Appendix E3: Mid-upper arm circumference and upper arm muscle circumference:⁴⁹

AGE GROUP	ARM CIRCUMFERENCE (mm)							ARM MUSCLE CIRCUMFERENCE (mm)						
	5	10	25	50	75	90	95	5	10	25	50	75	90	95
Males														
1-1.9	142	146	150	159	170	176	183	110	113	119	127	135	144	147
2-2.9	141	145	153	162	170	178	185	111	114	122	130	140	146	150
3-3.9	150	153	160	167	175	184	190	117	123	131	137	143	148	153
4-4.9	149	154	162	171	180	186	192	123	126	133	141	148	156	159
5-5.9	153	160	167	175	185	195	204	128	133	140	147	154	162	169
6-6.9	155	159	167	179	188	209	228	131	135	142	151	161	170	177
7-7.9	162	167	177	187	201	223	230	137	139	151	160	168	177	190
8-8.9	162	170	177	190	202	220	245	140	145	154	162	170	182	187
9-9.9	175	178	187	200	217	249	257	151	154	161	170	183	196	202
10-10.9	181	184	196	210	231	262	274	156	160	166	180	191	208	221
11-11.9	186	190	202	223	244	261	280	159	165	173	183	195	205	230
12-12.9	193	200	214	232	254	282	303	167	171	182	195	210	223	241
13-13.9	194	211	228	247	263	286	301	172	179	196	211	226	238	245
14-14.9	220	226	237	253	283	303	322	189	199	212	223	240	260	264
15-15.9	222	229	244	264	284	311	320	199	204	218	237	254	266	272
16-16.9	244	248	262	278	303	324	343	213	225	234	249	269	287	296
17-17.9	246	253	267	285	308	336	347	224	231	245	258	273	294	312
18-18.9	245	260	276	297	321	353	379	226	237	252	264	283	298	324
19-24.9	262	272	288	308	331	355	372	238	245	257	273	289	309	321
25-34.9	271	282	300	319	342	362	375	243	250	264	279	298	314	326
35-44.9	278	287	305	326	345	363	374	247	255	269	286	302	318	327
45-54.9	267	281	301	322	342	362	376	239	249	265	281	300	315	326
55-64.9	258	273	296	317	336	355	369	236	245	260	278	295	310	320
65-74.9	248	263	285	307	325	344	355	223	235	251	268	284	298	305
Females														
1-1.9	138	142	148	156	164	172	177	105	111	117	124	132	139	143
2-2.9	142	145	152	160	167	176	184	111	114	119	126	133	142	147
3-3.9	143	150	158	167	175	183	189	113	119	124	132	140	146	152
4-4.9	149	154	160	169	177	184	191	115	121	128	136	144	152	157
5-5.9	153	157	165	175	185	203	211	125	128	134	142	151	159	165
6-6.9	156	162	170	176	187	204	211	130	133	138	145	154	163	171
7-7.9	164	167	174	183	199	216	231	129	135	142	151	160	171	176
8-8.9	168	172	183	195	214	247	261	138	140	151	160	171	183	194
9-9.9	178	182	194	211	224	251	260	147	150	158	167	180	194	198
10-10.9	174	182	193	210	228	251	265	148	150	159	170	180	190	197
11-11.9	185	194	208	224	248	276	303	150	158	171	181	196	217	223
12-12.9	194	203	216	237	256	282	294	162	166	180	191	201	214	220
13-13.9	202	211	223	243	271	301	338	169	175	183	198	211	228	240
14-14.9	214	223	237	252	272	304	322	174	179	190	201	216	232	247
15-15.9	208	221	239	254	279	300	322	175	178	189	202	218	228	244
16-16.9	218	224	241	258	283	318	334	170	180	190	202	218	234	249
17-17.9	220	227	241	264	295	324	350	175	183	194	205	221	239	257
18-18.9	222	227	241	258	281	312	325	174	179	191	202	215	237	245
19-24.9	221	230	247	265	290	319	345	178	185	195	207	221	236	249
25-34.9	233	240	256	277	304	342	368	183	188	199	212	228	246	264
35-44.9	241	251	267	290	317	356	378	186	192	205	218	236	257	272
45-54.9	242	256	274	299	328	362	384	187	193	206	220	238	260	274
55-64.9	243	257	280	303	335	367	385	187	196	209	225	244	266	280
65-74.9	240	252	274	299	326	356	373	185	195	208	225	244	264	279

from Fisancho AR. New norms of upper limb fat and muscle areas for assessment of nutritional status. *Am J Clin Nutr* 34:2540, 1981.

⁴⁹Percentiles are not yet available for the black population for upper arm circumference or arm muscle circumference.

Appendix E4: Triceps skinfold and bone-free upper arm muscle area (small frame size):⁴⁹

Table II.54 Selected percentiles of weight, triceps and subscapular skinfolds, and bone-free upper arm muscle area (AMA) for United States men and women with small frames (25 to 54 years old)

Ht			Wt (kg)							Triceps (mm)							Subscapular (mm)							Bone-free AMA (cm ²)													
in	cm	n	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95							
Men																																					
62	157	23	46*	50*	52*	64	71*	74*	77*				11							16																52	
63	160	43	48*	51*	53	61	70	75*	79*			6	10	17					8	12	20													32	48	54	
64	163	73	49*	53	55	66	76	76	80*		5	5	10	16	18			7	7	15	25	29											37	38	49	58	63
65	165	112	52	53	58	66	77	81	84	4	5	6	11	17	19	21	7	8	9	14	25	28	35	31	35	37	47	60	63	71							
66	168	129	56	57	59	67	78	83	84	5	6	6	11	18	18	20	7	8	8	14	26	26	32	31	36	38	49	60	62	71							
67	170	132	56	60	62	71	82	83	88	5	6	6	11	18	20	22	6	7	9	15	23	25	30	35	39	41	49	58	60	62							
68	173	107	56	59	62	71	79	82	85	5	6	6	10	15	16	20	7	8	9	13	24	30	40	33	37	40	49	59	62	69							
69	175	97	57*	62	65	74	84	87	88*		6	6	11	17	20			7	7	13	24	26				36	40	58	61	63							
70	178	46	59*	62*	67	75	87	86*	90*			7	10	17					9	14	23						35	48	57								
71	180	49	60*	64*	70	76	79	88*	91*			7	10	16					8	13	22					39	47	52									
72	183	21	62*	65*	67*	74	87*	89*	93*				10							14								45									
73	185	9	63*	67*	69*	79*	89*	91*	94*																												
74	188	6	65*	68*	71*	80*	90*	92*	96*																												
Women																																					
58	147	53	37*	43	43	52	58	62	66*			12	13	24	30	33		10	12	23	34	38				22	24	29	36	44							
59	150	108	42	43	44	53	63	69	72	8	11	14	21	29	36	37	6	9	10	17	29	32	34	17	20	22	28	38	39	43							
60	152	142	42	44	45	53	63	65	70	8	11	12	21	28	29	33	6	7	8	18	27	32	39	19	21	22	28	36	40	44							
61	155	218	44	46	47	54	64	66	72	11	12	14	21	28	31	34	7	8	9	16	28	32	36	20	21	23	28	38	39	42							
62	157	255	44	47	48	55	63	64	70	10	12	14	20	28	31	34	6	7	8	14	22	27	32	20	21	21	27	33	35	37							
63	160	239	46	48	49	55	65	68	79	10	11	13	20	27	30	36	6	7	7	14	27	29	31	20	21	22	27	33	35	38							
64	163	146	49	50	51	57	67	68	74	10	13	13	20	28	30	34	6	7	8	13	24	27	34	22	23	23	28	34	38	42							
65	165	113	50	52	53	60	70	72	80	12	13	14	22	29	31	34	7	8	8	15	26	30	33	21	22	23	28	37	39	47							
66	168	47	46*	49*	54	58	65	71*	74*			12	19	30					9	12	25					23	27	35									
67	170	18	47*	50*	52*	59	70*	72*	76*				18							13							26										
68	173	18	48*	51*	53*	62	71*	73*	77*				20							15							25										
69	175	5	49*	52*	54*	63*	72*	74*	78*																												
70	178	1	50*	53*	55*	64*	73*	75*	79*																												

*Value estimated through linear regression equation.
(From Frisancho, A.R. (1984) *Am. J. Clin. Nutr.* 40 pp. 808-19, with permission.)

Table II.57 Selected percentiles of weight, triceps and subscapular skinfolds, and bone-free upper arm muscle area (AMA) for United States men and women with small frames (55 to 74 years old)

Ht			Wt (kg)							Triceps (mm)							Subscapular (mm)							Bone-free AMA (cm ²)									
in	cm	n	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95			
Men																																	
62	157	47	45*	49*	56	61	68	73*	77*			6	9	12					11	16	23						38	46	52				
63	160	78	47*	49	51	62	71	71	79*		5	5	10	16	17		6	6	12	21	22					34	35	43	54	55			
64	163	107	47	50	54	63	72	74	80	4	4	4	9	20	21	22	6	7	7	14	24	25	29	26	30	31	44	53	54	56			
65	165	132	48	54	59	70	80	90	90	5	6	7	11	18	19	24	6	8	8	16	28	28	29	26	30	34	48	57	60	62			
66	168	112	51	55	59	68	77	80	84	5	6	7	11	16	20	20	7	7	8	15	25	26	30	25	31	35	45	54	58	64			
67	170	128	55	60	61	69	79	81	88	5	6	6	10	15	17	25	7	8	9	13	22	25	31	30	36	37	45	53	55	59			
68	173	95	54*	54	58	70	79	81	86*		5	5	10	15	17			7	7	13	21	22			35	35	43	55	60				
69	175	47	56*	59*	63	75	81	84*	88*			8	10	15					10	16	27					38	47	62					
70	178	29	57*	61*	63*	76	83*	86*	89*				11							13							48						
71	180	14	59*	62*	65*	69	85*	87*	91*				9							10							43						
72	183	6	60*	64*	66*	76*	86*	89*	92*																								
73	185	1	62*	65*	68*	78*	88*	90*	94*																								
74	188	1	63*	67*	69*	77*	89*	92*	95*																								
Women																																	
58	147	85	39*	46	48	54	63	65	71*		14	16	21	31	34		8	9	18	32	33					22	23	29	40	42			
59	150	122	41	45	48	55	66	68	74	11	13	15	21	30	31	33	6	7	9	19	29	30	33	22	23	24	30	39	40	44			
60	152	157	43	45	47	54	67	70	73	10	11	13	20	29	31	35	5	7	8	15	27	32	36	20	22	23	30	37	41	44			
61	155	145	43	43	45	56	65	70	71	10	12	14	22	29	29	32	6	7	8	17	29	31	34	18	21	23	28	36	40	42			
62	157	158	47	49	52	58	67	69	73	11	11	12	21	29	30	32	7	8	9	17	25	26	30	20	23	24	30	37	40	43			
63	160	89	42*	45	48	58	67	68	74*		12	13	20	29	30		6	7	14	25	27				19	20	27	35	36				
64	163	50	43*	47	49	60	68	70	75*		12	13	21	27	29		6	7	18	24	25				21	21	28	37	42				
65	165	26	43*	47*	49*	60	69*	72*	75*				18							13							28						
66	168	12	44*	48*	50*	68	70*	72*	76*				23							13							33						
67	170	1	45*	48*	51*	61*	71*	73*	77*																								
68	173	1	45*	49*	51*	61*	71*	74*	77*																								
69	175	0	46*	49*	52*	62*	72*	74*	78*																								
70	178	0	47*	50*	52*	63*	73*	75*	79*																								

*Value estimated through linear regression equation.
 (From Frisancho, A.R. (1984) *Am. J. Clin. Nutr.*, 40 pp. 808-19, with permission.)

Appendix E4: Triceps skinfold and bone-free upper arm muscle area (medium frame size):⁴⁹

Table II.55 Selected percentiles of weight, triceps and subscapular skinfolds, and bone-free upper arm muscle area (AMA) for United States men and women with medium frames (25 to 54 years old)

Ht		Wt (kg)								Triceps (mm)							Subscapular (mm)							Bone-free AMA (cm ²)							
in	cm	n	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	
Men																															
62	157	10	51*	55*	58*	68	81*	83*	87*				15							13											58
63	160	30	52*	56*	59*	71	82*	85*	89*				11							18										55	
64	163	71	54*	60	61	71	83	84	90*		6	6	12	18	20			7	9	17	30	32					43	47	56	67	71
65	165	154	59	62	65	74	87	90	94	5	7	8	12	20	22	25	8	9	10	16	26	29	32	40	43	45	56	67	69	70	
66	168	212	58	61	65	75	85	87	93	5	6	7	11	16	18	22	7	7	9	16	25	27	33	38	42	44	55	69	72	78	
67	170	409	62	66	68	77	89	93	100	5	7	7	13	21	23	28	8	9	10	18	26	30	33	39	42	44	53	66	69	73	
68	173	478	60	64	66	78	89	92	97	4	5	7	11	18	20	24	7	8	9	16	25	28	31	41	44	45	55	67	71	76	
69	175	464	63	66	68	78	90	93	97	5	6	7	12	18	20	24	7	8	9	16	25	27	31	38	41	44	54	66	69	73	
70	178	419	64	66	70	81	90	93	97	5	6	7	12	18	20	23	7	8	9	15	24	27	30	39	42	43	55	65	68	72	
71	180	282	62	68	70	81	92	96	100	4	5	7	12	19	21	25	7	8	9	14	24	27	30	37	41	44	54	67	68	73	
72	183	231	68	71	74	84	97	100	104	5	7	7	12	20	22	26	7	8	9	15	26	30	32	40	42	44	56	65	67	74	
73	185	106	70	72	75	85	100	101	104	6	7	8	12	20	24	27	8	9	9	15	25	29	32	39	42	43	55	67	69	73	
74	188	50	68*	76	77	88	100	100	104*		6	9	13	21	23			7	9	14	25	30			43	43	55	62	63		
Women																															
58	147	40	41*	46*	50	63	77	75*	79*			20	25	40					15	23	38					24	35	42			
59	150	104	47	50	52	66	76	79	85	15	19	21	30	37	40	40	10	12	13	29	38	39	43	23	24	26	33	43	45	49	
60	152	208	47	50	52	60	77	79	85	14	15	17	26	35	37	41	8	10	11	22	35	37	41	22	25	25	32	42	45	49	
61	155	465	47	49	51	61	73	78	86	11	14	15	25	34	36	42	7	9	10	19	32	36	42	21	24	25	31	42	45	51	
62	157	644	49	50	52	61	73	77	83	12	14	16	24	34	36	40	7	9	10	18	33	37	40	21	23	25	31	40	43	48	
63	160	685	49	51	53	62	77	80	88	12	13	15	24	33	35	38	7	8	10	18	31	34	38	22	23	25	32	41	43	50	
64	163	722	50	52	54	62	76	82	87	11	14	15	23	33	36	40	7	7	8	16	31	35	38	21	23	24	31	40	43	48	
65	165	628	52	54	55	63	75	80	89	12	14	15	22	31	34	38	7	8	8	15	29	33	38	21	23	24	31	40	43	49	
66	168	428	52	54	55	63	75	78	83	11	13	14	22	31	33	37	7	8	9	14	28	30	35	21	23	24	30	39	41	44	
67	170	257	54	56	57	65	79	82	88	12	13	15	21	29	30	35	7	8	8	15	28	32	37	22	24	25	30	40	43	48	
68	173	119	58	59	60	67	77	85	87	10	14	15	22	31	32	36	8	8	9	15	29	33	35	22	24	25	30	37	38	39	
69	175	59	49*	58	60	68	79	82	87*		11	12	19	29	31			8	8	12	25	29			23	24	30	36	39		
70	178	15	50*	54*	57*	70	80*	83*	87*				19							20							32				

*Value estimated through linear regression equation.
 (From Frisancho, A.R. (1984) *Am. J. Clin. Nutr.*, 40 pp. 808-19, with permission.)

Table II.58 Selected percentiles of weight, triceps and subscapular skinfolds, and bone-free upper arm muscle area (AMA) for United States men and women with medium frames (55 to 74 years old)

Ht			Wt (kg)							Triceps (mm)							Subscapular (mm)							Bone-free AMA (cm ²)									
in	cm	n	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95			
Men																																	
62	157	49	50*	54*	59	68	77	81*	85*			5	12	25					11	19	27							39	48	61			
63	160	89	51*	57	60	70	80	82	87*		7	7	11	20	23			8	10	15	26	28					36	38	50	60	63		
64	163	210	55	59	62	71	82	83	91	5	6	6	10	17	20	26	6	7	9	15	25	27	35	35	39	40	51	64	66	71			
65	165	335	56	60	64	72	83	86	89	5	6	7	11	17	19	24	7	8	9	17	25	29	31	35	38	41	52	63	65	72			
66	168	405	57	62	66	74	83	84	89	6	6	7	12	18	19	22	7	9	10	16	25	28	31	34	39	42	51	60	62	67			
67	170	509	59	64	66	78	87	89	94	5	6	7	12	18	20	23	7	9	10	17	26	29	34	35	39	42	52	65	67	70			
68	173	413	62	66	68	78	89	95	101	6	7	8	12	18	21	23	7	9	10	17	26	29	32	37	40	42	52	65	67	70			
69	175	366	62	66	68	77	90	93	99	5	6	7	12	19	22	25	6	8	9	16	25	28	30	31	36	40	51	62	65	72			
70	178	248	62	68	71	80	90	95	101	6	7	7	11	18	19	21	7	9	10	16	25	27	30	36	41	44	53	63	65	68			
71	180	146	68	70	72	84	94	97	101	5	6	6	11	16	17	20	7	9	10	15	25	26	31	36	42	44	56	65	67	71			
72	183	81	66*	65	69	81	96	97	101*		6	8	11	19	20			8	10	16	28	30			27	39	50	58	59				
73	185	35	68*	72*	79	88	93	99*	103*			8	13	16					10	15	26					43	56	67					
74	188	11	69*	73*	76*	95	98*	101*	104*				11							18							56						
Women																																	
58	147	105	40	44	49	57	72	82	85	5	13	17	28	40	40	41	3	7	10	25	37	43	48	21	23	25	32	46	47	51			
59	150	198	47	49	52	62	74	78	86	12	15	18	26	34	38	41	8	9	11	23	32	36	43	24	26	27	35	44	48	48			
60	152	358	47	50	52	65	76	79	86	13	17	18	25	33	34	38	8	10	12	22	34	36	40	21	24	26	35	45	49	57			
61	155	543	49	51	54	64	78	81	86	13	16	18	25	35	37	42	8	10	10	20	33	36	42	22	24	26	34	44	49	52			
62	157	576	49	53	54	64	78	82	88	13	15	17	24	33	36	39	7	8	10	20	33	36	38	24	25	26	35	45	47	54			
63	160	551	52	54	55	65	79	83	89	12	14	16	24	32	35	38	8	8	10	18	32	37	41	24	26	27	35	44	45	51			
64	163	406	51	54	57	66	78	81	87	12	14	16	25	33	34	37	7	9	10	17	30	33	38	21	24	26	33	44	46	49			
65	165	307	54	56	59	67	78	84	88	14	16	17	24	33	35	39	7	8	9	17	30	35	37	24	25	27	34	44	45	50			
66	168	119	54	57	57	66	79	85	88	12	13	16	24	33	33	36	6	7	8	16	30	31	34	24	26	27	33	41	43	49			
67	170	63	51*	59	61	72	82	85	89*		17	17	27	35	35			9	10		35	35			27	28	32	41	43				
68	173	28	52*	56*	59*	70	83*	86*	90*				25							16							36						
69	175	5	53*	57*	60*	72*	84*	87*	91*																								
70	178	1	54*	58*	61*	73*	85*	88*	92*																								

*Value estimated through linear regression equation.

(From Frisancho, A.R. (1984) *Am. J. Clin Nutr.*, 40 pp. 808-19, with permission.)

Appendix E4: Triceps skinfold and bone-free upper arm muscle area (large frame size):⁴⁹

Table II.56 Selected percentiles of weight, triceps and subscapular skinfolds, and bone-free upper arm muscle area (AMA) for United States men and women with large frames (25 to 54 years old)

Ht			Wt (kg)							Triceps (mm)							Subscapular (mm)							Bone-free AMA (cm ²)																		
in	cm	n	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95												
Men																																										
62	157	1	57*	62*	66*	82*	99*	103*	108*																																	
63	160	1	58*	63*	67*	83*	100*	104*	109*																																	
64	163	5	59*	64*	68*	84*	101*	105*	110*																																	
65	165	15	60*	65*	69*	79	102*	106*	111*				14																													
66	168	37	60*	65*	75	84	103	106*	112*			9	14	30																												
67	170	54	62*	70	71	84	102	111	113*		7	7	11	23	27																											
68	173	84	63*	74	76	86	101	104	114*		9	10	14	22	23																											
69	175	126	68	71	74	89	103	105	114	6	7	8	15	25	29	31	9	10	11	18	31	32	38	46	48	49	61	73	78	83												
70	178	150	68	72	74	87	106	112	114	7	7	7	14	23	25	30	7	10	11	17	31	35	38	43	47	48	50	62	75	81	83											
71	180	123	73	78	82	91	113	116	123	6	8	10	15	25	27	31	9	11	11	20	35	40	46	47	48	50	62	75	81	83												
72	183	114	73	76	78	91	109	112	121	5	6	7	12	20	22	25	8	9	9	19	28	30	36	45	48	50	61	77	80	86												
73	185	109	72	77	79	93	106	107	116	5	6	7	13	19	22	31	7	9	9	18	27	28	30	47	49	51	66	79	83													
74	188	37	69*	74*	82	92	105	115*	120*				8	12	19																											
Women																																										
58	147	6	56*	63*	67*	86*	105*	110*	117*																																	
59	150	19	56*	62*	67*	78	105*	109*	116*																																	
60	152	32	55*	62*	66*	87	104*	109*	116*																																	
61	155	92	54*	64	66	81	105	117	115*																																	
62	157	135	59	61	65	81	103	107	113	16	19	22	34	48	50																											
63	160	162	58	63	67	83	105	109	119	18	20	22	34	46	48	51	11	14	16	32	44	46	50	27	30	32	43	60	65	77												
64	163	196	59	62	63	79	102	104	112	16	20	21	32	43	45	49	10	12	15	28	42	46	50	26	28	29	39	50	55	63												
65	165	242	59	61	63	81	103	109	114	17	20	21	31	43	46	48	10	12	14	29	42	48	52	27	28	29	39	56	59	67												
66	168	166	55	58	62	75	95	100	107	13	17	18	27	40	43	45	8	9	11	25	36	40	45	23	24	27	35	49	53	69												
67	170	144	58	60	65	80	100	108	114	13	16	17	30	41	43	49	7	10	11	25	41	46	55	25	28	30	37	50	53	55												
68	173	81	51*	66	66	76	104	105	111*																																	
69	175	39	50*	57*	68	79	105	104*	111*																																	
70	178	17	50*	56*	61*	76	99*	104*	110*																																	

*Value estimated through linear regression equation.
 (From Frisanchi, A.R. (1984) *Am. J. Clin Nutr.*, 40 pp. 308-19, with permission.)

Table II.59 Selected percentiles of weight, triceps and subscapular skinfolds, and bone-free upper arm muscle area (AMA) for United States men and women with large frames (55 to 74 years old)

Ht			Wt (kg)							Triceps (mm)							Subscapular (mm)							Bone-free AMA (cm ²)							
in	cm	n	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	5	10	15	50	85	90	95	
Men																															
62	157	7	54*	59*	63*	77*	91*	95*	100*				15							20										57	
63	160	12	55*	60*	64*	80	92*	96*	101*				21							31										44	
64	163	20	57*	62*	65*	77	94*	97*	102*																					66	
65	165	36	58*	63*	73	79	89	98*	103*			11	14	22						14	19	27						44	59	66	
66	168	58	59*	67	73	80	101	102	105*		7	8	13	21	25				9	11	20	31	35				43	47	56	67	72
67	170	114	65	71	73	85	103	108	112	6	8	9	16	21	25	27	8	11	12	20	35	35	38	41	43	44	46	57	69	70	74
68	173	128	67	71	73	83	95	98	111	6	7	8	13	20	21	23	8	10	11	18	27	30	32	40	41	43	46	57	69	70	74
69	175	131	65	70	74	84	96	98	105	6	7	8	12	18	20	23	7	11	11	19	27	30	33	40	41	43	46	57	69	70	74
70	178	144	68	73	77	87	102	104	117	5	6	8	14	22	25	31	9	11	13	20	30	33	37	43	48	50	59	70	71	87	
71	180	95	65*	70	70	84	102	109	111*		6	6	13	18	22				8	9	15	30	30			46	47	54	70	75	
72	183	72	67*	76	81	90	108	112	112*		8	8	13	23	26				8	9	20	28	31			47	48	59	73	78	
73	185	23	68*	73*	76*	88	105*	108*	113*																						59
74	188	15	69*	74*	78*	89	106*	109*	114*				11																	54	
Women																															
58	147	14	53*	59*	63*	78	95*	99*	104*				45							44										50	
59	150	26	54*	59*	63*	78	95*	99*	105*				36							31										49	
60	152	72	54*	65	69	78	87	88	105*		25	26	35	44	45				19	21	31	42	45			28	33	41	58	60	
61	155	117	64	68	69	79	94	95	106	18	22	24	33	40	44	46	13	16	19	29	40	43	48	31	32	34	44	59	61	71	
62	157	126	59	61	63	82	93	101	111	19	24	24	32	40	43	50	13	19	22	30	39	48	53	28	29	34	43	59	63	76	
63	160	154	61	65	67	80	100	102	118	20	24	25	33	41	43	45	13	15	16	29	40	45	51	27	32	33	41	56	62	67	
64	163	147	60	65	67	77	97	102	119	18	22	23	29	42	46	50	10	12	16	24	41	46	55	28	29	32	41	54	60	78	
65	165	117	60	66	69	80	98	102	111	15	17	20	30	43	44	46	8	9	12	26	42	46	48	29	32	32	42	53	57	65	
66	168	64	57*	60	63	82	98	105	109*		18	18	27	35	40				9	12	26	34	36			31	31	40	57	58	
67	170	40	58*	64*	68	80	105	104*	109*			22	32	44						14	25	46				30	40	58			
68	173	17	58*	64*	68*	79	100*	104*	110*				26																		48
69	175	7	59*	65*	69*	85*	101*	105*	110*																						
70	178	2	60*	65*	69*	85*	101*	105*	111*																						

*Value estimated through linear regression equation.
 (From Frisancho, A.R. (1984) *Am. J. Clin. Nutr.*, 40 pp. 808-19, with permission.)

Appendix E5: Frame size:⁴⁹

	Age (years)	Frame size		
		Small	Medium	Large
<u>Men</u>				
	18–24	≤6.6	>6.6 and <7.7	≥7.7
	25–34	≤6.7	>6.7 and <7.9	≥7.9
	35–44	≤6.7	>6.7 and <8.0	≥8.0
	45–54	≤6.7	>6.7 and <8.1	≥8.1
	55–64	≤6.7	>6.7 and <8.1	≥8.1
	65–74	≤6.7	>6.7 and <8.1	≥8.1
<u>Women</u>				
	18–24	≤5.6	>5.6 and <6.5	≥6.5
	25–34	≤5.7	>5.7 and <6.8	≥6.8
	35–44	≤5.7	>5.7 and <7.1	≥7.1
	45–54	≤5.7	>5.7 and <7.2	≥7.2
	55–64	≤5.8	>5.8 and <7.2	≥7.2
	65–74	≤5.8	>5.8 and <7.2	≥7.2

Appendix E6: Arm muscle area (Males):⁴⁹

AGE (yr)	N	MEAN	SD	PERCENTILES								
				5	10	15	25	50	75	85	90	95
Males With Small Frames												
18.0-24.9	443	45.6	10.6	30.8	33.8	35.8	38.7	44.6	51.3	55.2	58.1	63.2
25.0-29.9	318	48.2	9.8	33.5	36.8	39.2	41.8	47.6	53.5	57.7	61.2	63.7
30.0-34.9	237	49.6	10.2	35.0	37.5	38.9	42.0	48.8	56.4	60.0	62.7	66.9
35.0-39.9	212	51.2	10.4	34.7	38.7	40.9	44.1	50.7	57.5	61.7	63.8	70.0
40.0-44.9	210	51.5	10.1	34.9	38.1	40.6	44.2	51.6	58.2	61.6	64.5	66.9
45.0-49.9	220	49.7	10.8	32.8	36.5	38.9	42.9	49.1	55.7	59.5	63.3	68.8
50.0-54.9	225	49.1	11.2	33.8	36.0	38.2	41.5	47.6	55.5	60.7	63.8	69.3
55.0-59.9	204	47.9	10.1	31.2	35.4	37.8	41.7	47.8	54.3	58.8	61.4	64.2
60.0-64.9	318	48.7	11.2	32.5	36.3	38.7	41.4	48.0	54.6	59.6	62.2	68.0
65.0-69.9	446	45.1	10.7	26.7	31.5	34.7	37.6	44.7	52.5	56.1	58.5	62.7
70.0-74.9	314	43.5	10.3	27.7	30.8	32.9	36.1	43.4	49.6	53.4	56.6	59.9
Males With Medium Frames												
18.0-24.9	875	50.5	10.5	35.5	38.2	40.8	43.6	49.5	56.5	60.8	63.2	69.3
25.0-29.9	626	54.0	11.3	37.0	40.1	42.9	46.8	53.2	60.9	65.6	67.7	73.0
30.0-34.9	472	55.0	10.4	38.5	42.2	44.8	48.0	54.3	61.8	65.7	68.6	72.7
35.0-39.9	416	56.7	11.7	39.9	43.1	45.2	48.8	55.9	64.0	69.0	71.6	75.6
40.0-44.9	413	56.7	11.0	39.2	42.6	45.8	49.2	56.3	64.0	68.0	71.1	74.4
45.0-49.9	433	56.6	11.2	39.0	42.6	45.6	49.4	55.9	63.7	69.6	72.8	76.2
50.0-54.9	440	55.3	11.7	37.6	41.8	44.5	47.7	54.2	62.5	65.9	69.6	74.1
55.0-59.9	403	55.4	10.8	39.2	42.5	44.4	48.5	54.8	62.2	66.7	69.5	75.0
60.0-64.9	627	52.3	10.8	34.5	38.3	41.6	45.0	52.1	59.2	63.3	66.3	70.4
65.0-69.9	886	49.8	10.5	33.4	37.2	39.6	43.0	49.2	56.7	60.1	62.4	68.1
70.0-74.9	626	47.8	10.8	30.8	34.6	36.9	40.6	47.5	54.4	59.1	62.0	66.8
Males With Large Frames												
18.0-24.9	431	55.7	12.2	37.6	40.8	43.0	47.3	54.6	63.5	67.0	71.6	76.7
25.0-29.9	306	60.3	12.0	42.6	45.7	48.4	52.6	60.4	67.3	72.8	75.8	81.2
30.0-34.9	230	62.8	13.4	44.2	46.9	49.2	53.3	62.6	70.6	75.3	78.8	84.0
35.0-39.9	203	61.6	13.3	43.2	46.0	48.9	51.8	59.9	70.3	76.6	79.4	82.8
40.0-44.9	204	61.8	12.3	44.9	47.4	49.6	53.2	60.0	69.8	74.4	79.4	83.7
45.0-49.9	214	61.1	13.0	42.9	46.3	48.1	52.4	59.6	67.5	71.1	74.9	86.4
50.0-54.9	214	60.5	12.8	41.8	46.0	47.8	51.6	59.4	67.6	72.5	77.6	85.4
55.0-59.9	198	60.2	12.0	42.3	45.0	47.9	52.9	59.8	66.9	71.8	75.3	83.8
60.0-64.9	311	57.9	12.1	38.9	43.9	46.8	50.1	57.5	65.8	69.0	71.8	77.4
65.0-69.9	439	54.5	12.7	35.6	39.4	41.7	46.0	53.7	62.7	66.9	70.7	75.6
70.0-74.9	310	52.0	12.4	33.2	38.3	40.3	43.6	51.6	59.0	63.8	67.2	72.2

From Graiancho AR. Anthropometric standards for the assessment of growth and nutritional status, Ann Arbor, 1990, The University of Michigan Press.
 Note: Values for males age 18 years and older have been adjusted for bone area by subtracting 10.0 cm² from the calculated mid-upper arm muscle area.

Appendix E6: Arm muscle area (Females):⁴⁹

AGE (yr)	N	MEAN	SD	PERCENTILES								
				5	10	15	25	50	75	85	90	95
Females With Small Frames												
18.0-24.9	651	26.2	6.0	18.2	19.6	20.7	22.5	25.5	29.2	31.2	32.8	36.2
25.0-29.9	486	27.8	7.4	19.5	20.6	21.6	23.2	26.9	30.8	33.3	35.2	38.1
30.0-34.9	413	28.6	7.8	19.1	21.6	22.4	24.5	27.8	31.4	33.7	36.2	38.8
35.0-39.9	368	29.8	10.1	19.7	21.4	22.9	24.4	28.8	32.5	35.4	37.5	42.2
40.0-44.9	350	29.8	6.6	20.9	22.1	23.4	25.7	28.9	33.2	36.0	37.9	41.8
45.0-49.9	241	29.2	7.4	19.1	21.5	22.6	24.3	28.3	33.3	36.1	38.7	41.2
50.0-54.9	256	30.3	7.3	20.8	22.1	23.9	25.5	29.1	33.4	36.7	38.5	41.3
55.0-59.9	223	30.9	7.6	20.4	22.3	23.6	25.8	30.2	34.8	37.6	41.3	45.1
60.0-64.9	351	31.9	8.7	20.9	22.4	23.6	25.8	31.2	36.4	39.1	41.1	46.2
65.0-69.9	491	31.3	8.1	19.4	22.1	23.7	25.7	30.6	35.4	39.8	41.8	45.7
70.0-74.9	367	32.0	9.9	20.3	22.5	24.1	25.9	30.3	36.1	39.8	42.6	47.3
Females With Medium Frames												
18.0-24.9	1296	29.3	7.0	19.8	21.9	23.2	24.9	28.4	32.8	35.2	37.2	41.7
25.0-29.9	964	30.0	7.2	20.7	22.1	23.3	25.0	29.0	33.9	36.8	39.0	43.3
30.0-34.9	814	32.0	9.1	21.4	23.1	24.2	26.3	30.8	36.1	39.4	41.8	46.4
35.0-39.9	728	32.7	8.4	21.4	23.6	24.9	27.3	31.4	37.3	40.8	43.0	47.0
40.0-44.9	686	33.7	12.1	21.2	23.2	25.1	27.2	31.6	37.7	43.1	47.1	52.3
45.0-49.9	484	33.8	8.8	22.2	23.6	25.5	27.9	32.2	37.9	42.5	45.4	49.6
50.0-54.9	502	35.0	9.7	22.8	25.2	26.2	28.5	33.7	40.0	43.5	46.7	51.4
55.0-59.9	442	36.3	11.5	23.7	25.3	26.6	28.7	34.5	41.5	44.9	49.2	53.4
60.0-64.9	685	35.1	9.1	23.0	25.3	26.5	29.2	33.9	39.9	43.7	46.1	49.4
65.0-69.9	971	35.7	10.0	22.4	24.8	26.4	29.1	34.6	40.7	44.5	48.1	51.9
70.0-74.9	731	35.3	9.7	22.2	24.3	26.1	28.9	34.0	40.0	44.4	46.7	51.3
Females With Large Frames												
18.0-24.9	641	34.4	10.7	21.9	23.8	25.3	27.3	31.9	38.7	43.9	47.5	55.8
25.0-29.9	471	36.7	11.5	22.2	25.4	26.8	29.3	34.5	42.0	46.8	50.3	60.1
30.0-34.9	392	38.8	12.3	24.0	25.8	27.3	30.1	36.3	45.1	50.7	55.1	61.2
35.0-39.9	357	41.6	14.4	23.9	27.4	29.1	32.2	39.1	47.2	53.7	61.0	72.1
40.0-44.9	344	43.5	16.6	26.2	28.8	30.5	32.9	40.3	49.5	54.4	58.7	71.6
45.0-49.9	236	43.0	15.8	25.0	28.0	29.4	32.5	39.7	49.0	58.3	62.8	69.9
50.0-54.9	246	42.4	13.1	25.1	28.4	30.1	33.4	39.6	49.5	54.8	59.7	68.4
55.0-59.9	213	45.2	16.9	27.0	30.0	32.4	35.8	42.0	51.0	58.5	62.2	65.7
60.0-64.9	341	43.1	14.2	26.6	29.1	31.2	33.9	40.7	49.8	54.8	57.5	67.6
65.0-69.9	482	42.5	13.4	26.4	28.4	30.6	33.5	40.0	48.7	55.3	58.7	66.5
70.0-74.9	363	41.5	11.6	25.7	28.8	30.2	32.8	40.1	48.7	51.4	54.8	60.3

From Friaancho AR: *Anthropometric standards for the assessment of growth and nutritional status*, Ann Arbor, 1990, The University of Michigan Press.

Note: Values for females age 18 years and older have been adjusted for bone area by subtracting 6.5 cm² from the calculated mid-upper arm muscle area.

7.6 APPENDIX F

Appendix F: Upper arm fat area.⁴⁹

AGE (yr)	N	MEAN	SD	PERCENTILES								
				5	10	15	25	50	75	85	90	95
Males												
1.0-1.9	681	7.5	2.2	4.5	4.9	5.3	5.9	7.4	8.9	9.6	10.3	11.7
2.0-2.9	672	7.4	2.3	4.2	4.8	5.1	5.8	7.3	8.6	9.7	10.6	11.6
3.0-3.9	715	7.6	2.4	4.5	5.0	5.4	5.9	7.2	8.8	9.8	10.6	11.8
4.0-4.9	707	7.3	2.5	4.1	4.7	5.2	5.7	6.9	8.5	9.3	10.0	11.4
5.0-5.9	676	7.4	3.1	4.0	4.5	4.9	5.5	6.7	8.3	9.8	10.9	12.7
6.0-6.9	298	7.7	4.1	3.7	4.3	4.6	5.2	6.7	8.6	10.3	11.2	15.2
7.0-7.9	312	8.1	4.2	3.8	4.3	4.7	5.4	7.1	9.6	11.6	12.8	15.5
8.0-8.9	296	8.9	5.0	4.1	4.8	5.1	5.8	7.6	10.4	12.4	15.6	18.6
9.0-9.9	322	10.1	6.2	4.2	4.8	5.4	6.1	8.3	11.8	15.8	18.2	21.7
10.0-10.9	333	12.0	7.3	4.7	5.3	5.7	6.9	9.8	14.7	18.3	21.5	27.0
11.0-11.9	324	13.6	9.4	4.9	5.5	6.2	7.3	10.4	16.9	22.3	26.0	32.5
12.0-12.9	348	13.9	9.6	4.7	5.6	6.3	7.6	11.3	15.8	21.1	27.3	35.0
13.0-13.9	350	13.0	9.2	4.7	5.7	6.3	7.6	10.1	14.9	21.2	25.4	32.1
14.0-14.9	358	13.3	10.2	4.6	5.6	6.3	7.4	10.1	15.9	19.5	25.5	31.8
15.0-15.9	356	12.8	9.0	5.6	6.1	6.5	7.3	9.6	14.6	20.2	24.5	31.3
16.0-16.9	350	13.9	9.5	5.6	6.1	6.9	8.3	10.5	16.6	20.6	24.8	33.5
17.0-17.9	337	12.9	8.9	5.4	6.1	6.7	7.4	9.9	15.6	19.7	23.7	28.9
18.0-24.9	1752	16.9	10.8	5.5	6.9	7.7	9.2	13.9	21.5	26.8	30.7	37.2
25.0-29.9	1250	18.8	11.6	6.0	7.3	8.4	10.2	16.3	23.9	29.7	33.3	40.4
30.0-34.9	940	20.4	11.4	6.2	8.4	9.7	11.9	18.4	25.6	31.6	34.8	41.9
35.0-39.9	832	20.1	10.5	6.5	8.1	9.6	12.8	18.8	25.2	29.6	33.4	39.4
40.0-44.9	828	20.4	11.2	7.1	8.7	9.9	12.4	18.0	25.3	30.1	35.3	42.1
45.0-49.9	867	20.1	11.0	7.4	9.0	10.2	12.3	18.1	24.9	29.7	33.7	40.4
50.0-54.9	879	19.4	10.3	7.0	8.6	10.1	12.3	17.3	23.9	29.0	32.4	40.0
55.0-59.9	807	19.2	10.2	6.4	8.2	9.7	12.3	17.4	23.8	28.4	33.3	39.1
60.0-64.9	1259	19.1	10.2	6.9	8.7	9.9	12.1	17.0	23.5	28.3	31.8	38.7
65.0-69.9	1773	18.0	9.8	5.8	7.4	8.5	10.9	16.5	22.8	27.2	30.7	36.3
70.0-74.9	1250	17.5	9.4	6.0	7.5	8.9	11.0	15.9	22.0	25.7	29.1	34.9
Females												
1.0-1.9	622	7.3	2.3	4.1	4.6	5.0	5.6	7.1	8.6	9.5	10.4	11.7
2.0-2.9	614	7.7	2.3	4.4	5.0	5.4	6.1	7.5	9.0	10.0	10.8	12.0
3.0-3.9	651	7.8	2.5	4.3	5.0	5.4	6.1	7.6	9.2	10.2	10.8	12.2
4.0-4.9	680	8.0	2.6	4.3	4.9	5.4	6.2	7.7	9.3	10.4	11.3	12.8
5.0-5.9	672	8.5	3.4	4.4	5.0	5.4	6.3	7.8	9.8	11.3	12.5	14.5
6.0-6.9	296	8.7	3.9	4.5	5.0	5.6	6.2	8.1	10.0	11.2	13.3	16.5
7.0-7.9	329	9.8	4.5	4.8	5.5	6.0	7.0	8.8	11.0	13.2	14.7	19.0
8.0-8.9	275	11.3	6.5	5.2	5.7	6.4	7.2	9.8	13.3	15.8	18.0	23.7
9.0-9.9	321	13.1	7.3	5.4	6.2	6.8	8.1	11.5	15.6	18.8	22.0	27.5
10.0-10.9	329	14.1	7.7	6.1	6.9	7.2	8.4	11.9	18.0	21.5	25.3	29.9
11.0-11.9	302	16.3	9.7	6.6	7.5	8.2	9.8	13.1	19.9	24.4	28.2	36.8
12.0-12.9	323	16.9	8.9	6.7	8.0	8.8	10.8	14.8	20.8	24.8	29.4	34.0
13.0-13.9	360	19.1	11.0	6.7	7.7	9.4	11.6	16.5	23.7	28.7	32.7	40.8
14.0-14.9	370	20.4	11.0	8.3	9.6	10.9	12.4	17.7	25.1	29.5	34.6	41.2
15.0-15.9	309	20.7	11.4	8.6	10.0	11.4	12.8	18.2	24.4	29.2	32.9	44.3
16.0-16.9	343	23.5	10.9	11.3	12.8	13.7	15.9	20.5	28.0	32.7	37.0	46.0
17.0-17.9	291	23.9	13.0	9.5	11.7	13.0	14.6	21.0	29.5	33.5	38.0	51.6
18.0-24.9	2588	25.2	13.4	10.0	12.0	13.5	16.1	21.9	30.6	37.2	42.0	51.6
25.0-29.9	1921	28.1	14.7	11.0	13.3	15.1	17.7	24.5	34.8	42.1	47.1	57.5
30.0-34.9	1619	31.6	16.1	12.2	14.8	17.2	20.4	28.2	39.0	46.8	52.3	64.5
35.0-39.9	1453	33.6	16.8	13.0	15.8	18.0	21.8	29.7	41.7	49.2	55.5	64.9
40.0-44.9	1390	34.3	16.2	13.8	16.7	19.2	23.0	31.3	42.6	51.0	56.3	64.5
45.0-49.9	961	36.0	17.2	13.6	17.1	19.8	24.3	33.0	44.4	52.3	58.4	68.8
50.0-54.9	1004	36.7	15.9	14.3	18.3	21.4	25.7	34.1	45.6	53.9	57.7	65.7
55.0-59.9	879	37.6	17.7	13.7	18.2	20.7	26.0	34.5	46.4	53.9	59.1	69.7
60.0-64.9	1389	37.1	16.0	15.3	19.1	21.9	26.0	34.8	45.7	51.7	58.3	68.3
65.0-69.9	1946	34.7	15.1	13.9	17.6	20.0	24.1	32.7	42.7	49.2	53.6	62.4
70.0-74.9	1463	32.9	14.6	13.0	16.2	18.8	22.7	31.2	41.0	46.4	51.4	57.7

7.7 APPENDIX G

ADAPTED NUTRITIONAL SCREENING TOOL FOR ADULTS WITH INTELLECTUAL DISABILITY

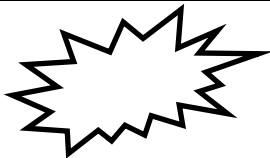
Date: _____

Weight (kg) = _____

Height (m) = _____ BMI (kg/m²) = _____

* Refer immediately to dietitian

** Adapted

NUTRITIONAL STATUS:		DEGREE OF LEARNING DISABILITY:	
An acceptable weight (BMI 18.5 - 25)	0	Mild	0
Overweight (BMI above 25)	2	Moderate	1
Underweight (BMI below 18.5)	3	Severe	3
*Lost more than 3kg in last month (not on slimming diet)	4	Profound	4
**WAIST CIRCUMFERENCE:		FEEDING ABILITY:	
Normal waist circumference	0	Eats independently	0
High risk waist circumference (obese abdomen)	2	Chewing problems	2
		Needs to be fed	3
		*Swallowing problems	5
APPETITE AND DIETARY INTAKE:		SYMPTOMS:	
Normal intake	0	None	0
Special diets e.g. : Puree, Diabetic	2	Vomiting	2
Reduced intake	3	Diarrhoea	2
*Very poor intake most days	4	Constipation	2
PSYCHOLOGICAL STATE:		**MEDICATIONS:	
Enjoys mealtimes	0	None	0
Disruptive behavior at mealtimes	2	Depo Provera / Medroxyprogesterone	0
Eats inedible matter (PICA)	3	Carbamazepine / Tegretol	2
*Regurgitates	4	Epilim / Sodium Valproate	3
		Risperidone / Risperdal	3
SKIN TYPE:		AGE	
Healthy	0	If < 65 years	0
Dry and flaky	3	If > 65 years	2
Oedematous	3		
Leg ulcer / pressure sore	4		
**OTHER DISEASES:		TOTAL SCORE:	
None	0		
Epilepsy	1		
	130		

****ACTION:**

Nutritional score 0 - 7 → Continue a healthy diet

Nutritional score 8 - 14 → At risk of malnutrition, reassess monthly, if not improved refer to dietitian

Nutritional score >14 → Refer to dietitian

DATE	WEIGHT (kg)	TOTAL SCORE	DIETETIC REFERRAL		NURSE SIGNATURE
			SCORE	DATE	
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

7.8 APPENDICES H

PARTICIPANT INFORMATION AND CONSENT FORM: NURSING STAFF

TITLE OF THE RESEARCH PROJECT:

The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

REFERENCE NUMBER:

N11/03/062

PRINCIPAL INVESTIGATOR:

Maretha Nel

ADDRESS:

Stellenbosch University

Department of Human Nutrition

3rd Floor

Clinical Building

CONTACT NUMBER:

082 541 1363

Dear Colleague

My name is Maretha Nel and I am a registered dietitian. I would like to invite you to participate in a research project that aims to investigate if the current screening tool is

applicable for the early detection of malnutrition in patients with intellectual disability (ID) and to adjust the screening tool as necessary. This will help dietitians to treat malnutrition from an early stage. The screening tool will be developed using different parameters, which include anthropometrical measurements as well as information taken from patients' medical records.

Please take some time to read the information presented here, which will explain the details of this project and contact me if you require further explanation or clarification of any aspect of the study. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee (HREC) at Stellenbosch University** and will be conducted according to accepted and applicable National and International ethical guidelines and principles, including those of the international Declaration of Helsinki October 2008.

As mentioned above, anthropometrical measurements of the patients will be taken, which includes; weight, height, waist circumference, skinfold measurement as well as the elbow width. These measurements together with the information taken from the medical file will be used to adjust the current screening tool. If you agree to participate in the study, some questions regarding the patients eating habits and overall symptoms will be asked. The adapted screening tool will then be used by you (nursing staff) in The Psychiatric Hospital for one week, to identify participants who are at risk for malnutrition or already malnourished. No training on the completion of screening tool will be given prior to the implementation to simulate the habitual use of the tool, where nursing staff will use the tool without the assistance of a dietitian. You (nursing staff) will complete the face validity questionnaire after completion of the adapted screening tool.

The researcher will then use your comments and suggestions and adjust the screening tool accordingly.

The information will be handled in an anonymous and confidential manner. Please note that you will not be paid to take part in the study and there will be no costs involved for you as the participant, if you do take part.

If you are willing to participate in this study please sign the attached Declaration of Consent and hand it to the investigator.

Yours sincerely

Maretha Nel

Principal Investigator

Declaration by participant

By signing below, I agree to take part in a research study entitled “The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).”

I declare that:

- I have read the attached information leaflet and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.

- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) On (*date*) 2012

.....

Signature of participant

DEELNEMERINLIGTINGSBLAD EN –TOESTEMMINGSVORM: VERPLEEGPERSONEEL

TITEL VAN DIE NAVORSINGSPROJEK:

Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde (IG) pasiënte in die Psigiatriese Hospitaal, Noordwes Provinsie (Suid Afrika).

The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

VERWYSINGSNOMMER:

N11/03/062

HOOFNAVORSER:

Maretha Nel

ADRES:

Universiteit van Stellenbosch

Departement Menslike Voeding

3^{de} Vloer

Kliniese Gebou

KONTAKNOMMER:

082 541 1363

Beste Kollega

My naam is Maretha Nel en ek is 'n registreerde dieetkundige. Ek wil u graag nooi om aan 'n navorsingsprojek deel te neem waar beoog word om te bepaal of die huidige siftingshulpmiddel toepaslik is om wanvoeding vroegtydig te identifiseer in intellektueel gestremde pasiënte, en om aanpassings te maak soos nodig. Hierdie siftingshulpmiddel kan deur dieetkundiges gebruik word om wanvoeding reeds in 'n vroeë stadium te behandel. Die siftingshulpmiddel sal ontwikkel word deur verskeie parameters in te sluit, wat antropometriese meetings sowel as inligting vanaf pasiënte se mediese rekords insluit.

Gebruik asseblief u tyd om die inligting wat hier aangebied word, en wat die besonderhede van hierdie projek uiteensit, te lees, en kontak my gerus indien u verdere verduideliking of opklaring van enige aspek van die studie benodig. U deelname is **volkome vrywillig** en u kan weier om deel te neem. Indien u nee sê, sal dit jou op hoegenaamd geen manier negatief raak nie. Dit staan u ook vry om op enige tydstip van die studie te onttrek, selfs indien u instem om deel te neem.

Hierdie studie is goedgekeur deur die **Etiëkomitee oor Gesondheidsnavorsing (HREC)** aan die Universiteit Stellenbosch en sal uitgevoer word in ooreenstemming met aanvaarde en toepaslike nasionale en internasionale etiese riglyne en beginsels, met inbegrip van dié van die Internasionale Verklaring van Helsinki Oktober 2008.

Soos reeds genoem, sal antropometriese meetings van die pasiënte geneem word, wat die volgende insluit; gewig, lengte, middel omtrek, velvoumeting en elmboog wydte sal geneem word. Hierdie inligting tesame met inligting vanaf die mediese rekords sal gebruik word om die huidige siftingshulpmiddel aan te pas. Indien u instem om deel te neem aan die studie, sal daar sommige vrae rondom die pasiënte se eetgewoontes en algemene simptome aan u gevra word. Die aangepaste siftingshulpmiddel sal dan deur u (verpleeg personeel) in die Psigiatrisiese Hospitaal gebruik word vir een week, om

deelnemers wat 'n risiko het vir wanvoeding of reeds wangevoed is, te identifiseer. Geen opleiding oor die voltooiing van die siftingshulpmiddel sal vooraf gegee word nie, om gewoontlike gebruik te stimuleer, waar dieetkundige nie teenwoordig gaan wees nie. U (verpleeg personeel) sal die voorkomsgeldigheid vraelys voltooi na voltooiing van die aangepaste siftingshulpmiddel. Die navorser sal u kommentaar en voorstellings in ag neem, en aanpassings maak soos nodig.

Die inligting sal op 'n anonieme en vertroulike wyse hanteer word. Let asb op dat u sal nie betaal word om deel te neem aan die navorsingsprojek nie en deelname aan die navorsingsprojek sal u niks kos nie.

Indien jy gewillig is om aan hierdie studie deel te neem, onderteken asseblief die aangehegte Verklaring van Instemming en oorhandig dit aan die ondersoeker.

Vriendelike groete

Maretha Nel

Hoofnavorser

Verklaring deur deelnemer

Deur hieronder te onderteken, stem ek in om deel te neem aan 'n navorsingstudie getiteld “Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde (IG) pasiënte in die Psigiatrisiese Hospitaal, Noordwes Provinsie (Suid Afrika).”

Ek verklaar dat:

- Ek die aangehegte inligtingsblaadje gelees het en dat dit in 'n taal geskryf is waarin ek vaardig en gemaklik is.

- Ek 'n geleentheid gehad het om vrae te vra en al my vrae is bevredigend beantwoord.
- Ek verstaan dat deelname aan hierdie studie **vrywillig** is en ek was onder geen druk om deel te neem nie.
- Ek kan kies om die studie op enige tydstip te verlaat en dat ek nie op enige manier gestraf of benadeel sal word nie.

Geteken te (*plek*) op (*datum*) 2012.

.....

Handtekening van deelnemer

7.9 APPENDICES I

Nursing staff: Face Validity

Title of study: The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

During the next couple of weeks, a study which forms part of a post graduate research project will be executed in The Hospital on some of the patients. The main aim of the study is to determine the degree of malnutrition and body composition in patients with intellectual disability (ID), in the Psychiatric Hospital, North West Province (South Africa), and to adjust the current screening tool (*Nutritional Screening Tool for Adults with Learning Disabilities*) accordingly. This screening tool will be used by the nursing staff, so the following questionnaire is to determine the face validity of this particular screening tool.

Please complete the questionnaire and mark the appropriate block with an X.

a) Overall impression:

Is it easy to complete / user friendly?	YES	NO
How long did it take you to complete the screening tool?	minutes	
Are the instructions clear?	YES	NO

If NO, please provide an explanation:

b) Readability:

Is the font size legible?	YES	NO
Is the font type legible?	YES	NO
Can you differentiate between the different sections with ease?	YES	NO

c) Content:

Do you understand the questions used in the screening tool?	YES	NO
---	-----	----

If No, please explain which section is unclear:

Will you be able to complete this screening tool independently?	YES	NO
---	-----	----

If NO please provide an explanation:

Any other comments/ suggestions:

Thank you for your time and cooperation.

Principle Investigator

Maretha Nel

RD SA

Verpleeg personeel: Voorkomsgeldigheid

Die titel van die studie is: Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde (IG) pasiënte in die Psigiatriese Hospitaal, Noordwes Provinsie (Suid Afrika).

As deel van 'n nagraadse navorsingsprojek gaan daar gedurende die volgende paar weke 'n studie uitgevoer word op sekere pasiënte in die Hospitaal. Die hoofdoel van die studie is om te bepaal wat is die graad van wanvoeding en liggaams komposisie in pasiente wat intellektueel gestremd is in die Psigiatriese Hospitaal, Noordwes Provinsie (Suid Afrika), en om die huidige siftingshulpmiddel toepaslik aan te pas. Hierdie siftingshulpmiddel sal deur die verpleeg personeel gebruik word, so hierdie vraelys is om die voorkomsgeldigheid van die siftingshulpmiddel te bepaal.

Voltooi asseblief die vraelys en merk die toepaslike blok met 'n X.

a) Algehele indruk:

Is die vorm maklik om in te vul / gebruikersvriendelik?	JA	NEE
Hoe lank het dit u geneem om die siftingshulpmiddel te voltooi?	minute	
Is die instruksies duidelik?	JA	NEE

Indien NEE, verduidelik asb:

b) Leesbaarheid:

Is die letter grootte maklik leesbaar?	JA	NEE
Is die tipe skrif maklik leesbaar?	JA	NEE

Kan u maklik onderskei tussen die verskillende afdelings?	JA	NEE
---	----	-----

c) Inhoud:

Verstaan u die vrae wat gebruik is in die siftingshulpmiddel?	JA	NEE
---	----	-----

Indien NEE, verduidelik watter deel is onduidelik:

Sal u die siftingshulpmiddel op u eie kan voltooi?	JA	NEE
--	----	-----

Indien NEE, verduidelik asb:

Enige ander kommentaar / aanbevelings:

Dankie vir jou tyd en samewerking.

Hoofnavorsers

Maretha Nel

RD SA

7.10 APPENDICES J

Dietitians: Content Validity

Title of study: The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

I'm currently busy with my Master of Nutrition, and doing my research project in The Hospital, North West Province. The main aim of the study is to determine the degree of malnutrition and body composition in patients with intellectual disability (ID), in The Psychiatric Hospital, North West Province (South Africa), and to adjust the current screening tool (*Nutritional Screening Tool for Adults with Learning Disabilities*) accordingly. This screening tool will be used by the nursing staff, so the following questionnaire is to determine the content validity of this particular screening tool.

Please complete the questionnaire and mark the appropriate block with an X.

a) Overall impression:

Is the questionnaire in a logical format?	YES	NO
Is it easy to complete / user friendly?	YES	NO
How long did it take you to complete the screening tool?	minutes	
Are the instructions clear?	YES	NO

If NO, please provide an explanation:

b) Readability:

Is the font size legible?	YES	NO
Is the font type legible??	YES	NO
Can you differentiate between the different sections with ease?	YES	NO

c) Content:

Do you understand the questions used in the screening tool?	YES	NO
---	-----	----

If No, please explain which section is unclear:

Is any relevant information about this topic left out?	YES	NO
--	-----	----

If YES please provide an explanation:

Is the content of the screening tool efficient?	YES	NO
---	-----	----

If No, please provide an explanation:

Will the nursing personnel be able to complete this screening tool?	YES	NO
---	-----	----

If No, please explain which section will be a problem:

Is there any unnecessary information included in the screening tool?	YES	NO
--	-----	----

If YES please provide an explanation:

Any other comments:

Thank you for your time and cooperation.

Principle Investigator

Maretha Nel

RD SA

Dieetkundiges: Inhoudsgeldigheid

Die titel van die studie is: Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde (IG) pasiënte in die Psigiatrisiese Hospitaal, Noordwes Provinsie (Suid Afrika).

Ek is tans besig met my Meesters in Voeding, en my navorsings projek gaan in die Hospitaal, Noordwes uitgevoer word. Die hoofdoel van die studie is om te bepaal wat is die graad van wanvoeding en liggaamskomposisie in pasiënte wat intellektueel gestremd is in die Psigiatrisiese Hospitaal, Noordwes Provinsie (Suid Afrika), en om die huidige siftingshulpmiddel toepaslik aan te pas. Hierdie siftingshulpmiddel sal deur die verpleeg personeel gebruik word, so hierdie vraelys is om die inhoudsgeldigheid van die siftingshulpmiddel te bepaal.

Voltooi asseblief die vraelys individueel en merk die toepaslike blok met 'n X.

a) Algehele indruk:

Is die vraelys se formaat logies uiteengesit?	JA	NEE
Is die vorm maklik om in te vul / gebruikersvriendelik?	JA	NEE
Hoe lank het dit u geneem om die siftingshulpmiddel te voltooi?	minute	
Is die instruksies duidelik?	JA	NEE

Indien NEE, gee 'n verduideliking:

b) Leesbaarheid:

Is die letter grootte maklik leesbaar?	JA	NEE
Is die tipe skrif maklik leesbaar?	JA	NEE
Kan u maklik onderskei tussen die verskillende afdelings?	JA	NEE

c) Inhoud:

Verstaan u die vrae wat gebruik is in die siftingshulpmiddel?	JA	NEE
---	----	-----

Indien NEE, verduidelik watter deel is onduidelik:

Is enige belangrike inligting oor hierdie tema uitgelaat?	JA	NEE
---	----	-----

Indien JA, verskaf asseblief 'n verduideliking:

Is die inhoud van die siftingshulpmiddel voldoende?	JA	NEE
---	----	-----

Indien NEE, verskaf asseblief 'n verduideliking:

Sal die verpleeg personeel in staat wees om hierdie siftingshulpmiddel te voltooi?	JA	NEE
--	----	-----

Indien NEE, verduidelik watter afdeling sal 'n probleem wees?

Is daar enige onnodige inligting ingesluit in die siftingshulpmiddel?	JA	NEE
---	----	-----

Indien JA, verskaf asseblief 'n verduideliking:

Enige ander opmerkings?

Dankie vir jou tyd en samewerking.

Hoofnavorser

Maretha Nel

RD SA

7.11 APPENDIX K

LETTER FOR APPROVAL: HOSPITAL MANAGER

Psychiatric Hospital

Potchefstroom

2520

Attention: Hospital Manager

RE: Request to conduct research study at The Hospital

Hereby I would like to request permission to conduct my post graduate (Masters of Nutrition) research project at the Psychiatric Hospital. The topic of my research project is: “The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).”

The main aim of the study is to determine the degree of malnutrition and body composition in patients with intellectual disability (ID), in the Psychiatric Hospital, North West Province (South Africa), and to adjust the current screening tool (*Nutritional Screening Tool for Adults with Learning Disabilities*) accordingly. This screening tool will be used by the nursing staff and this will help dietitians to treat malnutrition from an early stage.

The screening tool will be developed using different parameters, which include anthropometrical measurements and calculations of indices of fat mass and fat free mass. Objectives of the study includes; to determine which degree of ID are more prone to malnutrition and to investigate the different risk factors for malnutrition in this group of patients with ID. The full protocol is attached should you require more information.

I would greatly appreciate if I could conduct my research study at the Psychiatric Hospital, and thereby help to improve the nutritional service that is being delivered.

Yours sincerely

Maretha Nel

R.D (SA)

7.12 APPENDICES L

Participant information:

What is the study about?

The title of the study is: The adaptation of an appropriate screening tool for the early detection of malnutrition in individuals with intellectual disability (ID) in a psychiatric hospital in North West Province (South Africa).

In summary it means that I will be taking different measurements of you as the patient.

Examples of measurements will include:

Height



Weight



Waist circumference



Elbow width



None of the measurements will hurt you. I will also look at your medical records to get additional information which is needed for the study. All of this information will be kept confidential.

When I have obtained all the necessary information, I will determine your nutritional status, e.g.

Undernourished



Normal



Overnourished



I will then develop a screening tool (a form) which the nursing staff could use in future to detect malnutrition timeously, then the dietitian can assist patients to prevent the development of malnutrition.

Thank you for your cooperation, it is greatly appreciated.

Primary investigator

Maretha Nel

R.D SA

Deelnemer informasie:

Waaroor gaan die studie?

Die titel van die studie is: Die aanpassing van 'n toepaslike siftingshulpmiddel om wanvoeding vroegtydig te identifiseer in intellektueel gestremde (IG) pasiënte in die Psigiatriese Hospitaal, Noordwes Provinsie (Suid Afrika).

Dit beteken kortliks dat ek sal verskillende metings op u doen as die pasiënt.

Voorbeelde van die metings sluit in:

Lengte



Gewig



Middel omtrek



Elmboog wydte



Die metings sal u glad nie seermaak nie. Ek sal ook na u mediese rekords kyk om verdere inligting vir die studie te kry. Al die inligting wat versamel word sal vertroulik hanteer word.

Wanneer ek al die nodige inligting het, sal ek u voedingstatus bepaal, bv

Ondervoeding



Normal



Oorvoeding



Ek sal dan 'n siftingshulpmiddel ('n vorm) ontwikkel wat die verpleegpersoneel in die toekoms kan gebruik om wanvoeding vroegtydig te identifiseer dan kan die dieetkundige pasiënte betyds help om wanvoeding te voorkom.

Dankie vir u samewerking, dit word baie waardeer.

Primêre navorser

Maretha Nel

R.D SA