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Clinical Nutrition Internship Report: Nutritional Assessment and Intervention

Research: Nutritional Status and Quality of Life in HIV-infected patients

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RESUMO EM LÍNGUA PORTUGUESA

Estágio: Avaliação do Estado Nutricional e Intervenção Nutricional

Investigação: Estado Nutricional e Qualidade de Vida em doentes infectados pelo VIH

Palavras chave

Estado Nutricional, VIH, Qualidade de vida

Introdução

O estágio curricular realizou-se no Hospital Santa Maria que é composto por doze departamentos de diferentes especialidades. O estágio decorreu em dois serviços pertencentes à especialidade de Medicina: Serviço de Medicina (1D), e o Serviço de Infecciologia. O estágio teve a duração de 13 semanas, e portanto as atividades dividiram-se entre estes dois serviços; inicialmente as atividades concentraram-se no serviço de medicina, e posteriormente na Infecciologia, tanto no internamento como no hospital de dia de Infecciologia.

Objectivos

Os objectivos do estágio envolveram a aprendizagem e o desenvolvimento de competências associadas à profissão de Nutricionista e ao perfil do Mestrado em Nutrição Clínica, no âmbito da intervenção nutricional a nível hospitalar. Nomeadamente na avaliação de risco e estado nutricional, na implementação de planos de intervenção nutricional adaptados ao estado nutricional e às diferentes situações clínicas dos utentes. Outro objectivo relacionou-se com o conhecimento e a integração na organização hospitalar. Através da elaboração de um projeto de investigação, pretendeu-se desenvolver competências científicas associadas à investigação clínica. O objectivo da investigação foi avaliar a relação entre o estado nutricional e a qualidade de vida de indivíduos portadores do Vírus da Imunodeficiência Humana (VIH).

População de Estudo

A população em estudo foram os doentes em regime de internamento no serviço de Medicina 1D, no serviço de Infecciologia, os doentes seguidos em consulta de VIH, obesidade, e esteatose hepática. Para o trabalho de investigação, apenas os doentes seguidos em consulta do VIH forma incluídos.

Considerações Éticas e Deontológicas

No decorrer do estágio foram respeitadas as condições éticas e deontológicas inerentes à profissão de acordo com a declaração de Helsínquia. Assim sendo, assegurou-se a confidencialidade e anonimato dos dados e respeitou-se a participação voluntária e informada de cada indivíduo.

Atividades Comuns: Serviço de Medicina e Infecciologia

A malnutrição hospitalar é elevada e implica graves consequências no prognóstico do doente. Foram aplicadas várias ferramentas de avaliação de risco e estado nutricional, adaptadas à idade bem como o desenvolvimento de planos adaptados às necessidades, sintomatologia, e patologia dos doentes. A monitorização e a reavaliação do plano e estado nutricional foram tarefas realizadas diariamente. Várias estratégias foram utilizadas para complementar a avaliação do estado nutricional como a verificação de parâmetros bioquímicas, a identificação da dificuldade na mastigação e deglutição, o diálogo com outros profissionais de saúde para obter uma melhor compreensão do estado geral do doente, etc. Recomendações oficiais tanto para a avaliação do estado, como para o desenvolvimento de um plano e da monitorização foram utilizadas de acordo com a situação clínica do doente. As preferências alimentares do doente foram sempre tomadas em consideração. A importância e os pormenores relativos à monitorização foram também abordados tais como a avaliação da tolerância, a realização de recalls de 24 horas, e a necessidade de alteração ao plano. A medição do peso, perímetro braquial, perímetro geminal e pregas cutâneas fizeram parte da recolha dos parâmetros, pertencentes ao processo de reavaliação.

Outras atividades

O estágio permitiu a realização de outras atividades para além daquelas realizadas diariamente; as reuniões multidisciplinares, uma conferência, e a participação no rastreio do acidente vascular cerebral.

Resultados das Atividades do Internamento

Na admissão ao serviço de Medicina, foram avaliados 216 doentes; 70% dos doentes tinham idades superiores aos 65 e os motivos de internamento mais comuns foram doença renal aguda e crónica, infecção urinária, desidratação, acidente vascular cerebral, doença oncológica, entre outros. No serviço de Infecciologia foram avaliados 60 doentes na admissão dos quais 18% eram idosos; os motivos de internamento mais comuns foram a tuberculose pulmonar/ganglionar, meningite, sepsis, a infecção pela klebsiella pneumoniae carbapenemases, e o sarcoma de Kaposi. Na admissão, em ambos os serviços, mais de metade dos doentes encontravam-se em risco nutricional, e mais de um terço estava malnutrido. Verificou-se maior tempo de internamento no serviço de Infecciologia, em comparação com o serviço de Medicina. A abordagem nutricional foi diferente em cada serviço, sendo que cada doente apresentou características diferentes em termos de diagnóstico, severidade da patologia, sintomatologia, terapêutica, estado mental, etc. Houveram várias barreiras que por vezes impediram uma avaliação completa do estado nutricional tais como o isolamento na Infecciologia, ou a impossibilidade da medição do peso devido à imobilidade, na Medicina. Devido aos vários motivos de internamento de cada doente, diferentes planos alimentares foram desenvolvidos, tanto para o internamento como para alta. Para 30, e para 15 doentes pertencentes ao serviço de Medicina e Infecciologia, respectivamente, foram desenvolvidos planos personalizados. Estes planos foram adaptados e personalizados para doentes com doença oncológica, doença inflamatória intestinal,

doença neurológica, doença renal crónica, alterações metabólicas, doença hepática crónica, com necessidade de nutrição entérica, entre outros.

Unidade de Cuidados Intensivos

Este serviço não foi abordado de forma autónoma. De qualquer forma a avaliação do estado nutricional destes doentes, a elaboração de planos para nutrição parentérica, e a monitorização do balanço hídrico, foram algumas das atividades observadas com regularidade.

Doentes em Ambulatório

As consultas do doente em ambulatório foram realizadas em três contextos diferentes: na Obesidade e Cirurgia Bariátrica, na Esteatose hepática, e no VIH. Na primeira, as consultas tinham como objectivo a recolha de parâmetros antropométricos, a avaliação da ingestão, a identificação de distúrbios e comportamentos alimentares inadequados, a elaboração de um plano alimentar para emagrecimento, a preparação para cirurgia bariátrica, entre outros. Na consulta de esteatose hepática, as consultas foram apenas observadas; neste contexto aplicava-se o questionário de frequência alimentar e elaborava-se um plano para promover a reversão ou prevenir a progressão da esteatose hepática não alcoólica.

Na consulta de VIH, avaliava-se o estado nutricional usando a história alimentar, antropometria, bioimpedância, e desenvolvia-se um plano de acordo com as necessidades do doente, as análises bioquímicas, a sintomatologia, e a terapia anti-retrovírica, entre outros.

Investigação – Contextualização e Recolha de Dados

É importante avaliar o estado nutricional do doente com VIH já que a progressão da doença está associada a alterações na composição corporal, à perda de peso, ao declínio da função do sistema imunitário, e ao aparecimento de infecções oportunistas recorrentes. Devido ao aumento da esperança de vida nesta população, é essencial investir no tratamento dos sintomas físicos e psicológicos destes doentes, com a intenção de aumentar a qualidade de vida e consequentemente contribuir para a manutenção da aderência ao tratamento. Apesar de vários estudos já terem avaliado o impacto do estado nutricional na qualidade de vida em várias patologias crónicas, poucos estudaram esta relação no VIH, em especial na população ocidental. A relação entre o estado nutricional e a qualidade de vida foi estudada nos doentes seguidos em consulta do VIH no Hospital de Santa Maria e a recolha de dados ocorreu durante o estágio. Os doentes das consultas com um diagnóstico de VIH inaugural foram convidados a participar na investigação, respeitou-se a participação voluntária e informada de cada indivíduo e assegurou-se a confidencialidade e anonimato dos dados, de acordo com a declaração de Helsínquia. A estrutura da consulta era a mesma que a descrita anteriormente, mas recolheram-se dados antropométricos adicionais, dados socio-demográficos, clínicos, laboratoriais, aplicou-se um questionário de frequência alimentar validado para a população portuguesa, e um questionário de qualidade de vida desenvolvido pela Organização Mundial de Saúde (WHOQOL-HIV-BREF) também validado para a população portuguesa. O artigo (em apêndice) foi submetido para a revista,

Nutrición Hospitalaria, foram já efetuadas algumas alterações sugeridas pelos revisores, e aguardam decisão final.

1.9 Investigação: Análise estatística dos Dados Recolhidos e Conclusões

Os dados referentes à atuação desenvolvida durante o estágio para desenvolvimento do estudo, foram analisados com recurso ao software SPSS. Foi efectuada estatística descritiva e de inferência para caracterização da população e para avaliar a associação entre os parâmetros nutricionais e a qualidade de vida. Através de uma regressão linear múltipla, ajustada para as variáveis de confusão, foi possível estabelecer uma direção para as associações identificadas anteriormente na estatística bivariada. A conclusão do estudo permitiu que uma relação entre o estado nutricional e a qualidade vida fosse estabelecida nesta população de doentes já que se verificaram associações significativas entre vários parâmetros nutricionais e a qualidade de vida tais como a ingestão energética, o perímetro da cintura, a área muscular braquial e a perda de peso.

2.0 Conclusão

Os objectivos gerais do estágio foram atingidos sendo que foi possível adquirir experiência necessária para o desempenho apontado pelo perfil do Mestrado em Nutrição Clínica, no âmbito da intervenção nutricional a nível hospitalar, e de desenvolver competências científicas associadas à investigação clínica, através da participação num projeto de investigação. O estágio permitiu também melhorar a componente de comunicação a nível interdisciplinar, e com o doente já que a adequação do discurso era necessária para cada situação. De um modo geral, foi possível integrar equipas multidisciplinares, adquirir uma perspectiva prática do trabalho de um Nutricionista no contexto hospitalar, obter experiência profissional, e aprofundar e aplicar conhecimentos anteriormente adquiridos no Mestrado em Nutrição Clínica.

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RESUMO EM LÍNGUA INGLESA

Internship Report: Nutritional Assessment and Intervention
Research: Nutritional Status and Quality of Life in HIV-infected patients

Introduction

The internship took place at Santa Maria Hospital and lasted thirteen weeks. It allowed for the performance of activities and hence development of skills in two different services: Medicine Service, and Infectious Diseases (ID) service. The infectious diseases service is composed of an inpatient unit, an infectious diseases intensive care unit and an infectious diseases outpatient clinic. The internship was focussed in the medicine service in Month 1, and in the infectious diseases service in Months 2 and 3.

Objectives

The general objectives of the internship involved learning and developing skills that meet the expectations of a Clinical Nutritionist in the hospital setting, understand the structure, organization of the hospital and be able to adapt to it, establish contact with other health professionals and integrate in multidisciplinary teams, improve communication skills and confidence when interacting with patients. One of the main objectives was to also develop scientific skills associated to clinical investigation by participating in an investigation study. Specific goals involved collaborating in the nutrition screening process, nutritional assessment, and implementation of individual nutrition intervention plans of patients on admission, adapted to clinical situations. To collaborate in the nutritional status assessment of HIV-infected outpatients, and in the assessment of their Quality of Life (QoL), was another goal, previously established. This allowed for the necessary data collection to develop a scientific article, which was the final goal (Appendix 13).

Study Population

Concerning the internship, the study population included patients admitted to the Medicine and Infectious Diseases Service, and patients followed for an appointment in three different areas; HIV, obesity, non-alcoholic fatty liver disease. For the investigation, only patients visiting the hospital for their HIV infection appointment were included.

Methods

Nutritional status was assessed using anthropometry, body composition analysis, assessment of dietary intake, laboratory data evaluation and clinical signs. The validated screening tools used to detect the risk of developing malnutrition in hospital setting were the Nutritional Risk Screening (2002), and the Mini Nutritional Assessment (MNA), for adults and elderly, respectively. The Subjective Global Assessment, for adults and the Full-Mini Nutritional Assessment, for elderly were used to assess nutritional status.

Organization

The internship, the report and the study were part of the MSc program in Clinical Nutrition from the Lisbon Faculty of Medicine and Lisbon School of Health Technology, Lisbon, Portugal. The Infectious Diseases and Medicine 1D service, belonging to Hospital Santa Maria, were the sites where the internship and data collection for the study took place. Professora Doutora Ana Catarina Moreira, supervisor, and Dra. Sara Policarpo, co-supervisor, both supervised the development of the internship report, and the study investigation. Professora Doutora Ana Catarina Moreira supervised the elaboration of the scientific article. Dra. Sara Policarpo was the Dietician responsible for supervising the activities during the course of the internship. The University, the Nutrition and Dietetics service of Santa Maria Hospital, and the Head of the Infectious Diseases service approved the internship and the latter also authorized the data collection process. No funding was involved in this work.

Key words: nutritional status, HIV, quality of life

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Abbreviation List

BIA: Bioelectrical Impedance Analysis

BMI: Body Mass index

BW: Body Weight

CC: Calf Circumference

CKD: Chronic Kidney Disease

ESPEN: European Society for Parenteral and Enteral Nutrition

FFQ: Food Frequency Questionnaire

FMNA: Full-MNA

HAART: Highly Active Antiretroviral Treatment

HF: Heart Failure

HIV: Human Immunodeficiency Virus

ID: Infectious Disease

ISAK: International Society for the Advancement of Kineanthropometry

MUAC: Mid Upper Arm Circumference

MNA: Mini Nutritional Assessment

M1D: Medicine 1D

NRS: Nutritional Risk Screening

NS: Nutritional Status

PEG: Percutaneous Endoscopic Gastrostomy

QoL: Quality of Life

SMH: Santa Maria Hospital

TSF: Tricipital Skinfold Thickness

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1.   Introduction

1.1 The role of a Nutritionist in the Hospital Setting

A Nutritionist is in charge of assessing, diagnosing and treating dietary and nutritional problems to improve (or prevent a deterioration in nutritional status). (1) Nutritional screening is performed prior to assessment to identify patients at risk for malnutrition or those already malnourished. (2) Nutritional status (NS) assessment involves anthropometry, body composition analysis, assessment of dietary intake, laboratory data and clinical signs. (2) The validated screening tools used to detect the risk of developing malnutrition in the hospital setting are the Nutritional Risk Screening (NRS)-2002, and the Mini Nutritional Assessment (MNA), for adults and elderly, respectively. (2) The Subjective Global Assessment (SGA), for adults and the Full-Mini Nutritional Assessment (FMNA), for elderly, assess nutritional status and are administered when a patient is identified to be at risk for malnutrition. (2) If a hospitalized patient cannot stand, weight and height can be estimated. (3,4) The tools described allow for the monitoring of body fat and muscle tissue loss; calf circumference (CC), in the elderly has shown to be a complementary tool to monitor nutritional status (5) and is considered in the MNA, whilst the SGA allows for the subjective estimation of muscle wasting and subcutaneous fat loss by having a physical examination section. (2) The nutritional care process in clinical practice, as recommended by the European Society for clinical Nutrition and Metabolism (ESPEN) is appropriate for the hospital setting (Appendix 1). The dietary requirements of patients can also be calculated based on ESPEN guidelines. (2)

1.2 Malnutrition in the Hospital setting

Overall, malnutrition affects 20%–50% of hospitalized patients, and this worsens during inpatient stay. (6) Malnutrition may slow down drug metabolism, affect the response to treatment of infection and is associated with a prolonged hospital stay. (7) The nutritional impairment of a patient will vary depending on type of disease, age, and other clinical/ demographic factors. It is crucial to find strategies to prevent nutritional status deterioration, or at least slow it down; nutritional screening can predict the probability of a better or worse outcome. Outcome can be measured by taking into consideration improvement or deterioration in mental and physical function, number of disease-related complications and length of hospital stay (8) among others.

1.3 Internship: setting

The curricular internship took place at Santa Maria Hospital (SMH) that, together with Polido Valente Hospital (University Hospitals), form the Centro Hospitalar Lisboa Norte, a major Portuguese public health unit. SMH is composed of twelve different specialty departments. (9) The duration of the internship, thirteen weeks, allowed for the performance of activities and hence development of skills in two of these services belonging to the specialty of Medicine: Medicine 1, and the Infectious Diseases (ID) service. Medicine 1 is divided into four different wards (1A − 1D). The nutrition-related activities took place in one of them, Medicine 1D. The infectious diseases service is composed of an inpatient unit, an infectious diseases

intensive care unit and an infectious diseases outpatient clinic. The inpatient unit is composed of four rooms, a double room, and seven isolation rooms; in total there are twenty-three beds available. The intensive care unit consists of five individual rooms, five beds. The outpatient clinic provides patients with Medical, Nursing, Nutritional, Psychological and Social support; total of 3145 HIV-patients are followed here and approximately 170 new patients initiate follow up, yearly. The internship was focussed in the medicine service in Month 1, and the infectious diseases service in Month 2 and 3.

1.4 Internship: General Objectives

√ Learn and develop skills that meet the expectations of a Clinical Nutritionist in the hospital setting

√ Understand the structure, organization of the hospital and be able to adapt to it

√ Establish contact with other health professionals and integrate in multidisciplinary teams

√ Improve communication skills and confidence when interacting with patients

√ Develop scientific skills associated to clinical investigation by participating in an investigation study

1.5 Specific goals

√ Collaborate in the nutrition screening process and nutritional assessment of patients on admission to the medicine 1D and infectious diseases service

√ Collaborate in the nutritional status assessment of HIV-infected outpatients daily

√ Collaborate in the implementation of individual nutrition intervention plans adapted to clinical situations and nutritional status of patients, in both hospitalized and ambulatory patients

√ Assess the Quality of Life (QoL) of HIV-infected patients

√ Collect data to investigate the relationship between nutritional status and QoL in HIV-infected patients

2.0 Internship Activities Report

2.1 Hospital Admission

2.1.2 Nutritional Screening and Nutritional Status Assessment

Newly-admitted patients were identified daily by consulting the hospital's computer software, and their medical process was analysed before assessment; this included gathering information concerning previous admissions, appointments, current and past medication/treatment, exams, and information on body weight history. A sheet providing information on patient name, bed number, diet (prescribed by the physician), and any other relevant observations regarding food intake, was provided daily (Appendix 2). Additional information regarding the patient was collected from Nurses and clinical charts upon arrival at the ward. This included personal information (eg. if the patient came from home/nursing home/other service), general state of health and neurological state, presence of pressure ulcers, blood pressure, blood glucose level, bowel movement frequency, appearance/consistency of faeces, dysphagia, odynophagia, food intake etc.). If any

health or diet-related information was provided by the patient it was always confirmed with nurses since patient could be confused (e.g. due to medication or disease), could have forgotten past information (e.g. due to old age), or may not report accurate information such as amount of food intake. Risk assessment was performed to all patients on admission. Patients were weighed using an OMRON Composition Monitor/Scale and if they could not stand, their weight and height was estimated using specific formulas. (3,4) A form for data collection was used in the field to collect additional information (eg. clinical signs and symptoms, food preferences, allergies, intolerances, 24h recall for food intake assessment, bowel movements etc.) required for the development of a nutrition care plan (Appendix 3).

2.1.3 Patient Nutritional Requirements

Once malnutrition or risk for malnutrition was detected, a patients' energy and nutrient requirements were immediately determined. Age, gender, diagnosis, medical history, metabolic stress, medication, renal and hepatic function, food preferences, eating habits, denture status, swallowing difficulties, and other symptoms previously registered during patient assessment were considered when calculating requirements. In case a standardized diet (see below) didn't meet an individual's energy or protein requirements, a personalized nutrition care plan was developed.

2.1.4 Diets and Personalised Intervention

There are twenty-four (standard) diets available for hospitalised patients; these are specific diets that have been previously planned and vary in terms of consistency, macronutrient content, salt content, and other may have other specifications such as exclusion of certain foods. A general, soft, or pureed consistency is available. On admission, the patients' doctor designates the diet he finds most suitable for his patients. A null diet can also be prescribed in situations where it is not suitable for the patient to feed (i.e. absence of a diagnosis, preparation for an exam, or in situations where feeding may worsen the condition or is unsafe). It is the role of the nutritionist/dietitian to modify the prescribed diet in the event of there being a more suitable alternative for the patient compared to what was initially prescribed; when the dietician identifies difficulties in chewing or swallowing (i.e. due to absence of teeth, altered state of conscience, dysphagia, odynophagia, etc.) the consistency may be changed (i.e. from general to soft or from soft to pureed).

Patients would receive one of the following three dietary approaches when admitted to hospital, (a) were attributed with a standard diet if this satisfied energy and nutrient requirements (b) a personalised nutrition care plan was developed (c) given a standard diet but with certain specifications to ensure adequate intakes - a 'special diet'. Examples of the latter included: no fish and/or meat, no rice/pasta/potatoes (according to preferences), substitution of regular milk for lactose-free milk, inclusion of specific fruits (e.g. only soft fruits), specific bread or cereal (i.e. only whole-grain), addition of a protein and/or energy supplement, addition of a juice, etc. There were numerous dietary modifications that could and were made after being agreed on with the patient. This would promote adequate intakes, or at least prevent low intakes that could

compromise nutritional status. This third approach on admission was different from a personalised plan since the latter commonly involved changes in portion sizes of protein and/or other macronutrient from the meal.

To develop a personalised diet, an Excel sheet was used developed and shared by all dieticians at the Hospital) to aid in the calculation of requirements. The sheet was composed of a list of all the foods available for patients at the hospital; once the portion of the food/drink was inserted, the corresponding energy, and nutrient content was obtained. The nutritional requirements were calculated based on current body weight (per kg body weight per day); an appropriate macronutrient distribution (%) was also a goal in the development of a personalised plan. After deciding on the consistency, the next step was to decide on the diet's energy density; the choice would vary between a hypocaloric (20-25kcal/kg bw), a eucaloric (25-30kcal/kg bw), or a hypercaloric diet 30-35kcal/bw). The same applied for protein requirements; low-protein (<0.8g/kg bw), normal protein (0.8-1.2g/kg), high protein (>1.2g/kg). It was crucial to assess if this was achievable, and if so, predict if it would be well tolerated, independent of requirements. In case it was expected that the patient was not going to meet their needs, these were nevertheless established, recorded, and the goal was to reach them gradually, according to tolerance.

Two strategies were used interchangeably to enrich the diet; one was using food (i.e. adding an extra portion(s) of yoghurt/milk/cheese/etc. or of juice/bread/dessert/etc. in case protein or energy requirements were high, respectively). When food was not sufficient additional energy and/or protein was provided in the form of supplements. The choice of supplement was dependent on requirements (high-protein & high-energy/ high-protein/ high-energy), patient condition (i.e. tolerance, dysphagia, etc), medical history (i.e. diabetic/ kidney disease, etc), and preference (i.e. flavour). A protein (i.e protifar) or energy (i.e maltodextrin) powder supplement was used to enrich foods such as soup. Different supplements were available to match the different patient requirements, and some were specific for certain diseases.

2.1.5 Monitoring

The diet of hospitalized patients was monitored daily. This involved assessing diet tolerance; understanding if the diet consistency was adequate, if the food matched preferences, and if the composition (i.e. macronutrient distribution) was appropriate with regards to symptoms associated to the underlying disease. Relevant nutrition-related symptoms such as nausea, appetite, vomiting, abdominal distension, bowel movements, bowel consistency, and dysphagia were also monitored. The diet was adapted, when possible, to improve symptoms i.e. when early signs of satiety were identified the volume of the diet was decreased, but the energy density maintained/increased (i.e. by adding a supplement). Food intake was monitored and quantified to ensure nutrient intake met requirements and that current feeding method was the most appropriate; this was done by carrying out regular 24-hour recalls of malnourished or at-risk patients. The nutrition care plan was adapted in cases where the patient was far from meeting the target energy and nutrient intake for more than one day, and if the change would promote an increase in nutrient intake.

The patient's clinical condition was monitored regularly by communicating with the nurse or doctor responsible and re-adjustments to the nutrition support plan were carried out if needed. When necessary, staff would be informed of which patients would need assistance feeding.

2.1.6 Reassessment

Though many aspects of NS were reassessed daily, anthropometric measurements were repeated weekly, regardless the NS (weight (weighed, or estimated), mid-upper arm circumference, calf-circumference). Whenever available, biochemical records would be checked and considered when modifying the plan (i.e. reduce potassium in the diet in the case of hyperkalaemia). On-going nutritional status would determine whether the nutritional goals were being achieved. (10)

2.2 Medicine Service: Outcomes of Activities

2.2.1 Results

Patients were hospitalised for multiple reasons and had multiple comorbidities in this service. The most common reasons for admission were heart failure, respiratory failure, kidney failure, stroke, pneumonia, neurological disease, chronic obstructive pulmonary disease and cancer. Other less common diseases encountered were acute sickle cell anaemia, rhabdomyolysis, pneumothorax, amyotrophic lateral sclerosis and others. Table 1 illustrates the number of nutritional risk assessments performed per week and describes outcomes of screening. On average, 4 patients were assessed per day. In total, 227 nutritional risk assessments were performed during the 13-week period in this service. The MNA was used in 177 patients (78% were elderly). The average age of the 227 patients was 73.2±16.3 years. Using the screening tools, 150 (66%) patients were identified as being at risk of becoming malnourished or were already malnourished on admission, and 44% were not at risk of malnutrition (Table 1). Tables 2 and 3 illustrate outcomes of the nutritional status assessment, for adults and elderly, respectively. For 19 elderly patients it was not possible to proceed to the FMNA due to neurological state/other medical condition/ the family was not present to help in the performance of the assessment. Using the NS assessment tools, 69 (31%) patients were identified as being malnourished, and 128 (56%) were at risk of malnutrition out of the 227 (100%) assessed in this service.

Table 1. *Number and nutritional status of patients assessed on admission to the M1D service*

Wk nº	Nº of patients assessed	Tool Used		Risk for malnutrition	
		MNA	NRS	At risk/ Malnourished	No risk
1	25	16	9	18	7
2	21	18	3	20	1
3	17	14	3	8	9
4	15	14	1	8	7
5	19	15	4	13	6
6	21	20	1	15	6
7	18	16	2	12	6
8	20	18	2	14	6
9	15	11	4	10	5
10	16	10	6	10	6
11	11	8	3	8	3
12	9	8	1	5	4
13	20	9	11	9	11
TOTAL	**227**	**177**	**50**	**150**	**7**

Table 2. *Nutritional status of adult patients in Medicine 1D using the NRS and SGA*

	TOTAL	At Risk	No risk (A)	Suspected Malnutrition (B)	Severely Malnourished (C)
NRS	50	20	30	-	-
SGA	20	-	6	11	3

Table 3. *Nutritional status of elderly admitted to the Medicine 1D using the MNA and FMNA*

	TOTAL	No risk	At risk	Malnourished
MNA	177	77	52	48
LF-MNA	33	-	26	7

The frequency of the different activities performed in this service is described in Table 4. It was not possible to weigh or estimate the weight of 11 patients on admission. The weight of 216 patients was obtained (128 estimated, and 88 weighed or reported from previous 2 weeks). Their average BMI was 24k±3.9g/m². The average BMI of adults and elderly was similar (adults: 24.5kg/m² range: 17.02-39.7, elderly: 24.4kg/m² range: 13.0 – 35.4). Figure 1 shows the BMI, in classes, of patients on admission. The mean mid-upper arm circumference (MUAC) and CC of patients on admission was 26.7 and 31.4cm, respectively. MUAC was measured mainly in the elderly (87%) for weight estimation and to be able to complete the full MNA version. It was only measured in individuals <65 when it was not possible to weigh them or if they were severely malnourished. On average, for both the elderly and the adults, the MUAC was not indicative of malnutrition since it was above 21.0 cm. (11) CC was only measured in the elderly. The average CC of the elderly was 31.4 cm. The CC of 67 patients (40%) patients was <31.0 cm, the reference cut-off value for malnutrition. (12) Figure 2 illustrates the MUAC of patients classified into percentiles (13); over 50% of patients were below the 10th percentile according to gender and age.

Table 4. Description and frequency of activities performed in M1D service (n=216)

Anthropometric measurement collected/ calculated	Frequency
Weight (Weighed/Estimated, in kg)	264
MUAC (cm)	222
CC (cm)	205
BMI (kg/m²)	264

Figure 1. *BMI classification of patients (n=216) on admission to the M1D service.*

19
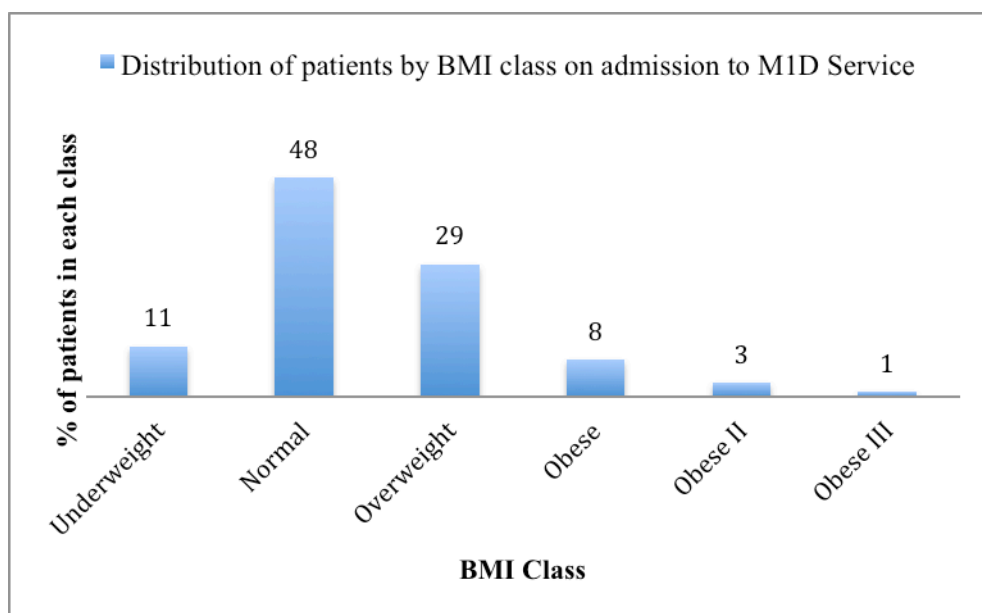
Figure 2. *MUAC classification of patients (n=173) on admission to M1D service*
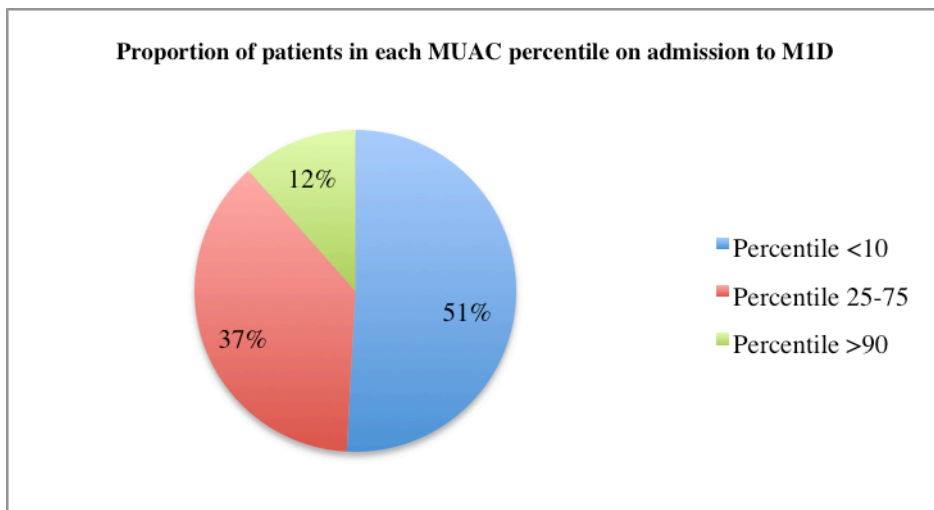
The reasons for admission in this service were most of the time resolved in less than one week. Of the 227 patients assessed, only 36 (16%) remained hospitalized after one week, 12 (6%) after two weeks, 9 (4%) after three weeks, 4 (2%) after four weeks, and 3 (2%) after five weeks (Figure 5).

Out of the 28 patients who remained hospitalised after week one, 17 lost weight, 8 gained, and 3 maintained their weight. The average weight loss from week 1 to week 2 was 6.2 kg, representing a 9% body weight loss from the average weight of the initial 216 patients on admission.

It was necessary to personalize the diets of 39 patients admitted to the Medicine 1D service; 7 were enteral nutrition plans, of which 6 were to be administered via a nasogastric tube, and 1 via a Percutaneous Endoscopic Gastrostomy (PEG). Six individualized care plans were developed and explained to patients before discharge adapted to a different range of pathologies. These included cancer (oesophageal and pancreatic cancer, burkit lymphoma), intestinal bowel disease (ulcerative colitis), neurological disease (dementia), chronic kidney disease (CKD), cardiovascular disease (stroke), and metabolic disorders (diabetes, metabolic ketoacidosis). The plans developed included: a low residue diet for ulcerative colitis, a low potassium/protein diet for acute kidney diseases or CKD not on dialysis, high-protein diets for dialysis, enteral plans with conventional food for oesophageal and stomach cancer, enteral plans with polymeric formula for neurological disease, low purine diet for gout attacks, hypocaloric diet for post-stroke events, volume and salt restricted diets for heart failure, and others. Clinical cases involving nutritional intervention are described in Appendix 5-7. The care plans were developed based on information gathered on admission, and the result from the nutritional screening.

2.3 Infectious Disease Service: Outcome of Activities

       2.3.1 Results

At any moment in this service approximately 50% of beds are occupied by HIV-infected individuals. Main causes for hospital admission in this service were Pulmonary/Ganglionar Tuberculosis, Meningitis, Sepsis, Klebsiella Pneumoniae Carbapenemases infection, and Kaposi's Sarcoma. Most of these infections are commonly found in immunocompromised patients, such as those infected with HIV.

The screening method used in all patients in this service was the NRS-2002 since it seems to be the best validated screening tool, in terms of predictive validity, for hospitalized adult patients. (2)

Table 5 illustrates the number of patients assessed per week, and quantifies the number of those who were at risk of malnutrition or malnourished on admission. 59 nutritional risk assessments were performed during the 10-week period in this service. Most patients screened were males (n=44, 75%). The proportion of patients who were at risk for malnutrition or malnourished on admission was 83% (n=49). The remaining 17% (n=10) were not at risk of malnutrition. The nutritional status of patients is described in Table 6, and in Table 7 are the different parameters collected from patients. From the total 59 patients, 48 were weighed and 11 either had their weight estimated or it was reported from the 2 weeks prior to admission. The average BMI of these patients was $21.3k\pm5.3g/m^2$, which is within the healthy range for adults. BMI range was 13.7 – $30.7kg/m^2$. Figure 3 describes the BMI of patients, in classes on admission. The mean MUAC (n=10) was not indicative of malnutrition since it was above 21.0cm. In contrast, the average CC (n=5) was below 31.0cm (28.0cm), which is associated to malnutrition and loss of lean mass.

Table 5. *Frequency and screening results of patients assessed on admission in the ID service*

Wk nº	Nº of patients assessed	Risk for malnutrition	
		At risk/ Malnourished	No risk
Wk 4	9	7	2
Wk 5	3	3	0
Wk 6	0	0	0
Wk 7	3	3	0
Wk 8	11	9	2
Wk 9	6	4	2
Wk 10	5	5	0
Wk 11	8	6	2
Wk 12	8	7	1
Wk 13	6	5	1
TOTAL	**59**	**49**	**10**

Table 6. *Nutritional status of patients on admission to the ID service using SGA*

	TOTAL	At Risk	No risk (A)	Suspected Malnutrition (B)	Severely Malnourished (C)
NRS	59	49	10	-	-
SGA	49	-	10	29	10

Table 7. Description and frequency of activity performed in ID service

Anthropometric measurement collected/ calculated	Frequency
Weight (weighed/estimated, in kg)	108
MUAC (cm)	17
CC (cm)	8
BMI (kg/m^2)	109
TSF & BSF Thickness (mm)	7

Figure 3. *BMI classification of patients (n=59) on admission to the ID service.*
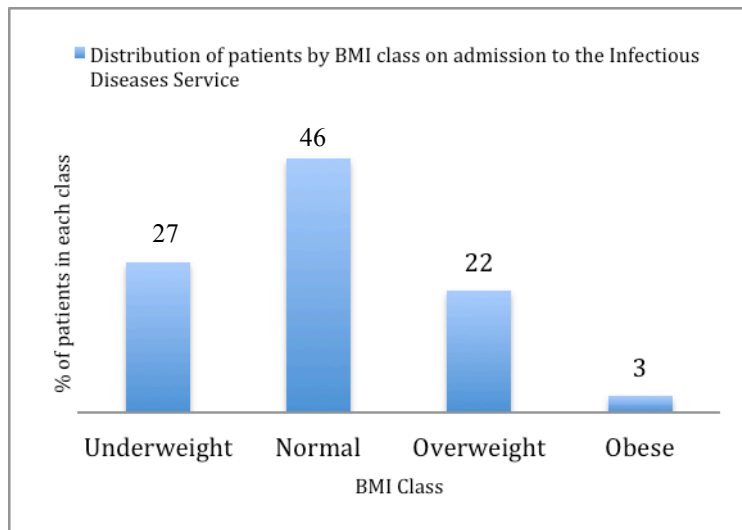
The reasons for admission in this service were not always resolved in less than one week. Thirty patients (51%) remained hospitalized after one week of admission, 14 (24%) after two weeks, 8 (14%) after three weeks, 3 (5%) after four weeks, 1 (2%) after five weeks, and 1 (2%) after six weeks (Figure 5).

Out of the 30 patients who remained hospitalised after week one, 15 lost weight, 11 gained, and 3 maintained their weight. The average weight loss from week 1 to week 2 was 2.5 kg, representing a 4% body weight loss from the average weight of the initial 59 patients on admission.

It was necessary to personalize the diets of 16 patients admitted to this service; 2 were enteral nutrition plans, of which 1 was to be administered via a nasogastric tube, and 1 via a PEG. All diets of patients in this service were to some extent modified to meet requirements and/or preferences. Three different personalised care plans adapted to three different diseases were developed and explained to patients before discharge; Crohn's disease (low residue diet), Chronic liver disease (high-energy, high-protein, poly-fractionated diet), and Oesophageal cancer (high-energy, high-protein puréed diet).

2.3.2 Comparing BMI and Length of Stay (LOS) of both services

Figure 4. *BMI of patients who remained hospitalized after one week (both services combined)*

23
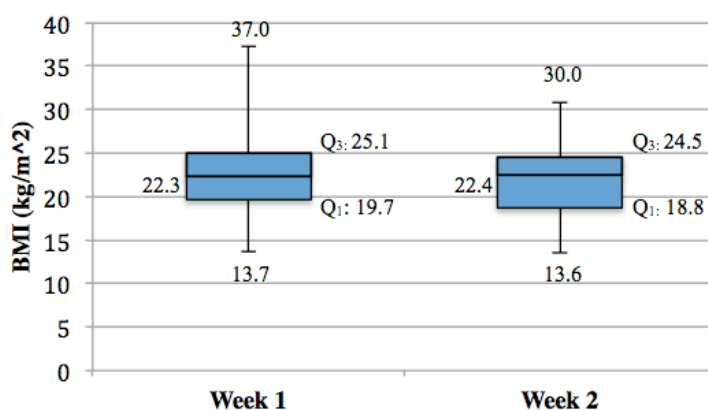
Figure 5. *Comparing proportion of patients who remained hospitalized after admission in both services*
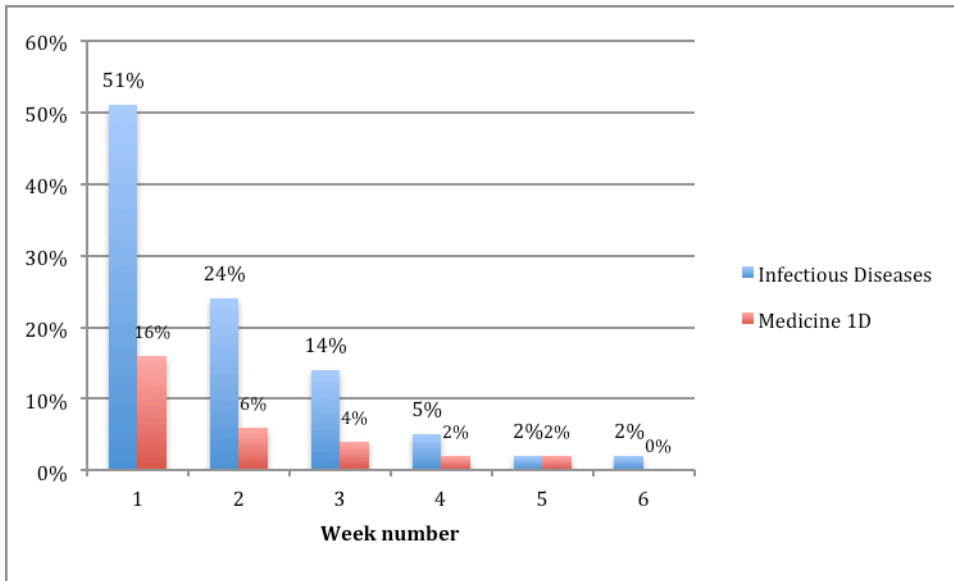
2.4 Intensive Care Unit

2.4.1 Summary

There are 5 individual rooms available in this unit. Activities were shadowed, and not performed, due to the critical status of patients and the need for an experienced health professional to accurately assess and evaluate their nutritional requirements, to then perform a detailed dietetic intervention. This unit was visited weekly during the 13-week period. On each visit, 1 patient was assessed and others were monitored. Monitoring involved checking tolerance to the diet (oral, enteral, or parenteral), fluid balance, bowel movements, gastrointestinal symptoms, disease progression (and its effect on general state of health), mental status, and relevant biochemical markers (i.e. kidney function indicators). For most of the cases studied in this unit, enteral or parenteral nutrition was the exclusive mode of feeding. Even though nutritional and fluid requirements were established on admission, it was rare for these to be achieved within 24 hours. The goal was to meet the energy and protein requirements within 72 hours following admission and therefore the plan developed would describe the step-by-step progression to achieve this.

2.5 Shadowing and Performing: Nutrition and Dietetics Outpatient Appointments

2.5.1 Summary of appointments shadowed and performed

Table 8. *Summary of activities performed with outpatients*

Appointment Type/Specification	Nº of Appointments	
	Shadowing	Nutritional Intervention
Infectious Diseases – HIV	15	66
Obesity and Endocrinology	12	7
Non-Alcoholic Fatty Liver Disease	5	0
Total	**32**	**73**

2.5.2 Nutritional Intervention: HIV

The main goal of the 66 HIV nutrition appointments performed was to develop a personalised plan based on the information gathered by the patient and their medical process. For 55 patients the goal was also to collected additional information for the study investigation. The aims and methods of the work are described in the paper associated to this report. The reason for the referral to the appointment would first be identified. The patients' medical process, their most recent blood tests (viral load, CD4 lymphocyte count, lipid profile, kidney function, blood glucose levels, etc), and their current medication (including anti-retroviral treatment) would then be collected. With the patient, current symptoms, bowel movements, food allergies and intolerances would be evaluated. Symptoms or dietary requirements associated to the type of Highly Active Antiretroviral Therapy (HAART) regimen were considered: for example, patients with lopinavir experience frequent diarrhoea episodes and patients on Stribild® or Eviplera® must ensure they take their medication with a meal of a specific energy density. (14,15)

Anthropometry, bioelectrical impedance analysis, and dietary intake would further be used to assess NS. The anthropometric parameters considered for evaluation were weight, height, BMI, MUAC, tricipital and bicipital skinfold fold thickness and waist circumference. For 55 patients, hip circumference was also measured to calculate waist to hip ratio, and arm muscle area was also calculated. Weight was measured to the nearest kg with a calibrated digital scale, and height to the nearest millimetre using a stadiometer. Skinfold thickness was measured to the nearest 0.2 millimetre using a Harpenden Skinfold Caliper. Circumferences were measured to the nearest millimetre using a non-elastic measurement tape. These anthropometric variables were measured following the recommendations of the International Society for the Advancement of Kineanthropometry. (16) Diet history was assessed and quantified in the form of an interview. Frequency of consumption and portion sizes of foods consumed, were recorded on electronic clinical charts. For the 55 study participants, a semi-quantitative food frequency questionnaire was administered. Fluid intake was also assessed as well as certain foods or teas that could possibly interact with certain HAART (i.e. grapefruit, hypericum tea). When teas or supplements with active components were being taken, and the composition was unknown by the dietician or doctor, this would be discouraged.

The identification of inadequate food-related behaviours and food choices, understanding food preferences and patients' daily schedules, were considered and when necessary patients were encouraged to change their schedule to one that would allow for the nutrition plan to be followed correctly. Diets were adapted to different conditions, comorbidities, and to stage of HIV infection. Examples of situations encountered to which the diet was adapted for included the following: lipodystrophy, elevated cholesterol/ triglycerides/ glucose levels, underweight, overweight, obesity, poor appetite, diarrhoea, diabetes, high cardiovascular risk, and others. Often, complicated financial and social circumstances were present and it was necessary to adapt the plan to the (tight) budget. Patients working during night shifts were also encountered and it was challenging to plan meals adapted to their schedule. The nutritional status assessment process and

intervention were all performed following evidence-based recommendations available for this population. (17). Towards the end of the appointment, 55 patients were asked to fill in a Quality of Life Questionnaire developed by World Health Organization, for investigation purposes. The article is attached to this document (Appendix 13); it has been submitted to the Journal, Nutricion Hospitalaria, and changes, suggested by the reviewers, have already been made, and therefore await final decision.

2.5.3 Nutritional Intervention: Obesity and Endocrinology

The Obesity and Endocrinology outpatient service is composed of Doctors (Endocrinologists), Psychologists, and Dieticians. Nutrition and Dietetics appointments occur after referral by a doctor. Patients attending this service were obese, and therefore at risk of developing comorbidities. Patients with a BMI $\geq$ 40kg/m^2 (Class III) or those with a BMI between 35-39.9 (Class II) in combination with an associated comorbidity were eligible for bariatric surgery. (18) In these circumstances, the multidisciplinary team worked together to prepare the patient for surgery. Eating patterns, eating behaviours, weight history, social background, medical history and any other relevant health or personal-related information was considered to develop a plan intended for weight loss, where individual requirements were calculated. Anthropometric parameters measured were weight, height, waist and hip circumference. Bioelectrical impedance analysis was also performed. Diet history was assessed and quantified in the form of an interview. The appointment would attempt to identify behaviours potentially indicative of an eating disorder (i.e. Bulimia, Binge-Eating Disorder, etc.), and syndromes such as night-eating syndrome. Regardless if a patient was in preparation for surgery, the risks associated to their weight and eating behaviour were topics that were routinely discussed. Those in preparation for surgery were frequently reminded of the restricted diet in terms of volume and content, following surgical intervention. It was fundamental to create awareness of the drastic dietary and lifestyle change that would need to be sustained for life, in order to achieve goals and promote health, and of the challenges this would pose on a physical and psychological level. All patients seen were follow-ups from previous nutrition appointments.

2.6 Other Activities and Events

Despite the focus of the internship being on nutritional status assessment and intervention, it was possible to take part in a variety of health-related activities and events.

2.6.1 Multidisciplinary Meetings

Multidisciplinary team meetings were held weekly to discuss the clinical condition of all patients hospitalised in the infectious diseases service. All health professionals would have a say in the prognosis of the patient, and decisions concerning the management of the patients' condition were decided upon. Nurses, a dietician, and psychologists also attended the meeting to understand the impact that the clinical decisions were having or were going to have on patient's physical and mental wellbeing. This way they could support the patient and adapt their approach to the upcoming clinical changes. A social worker would also be present

and was responsible for ensuring and preparing adequate living conditions for the patient once he/she returned home. In this meeting, a physiotherapist would identify patients with physical difficulties in need of their support, to improve movement, function, and aid in the rehabilitation process. During the internship, 10 meetings were attended.

2.6.2 National Stroke Day

The National Stroke Day is held every year on the 31st of March, since 2003, in Portugal. The Mediterranean diet has shown to play a role in the prevention of cardio-vascular disease-related events, such as stroke (19). A free nutritional screening was provided for those interested on this day, by the Nutrition and Dietetics department in partnership with the Neurology department of SMH. The activity was performed by the Dieticians and Nutritionists at SMH, and took approximately 2 hours, which allowed for the assessment of 15 individuals. The screening process involved 4 stages: (1) Anthropometric measurements (weight, height, waist circumference, hip circumference) (2) Body composition analysis, using Bioimpedance equipment (3) filling in a questionnaire concerning frequency of intake of specific foods belonging to the Mediterranean diet (4) Discussion of anthropometric data, risk factors, and questionnaire responses. The individual was provided with general recommendations concerning the composition of the Mediterranean Diet and was given a leaflet with food groups to be consumed, with their corresponding portion sizes.

2.6.3 Infectious Diseases Conference

Curry Cabral Hospital held their 10th annual conference on the updates concerning the management of Infectious Diseases on the 28th and 29th of January. This event was attended on both days where topics such as Anti-Retroviral Therapy, Emerging Infections, Viral Hepatitis, Liver Transplants, Tuberculosis, Fungal Infections, Fever and Neutropenia, were discussed, and therefore an opportunity to learn on these topics.

2.7 Discussion

There were many differences between both services experienced in terms of patient characteristics, and type of dietary and medical interventions necessary. In contrast to the greater proportion of elderly admitted to the medicine service, the majority of patients were adults in the ID service (adults: 71%, elderly: 18%). Average age was 52.8 and 73.2 years in the ID and medicine service, respectively. Patients in the ID service required further precaution in their evaluation since many were placed in isolation, which was often a barrier to perform a thorough nutritional assessment. They often had their immune system seriously compromised with an infection that could be transmittable, and their diagnosis was frequently undetermined to begin with. It was important to understand, and act upon the metabolic response to stress due to infection by observing, assessing and finding nutritional strategies to slow down muscle catabolism associated with infection. Malnutrition increases susceptibility to infection, and infection is also known to contribute to malnutrition, suggesting a vicious cycle between the two. (20) Preserving muscle mass is essential due to its' associations

with physical function, strength, and morbidity. Small losses of lean tissue have been associated to a weaker immune system, an increased risk for infection, and mortality. (21, 22)

The precautions to take in the medicine service were different and involved assessing chewing and swallowing difficulties, understanding patients' level of independence and if assistance feeding was required due to a poor functional status (frailty), or to neuropsychological problems. A frequent issue was also the lack of appetite and anorexia experienced by the elderly that was caused by several factors ranging from depression, early satiety, loss of taste and smell, side effects of drugs, etc. Hospital food acceptance was, in general, a common issue to both services, and this was, when possible, tackled by making dietary modifications to promote intake.

The proportion of patients who were at risk for malnutrition or malnourished on admission in the ID service was greater compared to the medicine service (83% vs. 66%). This could be attributed to the nature of the reason for admission; in the ID service, symptoms were in general more severe and diseases more acute which would immediately put a patient at risk. The reasons for admission in the ID service were not always resolved in less than one week in contrast to the M1D service; more than half (51%) of the patients admitted to the ID service, remained hospitalized after one week, compared to 16% in the medicine service. The reason for this difference was also related to the reason for admission; whilst in the medicine service the main causes for admission could be resolved in a few days, in the ID service, the cause for admission was complex, and it could take weeks to perform a diagnosis. Length of hospital stay is associated to weight loss, and a declining nutritional status, which in turn are also factors associated to this. (23, 24) Thus, thorough monitoring and reassessment in these patients be it daily, bi-weekly, or weekly, was indispensable to guarantee adequate intakes, and slow down deterioration in nutritional status, which is associated to morbidity and mortality in the hospital setting. (24)

2.8 Conclusion

At the end of the 13 weeks, all goals established prior to the start of the internship had been met; numerous activities such as nutritional screening, nutritional assessment, and collaboration in the implementation of individual nutritional plans were being executed regularly and successfully. Data collection for the investigation study was also successful since the number of eligible subjects recruited was representative of the HIV population at SMH. The administration of more than 50 FFQ, and interviews to estimate food intake allowed for the improvement of nutritional skills such as portion size estimation and understanding of dietary habits/food choices of individuals from different backgrounds (cultural, religious, socioeconomic, etc). Since different methods were used to assess nutritional status it was possible to improve skills on many levels; anthropometric skills (and reduce intra-observer error), and communication skills, by adapting dialogue to patient characteristics. The general goals involving understanding the structure, organization of the hospital to integrate within it, were also achieved since the different services were approached in an autonomous manner. The internship provided excellent practical and professional experience and the possibility to develop skills on an interdisciplinary level by communicating with other health professionals on a daily

basis. By shadowing a dietician in various activities, and discussing several cases using scientific evidence, it was possible to deepen the theoretical knowledge of concepts learnt during the Master's course. The chance to provide diverse scientific information and make recommendations according to the clinical situation encountered was a new, rewarding experience. Overall, this internship was a dynamic and enriching opportunity that allowed for the improvement of interpersonal, analytical, and problem solving skills in the clinical setting.

2.9 Acknowledgements

3.0 References

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3.1 Appendix

Appendix 1: Figure showing nutrition care process employed
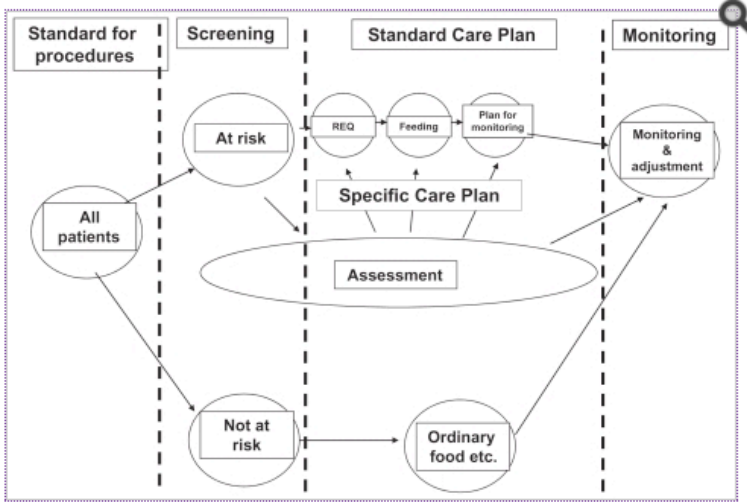
The nutritional care process including screening, planning, and monitoring according to ESPEN guidelines.[10]

Notes: REQ (requirements of energy and protein), feeding (ie, food, supplements, tube feeding, and parenteral nutrition), monitoring (weight and food registration).

Appendix 2: Sheet provided daily with patient (dietary) information on admission

Appendix 3: Form used to collect data from patients admitted to the Medicine and ID Service

DADOS	Data:	Data:	Data:
Cama			
Nome			
Diagnóstico			
Antecedentes			
Alt. Consciência			
Prob. Neuropsicológico			
Mobilidade			
Dieta Prescrita			
Idade			
Altura	**Real**	**Joelho**	**Ulna**
Peso actual			
Peso	**Peso 1 mês**	**Peso 6 meses**	**Habitual**
Pbraquial			
Pgeminal			
Edema/ascite			
Apetite			
Razão alteração			
Em casa	P.alm: Almoço: Lanche: Jantar: Ceia:		
Recall 24h	P.alm: Manhã: Almoço: Lanche: Jantar: Ceia:	P.alm: Manhã: Almoço: Lanche: Jantar: Ceia:	P.alm: Manhã: Almoço: Lanche: Jantar: Ceia:
Pão Leite Fruta Carne Peixe Leguminosas Ovos Legumes Iogurtes Massa Arroz Batata Sopa Sumos Chá Açucar Gelatina			
Água			
Diarreia Obstipado Vómitos Enjoos Enfartado Disfagia Mastigação			
Nec. alteração da dieta:			
Outros:			
Score:			

Appendix 4: Continuation of previous form; where nutritional requirements and nutrition care plan were recorded

Cálculos p/ plano	Data:	Data:	Data:
Peso actual:			
Altura:			
IMC:			
Kcal/d peso actual:			
Prot/kg/d peso actual:			

DIETA PRESCRITA:
Pequeno Almoço
Manhã
Almoço
Lanche
Jantar
Ceia

Name/Sex/Age	AC/F/55
Reason for Admission	Acute on chronic kidney disease + Urinary tract infection + Dysautonomia
Patient history	1 Stroke, Epilepsy
Screening & NS Assessment	bw: 57.9kg, BMI: 23.2 kg/m^2, anorexia (for 4 days previous to admission), no difficulty chewing/swallowing NRS: 1
Blood test	GFR: <30ml/mln/1.73m^2, Creat: 2.6 mg/dl, K: 2.8 mmol/L
Blood Pressure	81/58 mm/Hg
Nut. Interv for Dysautonomia	Fluid intake + 15g NaCl intake
Indiv. Nut Interv for AKI	Energy: 25kcal/kg bw, Protein: 0.7g/kg bw Pi: 800-1000mg K: 2-2.5g
Individual Nut Req.	E: 1448kcal P: 40.5g K: 1.5-2g
Diet	General consistency, Personalized composition
Nutrition Plan (adapted to cultural and personal preferences) Note: AC did not like soup	**Breakfast:** 50g Bread + 10g Salted butter + 125g Yoghurt **Morning snack:** 100g Banana **Lunch:** 50g meat/fish + 120g potato/100g rice/100g pasta + 80g vegetables + salad + 200ml juice + 80g raw fruit (apple/pear) **Afternoon snack:** 200ml Tea+ 50g Bread + 10g Jam **Dinner** (Vegetarian meal): 100g Pasta + 240g Vegetables + Salad + 200ml Juice + 80g raw fruit (apple/pear) **Feast:** 40g Plain cookies + 200ml Tea

AC's renal function was severely decreased since her Glomerular Filtrate Rate (GFR) was classed in the G4 category of the Kidney Disease Improving Global Outcomes. She also had hypercreatinemia (>1.3 mg/dl), and low levels of potassium (<3.5mmol/L). When GFR is low, NS is compromised since it contributes to the retention of nitrogen compounds, compromises electrolyte fluid balance, and can cause vitamin deficiencies. The main causes of malnutrition in chronic kidney disease are inadequate energy and protein intake (due to many central nervous system-related hormones that contribute to anorexia), loss of nutrients due to dialysis proteins, amino acids, and water-soluble vitamins), protein catabolism (loss of visceral and somatic reserves, metabolic acidosis, bioincompatible dialysis membranes, protein degradation, corticotherapy, etc).

Therefore, the aim of nutritional intervention was to decrease protein intake to 0.6-0.8g/kg (National Kidney Foundation recommendations for acute kidney injury). Fluid intake was encouraged above the recommendations since it has been shown to improve symptoms associated to dysautomnia and because the treatment goal was to increase blood volume, and correct blood pressure. There is a general recommendation to maintain fluid intake above 2 litres per day in dysautomnia (25), which contributes to the increase in blood volume. Since this syndrome is associated with changes in blood pressure, there is a general recommendation to increase salt intake to 6-8g/day if this is not already being achieved. However in AC's

case, 15g NaCl were provided by intravenous fluids, and these fluids were also responsible for keeping her hydrated. After 2 days, AC had normalized her creatinine levels and her blood pressure had returned to normal. She was advised to control her protein intakes, to maintain salt intakes, and to follow a balanced diet.

Appendix 6: **Clinical Case 1 - Kidney Failure + Hyperuricaemia**

Name/Gender/Age	VB/F/87
Reason for Admission	Atrial Fibrillation + Acute exacerbation of CKD (under dialysis)
Patient history	HBP + Dyslipidaemia + Dysrhythmia
Screening & NS Assessment	bw: 61.9kg, BMI: 26.5 kg/m^2, reduced food intake (<75%) 2 weeks before admission due to constant nausea, and vomiting (24h recall: 450kcal – persistent for >2 weeks), difficulties chewing
Blood test	GFR: 5ml/mln/1.73m^2, Creat: mg/dl, Pi: 8.1 Urea: 275 Uric acid: 13 mg/dL Glycted Hb: 6.8 Tot. Protein: 5.5
Bloos pressure	160/100 mm/Hg
Indiv. Nut Interv for AKI	Energy: 20kcal/kg bw, Protein: 0.6g/kg bw Pi: 800-1000mg K: 2-2.5g
Individual Nut Req.	E: 1238kcal P: 37g K: 1.5-2g
Diet	Soft consistency, no main plate
Nutrition Plan	**Breakfast:** 50g Bread + 200ml Semi-skimmed milk + 10g Salted butter **Morning snack:** **Lunch:** 250ml Vegetable Soup with 30g meat/fish + 80g pureed fruit (apple/pear) **Afternoon snack:** 200ml Tea+ 50g Bread + 10g Jam **Dinner** 250ml Vegetable soup **Feast:** 40g Plain cookies (Maria) + 200ml Tea

VB's phosphorous (8.1 mg/dL) and uric acid levels were above the reference interval of 2.5-4.5 mg/dL, and >6.8 mg/dL, respectively. From this, a nutrition plan with phosphorous restriction was one of the aims since a it has been associated with the progression of chronic kidney disease. By restricting protein intake, which is also recommended in acute renal failure for the same reasons, phosphorous intake will also decrease since sources of protein in the diet are rich in phosphorous (1g P = 10-12mg Pi). Protein was restricted to 0.6g/day (37g) and phosphorous to a maximum of 600mg/day. Protein provided a maximum of 444mg of Pi/day. Although the diet at the hospital provides little or no processed foods, it is important to remember that these foods are important sources of inorganic phosphorous (additives and preservatives) which in contrast to organic phosphorous (associated to protein), the body can absorb efficiently (up to 90%). Protein restriction also helped in the management of VB's hyperuricemia. Causes of increased uric acid production may be a purine-rich diet (though it is rare for diet alone to lead to hyperuricemia), and certain drugs (i.e. thiazides and loop diuretics). These drugs, simultaneously contribute to both the reduction in excretion, and towards increased production. This was possibly one of the contributing factors for VB's uric acid levels. VB's

hypertension may also be a contributing cause or consequence of her hyperuricemia. The metabolic syndrome has long been associated with hyperuricemia however, more research is needed to understand if hypertension (a component of the metabolic syndrome) is a cause or a consequence of this condition. (26) In addition to protein and phosphorous restriction, purines in the diet were also limited (cauliflower, spinach, peas, beans, and lentils) and poultry since they can be catabolized to uric acid in the body and lead to uric acid crystal deposition. Approximately 70% of uric acid is excreted from the kidneys, therefore it is crucial to restore renal function as well as prevent uric acid accumulation in the plasma. (27) VB's followed the plan but with difficulty; she slowly regained appetite as her uric acid levels went back to normal.

Appendix 7: **Clinical Case 3 – Heart Failure**

Name/Sex/Age	AG/M/86
Reason for Admission	Acute exacerbation of Chronic HF + acute exacerbation of CKD
Patient history	HBP + Dyslipidaemia + Dysrhythmia
Screening & NS Assessment	bw: 64kg, BMI: 20.6 kg/m^2, reduced food intake (<25%) 4 weeks before admission (24h recall:), difficulties chewing
Blood test	GFR: 21ml/mln/1.73m^2, Creat: mg/dl, Pi: 7 K: 2 Urea: Uric acid: Glyc Hb: 6.1 Tot. P: 6.1 INR: 5.65
Blood Pressure	mm/Hg
Indiv. Nut Interv for AKI	Energy: 25kcal/kg bw, Protein: 0.6g/kg bw Pi: 800-1000mg K: 2-2.5g
Individual Nut Req.	E: 1600kcal P: g K: 1.5-2g Fluid: 800ml
Diet	Soft consistency, no main plate
Nutrition Plan (adapted to cultural and personal preferences)	**Breakfast:** 50g Bread + 200ml SSMilk + 10g Salted butter **Morning snack:** **Lunch:** 250ml Vegetable Soup with 30g meat/fish + 80g pureed fruit (apple/pear) **Afternoon snack:** 200ml Tea+ 50g Bread + 10g Jam **Dinner** 250ml Vegetable soup **Feast:** 40g Plain cookies (Maria) + 200ml Tea

Whilst VB's food intake was due to her symtopmatic hyperuricemia, AG's reduced food intake was due to his dyspnea and fatigue (reduced amount of blood being delivered to tissues). In heart failure exacerbations, the main dietary goal is to monitor volume of fluid and food intake. It is important to limit volume intake to 200ml per meal and to encourage the patient to make various meals, in small quantities/volumes throughout the day to ensure adequate intakes. The intervention in this case, was for the patient to drink one soup for lunch and one for dinner (each with 200ml); water was drank outside meal times and a volume of 0.5ml/kg was suggested to be the limit (800ml/day). Due to the use of loop diuretics (i.e.furosemide) that cause sodium and water excretion, it is not necessary that salt intake should remain at 2-3g/day. In case of high doses of diuretics, patients should be monitored for hypokalaemia, which may precipitate arrhythmias; increased potassium intakes may therefore be necessary. There are four main approaches to prevent

hypokalaemia which involve blocking aldosterone production: ACE inhibitors, Angiotensin type 1 receptor blockers, potassium-sparing diuretics, and aldosterone receptor blockers. In case these are being taken, there is no need to increase potassium intakes. Since HF is characterized by reduced renal perfusion, which leads to sympathetic and renin-angiotensin-aldosterone system activation, sodium and water retention occur. Excess sodium may promote further volume retention and development of HF-related symptoms. Sodium restriction in HF may need to be tailored to a patients' HF severity. However, there are inconsistent findings as to weather it is appropriate to restrict dietary sodium in heart failure, even though all HF management guidelines state it. (28) The recommendation is based on 2g-3g sodium per day, however the level of evidence is weak and there is insufficient evidence to endorse any specific level of sodium intake with certainty. (28) Though sodium restriction may increase plasma levels of renin, aldosterone, epinephrine, and norepinephrine, a low safe range of sodium intake has not yet been established for HF. In general, fluid intake during HF should be limited to 2 litres of water per day. However, in case of oedema it is necessary to consider the patients' requirements individually; as mentioned previously the recommendation for this patient was to limit intake to 0.5ml of fluid per kilocalorie, hence the 800ml recommended for patient AG.

Appendix 8: Data collection form used for Nutritional Status and Quality of Life Study

RECOLHA DE DADOS	Data:						
Doente nº							
Nacionalidade							
Nome							
Idade							
Diagnóstico VIH	ANO:		TARV:				
Info. VIH	Ano de Infecção:		Via de Transmissão:		Sente-se Doente:		
Atividade Física							
Demográfico	Ocupação:		Estado Civil:		Escolaridade:		
Antecedentes Toxicodep.							
Antecedentes pessoais							
Infecções Oportunistas							
Medicação Actual							
Peso	atual	hab	1m	3m	6m	1ano	<diag
PP & Razão alteração							
Altura & IMC	Altura:	IMC:					
BIA	MG (%)	MM (%)	GV:				
Perímetros	PB:	PC:	PAbd:		PAnca:		
Pregas	PCT:	PCB:					
Apetite & Justificação							
Ingestão 24h	Peq. Almoço: MM: Almoço: Lanche: Jantar: Ceia:						
Sintomatologia	vómitos	nauseas	enfartam.	disfagia	dor	disgeusia	
Trânsito Intestinal							
SGA							
Outros							

Appendix 9: Continuation of form used; data collection of laboratory data

Análises Clínicas	Data:
CD8	
CD4	
Carga viral	
Col. Total	
LDL-c	
HDL-c	
Triglicéridos	
Hb	
Fosfatase alcalina	
Glucose jejum	
Glucose aleatório	
HbA1c	
Vitamina B12	
Creatinina	
Ureia	
TFG	
Magnésio	
Calcio	
Sodio	
Fosforo	
Potássio	
PCR	
Vitamina D	
Proteinas totais	
Albumina	
Bilirubina Tot	
AST	
ALT	
GGT	
Pressão Arterial	

Appendix 10: Table showing the number of patients assessed in Month 1 and their nutritional status on admission (Medicine 1D Service)

	Day nº	Nº of patients assessed	Questionnaire used		Risk for malnutrition	
			MNA	NRS	At risk/ Malnou rished	No risk
Wk 1	1	10	5	5	6	4
	2	5	5	0	5	0
	3	3	1	2	2	1
	4	5	3	2	3	2
	5	2	2	0	2	0
Wk 2	6	5	5	0	5	0
	7	6	5	1	6	0
	8	3	3	0	2	1
	9	3	3	0	3	0
	10	4	2	2	4	0
Wk 3	11	5	4	1	2	3
	12	3	3	0	2	1
	13	1	1	0	1	0
	14	5	4	1	2	3
	15	3	2	1	1	2
Wk 4	16	8	8	0	5	3
	17	2	2	0	1	1
	18	2	2	0	1	1
	19	3	2	1	1	2
	20	Infectious Diseases Congress				

Appendix 11: Table showing the number of patients assessed in Month 2 and their nutritional status on admission (Medicine 1D Service)

	Day nº	Nº of patients assessed	Questionnaire used		Risk for malnutrition	
			MNA	NRS	At risk/ Malnour ished	No risk
Wk 5	21	NA				
	22	NA				
	23	7	5	2	5	2
	24	6	6	0	3	3
	25	6	4	2	5	1
Wk 6	26	8	8	0	6	2
	27	5	5	1	3	2
	28	3	3	0	3	0
	29	5	4	1	3	2
	30	NA				
Wk 7	31	7	6	1	6	1
	32	3	2	0	3	0
	33	4	4	0	1	3
	34	2	2	0	1	1
	35	2	2	0	1	1
Wk 8	36	7	7	0	6	1
	37	4	3	1	3	1
	38	3	2	1	2	1
	39	2	2	0	1	1
	40	4	0	0	2	2

Appendix 12: Table showing the number of patients assessed in Month 3 and their nutritional status on admission (Medicine 1D Service)

	Day nº	Nº of patients assessed	Questionnaire used		Risk for malnutrition	
			MNA	NRS	At risk/ Malnou rished	No risk
Wk 9	41	5	3	2	3	2
	42	NA	NA	NA	NA	NA
	43	2	2	0	2	0
	44	4	4	1	2	2
	45	4	3	1	3	1
Wk 10	46	3	3	0	3	0
	47	NA	NA	0	NA	0
	48	8	2	6	3	5
	49	1	1	0	1	0
	50	4	4	0	3	1
Wk 11	51	5	5	0	5	0
	52	2	1	1	1	1
	53	NA	NA	NA	NA	NA
	54	1	1	0	0	1
	55	4	2	2	2	2
Wk 12	56	NA	NA	NA	NA	NA
	57	3	3	0	2	1
	58	3	3	0	2	1
	59	3	2	1	1	2
	60	NA	NA	NA	NA	NA
Wk 13	62	8	2	6	1	7
	63	4	2	2	2	2
	66	3	2	1	2	1
	67	3	2	1	3	0
	68	2	1	1	1	1

Nutritional Status and Quality of Life in HIV-infected patients

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ABSTRACT

Introduction: Nutritional status and the progression of the Human Immunodeficiency Virus (HIV) are interlinked; though some studies have looked at the impact nutritional status has on Quality of life (QoL) in patients with chronic diseases, few have studied this in HIV-infected individuals.

Objective: To investigate the relationship between nutritional status and QoL in adults with a recent HIV diagnosis.

Methods: Individuals with an HIV diagnosis performed in the fourteen months prior to a medical visit to Lisbon's central hospital were eligible. Nutritional status was assessed by anthropometry, body composition analysis, and dietary intake; QoL was assessed using the WHOQOL-HIV-BREF questionnaire. Socio demographic and clinical data were also considered.

Results: Fifty-one subjects were eligible for enrolment; the majority were male, Caucasian, employed, single, and under Highly Active Antiretroviral Therapy (HAART). Lower QoL scores were observed in subjects with inadequate energy intakes, reported weight loss, and a high waist circumference in bivariate analysis ($p<0.05$); the same variables influenced QoL negatively after adjusting for confounders in multivariate analysis ($p<0.05$). Various socio demographic characteristics such as level of education, age, gender, and current health problems also predicted QoL significantly ($p<0.05$).

Conclusion: Various aspects of nutritional status were responsible for the variations observed in QoL, suggesting a potential for nutritional intervention in improving QoL in this population.

Keywords: HIV, nutritional status, quality of life

INTRODUCTION

Nutrition has always played a role in Human Immunodeficiency Virus (HIV) care, but changes in the disease pattern, a fall in mortality rates, and hence a longer life expectancy, have lead to changes in nutritional requirements (1) and drove attention to Quality of Life (QoL) as an important health care indicator, given the chronicity of the disease. (2) QoL is considered a 'broad range concept', by the World Health Organization (WHO), influenced by 'physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment'. (3) A better QoL has been observed in healthy populations compared to patients with chronic diseases. (4) The relationship between

nutrition, QoL and immune dysfunction, such as that seen in HIV, is interconnected (5); the disease progression is associated with a decline in nutritional status and immune function, even during Highly Active Antiretroviral Therapy (HAART), contributing to recurrent opportunistic infections (6) but a decline in nutritional status alone can also weaken the immune system and hence, increase vulnerability to opportunistic infections. (7) Malnutrition and HIV therefore have a negative effect on each other by acting synergistically on the immune system, and consequently affecting QoL. (1, 7) It is important to understand the impact nutritional status has on these patients' physical and mental health (3) since they are known to predict QoL. In the general population, lower anthropometric measurements are not only associated with a lower QoL, but being overweight or obese, according to BMI, having a high waist circumference have also been associated to morbidity, and an impaired QoL (8, 9); however, there is little data regarding HIV individuals.

Like with any other chronic disease, the risk for malnutrition in HIV is high (10) and therefore it is fundamental to timely assess their nutritional status for the early detection of malnutrition, and to prevent morbidity and mortality. (11, 12) Although it is well established that improvements in nutritional status translate to QoL enhancement in chronic diseases such as cancer (13), the relationship between nutritional status and QoL is still unclear in HIV, due to a scarcity of studies on this topic, especially in the western world (7, 8, 14-16). In other continents other than Europe, some have suggested a good nutritional status to improve QoL in this population. (7) Lower anthropometric measurements have been correlated with a lower QoL. (14) Nutritional status could have a positive impact on QoL by assisting in symptom management (14), improving HAART absorption and tolerance, contributing to resistance against infection, and delaying the progression of HIV to Acquired Immunodeficiency Syndrome. (17) More studies are needed to understand the impact nutrition has on QoL in HIV patients, to achieve desired outcomes in the management of HIV and QoL.

OBJECTIVE

The aim of this study was to investigate the impact nutritional status has on QoL in a sample of HIV-infected adult patients. Socio-demographic and HIV clinical-related variables were also considered.

MATERIALS AND METHODS

Subjects

The sample, included outpatients followed at Lisbon central hospital's HIV appointment. Those previously identified from clinical records as having a recent HIV diagnosis were eligible for enrolment. On the day of the visit, they were asked if they were willing to participate in the study; they were given a brief explanation describing the purpose of the study and what it involved, and the right to refuse to participate. Eligible subjects included those (a) who had tested positive for HIV in the 14 months prior to the start of the study (i.e. between November 2014 and April 2016) (b) were followed at the hospital for the first time in 2015 or

2016, and (c) subjects who agreed to participate in the study. Exclusion criteria included (a) subjects under eighteen years of age, (b) pregnant women, (c) subjects who didn't respond to the WHOQOL-HIV-BREF questionnaire, (d) those who did not speak Portuguese or English.

Socio demographic and Clinical data

Socio demographic data collected included gender, age, race, level of education, employment status, marital/relationship status. Regarding clinical data: date of diagnosis, year of infection, mode of transmission, HAART regimen (yes/no), HIV single tablet regimen (yes/no), past opportunistic infections, current medication, medical history, current problems, current drug use (yes/no), and physical activity (yes/no). Subjects under HAART for one month or less were considered naïve to therapy.

Nutritional Status Assessment

Nutritional status was assessed by (a) anthropometry, following the recommendations of the International Society for the Advancement of Kineanthropometry (18) (b) bioelectrical impedance analysis and (c) dietary intake.

(a) Anthropometric measurements considered were weight, height, Triceps Skinfold (TSF), Waist Circumference (WC), hip circumference. Body mass index (BMI), arm muscle area (AMA), waist to hip ratio (W/H ratio) and percentage weight loss were calculated. To quantify unintentional recent weight loss (if this information was not available from clinical records), subjects were asked about their weight history in the previous month. Weight was measured to the nearest kg with patients wearing light clothes and on bare foot using a calibrated scale, height to the nearest millimetre using a stadiometer, skinfold to the nearest 0.2 millimetre using a Harpenden caliper, WC and hip circumference to the nearest millimetre using a non-elastic measurement tape. TSF was measured at the mid-point between the acromion and the tip of the olecranon, WC, between the lowest rib and the iliac crest, and hip circumference, at the level of the anterior superior iliac spine at the end of a normal expiration. Male and female subjects with a WC ≥94 cm and ≥80 cm, and a W/H ratio ≥0.90 cm or ≥0.85 cm, respectively, were considered at risk for metabolic complications. (19, 20) Frisancho's data (21) were used as references for TSF and AMA measurements. TSF and AMA were considered in terms of their (%) adequacy, obtained according to the following formula (22):
TSF or AMA adequacy (%) = TSF obtained (cm) or AMA calculated (mm) x *100 / 50th percentile of TSF or AMA*. values ≥110% were considered more than adequate measurements, 90-110%, adequate, and a measurement <90% was considered lower than adequate. Since Frisancho's data is derived from a Caucasian population, a second analysis, excluding black subjects was performed when these variables were used.

(b) Bioelectrical impedance analysis was performed using a single-frequency analyzer (OMNRON BF350) to assess body fat percentage, and visceral fat; cut-off points for both measurements were used to classify the data. (23, 24)

(c) To estimate dietary intake, a semi-quantitative Food Frequency Questionnaire (FFQ), validated for the Portuguese population, was used. (25) The intake of macronutrients and micronutrients were analysed continuously and in categories of intake to understand the adequacy of subjects' nutrient intake; this was done for protein, calcium, iron, water soluble and fat-soluble vitamins. The following formula was used to calculate nutritional adequacy: % Adequacy = (Nutrient intake*100)/Recommended Daily Allowance (RDA). Two designations were used to describe the adequacy of intake: inadequate (<90% of requirements), and adequate/more than adequate (≥90% of requirements). (26, 27) This was done for protein, calcium, iron, and water-soluble vitamins, and the fat-soluble vitamins. Adequate intakes for protein were ≥1.2g/kg/day. (28) Adequate energy intakes were those within 25-35kcal/kg/day and inadequate, those above or below the 25-35kcal/kg range. (29)

Laboratory Data

Only results from blood samples that had been collected in the 30-day period prior to the assessment were considered. The following were collected: blood pressure, lymphocyte CD4 and CD8 count, viral load, haemoglobin, lipid profile, fasting glucose concentration, liver and kidney function tests, total proteins, albumin, c-reactive protein (CRP), blood serum concentrations of ions. CD4 count was divided into three categories, according to Centres for Disease Control. (30)

QOL Assessment

The Portuguese version of the WHO Quality of Life Questionnaire (WHOQOL-HIV-BREF) was used to assess the QoL of the study population. (31) The psychometric properties of the questionnaire have been validated for its use in Portuguese people living with HIV. The instrument contains six domains to assess QoL: physical health, level of independence, psychological health, social relations, environmental health, and spirituality. Thirty-one items are used to construct the 6 domains. There is also a general facet (General QoL), composed of two items, which examines QoL and health, in general (Q1 and Q2). All items are rated on a 5-point likert scale; scores are scaled in a positive direction, where higher scores suggest a better QoL. Mean score of items in each domain were used to obtain the domain score. After computed, domain scores were transformed to a 0-100 scale to allow for comparison with the WHOQOL-100 instrument. The instrument's Users' Manual was used to score, code, check and clean data.

Statistical Analysis

The data collected was processed and analysed using the IBM® SPSS® software, version 21. The internal consistency of the QoL instrument was measured with Cronbach's alpha. Descriptive statistics such as mean and standard deviation were used to summarize continuous data, and frequencies and proportions were used to summarize categorical variables. Parametric and non-parametric tests were used depending on variable distribution. Student t-test and Analysis of Variance (ANOVA) were used to investigate differences in mean QoL scores of dichotomous variables, and variables with more than 2 groups, respectively. The level of significance was set at $p<0.05$ in this study. Relevant variables that were found to be significantly related ($p<0.05$) with QoL in bivariate analysis, were subjected into multivariable analysis using a stepwise forward model building strategy to understand the effect that each significant independent variable had on the association nutrition-QoL, with other independent variables remaining constant. Outliers were excluded in multivariate analysis.

Ethical and Deontological considerations

The hospital's ethics' committee approved the study, and the permission to gather information from patients registered at the hospital, was obtained for a period of 12 weeks (between January and March, 2016) by the director of the infectious diseases department. The study followed the hospital's protocols with regard to access to medical records.

RESULTS

Study Sample

There were 191 patients who visited the outpatient clinic for the first time in 2015; 20 were excluded before screening because they were identified in advance as having tested positive for HIV before November 2014, elsewhere. Considering the remaining 171 potential eligible subjects in a year, a minimum of 43 subjects would need to be included to be representative of one trimester (12 weeks). During the 12-week study period, 53 subjects were screened; one subject was excluded because he was deaf, and another refused to participate due to time constraint. Fifty-one subjects met the inclusion criteria for the study and were enrolled.

Study sample characteristics: Socio demographic & Clinical data

Patient characteristics are illustrated in Table 1. The majority of subjects were males (74.5%), Caucasian (74.5%), not married or in a relationship, and employed (60.8%). Mean age was 41.1 years (±14.2; range 21-74). The proportion of patients who did not conclude secondary school was similar to those with a higher education level (41.2% and 37.3%, respectively). About one third of patients reported to be physically active (31.4%), and a similar proportion were current smokers (29.4%), and had been hospitalised in the year prior to the assessment (31.4%). Eleven subjects (21%) were experiencing a current health problem; four had cancer (prostate, endometrial, Burkitt's lymphoma, Kaposi sarcoma), and the others ranged from heart

failure, respiratory infections, rheumatic disease, osteomyelitis. More than half of patients had a past medical history (60%), such as diabetes, hypertension, chronic hepatic disease, asthma, syphilis, uveitis (opportunistic infections not included here). Almost half the patients (45%) were taking some kind of medication besides HAART such as sleeping pills, antidepressants, antibiotics, oral antidiabetic medication, antihypertensive drugs, or oral chemotherapy.

The mean CD4 and CD8 cell count was 522 cells/mm^3 (±351; range 11-1899) and 1068.6 cells/mm^3 (±638; range 113.5-2942.0), respectively. The majority of patients (86%) had an inverted CD4:CD8 ratio (<1). More than half had detectable viral loads (54%), and were under HAART (58%). The mean duration (in months) since HAART initiation was 7.8 months (±4.5; range 1-19), and 6 patients (11.8%) were on a single tablet regimen. HIV diagnosis took place in 2015 for most patients (68.6%). The majority (47%) were either infected in the year prior to assessment (2015) or they didn't know when it happened (39.2%), and the remaining, were infected in 2014 (13.7%). Ten patients (20%) had experienced an opportunistic infection in the past. In one third of patients (31.4%) HIV transmission occurred in men who had sex with men (MSM).

Nutritional Status Assessment

Subjects' anthropometric, body composition and nutrient intake data are illustrated in Table 2. One patient was underweight, according to BMI, most were normal weight (60.8%), and more than one third (37.3%) were overweight or obese. TSF and AMA were lower than adequate for 66.7%, and for 33.3% of the sample, respectively. According to WC and W/H ratio, 20 (39.2%) and 16 (31.4%) subjects had a high metabolic risk, respectively. A similar proportion of patients had a healthy and a high body fat mass (41.2%, 47.1%, respectively), and the visceral fat of four subjects (8%) was above the ≥12% reference cut-off value. (22) Only 25.5% of patients had adequate energy intakes (25-35kcal/kg). Protein intakes were adequate for most subjects (82.4%). Folate and biotin intakes were inadequate for more than half of the study sample and one quarter had inadequate pantothenic acid intakes. Less than 5 individuals (9.8%) had an inadequate intake of one or more of the remaining water-soluble vitamins (data not reported). Over 80% of the sample had inadequate intakes of vitamins D, E, and K. Vitamin A was the exception, where intakes were adequate for all, but 2 individuals.

Laboratory Data

Data was not available for every biomarker of each of the 51 patients. Total cholesterol, LDL-c HDL-c, and triglycerides were measured in 31-35 individuals; 25.0% had levels above the reference interval for total cholesterol, 78.8% were not within the reference range for HDL-c, only one individual had and abnormal LDL-c, 17.6% had elevated triglycerides. Hepatic function indicators, ALT, AST, GGT, and bilirubin levels were measured in 39, 47, 31, and 34 subjects, respectively; less than half of subjects had inadequate levels of any one of these biomarkers. Haemoglobin was within a healthy range for 26 (63%) individuals out of a total measured of 41. From the 43 values available for blood glucose, eight subjects (18.6%) had elevated levels.

Other biomarkers such as total proteins, albumin, kidney function, were not considered relevant since they were only available for a small number of individuals (<14).

Quality of Life

The internal consistency of the WHOQOL-HIV-BREF using Cronbach's alpha coefficient, was > 0.7 for all 6 domains, and for General QoL, it was 0.6. Table 3 illustrates patient's mean QoL scores for each domain and for general QoL. When considering the mean scores of all subjects, the lowest scores observed were those for general QoL (61.3±18.8), followed by physical health (63.2 ±21.5). The highest scores were observed for the level of independence (72.1±20.2).

Socio-demographic & Clinical data

Table 3 illustrates results from bivariate analysis of socio-demographic, clinical and nutritional data with QoL. Gender, education level, infection route, current health problem, and physical activity were shown to be significantly different across three or more QoL dimensions. The significant differences in education level were only between <secondary and tertiary after multiple comparison tests. QoL scores were significantly different across the different employment, race, medical history, transmission mode and CD4 lymphocyte categories in one or two dimensions. The significant differences observed in CD4 lymphocyte count were between the lowest and highest class. Age was negatively and significantly correlated to the level of independence (r=-0.3, p=0.028. No other significant differences in QoL scores across the different socio-demographic (marital status/relationship), or clinical variables (hospitalised in the last year, HAART status, duration of infection, duration of HAART, viral load, history of opportunistic infections, HAART single-tab regimen, CD4/CD8 ratio), were observed.

Nutritional status and QoL

The QoL of patients, according to nutritional status is illustrated in Table 3. There was only one subject who was underweight, and he was excluded when testing BMI. Since there were few subjects in the remaining BMI classes, only two classes were compared (normal weight and overweight/obesity). No significant differences in QoL scores were observed across the different categories of BMI, %TSF adequacy, W/H ratio, % body fat, and protein intake. As a continuous variable, % body fat was inversely associated with general QoL (r=-0.4, p=0.010), psychological health (r=-0.3, p=0.043), and borderline significantly associated with level of independence (r=-0.3, p=0.064). Significant differences in QoL scores were found across the different categories of waist circumference, %AMA adequacy, unintentional weight loss, and energy intake (Table 3). The mean psychological domain score was significantly different across the three different AMA classes (lower than adequate, adequate, more than adequate), but a second analysis, comparing the lower and higher AMA class, showed that the difference remained significant in the psychological domain, and in addition, it became significant in the social domain, where higher QoL scores were observed in the lower (lower than adequate) AMA class. Excluding black subjects from analysis did not affect the results of the

variables using reference percentiles for Caucasians. Besides the significant differences in scores observed across the different %AMA categories for psychological health and social relationships, as a continuous variable, %AMA was correlated with general QoL (r=0.3, p=0.033), as well as to the same domains described previously (psychological: r=-0.4, p=0.010, social relationships: r=-0.3, p=0.042).

QoL scores across the different energy intake categories are shown in Table 3. The 13 subjects with adequate energy intakes (25-35kcal/kg) rated their general QoL significantly higher compared to subjects with inadequate intakes. Individuals consuming ≥adequate protein intakes, compared to those with inadequate intakes, did not differ significantly in QoL scores. Only 2 individuals had inadequate iron intakes and therefore results were not considered relevant (data not shown). Vitamin K and D intakes were not tested for the same reason. The correlations with other micronutrients were insignificant (data not show). Higher alcohol intakes were associated to significant lower scores in environmental health (r=-0.3, p=0.028).

Laboratory results and QoL

Haemoglobin level was significantly correlated to all but one domain; general QoL (r=0.4, p=0.013), physical (r=0.5, p<0.001), psychological (0.4, p=0.027), level of independence (r=0.5, p=0.001), social (r=0.4, p=0.011), environmental (r=0.4, p=0.028). CRP (only analysed 14 patients) correlated moderately with the level of independence (r=-0.5, p=0.157). AST correlated negatively and significantly with physical health (r=-0.4, p=0.023). The remaining biochemical biomarkers measured did not correlate significantly with QoL and were not reported.

Multivariate Analysis

To determine the strongest QoL predictors the variables that were significant in bivariate analysis were subjected into multivariate analysis. These included age, gender, race, employment status, education level, medication, medical history, current health problem, CD4 count, %AMA, weight loss that was unintentional, WC, energy intake, alcohol intake and haemoglobin. Table 4 illustrates the results of multivariate analysis. The regression models explained between 31.0% and 52.2% of the variance in the different domains. No significant predictor for the spiritual domain was identified. In general, many of the variables significantly associated with QoL in bivariate analysis, remained significant in multivariate analysis, with at least one domain (exception: CD4 lymphocyte count and alcohol intake). After adjusting for the different confounders, inadequate energy intakes, an unhealthy WC, a ≥adequate AMA (versus lower than adequate), and unintentional weight loss, were found to be significantly associated with lower QoL scores. WC and energy intake, were the strongest determinants of general QoL. A lower %AMA adequacy and weight loss were the strongest determinants of psychological health. Whilst in bivariate analysis energy intake and weight loss were only related to general QoL and psychological health, respectively (Table 3), in this model, energy was further associated with level of independence (p=0.025), and weight loss, associated with the environment (p=0.004). Despite the various significant observations between physical activity, and

haemaglobin with most of the QoL dimensions in bivariate analysis, physical activity only predicted QoL in social relationships, whilst haemoglobin predicted QoL in social relationships and physical health ($p<0.05$) in multivariate analysis. Education and current health problem significantly influenced most of the QoL domains.

DISCUSSION

As far as our knowledge, this is the first study investigating the relationship between nutritional status and QoL in HIV-infected individuals, in Europe. QoL is affected by culture and level of economic development, which explains why developing countries report poorer QoL outcomes compared to developed countries; as a result, extrapolation of other studies findings must be carefully made. (32) Although the relationship between HIV and malnutrition has been studied (33, 34), few have looked at QoL as a consequence of the synergy between these two. (7, 8, 14-16) This study involved 51 subjects with a relatively recent HIV diagnosis; the majority were Caucasian, male, employed, and had finished secondary school. More than half were under HAART, of which more than one third had detectable viral loads. Compared to the QoL of participants enrolled in the validation of the Portuguese WHOQOL-HIV-BREF, with the exception of physical health, the scores of all QoL dimensions were higher in this sample, independent of disease stage. (31) Our study only involves patients with a recent HIV diagnosis, which probably explains the better QoL outcomes compared to the former study, since patients with an advanced stage of the disease present a lower QoL. (35) In line with most studies reporting gender inequalities in QoL in this population (36, 37), men reported higher scores in QoL compared to women across most dimensions, although in multivariate analysis gender only associated with environmental health. Consistent with previous research (38, 39, 35), the present findings indicate that subjects with higher education have an enhanced QoL across all domains, compared to those who did not complete secondary education. A higher education, and income have been associated to better coping strategies (18, 35), which may explain the difference in scores. Similar to previous works (40, 41), this study did not detect significant differences in QoL among subjects who were married/in a relationship, compared to single subjects. In this study MSM were significantly more satisfied with their environment compared to heterosexuals; this could be related to the social support groups they are part of, which have shown to be inversely related to rates of depression (42). Patients who were currently ill reported significant lower scores in various domains, which is consistent with most QoL-related works in HIV subjects (43, 44). Although evidence is conflicting, significant differences among QoL domains with stages of HIV infection have been reported (40, 15, 35); similarly, in this study, level of independence was significantly superior in subjects with CD4 counts >500 compared to those with <200. Despite the absence of significance, patients under HAART had worst QoL outcomes compared to naïve-treatment patients. This finding is in agreement with results of a cross-sectional study (35), where lower scores in all domains were observed in patients in the first year of HAART, compared to naïve patients; the QoL of those who were being treated for more than one year however, was better than for those in the first year of treatment, and this has been documented in other studies too. (15) Again, despite the absence of significance, those under

HAART for a longer time had higher QoL scores across all domains compared to subjects under treatment for a shorter period. This could be related to the side effects of treatment experienced at the start of HAART (15). Patients switching to a HAART single-pill fixed dose regimen in an Italian trial, experienced none significant improvements in QoL (43); this can be paralleled with the findings in the present investigation which found an improved but none significant QoL in these subjects. The present study reports improved QoL scores for patients who were physically active compared to those who weren't, in most dimensions Physical activity and nutrition counselling contributed to significant improvements in QoL, nutritional status and clinical parameters in a trial (45) and in another study moderate physical activity was associated with physical, psychological and immunological benefits. (46)

This study did not find significant variations in QoL with BMI class, in contrast to other works involving HIV patients (7, 14, 16), However, only two classes of BMI were compared, due to the absence of underweight and obese class I-III subjects enrolled in the study. The poor psychological outcome observed in patients with unintentional weight loss in this study is in agreement with former studies that found the same relationship. (35) These findings may relate to the fact that weight loss is an important marker of disease progression and symptom status, but also to the known significant impact alterations in body image have on psychosocial wellbeing and QoL. (47)

In this study a moderate-high WC was a major contributor to a worst outcome in general QoL; this is strongly associated to a poor QoL. (48) Exercise has been shown to reduce WC in HIV-patients (49); therefore there may be a role for exercise as a potential strategy to improve nutritional status and consequently QoL. (45, 49) In contrast to the limited available evidence on AMA and QoL suggesting a positive relationship between the two (50), an inverse relationship was found in the present study, where the lowest QoL scores were observed in subjects with ≥ adequate AMA measurements (though similar scores were observed for lower than adequate and adequate categories). Heymsfield and colleagues (51) showed that the equation for calculating AMA, overestimated it by 25%; this could mean that part of the subjects who were found to exceed AMA adequacy (47.1%) in this study, could actually have adequate measurements, and this could have lead to the confusing interpretation of results. in this study lower QoL scores, particularly in general QoL and psychological health were observed in subjects with higher body fat percentages,. the association between body fat percentage and QoL in this population has not been well documented to date, but higher percentages of body fat were associated to lower QoL scores observed in other chronic disease patients (52).

When weight maintenance is the goal, energy requirements should match energy expenditure, however, the latter is poorly understood in chronic disease such as HIV (53). In this study, intakes ranging 25-35kcal/day were considered normal and subjects within this range of intake had better QoL outcomes for general QoL.

Biochemical markers did not play a significant role in predicting QoL in this study with the exception of haemoglobin. The strong correlations found are consistent with previous findings (54) where improvements in hemoglobin translated into significant improvements in QoL.

Deterioration in nutritional status, and the associated changes in muscle, immune, and cognitive function observed in other populations (53, 56) probably explain the decline in physical, mental, and environmental performance observed in this work and others investigating nutrition and QoL. Similar to the present work which reports nutritional status to explain over one third of the variance in QoL, regression analysis in other works with chronically ill patients, determined that >25% of the variation change in QoL was explained by changes in nutritional status. (57, 58) Correcting the energy density of the diet, becoming physically active, achieving a healthy body composition, and preventing unintentional weight loss could lead to improvements in QoL, according to the findings reported in this study.

STRENGHTS AND LIMITATIONS

Despite the small number of individuals enrolled in this study, all nutritional parameters associated with QoL in bivariate analysis remained significant in multivariate analysis, implying that different aspects of nutritional status are likely to have a reasonable impact on different QoL dimensions. Due to the heterogeneous characteristics of HIV patients, this study only focussed on patients with a recent HIV diagnosis to prevent further confounding of the data. This means that findings should carefully be extrapolated to the different stages of HIV infection.

Although the use of a FFQ relies on long-term memory and doesn't take into account the intake of foods from different ethnic/racial groups, a population validated FFQ was used in this work; other methods are unable to describe the usual diet, or they are very consuming.

Although the occurrence of physical activity was recorded, details on the nature of the exercise performed could have helped understand the type of exercise necessary to achieve beneficial outcomes in QoL.

Accurate individual nutritional requirements are dependent on stage of infection, HAART status, nutritional status, HIV-related symptoms, and many others. Equations to calculate energy requirements were not used since activity factors were not recorded. By establishing a large range of adequate energy intake (25-35kcal/kg), or a minimum adequate intake for protein (1.2g/kg), with the intention to cover the requirements of all individuals, is not sufficiently accurate to determine how far requirements are being met.

CONCLUSION

This study found worst QoL outcomes with inadequate energy intakes, presence of unintentional weight loss, and a moderate-high waist circumference. QoL was higher in subjects undergoing physical activity. Despite clinical and socio-demographic patient characteristics having shown to be significant predictors of QoL in this population, with advances in HIV treatment, and prolonged survival times, finding strategies to maximise QoL such as integrating nutrition advice and exercise into HIV-treatment plans, could serve as simple, cost-effective tools with the potential to improve or prevent the occurrence of events that have been

shown to deteriorate QoL. More studies involving on-going nutritional, and QoL assessment in HIV patients are required to understand the long-term impact therapeutic, dietary and lifestyle modifications have on the different QoL dimensions in this chronically-ill population.

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TABLES

Table 1 Socio demographic and clinical data

Socio demographic/Clinical Variable	N (%)
Gender	
Male	38 (74,5)
Female	13 (25.5)
Race	
Caucasian	38 (74.5)
Black	13 (25.5)
Literacy	
< Secondary	21 (41.2)
Secondary	6 (11.8)
Tertiary	19 (37.3)
Marital status	
Single	31 (60.8)
Married/In a relationship	18 (35.3)
Physical Activity	
Yes	16 (31.4)
No	35 (68.6)
Employment	
Working	31 (60.8)
Not working	20 (39.2)
Current Problem	
Yes	11 (21.6)
No	40 (78.4)
Hospitalised in the last year	
Yes	16 (31.4)
No	35 (68.6)
Medical History	
Yes	31 (60.8)
No	20 (39.2)
Other Medication	
Yes	23 (45.1)
No	28 (54.9)
CD4 Count	
<350	17 (33.3)
>350	34 (66.7)
CD4/CD8 Ratio (mean)	
>1	7 (13.7)
<1	44 (86.3)
Viral load	
Detectable	28 (54.9)
Undetectable	22 (43.1)
Opportunistic infection	
Yes	10 (19.6)
No	41 (80.4)
HIV Year Diagnosis	
2014	10 (19.6)
2015	35 (68.6)
2016	5 (9.8)
Infection route	
Heterosexual	35 (68.6)
MSM	16 (31.4)
HAART	
Yes	30 (58.8)
Naive	21 (41.2)
Single tablet HAART regimen	
Yes	6 (11.8)
No	24 (47.1)

Table 2: Nutritional status of study sample

Nutritional Parameter	N (%)
BMI (kg/m^2)	
Normal weight	31 (60.8)
Overweight/Obese	19 (37.3)
Waist Circumference (cm)	
Risk	20 (39.2)
No risk	29 (56.9)
W:H ratio	
Risk	16 (31.4)
No risk	32 (62.7)
% Adeq TSF thickness	
Lower than adequate	34 (66.7)
Adequate	6 (11.8)
$\geq$ Adequate	11 (21.6)
% Adeq AMA	
Lower than adequate	17 (33.3)
Adequate	10 (19.6)
$\geq$ Adequate	24 (47.1)
Fat mass (%)	
Under fat	5 (9.8)
Healthy	21 (41.2)
Over fat	24 (47.1)
Visceral Fat (%)	
>12%	4 (7.8)
<12%	45 (88.2)
Weight Loss $\geq$ 1kg	
Yes	14 (26.9)
No	21 (40.4)
Energy (kcal)	
Inadequate	38 (74.5)
Adequate (25-35kcal/kg)	13 (25.5)
Protein (g)	
Inadequate	9 (17.6)
$\geq$ Adequate	42 (82.4)
Folate (μg)	
Inadequate	16 (31.4)
$\geq$ Adequate	35 (68.6)
Vitamin A Tot (μg)	
Inadequate	2 (3.8%)
$\geq$ Adequate	49 (94.2)
Vitamin D (μg)	
Inadequate	51 (100)
$\geq$ Adequate	0 (0)
Vitamin E (mg)	
Inadequate	44 (84.6)
$\geq$ Adequate	7 (15,4)
Vitamin K (μg)	
Inadequate	50 (98.1)
$\geq$ Adequate	1 (1.9)

Table 3 Mean QoL scores by socio demographic, clinical and nutritional status

		Mean QoL domain score (SD)						
		General QoL	**Physical health**	**Psychological health**	**Level of Independence**	**Social Relationships**	**Environment**	**Spirituality**
Mean QoL								
		61.3 (18.8)	63.2 (21.5)	69.2 (18.4)	72.1 (20.2)	67.6 (19.3)	69.1(16.8)	66.3(23.7)
Gender								
	Female	49.0 (16.5)**	54.2 (19.3)**	60.8 (20.9)	61.4 (22.7)*	56.9 (18.0)*	58.9 (11.8)*	58.7 (20.8)
	Male	65.4 (17.8)	66.1 (21.6)	71.9 (16.9)	75.6 (18.4)	70.8 (18.7)	72.5 (16.9)	69.3 (24.4)
Race								
	Caucasian	65.2 (17.7)*	65.1 (20.8)	70.3 (18.2)	73.6 (18.6)	69.4 (19.3)	71.3 (16.1)	66.7 (24.1)
	Other	50.0 (17.7)	57.3 (23.5)	65.8 (18.6)	66.9 (25.7)	61.3 (18.6)	62.5 (17.6)	65.4 (23.6)
Level of Education								
	<Secondary	53.0 (19.3)**	52.2 (19.2)**	64.5 (21.3)	60.2 (21.1)**	63.5 (23.1)	64.2 (16.2)*	63.4 (23.9)
	Secondary	58.3 (15.1)	65 (14.4)	65.0 (12.2)	79.2 (13.0)	64.1 (13.9)	58.1 (14.8)	73.4 (21.3)
	Tertiary	73.6 (14.1)	75 (17.9)	76.1 (15.8)	84.3 (9.6)	72.4 (15.9)	78.5 (16.5)	68.3 (25.7)
Physical Activity								
	Yes	71.9 (15.5)**	75.4 (16.8)**	74.1 (21.8)	81.6 (14.2)*	74.6 (20.8)	76.8 (17.0)*	80.0 (27.1)
	No	56.3 (18.3)	57.0 (21.2)	66.7 (16.2)	66.8 (21.3)	64.0 (17.7)	65.2 (15.4)	64.2 (22.2)
Employment								
	Working	64.6 (16.8)	66.7 (19.5)	71.6 (19.4)	77.0 (16.9)*	67.5 (21.7)	72.3 (16.4)	67.5 (21.6)
	Not working	56.3 (20.9)	58.1 (23.6)	65.8 (16.7)	64.0 (23.0)	67.7 (15.6)	64.5 (16.6)	64.7 (24.6)
Current Problem								
	Yes	48.9 (17.2)*	43.1 (19.1)*	59.5 (21.1)*	49.3 (21.8)*	56.9 (17.0)*	58.5 (14.7)*	55.7 (17.8)
	No	64.7 (17.9)	69.0 (18.6)	72.0 (16.8)	77.8 (15.5)	70.7 (19.0)	72.2 (16.2)	69.6 (24.6)
Medical History								
	Yes	58.5 (18.9)	57.1 (22.1)*	66.9 (20.1)	66.7 (22.3)*	66.7 (19.5)	67.3 (17.9)	63.3 (23.8)
	No	65.8 (18.1)	74.3 (15.6)	73.2 (14.6)	80.9 (12.4)	69.1 (19.4)	72.2 (14.4)	71.9 (23.4)
Transmission mode								
	Heterosexual	58.2 (17.9)	62.1 (21.0)	66.5 (18.9)	69.2(20.2)	64.6(19.8)	65.4 (16.6)*	62.5(62.5)
	MSM	68.3 (19.4)	65.6 (23.2)	75.7 (15.9)	78.6 (19.4)	74.1 (17.0)	77.9 (13.9)	77.1 (77.1)
CD4 Count								
	≥500	63.0 (17.1)	68.5 (20.0)	70.5 (17.9)	78.4 (15.0)*	65.3 (19.5)	70.0 (15.8)	64.5 (24.3)
	200-499	59.4 (19.1)	57.0 (21.8)	64.7 (16.2)	67.2 (19.7)	68.4 (19.0)	69.9 (15.9)	65.8 (24.0)
	<200	58.3 (24.2)	59.1 (23.8)	71.7 (23.5)	57.3 (28.6)	70.5 (22.2)	62.5 (19.8)	68.0 (23.0)
Waist Circumference								
	Risk	51.3 (18.6)*	58.5 (22.2)	64.1 (20.4)	66.9 (23.4)	62.9 (22.2)	65.6 (17.5)	61.4 (25.6)
	No risk	67.2 (16.8)	66.8 (20.7)	72.4 (17.4)	75.9 (17.7)	70.9 (17.7)	71.2 (16.8)	69.9 (23.2)
% Adeq AMA								
	Lower than adequate	67.6 (15.3)	64.7 (19.4)	78.2 (10.4)*	76.3 (14.3)	74.2 (15.0)*	73.2 (15.5)	69.5 (21.5)
	Adequate	62.5 (13.2)	65.0 (22.7)	72.0 (14.8)	76.3 (18.4)	71.9 (14.5)	73.1 (16.2)	69.5 (23.3)
	≥Adequate	56.0 (21.9)	61.0 (23.4)	60.5 (21.4)	67.3 (23.9)	60.2 (22.5)	63.8 (17.3)	62.5 (26.1)
Weight loss ≥ 1kg								
	Yes	57.1 (22.3)	54.5 (26.1)	60.7 (23.1)*	64.9 (28.5)	65.9 (22.0)	62.7 (22.0)	62.9 (28.1)
	No	63.8 (20.6)	69.8 (19.0)	78.3 (16.2)	75.0 (15.8)	70.6 (20.8)	72.4 (15.5)	71.9 (23.6)
% Adequacy Energy intake								
	Not adequate	57.8 (17.0)*	61.4 (19.9)	67.9 (18.3)	70.1 (19.0)	66.2 (19.9)	67.4 (17.7)	63.8 (24.9)
	Adequate	71.2 (20.7)	67.8 (25.7)	72.7 (19.0)	76.9 (22.9)	71.4 (17.7)	73.6 (13.4)	74.4 (18.0)

*Significant at 95% CI, P value <0.05

**Significant 99% CI, at P value <0.01

Only variables with significant differences in one or more QoL dimensions are presented

Table 4 Multivariate analyses: Linear regression models to identify QoL predictors

Independent predictors for each dependent variable	Beta	R^2_a	F	p-value
General QoL		52.2%		
WC	-13.629		12.242	0.001
Energy	13.158		9.699	0.003
Education	-11.998		9.141	0.004
Current problem	-8.367		3.046	0.088
Physical health				
Education	-12.695	31.0%	6.331	0.016
Hb	3.924		5.811	0.020
Current problem	-12.949		4.240	0.046
Medical history	-10.066		4.068	0.050
Psychological health		32.2%		
AMA	13.972		11.119	0.002
Weight loss	-11.739		5.652	0.022
Education	-9.267		4.687	0.036
Level of Independence		57.5%		
Education	-13.943		12.838	0.001
Current problem	-16.028		9.240	0.004
Medication	-10.542		7.191	0.011
Energy	9.707		5.497	0.025
Social Relationships		55.5%		
Physical activity	12.899		10.220	0.003
Hb	3.899		9.601	0.004
Age	-0.248		4.404	0.045
Environment		50.9%		
Gender	-11.236		10.304	0.003
Weight loss	-12.918		9.677	0.004
Education	-9.598		8.119	0.007
Spirituality	No significant predictor identified			