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PROGRAMA DE PÓS-GRADUAÇÃO:
CIÊNCIAS EM GASTROENTEROLOGIA E HEPATOLOGIA

CAMILA SAUERESSIG

UTILIZAÇÃO DE INSTRUMENTOS SIMPLES PARA INICIAR A AVALIAÇÃO DO ESTADO NUTRICIONAL DE PACIENTES COM CIRROSE: ELABORAÇÃO DE PONTOS DE CORTE

PORTO ALEGRE
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Orientadora: Profa. Dra. Valesca Dall'Alba

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Esta Tese de Doutorado segue o formato proposto pelo Programa de Pós-graduação: Ciências em Gastroenterologia e Hepatologia da Universidade Federal do Rio Grande do Sul, apresentada na forma de breve revisão de literatura, seguido de três manuscritos principais confeccionados sobre o tema da tese (1 artigo a ser considerado e avaliado pela banca examinadora e 2 artigos já publicados), constituindo-se dos seguintes elementos textuais:

1. Introdução

2. Revisão bibliográfica

3. Justificativa

4. Objetivos

5. Artigos:

5.1 Artigo 1: Determining mid-arm muscle circumference cutoff points to assess muscle mass in malnourished patients with cirrhosis.

5.2 Artigo 2: Phase angle is an independent predictor of 6-month mortality in patients with decompensated cirrhosis: a prospective cohort study.

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5.4 Artigo 4: Food Intake Visual Scale - A practical tool for assessing the dietary intake of hospitalized patients with decompensated cirrhosis.

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SUMÁRIO

RESUMO

A cirrose é uma doença hepática crônica caracterizada pela presença de fibrose hepática difusa, cicatrização e formação de nódulos regenerativos, que levam à desestruturação do parênquima hepático. Além das complicações que caracterizam a descompensação da doença, como ascite, encefalopatia hepática (EH) e hemorragia digestiva, a cirrose é considerada uma condição de predisposição para o desenvolvimento de desnutrição e sarcopenia. Entretanto, a avaliação nutricional de pacientes com cirrose é considerada complexa devido a alterações importantes de composição corporal que estes pacientes apresentam. Neste sentido, este trabalho teve como objetivo principal avaliar a performance de instrumentos simples como marcadores do estado nutricional em pacientes com cirrose e sugerir pontos de corte para uso na prática clínica, bem como avaliar a associação entre os pontos de corte e mortalidade. Como objetivo secundário, propor uma ferramenta simples para avaliação da ingestão alimentar de pacientes com cirrose. Primeiramente, este estudo incluiu 100 pacientes adultos, de ambos os sexos, hospitalizados com cirrose descompensada de diferentes etiologias. A avaliação do risco nutricional foi realizada pela ferramenta *Royal Free Hospital – Nutritional Prioritizing Tool* (RFH-NPT). A avaliação nutricional compreendeu: índice de massa corporal (IMC), circunferência do braço (CB), dobra cutânea tricipital (DCT), circunferência muscular do braço (CMB), ângulo de fase (AF) e Avaliação Subjetiva Global (ASG). Os pontos de corte foram elaborados através de curva ROC e dos valores de sensibilidade e especificidade. A associação com a mortalidade foi avaliada através de Regressão de Cox, ajustada para variáveis como idade, sexo e gravidade da doença hepática. Na primeira etapa, foram sugeridos pontos de corte de AF (≤ 5.52º) e CB (mulheres ≤ 28 cm e homens ≤ 30cm). Os pontos de corte apresentaram boa acurácia como marcadores do estado nutricional, bem como associação com a mortalidade em pacientes com cirrose

descompensada. Sobre a ingestão alimentar, a Escala Visual de Ingestão Alimentar apresentou correlação forte com o registro alimentar. Na segunda etapa, foram incluídos dados de outros centros de referência do Brasil para a realização de um estudo multicêntrico, totalizando 1075 pacientes com cirrose. Nesta etapa foram sugeridos pontos de corte de CMB (mulheres = perda moderada ≤ 24,2 cm e perda grave ≤ 22,9 cm; homens = perda moderada ≤ 21,5 cm e perda grave ≤ 20.9 cm). Os pontos de corte para perda grave apresentaram associação com a mortalidade em pacientes com cirrose. As magnitudes de risco observadas nos estudos foram de HR: 3,44; 95%CI 1,51–7,84; p = 0,003, HR: 2,41, 95%CI 1,20 – 4,84; p = 0,014 e HR: 1,71, 95%CI: 1,24 – 2,35; p < 0,001 para AF, CB e CMB, respectivamente. Sendo assim, os pontos de corte podem ser utilizados na prática clínica diária como marcadores do estado nutricional de pacientes com cirrose e para identificar pacientes com maior risco de desfechos negativos. A Escala Visual de Ingestão Alimentar pode ser utilizada para avaliar a ingestão alimentar e as causas da redução da ingestão em pacientes com cirrose.

ABSTRACT

Cirrhosis is a chronic liver disease characterized by the presence of diffuse liver fibrosis, scarring, and formation of regenerative nodules, which lead to disruption of the liver parenchyma. In addition to the complications that characterize decompensation of the disease, such as ascites, hepatic encephalopathy (HE), and gastrointestinal bleeding, cirrhosis is considered a predisposing condition for the development of malnutrition and sarcopenia. However, the nutritional assessment of patients with cirrhosis is considered complex due to important changes in body composition that these patients present. In this sense, the main objective of this study was to evaluate the performance of simple instruments as markers of nutritional status in patients with cirrhosis and to suggest cutoff points for use in clinical practice, as well as to evaluate the association between cutoff points and mortality. As a secondary objective, to propose a simple tool to assess the food intake of patients with cirrhosis. First, this study included 100 adult patients, male and female, hospitalized with decompensated cirrhosis of different etiologies. Nutritional risk assessment was performed using the Royal Free Hospital – Nutritional Prioritizing Tool (RFH-NPT). The nutritional assessment comprised: body mass index (BMI), mid-arm circumference (MAC), tricipital skinfold (TSF), mid-arm muscle circumference (MAMC), phase angle (PA), and Subjective Global Assessment (SGA). The cutoff points were created using the ROC curve and sensitivity and specificity values. The association with mortality was assessed using Cox regression, adjusted for variables such as age, sex, and severity of liver disease. In the first stage, cutoff points for PA ($\leq 5.52^{\circ}$) and MAC (women $\leq$ 28 cm and men $\leq$ 30 cm) were suggested. The cutoff points showed good accuracy as markers of nutritional status, as well as association with mortality in patients with decompensated cirrhosis. Regarding food intake, the Food Intake Visual Scale showed a strong correlation with the food record. In the second stage, data from other

reference centers in Brazil were included to carry out a multicenter study, totaling 1075 patients with cirrhosis. At this stage, MAMC cutoff points were suggested (women = moderate loss ≤ 24.2 cm and severe loss ≤ 22.9 cm; men = moderate loss ≤ 21.5 cm and severe loss ≤ 20.9 cm). Cutoff points for severe loss were associated with mortality in patients with cirrhosis. The magnitudes of risk observed in the studies were HR: 3.44; 95%CI 1.51–7.84; $p = 0.003$, RH: 2.41, 95%CI 1.20 - 4.84; $p = 0.014$ and RH: 1.71, 95%CI: 1.24 - 2.35; $p < 0.001$ for PA, MAC, and MAMC, respectively. Therefore, cutoff points can be used in daily clinical practice as markers of the nutritional status of patients with cirrhosis and to identify patients at higher risk of negative outcomes. The Food Intake Visual Scale can be used to assess food intake and the causes of reduced intake in patients with cirrhosis.

LISTA DE ABREVIATURAS

AF – Ângulo de fase

ASG – Avaliação subjetiva global

BIA – Bioimpedância elétrica

CB – Circunferência do braço

CHC – Carcinoma hepatocelular

CMB – Circunferência muscular do braço

DCT – Dobra cutânea tricipital

DXA – Absortometria de raio-X de dupla energia

DHGNA – Doença hepática gordurosa não alcoólica

EH – Encefalopatia hepática

ESPEN – *European Society for Clinical Nutrition and Metabolism* (Sociedade Europeia de Nutrição Clínica e Metabolismo)

FAM – Força do aperto de mão

GLIM – *Global Leadership Initiative on Malnutrition* (Iniciativa de Liderança Global sobre Desnutrição)

HBV– Vírus da hepatite B

HCV – Vírus da hepatite C

IMC – Índice de massa corporal

INR – Razão de normatização internacional

MELD – *Model for End-stage Liver Disease* (Modelo para Doença Hepática Terminal)

NASH – *Non-alcoholic Steatohepatitis* (Esteato-hepatite não Alcóolica)

RFH-GA – *Royal Free Hospital – Global Assessment* (Royal Free Hospital – Avaliação Global)

RFH-NPT – *Royal Free Hospital – Nutritional Prioritizing Tool* (Royal Free Hospital – Ferramenta de Priorização Nutricional)

RM – Ressonância magnética

TC – Tomografia computadorizada

TIPS – *Transjugular Intrahepatic Portosystemic Shunt* (Derivação Portossistêmica Intra-Hepática Transjugular)

US – Ultrassonografia

1. INTRODUÇÃO

A cirrose é uma doença hepática crônica caracterizada pela presença de fibrose hepática difusa, cicatrização e formação de nódulos regenerativos, que levam à desestruturação do parênquima hepático.[1] As causas mais comuns de cirrose são hepatite crônica B e C, doença hepática relacionada ao álcool e esteato-hepatite não alcoólica (NASH).[2] Nesse sentido, é importante ressaltar que as principais causas da doença podem ser evitadas por meio de vacinação ou modificação do estilo de vida, e são prontamente tratáveis se diagnosticadas precocemente.[2]

A cirrose é tradicionalmente caracterizada por dois estágios clínicos distintos da doença. O estágio de doença compensada, geralmente assintomático, caracterizado por qualidade de vida preservada e maior sobrevida, e o estágio de doença descompensada, marcado pela ocorrência de complicações como ascite, encefalopatia hepática (EH), hemorragia digestiva e icterícia, com diminuição importante da sobrevida.[3] Além das complicações que caracterizam a descompensação da doença, a cirrose é considerada uma condição de predisposição para o desenvolvimento de desnutrição, fragilidade e sarcopenia.[4]

A desnutrição é considerada uma síndrome clínica, resultante de um desequilíbrio (por deficiência ou excesso) de nutrientes, causando efeitos adversos nos tecidos e na composição e/ou função corporal, associada a desfechos clínicos adversos.[4] Já a sarcopenia é caracterizada como uma desordem progressiva e generalizada do músculo esquelético, e envolve redução da força, massa e função muscular.[5] Ambas as condições estão associadas com o aumento de complicações e mortalidade em pacientes com cirrose.[6-11] Em relação a prevalência de desnutrição e sarcopenia em pacientes com cirrose, ambas as condições apresentam uma ampla variação entre os estudos, com números que vão de 5% a 99% e de 40% a 70%, respectivamente.[12,13]

Essa grande variação pode ser explicada pelos métodos de avaliação e pontos de corte utilizados, pelo perfil de pacientes estudados (cirrose compensada *versus* cirrose descompensada, pacientes ambulatoriais *versus* pacientes hospitalizados), bem como pela gravidade da doença.[12] Nesse sentido, é de extrema importância a seleção dos métodos utilizados para avaliação da composição corporal e do estado nutricional de acordo com o perfil dos pacientes, visto que pacientes com cirrose apresentam importantes alterações de composição corporal. Uma das complicações mais comum em pacientes com cirrose é a presença de ascite, caracterizada pelo acúmulo de líquido na cavidade abdominal.[14] Outra alteração comum que pacientes com cirrose apresentam é o edema de membros inferiores.[12] Ambas as condições podem limitar e dificultar a avaliação da composição corporal e do estado nutricional, podendo levar a resultados errôneos e condutas equivocadas.[15]

Nesse sentido, a avaliação do estado nutricional de pacientes com cirrose é de extrema importância, pois está diretamente associado a desfechos negativos. Considerando as especificidades que pacientes com cirrose apresentam, identificar métodos adequados e pontos de corte específicos para essa população, que sejam úteis na prática clínica diária, é relevante para auxiliar no diagnóstico nutricional e em intervenções nutricionais assertivas. Sendo assim, o presente estudo teve como objetivo desenvolver pontos de corte de instrumentos simples como marcadores do estado nutricional de pacientes com cirrose e testar a associação dos valores com a mortalidade, bem como propor uma ferramenta simples para avaliação da ingestão alimentar.

2. REVISÃO BIBLIOGRÁFICA

2.1 Cirrose

A cirrose é uma doença hepática crônica caracterizada pela presença de fibrose hepática difusa, cicatrização e formação de nódulos regenerativos, que levam à desestruturação do parênquima hepático.[1] Tradicionalmente, a cirrose é considerada uma condição irreversível e de estágio final da doença hepática. Entretanto, a questão da reversibilidade da cirrose, principalmente em estágios iniciais, é uma importante área de investigação, tendo sido demonstrado que a fibrose hepática é um processo dinâmico e possivelmente reversível após tratamento da causa da doença.[16]

As causas mais comuns de cirrose são hepatite crônica B e C, doença hepática relacionada ao álcool e NASH.[2] Nesse sentido, é importante ressaltar que as principais causas da doença podem ser evitadas por meio de vacinação ou modificação do estilo de vida, e são prontamente tratáveis se diagnosticadas precocemente.[2] A causa com aumento mais expressivo nos últimos anos é a cirrose por NASH, já sendo uma das principais indicações de transplante hepático em adultos nos Estados Unidos.[17]

Globalmente, o número de casos de cirrose aumentou de 1.075.12 milhões em 1990 para 1.602.43 milhões em 2019, apresentando uma tendência crescente desde 2005. Diferenças nas prevalências da doença são observadas conforme a distribuição geográfica dos fatores de risco. Nesse sentido, as altas prevalências de hepatites ainda são as principais causas de cirrose no leste e sudeste da Ásia, enquanto na América do Norte a DHGNA já aparece como a principal causa. Na América Latina e no Brasil, as hepatites e o uso abusivo de álcool ainda são as principais causas de cirrose. Ainda no Brasil, 265.180 óbitos foram identificados devido a cirrose no período de 2000 a 2012. Essa variação identificada nas principais etiologias da doença entre as diferentes regiões destaca a importância de desenvolver políticas e ações específicas considerando as características regionais.[18,19]

A cirrose é tradicionalmente caracterizada por dois estágios clínicos distintos da doença. O estágio de doença compensada, geralmente assintomático, caracterizado por qualidade de vida preservada e maior sobrevida, e o estágio de doença descompensada, marcado pela ocorrência de complicações como ascite, EH, hemorragia digestiva e icterícia, com diminuição importante da sobrevida. Embora a classificação da cirrose como compensada e descompensada seja clinicamente correta, essa classificação por vezes pode simplificar o curso clínico da doença, que abrange muitos subgrupos prognósticos diferentes.[3]

Na prática clínica, para classificação da gravidade da cirrose, são utilizados escores com diferentes critérios e pontuações. O escore de Child-Pugh foi proposto pela primeira vez em 1964 por Child e Turcotte para prever o risco operatório em pacientes submetidos à cirurgia de derivação portossistêmica devido a hemorragia digestiva. A primeira versão do escore incluiu ascite, EH, estado nutricional, bilirrubina total e albumina. Em 1973, Pugh e colaboradores modificaram a classificação, adicionando tempo de protrombina e removendo o estado nutricional. O escore de Child-Pugh é amplamente utilizado para avaliar a gravidade da disfunção hepática.[20-22]

Já o escore *Model for End-stage Liver Disease* (MELD) foi proposto inicialmente em 2000 para prever a sobrevida de pacientes submetidos a derivação intra-hepática portossistêmica transjugular (TIPS), incluindo a etiologia da cirrose. Já a versão atual incorporou apenas 3 variáveis objetivas: bilirrubina total, creatinina sérica e INR. Atualmente, o escore MELD tem sido utilizado para hierarquizar a prioridade dos candidatos ao transplante hepático.[22-24] Em 2005, foi proposta a adição do sódio sérico ao escore, parecendo ser um marcador precoce e sensível para detectar insuficiência renal e/ou disfunção circulatória em pacientes com cirrose avançada. O escore MELD-Na identificou um subgrupo de pacientes com maior risco de desfecho negativo de maneira mais eficiente do que o escore MELD inicialmente proposto, aumentando significativamente a eficácia do escore para prever a mortalidade na lista de espera.[25]

Além das complicações que caracterizam a descompensação da doença, a cirrose é considerada uma condição de predisposição para o desenvolvimento de desnutrição, fragilidade e sarcopenia.[4]

2.2 Cirrose e complicações do estado nutricional: desnutrição, fragilidade e sarcopenia

A desnutrição é considerada uma síndrome clínica, resultante de um desequilíbrio (por deficiência ou excesso) de nutrientes, causando efeitos adversos nos tecidos e na composição e/ou função corporal, associada a desfechos clínicos adversos.[4] A etiologia da desnutrição na cirrose é complexa e multifatorial, e seu desenvolvimento está associado com a diminuição da ingestão energética e proteica, má absorção e alteração no metabolismo de nutrientes, hipermetabolismo, inflamação, distúrbios hormonais e disbiose intestinal. Além disso, outros fatores externos como longos períodos de jejum (para exames ou procedimentos), dietas restritivas e/ou pouco palatáveis, e o consumo abusivo de álcool também exercem impacto negativo na desnutrição.[26]

A prevalência de desnutrição em pacientes com cirrose apresenta uma ampla variação entre os estudos, com números que vão de 5% a 99%. Essa grande variação pode ser explicada pelos métodos de avaliação utilizados, pelo perfil de pacientes estudados (cirrose compensada *versus* cirrose descompensada, pacientes ambulatoriais *versus* pacientes hospitalizados), bem como pela gravidade da doença.[12] A presença de desnutrição está associada à diminuição da qualidade de vida, ao aumento do risco de complicações, bem como a um aumento da morbidade e mortalidade.[6-8]

Outra condição que pode estar presente em pacientes com cirrose é a fragilidade, definida como um estado clínico de diminuição da reserva fisiológica e aumento da vulnerabilidade a estressores de saúde. Em pacientes com cirrose, predominantemente um componente da fragilidade é destacado: a fragilidade física, visto que manifestações clínicas de função contrátil muscular prejudicada são comumente relatadas por pacientes com cirrose, como diminuição da função física, diminuição do desempenho funcional e incapacidade.[4]

Já a sarcopenia é caracterizada como uma desordem progressiva e generalizada do músculo esquelético, e envolve redução da força, massa e função muscular.[5] Na cirrose, a sarcopenia parece ser uma condição secundária a doença hepática, e assim como na desnutrição, sua etiologia está associada a diferentes condições, resultando em um desequilíbrio entre a formação e a degradação muscular, embora as vias específicas envolvidas possam diferir entre os pacientes.[27] A prevalência de sarcopenia entre os pacientes com cirrose varia de 40% a 70%, e essa variação também ocorre de acordo com a população estudada e com os métodos de avaliação utilizados.[13] A presença de sarcopenia em pacientes com cirrose tem sido associada ao desenvolvimento de complicações e ao aumento da mortalidade.[9-11] É importante ressaltar que a sarcopenia é um processo diferente da baixa massa muscular por si só. Enquanto a sarcopenia é uma síndrome complexa que considera a baixa massa e função muscular e está diretamente relacionada com a desnutrição, a baixa massa muscular é um processo que pode ocorrer em qualquer idade, resultante de doenças crônicas ou agudas, com ou sem a presença de desnutrição.[28]

Nesse sentido, é de extrema importância a seleção dos métodos utilizados para avaliação da composição corporal e do estado nutricional de acordo com o perfil dos pacientes, visto que pacientes com cirrose apresentam importantes alterações de composição corporal. Uma das complicações mais comum em pacientes com cirrose é a presença de ascite, caracterizada pelo acúmulo de líquido na cavidade abdominal.[14] Outra alteração comum que pacientes com cirrose apresentam é o edema de membros inferiores.[12] Ambas as condições podem limitar e dificultar a avaliação da composição corporal e do estado nutricional, podendo levar a resultados errôneos e condutas equivocadas descritas no item 2.3[15]

2.3 Triagem de risco de desnutrição e avaliação do estado nutricional

Primeiramente, é importante que todos os indivíduos sejam submetidos à triagem nutricional inicial, que é o primeiro passo para avaliar o risco de desnutrição que um paciente apresenta. Deve ser um processo rápido e simples, que possa ser realizado por profissional de saúde não treinado ou mesmo pelo paciente, com razoável sensibilidade e especificidade.[29]

Na busca por ferramentas simples e confiáveis para avaliação do estado nutricional, em 2006 um grupo de pesquisadores do *Royal Free Hospital* de Londres definiu e validou um instrumento denominado *Royal Free Hospital – Global Assessment* (RFH-GA), que combina a avaliação subjetiva do estado nutricional com o índice de massa corporal (IMC), utilizando o peso seco/ajustado, circunferência muscular do braço (CMB) e estimativa de ingestão calórica diária. Entretanto, é considerado um instrumento demorado e que necessita de profissional treinado para realizar sua aplicação.[30] O mesmo grupo de pesquisadores desenvolveu em 2012 um instrumento para determinar o risco nutricional em pacientes com cirrose, o *Royal Free Hospital – Nutritional Prioritizing Tool* (RFH-NPT). O instrumento leva menos de 3 minutos para ser completado e pode ser utilizado por profissionais não especializados. O RFH-NPT classifica o risco nutricional como baixo (0 pontos), moderado (1 ponto) ou alto (2-7 pontos). Em primeiro lugar, a presença de hepatite alcoólica aguda ou alimentação através de sonda é avaliada, condições que classificam diretamente o paciente como de alto risco. O segundo passo distingue os pacientes com ou sem ascite ou edema. Então, a pontuação é computada e os pacientes atribuídos ao grupo de risco correspondente.[31,32] **(ANEXO 1)** Recentemente, a versão adaptada da ferramenta para a língua portuguesa foi publicada pelo nosso grupo de pesquisa e está disponível para uso.[33] **(ANEXO 2)**

Já a avaliação nutricional difere da triagem nutricional na profundidade das informações obtidas pelo indivíduo em relação às suas condições nutricionais, o que permitirá ao nutricionista formular um diagnóstico. Assim, ao avaliar nutricionalmente um paciente, será possível verificar se há desnutrição ou não e determinar a gravidade do quadro, planejar a intervenção mais adequada e monitorar a eficácia da conduta dietoterápica.[29]

Mesmo com a alta prevalência de sarcopenia e desnutrição, a avaliação da composição corporal e do estado nutricional de pacientes com cirrose ainda é um desafio na prática clínica. Devido a presença de sobrecarga hídrica, alguns métodos antropométricos como o IMC, circunferência da cintura (CC) e circunferência da panturrilha (CP), geralmente sofrem interferências pelo acúmulo de líquido e apresentam baixa acurácia em seus resultados.[15] Já outras medidas antropométricas como a circunferência do braço (CB), dobra cutânea tricipital (DCT) e a CMB, são realizadas na parte superior do corpo, em uma área menos propensa ao acúmulo de fluidos extravasculares em pacientes com cirrose.[34]

Outro método que pode sofrer interferência da sobrecarga hídrica é a bioimpedância elétrica (BIA). A BIA é considerada um método seguro, rápido, portátil e minimamente invasivo para estimar compartimentos corporais e a distribuição de fluidos nos espaços intra e extracelulares. Entretanto, alterações hídricas e eletrolíticas, como a presença de edema e/ou ascite, podem influenciar os resultados do exame. Nestas situações, é aconselhável o uso da BIA de forma segmentar para obtenção de melhores resultados. Nesse sentido, o ângulo de fase (AF), que é o ângulo que o vetor impedância forma com o vetor resistência, é indicado, visto que parece ser menos afetado pela hiper-hidratação.[35]

O AF reflete a vitalidade e integridade celular, onde valores normais indicam atividade celular preservada e uma função adequada da membrana celular, e valores reduzidos indicam diminuição do componente da matriz celular e apoptose da célula.[35,36] Estudos recentes têm demonstrado correlação entre baixos valores de AF e presença de sarcopenia em pacientes com cirrose.[37,38] Nesse sentido, os autores trazem que alterações que ocorrem em pacientes com sarcopenia, como o aumento dos níveis de miostatina, podem induzir o catabolismo muscular e a perda de massa magra por proteólise e apoptose celular, refletido nos baixos valores de AF.[37]

Atualmente, métodos de imagem são considerados padrão de referência para avaliação da composição corporal. Técnicas como tomografia computadorizada (TC), ressonância magnética (RM), ultrassonografia (US) e a absortometria de raios-x de dupla energia (DXA), têm sido amplamente utilizadas e estudadas em pesquisas. Entretanto, são métodos ainda pouco disponíveis na prática clínica diária, apresentam alto custo, necessidade de agendamento prévio e interpretação dos resultados por profissional capacitado, bem como a exposição à radiação ionizante nos casos de TC e DXA.[39,40]

Como método de avaliação global do estado nutricional e de diagnóstico de desnutrição, temos a Avaliação Subjetiva Global (ASG), que de acordo com a *American Association for the Study of Liver Diseases* (AASLD) e a *European Society for Clinical Nutrition and Metabolism* (ESPEN), é uma ferramenta adequada para identificar pacientes com cirrose com desnutrição.[12,41] A ASG inclui informações como história de perda de peso, alterações na ingestão alimentar, sintomas gastrointestinais, capacidade funcional, demanda metabólica relacionada à doença de base e exame físico (perda de gordura subcutânea, perda de massa muscular, presença de edema e ascite).[42] **(ANEXO 3)**

Estudos demonstraram que a presença de desnutrição avaliada através da ASG está relacionada com a diminuição da qualidade de vida em pacientes com cirrose, bem como está associada a desfechos clínicos negativos após a realização de transplante hepático, como maior tempo de internação hospitalar, infecção e mortalidade.[43,44] Por outro lado, a desnutrição avaliada através da ASG teve baixa concordância com a presença de sarcopenia e não foi associada com a mortalidade em pacientes com cirrose. Entretanto, os autores avaliaram somente a massa muscular através de TC, não sendo utilizado instrumento para avaliação da força e/ou função muscular. Nesse sentido, sabe-se que mesmo pacientes sem desnutrição podem apresentar baixa massa muscular por diversas causas, o que pode explicar a baixa concordância entre os métodos.[45]

Recentemente, a *Global Leadership Initiative on Malnutrition* (GLIM) surgiu como uma iniciativa das principais sociedades globais de nutrição clínica, com foco na construção de um consenso global em torno dos principais critérios diagnósticos para desnutrição em adultos em ambientes clínicos. A ferramenta é composta por critérios que se subdividem em fenotípicos (perda de peso não intencional, baixo IMC e redução da massa muscular) e etiológicos (redução da ingestão ou absorção de alimentos e inflamação ou carga da doença). Para o diagnóstico de desnutrição, ao menos um critério fenotípico e um critério etiológico devem ser preenchidos. Após o diagnóstico, a classificação da desnutrição em moderada ou grave baseia-se nos critérios fenotípicos.[46] A desnutrição avaliada pelo GLIM tem sido associada a ocorrência de desfechos negativos em pacientes com cirrose, como aumento do tempo de internação hospitalar e mortalidade.[47,48]

3. JUSTIFICATIVA

Pacientes com cirrose apresentam alterações importantes da composição corporal, bem como alterações de apetite e redução da ingestão alimentar. A sobrecarga hídrica, pela presença de edema e ascite, é uma condição comum neste grupo de pacientes. Desta forma, alterações importantes do estado nutricional e de composição corporal muitas vezes não são identificadas corretamente, levando a diagnósticos e condutas equivocadas. Nesse sentido, a identificação de instrumentos e pontos de corte que sejam simples e efetivos para uso em pacientes com cirrose, bem como a sugestão de uma ferramenta simples para avaliação da ingestão alimentar, é de extrema relevância para a prática clínica, proporcionando uma conduta dietoterápica mais assertiva e um melhor prognóstico ao paciente.

4. OBJETIVOS

4.1 Objetivo geral

Sugerir pontos de corte de instrumentos simples para avaliação inicial do estado nutricional e propor uma ferramenta para avaliação da ingestão alimentar de pacientes com cirrose.

4.2 Objetivos específicos

- Sugerir pontos de corte de AF, CB e CMB em pacientes com cirrose.
- Avaliar a associação entre os pontos de corte e a mortalidade em pacientes com cirrose.
- Propor uma ferramenta simples para avaliação da ingestão alimentar de pacientes com cirrose.

5. ARTIGOS

5.1 Artigo 1: Determining mid-arm muscle circumference cutoff points to assess muscle mass in malnourished patients with cirrhosis.

Artigo submetido ao periódico Clinical Nutrition (QUALIS A1)

5.2 Artigo 2 - Phase angle is an independent predictor of 6-month mortality in patients with decompensated cirrhosis: a prospective cohort study.

Artigo publicado no periódico Nutrition in Clinical Practice: Nutr Clin Pract. 2020 Dec;35(6):1061-1069. doi: 10.1002/ncp.10584. Epub 2020 Oct 15.

Abstract

Background: This study aimed to evaluate the nutritional status through phase angle (PA) and its association with mortality in patients with decompensated cirrhosis. **Methods*:*** A prospective cohort study was performed with hospitalized decompensated cirrhotic patients. Nutritional status was assessed through PA, bioelectrical impedance vector analysis (BIVA), and Subjective Global Assessment (SGA) within 72 hours of hospital admission. The best PA cut-off point for malnutrition diagnosis was determined by ROC curve analysis, considering SGA as the gold standard. Predictors of 6-month mortality were identified using Cox proportional hazards models. **Results:** This study included ninety-seven patients with a mean age of 60.1 ± 10.3 years and 63% were male. The median follow-up time of patients was 11.2 months (IQR, 2.4–21). Overall mortality was 58.8% (n = 57) and 6-month mortality was 35.1% (n = 34). Nutritional status according to BIVA indicated a risk for cachexia and normal hydration. Patients with values of PA ≤ 5.52º were considered malnourished. Malnourished patients according to PA (58.8%) had a higher risk of 6-month mortality (HR: 3.44; 95% CI 1.51–7.84; p = 0.003), and each increase of 1º in PA values was associated with a 53% reduction in 6-month mortality risk, even when adjusting for Child-Pugh and MELD scores, and hepatocellular carcinoma. **Conclusions:** The PA, a practical and clinically accessible tool, is an independent predictor of 6-month mortality in patients with decompensated cirrhosis. Therefore, PA may be useful to assess the nutritional status and identify patients at the highest risk of mortality in clinical practice.

Keywords:

Liver Cirrhosis; Malnutrition; Nutritional Assessment; Phase Angle; Bioelectrical Impedance Vector Analysis.

Introduction

Cirrhosis is a chronic liver disease characterized by an asymptomatic phase termed compensated cirrhosis, followed by a rapidly progressive phase marked by the development of complications such as ascites, variceal bleeding, and hepatic encephalopathy (HE), termed decompensated cirrhosis.[1] The survival of patients with decompensated cirrhosis is much lower than that of patients with compensated cirrhosis.[2] In addition, patients with decompensated cirrhosis not only have a significantly shorter survival but also a worse quality of life marked by the presence of overt signs of decompensation.[2]

Decompensated cirrhosis has a great impact on nutritional status due to changes in dietary intake, increased energy expenditure, absorption, and metabolism of nutrients.[3] Malnutrition is a common complication of cirrhosis and has been reported in more than 50% of patients with decompensated disease.[4] Furthermore, malnutrition appears to be associated with adverse clinical outcomes and mortality.[5,6,7,8] However, even with a high prevalence, malnutrition is often not diagnosed at admission to the hospital and may not be appropriately recognized in its earlier stages.[9] Hydric changes by the presence of edema and ascites are factors that can lead to underdiagnosed, reinforcing the importance of using appropriate assessment tools.[9]

The bioelectrical impedance analysis (BIA) is a method for assessing body composition trough an easy-to-use, non-invasive, and portable equipment. However, it presents some limitations in patients with fluid retention.[10] To avoid misleading results in subjects with abnormal hydration, several studies have suggested the use of raw BIA measurements, less influenced by overhydration, such as resistance (R), reactance (Xc), and phase angle (PA).[11,12,13]

The PA is calculated through the arc tangent formula (Xc/R) and reflects the cellular vitality and integrity, where normal values indicate preserved cellular activity, the integrity of cellular membranes, and water cellular distribution, reflecting nutritional status.[12,13,14] The bioelectrical impedance vector analysis (BIVA) is calculated from the R and Xc, adjusted for body height.[15] It provides graphic information regarding hydration status, body cell mass, and cell integrity, and complements an understanding of nutritional status obtained by PA.[16]

The Subjective Global Assessment (SGA) is a well-established and widely used bedside tool, and according to Tandon et al. and Guideline on Clinical Nutrition in Liver Disease, the tool is adequate for identifying cirrhotic patients with malnutrition.[9,17] ASPEN Clinical Guidelines also suggest the use of SGA for nutritional assessment of hospitalized adults.[18] However, it is important to consider the need for trained professionals to perform the tool.[17]

Previous studies in cirrhotic patients already highlighted the predictive value of PA on long-term mortality.[14,19] However, the association between PA and short-term mortality has not been widely investigated. Therefore, this study aimed to evaluate the nutritional risk and nutritional status through PA, BIVA, and SGA, and the association between PA and short-term mortality in patients with decompensated cirrhosis.

Methods

Study and sample design

This is a prospective cohort study was performed with patients ≥19 years of age with decompensated cirrhosis (ascites and/or HE, variceal bleeding, spontaneous bacterial peritonitis (SBP), hepatorenal syndrome (HRS), or Child-Pugh score B or C) who were hospitalized at the Gastroenterology and Hepatology Service in a Public Hospital, Brazil. Patients with bowel disease with malabsorption, HIV+, degenerative neurological diseases, with psychological and/or cognitive impairment that compromised participation, and pregnant women were not included. Baseline data were collected within 72 hours of admission, from April 2017 to April 2018, and then patients were followed until September 2019. All the patients hospitalized during this period who met the established eligibility criteria were invited to participate in the study.

Demographic, clinical, and laboratory assessment

Demographic and clinical data (age, etiology of cirrhosis, presence of complications, and hepatocellular carcinoma - HCC), biochemical markers (serum albumin, serum creatinine, total bilirubin, international normalized ratio (INR), insulin-like growth factor 1 (IGF1), total testosterone, magnesium), and length of hospital stay were collected from electronic medical records. The severity of liver disease was assessed by Child-Pugh score[20,21] and Model for End-Stage Liver Disease (MELD) score.[22] The Child-Pugh score has been widely used to assess the severity of liver dysfunction in the clinical setting and the MELD score has been widely used to rank the priority of liver transplantation candidates. Both scores have been widely used to predict the clinical outcomes of cirrhotic patients.[23] The ascites grade was assessed by physical examination performed by the physician or by ultrasound.

Nutritional Screening

Royal Free Hospital – Nutritional Prioritizing Tool (RFH-NPT)

The nutritional risk was assessed using the RFH-NPT, which is a validated tool for nutritional risk assessment in cirrhotic patients. First, the presence of acute alcoholic hepatitis or tube feeding is assessed. These conditions directly classify the patient as being at high risk. The second step distinguishes the patients with or without ascites or edema. Then the score is computed, and the patients classified into the corresponding risk group: low nutritional risk (0 points), moderate (1 point), or high (2-7 points).[24]

Nutritional Assessment

A detailed nutritional evaluation was performed by a trained registered dietitian in all patients and the following parameters were taken into consideration:

Weight, height, and body mass index (BMI)

The body weight was measured on a Filizola® digital upright scale, a Lider® portable electronic scale at the bedside, or Eleve® hoist scale for bedridden individuals. Estimated dry weight (kilograms) was calculated using current weight minus ascites weight based on severity (mild, 5%; moderate, 10%; severe, 15%). An additional 5% was subtracted if bilateral pedal edema was present.[25] Height was measured by a stadiometer fixed to the wall or recumbent height for bedridden individuals.[26] BMI was calculated as weight divided by height squared (kg/m2). Individuals were considered malnourished when they presented the following values: < 18.5 kg/m² for adults and < 22 kg/m² for the elderly.[27,28] The BMI classification proposed by Campillo et al.[29] for cirrhotic patients was also used with the following cut-off points for malnutrition: patients without ascites BMI ≤ 22 kg/m², moderate ascites ≤ 23 kg/m², and tense ascites ≤ 25 kg/m².

Phase Angle (PA)

BIA was performed in the morning and with fasting patients using portable tetrapolar equipment (Biodynamics® model 450, Biodynamics Corporation, Seattle, WA) with a current intensity of 800 μA and a single frequency of 50 kHz, enabling the measurement of the R, Xc, and PA, according to the ESPEN recommendations.[30] BIA was performed in duplicate and the mean values of R, Xc, and PA were used in statistical analyses.

Bioelectrical Impedance Vector Analysis (BIVA)

The components of the impedance vector, the R and the Xc, were normalized for the subject's height (R/H and Xc/H) and plotted on the RXc graph using the BIVA 2002 software.[31] BIVA was performed using the Italian reference population of Picolli et al.[31] because no data are available for Brazilians and this population was closest to the characteristics of our sample. Dehydration was considered when the vector was placed at the top and fluid overload at the bottom, both outside the 75% ellipses. Vectors in the right quadrants outside the 75% ellipse were considered as tissue depletion or cachexia, and those in the left quadrants, as an excess of body tissues (obesity or increase of muscle mass and fat). The vectors located within the 50 and 75% ellipses were considered as normal.[16]

Subjective Global Assessment (SGA)

The nutritional status diagnosis is obtained by combining the clinical and physical parameters such as weight changes, dietary intake, gastrointestinal symptoms, functional capacity, and physical examination, classifying the individuals as well-nourished (A), suspected malnutrition or moderately malnourished (B), or severely malnourished (C).[32] Individuals with a B or C classification were considered malnourished.

Survival

Mortality data were collected from electronic medical records or by telephone contact with patients at the end of the study.

Statistical Analysis

Quantitative variables were described by the mean and standard deviation or median and interquartile ranges (IQR, 25th-75th percentile), while the categorical variables were expressed as absolute frequency (n) and relative frequency (%). Chi-square or Exact Fisher test was performed to compare proportions. The Kolmogorov-Smirnov test evaluated the normality of the continuous variables. The Student T-test was used to compare variables with a parametric distribution and the Mann-Whitney test for the variables with a non-parametric distribution. The agreement level between RFH-NPT and

SGA was calculated using the Kappa test. The ROC (Receiver Operating Characteristic) curve was calculated to verify the area under the curve (AUC) and the accuracy of PA in predicting mortality and malnutrition, considering SGA as the gold standard. Based on the ROC curve analysis, the cut-off point with the best sensitivity and specificity was selected. Survival over time was estimated using Kaplan-Meier curves and compared using the Log-Rank test. Significant predictors of 6-month mortality were identified using multivariate Cox proportional hazard models and the results were reported as hazard ratios (HRs) and 95% confidence intervals (95%CIs). The statistical significance criterion was $p < 0.05$. The data analysis was performed with the SPSS 20.0 program (SPSS Inc., Chicago, IL, USA).

Ethical approval

This study was conducted following the Declaration of Helsinki and the local ethics committee approved the protocol. All the patients or persons responsible who accepted to participate signed the informed consent forms.

Results

General characteristics of the population

This study included ninety-seven patients with a mean age of 60.1 ± 10.3 years. Of these, 63% were men. The main etiology of cirrhosis was hepatitis C (HCV) (32%), followed by chronic alcohol consumption (23%), HCV plus chronic alcohol consumption (18%), nonalcoholic steatohepatitis (NASH) (13%), and others (14%, primary biliary cholangitis, hemochromatosis, autoimmune hepatitis, and cryptogenic cirrhosis). Concomitant HCC was present in 31% of patients. The presence of ascites was the most observed complication with a prevalence of 66%. Of these, 44% presented a moderate or severe grade. On physical examination, 49% presented some degree of edema. Ascites and edema were observed in 37% of patients. Other most prevalent complications were variceal bleeding in 24% and HE in 21%. High nutritional risk was observed in 77.3% of patients according to RFH-NPT and malnutrition was observed in 68% of patients according to SGA. A substantial agreement between the tools was found (Kappa = 0.666, $p < 0.001$). On the other hand, anthropometric parameters that use body weight almost exclusively, such as BMI and BMI cirrhosis, the frequency of malnutrition diagnosis was less, 11.3% and 16.5%, respectively **(Table 1)**.

Phase Angle (PA)

The mean value of PA in our population was 5.2º ± 1º. The mean value of men was 5.3º ± 0.9º and the mean value of women was 4.9º ± 1.2º. There was no statistical difference between men and women. Considering malnutrition by SGA as the gold standard, the AUC of PA was 0.796 (95% CI 0.700 – 0.891, $p < 0.001$). The PA cut-off point of ≤ 5.52º showed sensitivity and specificity of 73% and 75%, respectively **(Figure 1)**. We also performed two ROC curves divided by sex. However, there was no difference between the extracts. According to the cut-off point of PA ≤ 5.52º, 58.8% (n = 57) of patients had malnutrition. Malnourished patients had lower median values of total testosterone (0.5 vs 1.6 ng/mL, $p < 0.001$). Stratified by sex, malnourished men had lower median values of total testosterone compared to men without malnutrition (0.86 vs 2.68 ng/mL, $p = 0.001$, respectively), as women with and without malnutrition (0.25 vs 0.45 ng/mL, $p = 0.049$, respectively).

Bioelectrical Impedance Vector Analysis (BIVA)

A graphic representation of the mean BIVA vectors for the cirrhotic population, by sex, plotted against the reference population is shown in **Figure 2**. Both men and women fall within the lower right quadrant (cachexia). The mean vector of men was within the 50% tolerance ellipse (indicating normality) and the mean vector of women was on top of 75% tolerance ellipse (in the division for cachexia). About hydration status, men and women were in the lower half of the graphic. This can represent greater hydration status, but not fluid overload because they were within the 75% ellipses.

Mortality

Overall mortality was 58.8% (n = 57) and 6-month mortality was 35.1% (n = 34). All deaths were related directly to liver disease complications. The median follow-up time from hospitalization to death was 3.8 months (IQR, 1–8.4 months). The mean follow-up time of the remaining patients (41.2%, n = 40) after hospital discharge was 21.4 months ± 4.3 months. The 6-month mortality was significantly higher in patients with higher Child-Pugh score, patients with HCC, and malnourished patients according to SGA and PA, as shown in Table 1.

Phase Angle and Mortality

In the analysis of survival by Kaplan–Meier curves, patients with PA ≤ 5.52° were significantly more likely to die in 6-months **(Figure 3)**. The 30-days, 3-month, and 6-month probabilities of survival were 90%, 82%, and 80% in not malnourished patients, compared to 80%, 65%, and 54% in malnourished patients according to PA, respectively. In multivariate analysis, after adjusting for the Child-Pugh score, MELD score (< 14 and ≥ 14), and the presence of HCC, patients with malnutrition had a higher risk of 6-month mortality (HR: 3.44; 95% CI 1.51–7.84; p = 0.003). Additionally, for every increment of 1º in PA values, it was observed a 53% reduced mortality risk in a 6-month follow-up (HR: 0.47; 95% CI 0.34-0.66; p < 0.001). To predict 6-month mortality, the AUC of PA was 0.751 (95% CI 0.644 – 0.859, p < 0.001). The PA cut-off point of ≤ 5.52º showed sensitivity and specificity of 76% and 51%, respectively. This sample size provided a power of 77% to demonstrate the observed difference in the 6-month mortality rate comparing malnourished and not malnourished patients according to PA (46% vs 20%, p = 0.009, n = 57 and n = 40, respectively).

Discussion

This study investigated the nutritional status of hospitalized decompensated cirrhotic patients, as well as the association between PA and mortality. In the current study, we proposed a PA cut-off point of ≤ 5.52º for the classification of malnutrition. Our study demonstrates that malnutrition according to PA was independently associated with 6-month mortality. Additionally, each increase of 1º in PA values was associated with a 53% reduction in 6-month mortality risk.

The cut-off points previously proposed for cirrhotic patients were performed through studies that predominantly included outpatients and compensated patients[14,33,34] or that included other hepatic diseases.[35,36] In this sense, it's important to remember that compensated and decompensated cirrhosis are distinct clinical states of the disease[2], which reinforces the importance of using a specific cut-off point for decompensated cirrhotic patients. Furthermore, to our knowledge, our study was the first to use a nutritional assessment method as the gold standard for the elaboration of the cut-off point.

The SGA is a well-established and widely used bedside tool that takes into account information such as loss of weight, dietary intake, and physical examination.[32] It appears to be a good option for nutritional assessment of hospitalized patients with cirrhosis, showing association with mortality.[37] However, SGA performance may be limited in clinical practice for some cases. Patients with HE may have cognitive impairment and somnolence. Therefore, tools that depend on personal information can be difficult to perform.[38] SGA can also be insensitive for the detection of malnutrition in overweight/obese patients and compensated cirrhotic patients.[6,39] Thus, the PA arises as an alternative.

Previous studies in cirrhotic patients with different characteristics already highlighted the predictive value of PA on long-term mortality. According to these studies, PA values $\leq$ 4.9° were independently associated with mortality in compensated and male cirrhotic patients.[14,19] However, in decompensated patients, survival curves showed no difference between well-nourished and malnourished patients according to PA[14]. The authors speculate that the results seen in the decompensated group could be explained by the presence of multiple complications that could be disguising the impact of malnutrition. These results documenting the necessity of studies as ours, with more severely ill patients, evaluating the short-term mortality.

An important finding from this study is the high mortality rate. According to the literature, the greater short-term mortality found in our population is somehow expected, since the survival of hospitalized patients with decompensated cirrhosis is much lower than that of outpatients with compensated cirrhosis.[2] In addition to the presence of complications such as ascites, variceal bleeding, and HE, that contribute to increased mortality rate, patients with decompensated cirrhosis have a high prevalence of malnutrition, previously accepted as an important predictor of morbidity and mortality.[7,8]

Several mechanisms may explain the relationship between PA values and mortality. The PA is frequently lower than normal in sick individuals since the inflammation, infection, or disease-specific disturbances may impair its values.[16] In addition, both malnutrition and prolonged physical inactivity may also adversely affect tissue electrical properties, resulting in decreases in PA values.[16,40] Cirrhosis is associated with a systemic inflammation that results from the persistent stimulation of immune cells, characterized by enhanced serum levels of pro-inflammatory cytokines and the upregulated expression of cell activation markers.[41] Since PA is sensitive to these clinical and subclinical manifestations, PA is a good option for evaluating decompensated cirrhotic patients. Compared to other usually accepted methods for nutritional diagnosis, additional advantages of measuring PA is that it can be measured without difficulty, including in most debilitated patients, needs no formula for interpretation of values, and provides reliable and reproducible results.[11]

In addition to mortality, low PA values have also been associated with an increased incidence of HE in outpatients with cirrhosis.[42] Furthermore, recently it was suggested that PA could be used as a viable marker for the identification of sarcopenia, defined as a progressive and generalized loss of skeletal muscle mass, strength, and function.[43,44] In this sense, a link between low testosterone and sarcopenia could be assumed, as low testosterone contributes in part to the muscle loss seen in cirrhosis.[45] Our results showed that malnourished patients according to PA had lower values of total testosterone.

The use of PA may could then be considered promising, considering that other currently indicated methods for identifying low skeletal muscle mass, such as Computed Tomography (CT) or Magnetic Resonance Imaging (MRI), still present high costs in clinical settings.[43] Furthermore, it is also important to underscore the limited access to the methods and exposure to radiation that may limit its use, except when the patient needs to undergo the exam for other purposes. For instance, only 10 patients in our sample underwent CT (data not shown).

BIVA has been used to evaluate nutritional and hydration status.[46,47] In our population, both men and women were within the cachexia quadrant. Even with the ellipses indicating normality, this can suggest a risk of cachexia in this population, mainly in women. Other studies with diseases that involve nutritional risk also found patients classified in the cachexia quadrant, as in cancer and chronic heart failure.[48,49] Therefore, interpretation of BIVA graph data requires consideration of clinical factors and other methods available to complement nutritional assessment, mainly in cachexia, defined as a complex metabolic syndrome associated with underlying illness and characterized by loss of muscle with or without loss of fat mass[50], not involving only markers of body composition.

Considering the hydration status, the BIVA graph indicated normality and it can be justified because fluid retention was not a common condition for all evaluated patients. When analyzing the presence of edema and moderate or severe grade of ascites, both conditions were present in less than half of the sample. Considering the fluid overload is not usually detectable by BIVA until the interstitial fluid volume has risen to about 30% above normal, the results found can be explained.[51]

The major strengths of the present study include the focus on short-term mortality and the use of a simple nutritional assessment tool as a predictor of mortality independent of the severity of the liver disease assessed by the Child-Pugh and MELD scores, and the presence of HCC. The use of PA is clinically relevant, considering the difficulty of nutritional assessment of these patients by conventional methods. Furthermore, the anthropometric parameters, BIA, and SGA were obtained by a trained investigator and not by self-reported measures. Nevertheless, limitations do remain. First, the PA cut-off point of ≤ 5.52º was derived from the studied patients, with internal validity, but external validity needs further confirmation. However, to our knowledge, it is the first study to suggest a cut-off point designed especially with decompensated patients and using as gold standard a well-accepted tool of nutritional assessment. Other prospective studies in patients with decompensated cirrhosis are expected to validate this cut-off point. Second, malnutrition by SGA, which was considered for the elaboration of the cut-off point of PA, is theoretically an imperfect gold standard. However, in our study with hospitalized decompensated cirrhotic patients, SGA was associated with higher 6-month mortality.

In conclusion, malnutrition defined according to PA (≤ 5.52º) is an independent predictor of 6-month mortality and higher values of PA were independently associated with improved 6-month survival in patients with decompensated cirrhosis. BIVA evaluation indicated a risk of cachexia and normal hydration. Based on these results, we suggest performing a combined evaluation with PA and BIVA methods for a more complete nutritional assessment. The PA can be used as a marker to reflect the nutritional status and can be a useful prognostic indicator for survival in clinical practice.

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Table 1 – Demographic, clinical, and nutritional status characteristics of patients with decompensated cirrhosis at the first 72h from hospital admission, for the overall sample and according to 6-month mortality status (n = 97).

	All (n=97)	**Survivors (n=63)**	**Non-survivors (n=34)**	**p value**
Age (years)	60 ± 10.4	59 ± 10.3	61.9 ± 10.6	0.188
Sex				
Female	37.1%	61.1%	38.9%	0.543
Male	62.9%	67.2%	32.8%	
Child-Pugh Score				
A	9.3%	88.9%[a]	11.1%[a]	**0.042***
B	60.8%	69.5%[a]	30.5%[a]	
C	29.9%	48.3%[a]	51.7%[b]	
MELD score	14 (12-18)	14 (11–18)	15 (13–18)	0.261
MELD score				
< 14	39.2%	73.7%	26.3%	0.148
≥ 14	60.8%	59.3%	40.7%	
HCC				
No	69%	71.6%	28.4%	**0.039**
Yes	31%	50%	50%	
Total Testosterone (ng/mL)	0.7 (0.3-2.3)	1.3 (0.3-2.8)	0.6 (0.3–1.9)	0.140
IGF1 (ng/mL)	32.1 (18.1-44.6)	26.9 (17.8–51.7)	32.8 (19.9–41.5)	0.755
Magnesium (mg/dL)	1.8 (1.7-2.0)	1.8 (1.7 – 1.9)	1.8 (1.7–2.0)	0.390
RFH-NPT				
Low Risk	8.3%	87.5%	12.5%	0.154
Moderate Risk	14.4%	78.6%	21.4%	
High Risk	77.3%	60%	40%	
BMI (kg/m²)	26.0 ± 4.5	26.4 ± 4.5	25.2 ± 4.5	0.201
BMI				
No malnutrition	88.7%	65.1%	34.9%	0.923
Malnutrition [a]	11.3%	63.6%	36.4%	
BMI cirrhotic (kg/m²)	27.5 ± 4.8	27.7 ± 4.7	27.2 ± 4.9	0.612
BMI cirrhotic				
No malnutrition	83.5%	67.9%	32.1%	0.170
Malnutrition [b]	16.5%	50%	50%	
Phase angle	5.2 ± 1.0	5.5 ± 0.9	4.6 ± 1	**< 0.001**
Phase angle				
No malnutrition (> 5.52º)	41.2%	80%	20%	**0.009**
Malnutrition (≤ 5.52º)	58.8%	54.4%	45.6%	
SGA				
No malnutrition (A)	32%	87.1%	12.9%	**0.002**
Malnutrition (B+C)	68%	54.5%	45.5%	

Categorical variables data were expressed as relative frequency (%), compared by the Chi-square test. *Each subscript letter denotes a subset of Child-Pugh score categories whose column proportions do not differ significantly from each other at the 0.05 level. Quantitative variables are expressed by mean and standard deviation compared by the Student T-test, or median and interquartile ranges (IQR, 25^{th}-75^{th} percentile) compared by the Mann-Whitney test, according to distribution. p values < 0.05 were considered statistically significant. HCC, hepatocellular carcinoma; IGF1, Insulin-like growth factor 1; RFH-NPT, Royal Free Hospital – Nutritional prioritizing tool; BMI, Body mass index; SGA: Subjective Global Assessment. [a] Malnutrition: < 18.5 kg/m² for adults and < 22kg/m² for the elderly. [b] Malnutrition: patients without ascites ≤ 22 kg/m², moderate ascites ≤ 23 kg/m², and tense ascites ≤ 25 kg/m².

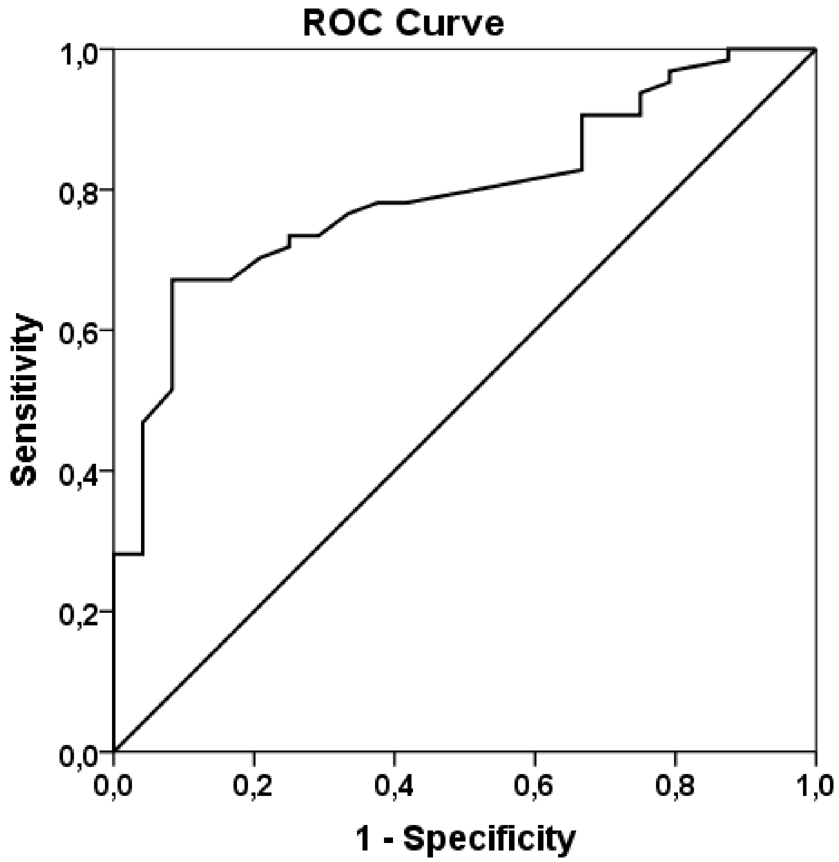

Figure 1 – ROC (Receiver Operating Characteristic) curve to determine the accuracy and the best PA cut-off point to predicting malnutrition defined trough SGA (B or C) in patients with decompensated cirrhosis (AUC: 0.796 (95% CI 0.700 – 0.891, $p < 0.001$). SGA, Subjective Global Assessment; PA, Phase angle; AUC, Area under the curve (n = 97).

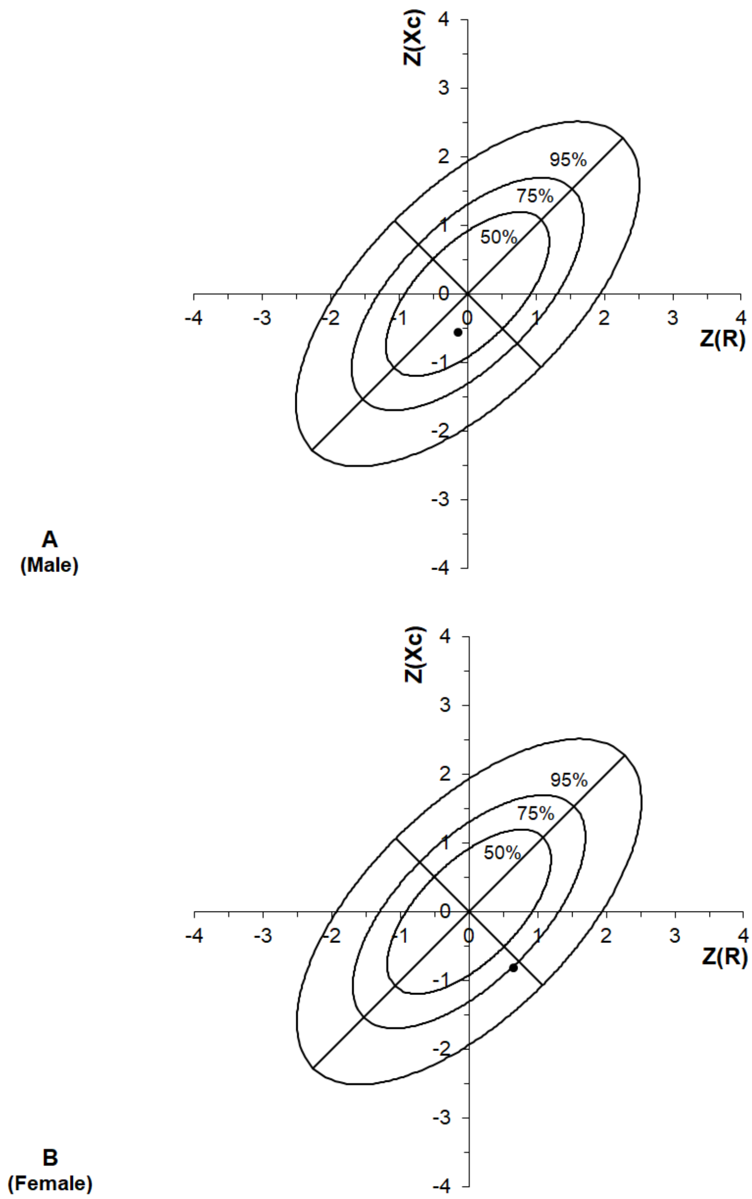

Figure 2 – BIVA plots for males (A) and females (B) patients. Graphic representation of mean BIVA parameters for the decompensated cirrhotic patients, separated by sex, plotted against the reference population. BIVA, Bioelectrical Impedance Vector Analysis; Xc, Reactance; R, Resistance (n = 97).

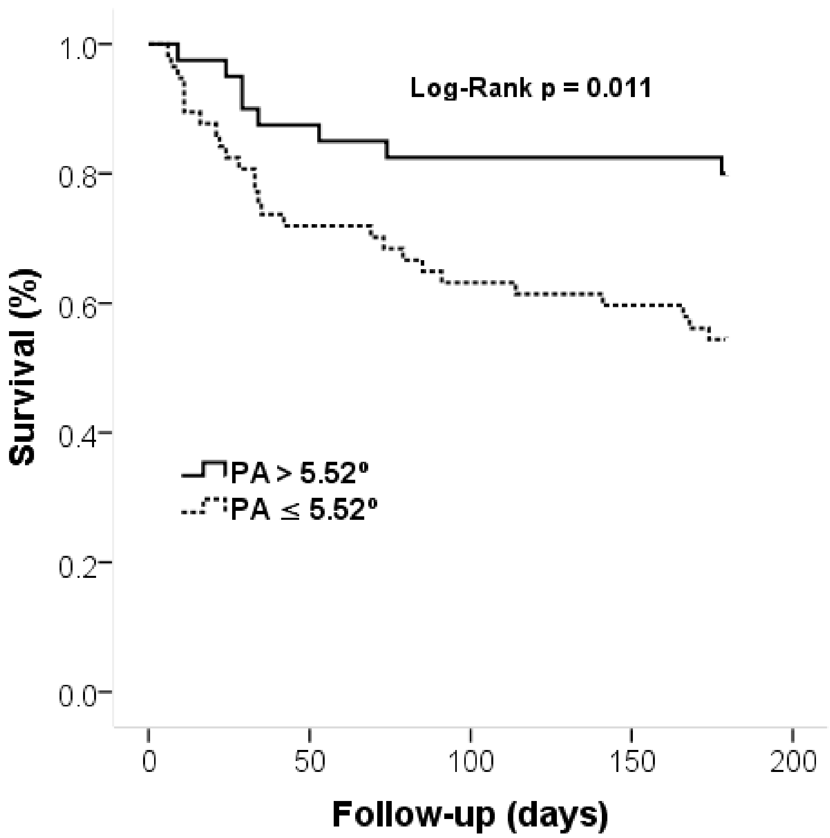

Figure 3 – Survival curve for patients with decompensated cirrhosis according to PA: ≤ 5.52° (n = 57) and > 5.52° (n = 40), Log-Rank p = 0.011. PA, Phase angle (n = 97).

5.3 Artigo 3 - Measurement of mid-arm circumference as a starting point for nutritional assessment of patients with decompensated cirrhosis: a prospective cohort study.

Artigo publicado no periódico Journal of Human Nutrition and Dietetics: J Hum Nutr Diet. 2022 Jul 13. doi: 10.1111/jhn.13067.

Abstract

Background: The mid-arm circumference (MAC) is an accessible, quick, and inexpensive measurement, which can be performed at the bedside only with a measuring tape. In this sense, this study aimed to suggest MAC cut-off values to assess the nutritional status and its association with mortality of hospitalized patients with decompensated cirrhosis. **Methods***:* A prospective cohort study was performed with decompensated cirrhotic patients. Nutritional status was assessed by MAC and Subjective Global Assessment (SGA). Considering the SGA as the reference standard and based on the ROC curve analysis, the MAC cut-off values with the best sensitivity and specificity were selected. Predictors of mortality were identified using multivariate analysis. **Results**: This study included 100 patients with a mean age of 60.1 ± 10.3 years. The median follow-up time was 11.2 months and overall mortality was 60%. Considering malnutrition assessed by SGA as the reference standard, the AUC of MAC for women and men was 0.947 (95% CI 0.878 – 1.000) and 0.813 (95% CI 0.694 – 0.932). The MAC cut-off values: ≤ 28 cm for women and ≤ 30 cm for men reached sensitivity and specificity of 85.5% and 71%, respectively. According to multivariate analysis, low MAC was significantly associated with mortality (HR: 2.41, 95% CI 1.20 – 4.84). **Conclusion:** The MAC cut-off values had satisfactory accuracy for men and women in predicting malnutrition. Additionally, low MAC was an independent predictor of mortality. Thus, these MAC cut-off values can be used as the first step of nutritional assessment to prioritize patients who need a more detailed assessment.

Keywords: Liver Cirrhosis; Malnutrition; Nutritional Assessment; Anthropometric Measurements; Mid-Arm Circumference; Subjective Global Assessment.

Introduction

Cirrhosis is a chronic liver disease, and your clinical course has been typically described by a compensated or decompensated state, where occurs the presence of complications such as variceal bleeding, ascites, and hepatic encephalopathy (HE).[1] Malnutrition is common in patients with advanced liver disease, and the prevalence is reported in more than 60% of patients with decompensated cirrhosis.[2] The etiology of malnutrition is multifactorial and primarily related to reduced liver function, poor oral intake, and complications such as ascites and HE.[3,4,5]

Despite the high prevalence, malnutrition is often underdiagnosed at hospital admission and may not be appropriately recognized in its earlier stages. Fluid overload is common in these patients, reinforcing the importance of using appropriate nutritional screening and assessment tools.[5,6,7] Several methods are available for nutritional assessment, most of them described many decades ago and with methodological or practical limitations, especially concerning their use in hospital environment.[8]

Anthropometric measurements are widely used in clinical practice and are quick, minimally invasive, inexpensive, and easy to perform.[9] However, anthropometric measurements that almost exclusively involve body weight, such as body mass index (BMI), have limited clinical value due to the fluid retention that occurs in cirrhosis.[5,10,11] Other anthropometric measurements, such as mid-arm circumference (MAC), are assessed in the upper compartment of the body, an area less prone to accumulating extravascular fluids.[12] Subjective Global Assessment (SGA) is a well-established and widely used bedside tool, and according to Tandon et al.[5] and the ESPEN Guideline on Clinical Nutrition in Liver Disease[2], it can adequately identify cirrhotic patients with malnutrition. However, trained professionals are required to use this tool.

Considering the specificity of patients with decompensated cirrhosis, and the importance of having a fast, practical, and accessible bedside method for the initial evaluation of these patients, this study aimed to suggest a MAC cut-off values to assess the nutritional status and its association with mortality of hospitalized patients with decompensated cirrhosis.

Material and Methods

Study and Sample Design

This prospective cohort study was performed with patients ≥ 19 years of age with decompensated cirrhosis (ascites and/or HE, variceal bleeding, spontaneous bacterial peritonitis, hepatorenal syndrome, or Child-Pugh score B or C) who were hospitalized at the Gastroenterology and Hepatology Division in a Public Hospital. Patients with bowel disease and intestinal malabsorption, human immunodeficiency virus, degenerative neurological diseases (with psychological and/or cognitive impairment that could compromise participation), and pregnant women were not included. Baseline data were collected within 72 hours of hospital admission between April 2017 and April 2018, and the patients were followed up until September 2019. All patients hospitalized during this period who met the established eligibility criteria were invited to participate in the study.

Demographic, Clinical, and Laboratory Assessment

Demographic, clinical, and biochemical data were collected from electronic medical records. The severity of liver disease was assessed by Child-Pugh score[13,14] and Model for End-Stage Liver Disease (MELD) score.[15] The Child-Pugh score has been widely used to assess the severity of liver dysfunction in the clinical setting, while the MELD score has been widely used to rank the priority of liver transplantation candidates. Both scores have been widely used to predict the clinical outcomes of patients with cirrhosis.[16] Ascites grade was determined through a physical exam by the physician or through ultrasound and the presence of edema was assessed through a physical exam.

Nutritional Assessment

A trained registered dietitian performed a detailed nutritional assessment within 72 hours of hospital admission that included the following measurements:

Nutrition Risk Screening

Royal Free Hospital – Nutritional Prioritizing Tool

Nutritional risk was evaluated using the Royal Free Hospital – Nutritional Prioritizing Tool (RFH-NPT), a tool for nutritional risk assessment in patients with cirrhosis. First, the presence of acute alcoholic hepatitis or tube feeding is assessed. These conditions automatically classify a patient as high risk. The second step distinguishes the patients with or without fluid overload. The score is then computed, and the patients are classified into one of the following risk groups: low (0 points), moderate (1 point), or high nutritional risk (2-7 points).[17]

Weight, Height, and Body Mass Index

Body weight was measured on a Filizola digital upright scale, a Lider portable electronic scale at the bedside, or an Eleve hoist scale for patients that are unable to stand or bedridden patients. Estimated dry body weight (kilograms) was calculated using the current weight minus ascites weight based on severity (mild, 5%; moderate, 10%; severe, 15%). An additional 5% was subtracted if bilateral ankle edema was present.[18] Height was measured with a stadiometer attached to the wall, while recumbent height was measured for patients that are unable to stand or bedridden patients.[19] BMI was calculated as estimated dry body weight divided by height squared (kg/m2), and malnutrition was considered < 18.5 kg/m² for adults or < 22 kg/m² for older adults.[20,21] We also used the BMI classification proposed by Campillo et al.[22] for malnutrition in cirrhotic patients, which includes the following cut-off points: patients without ascites ≤ 22 kg/m², moderate ascites ≤ 23 kg/m², and tense ascites ≤ 25 kg/m².

Mid-Arm Circumference

MAC was measured in centimeters with a non-stretchable tape measure at the mid-point between the acromion and the olecranon of the non-dominant arm. The mean of three consecutive measurements was used. The MAC cut-off values suggested in the present study were used to define low MAC.

Subjective Global Assessment

The nutritional status was diagnosed by combining clinical and physical measurements, such as weight changes, dietary intake, gastrointestinal symptoms, functional capacity, and physical exam. The patients were classified as well-nourished (A), moderately or suspected of being malnourished (B), or severely malnourished (C).[23] Individuals classified as B or C were considered malnourished.

Survival

Mortality data were collected from electronic medical records or by telephone contact with patients, relatives, or caregivers at the end of the study. Only deaths directly related to liver disease were considered.

Statistical Analysis

Quantitative variables were described as mean and standard deviation or median and interquartile range (IQR: 25th-75th percentile), while the categorical variables were expressed as absolute frequency (n) and relative frequency (%). The χ^2 or Fisher's exact test was performed to compare proportions. The Kolmogorov-Smirnov test was used to evaluate the normality of continuous variables. The Student's *t*-test was used to compare variables with a parametric distribution and the Mann-Whitney test was used for those with a non-parametric distribution. The agreement level between RFH-NPT and SGA was calculated using the Kappa test. The receiver operating characteristic (ROC) curve was performed to identify the area under the curve (AUC) of MAC for predicting malnutrition and mortality. SGA was considered the reference standard for nutritional diagnosis. Based on the ROC curve analysis, the cut-off values with the best sensitivity and specificity were selected. Survival over time was estimated using Kaplan-Meier curves and was compared using the Log-Rank test. Significant predictors of mortality were identified using multivariate Cox proportional hazard models, and the results were reported as hazard ratios (HR) and 95% confidence intervals (95%CI). $p < 0.05$ was considered statistically significant. Power was calculated to test two independent proportions using the PSS Health tool online version[24] to detect a significant difference at $p < 0.05$, considering the observed data on the number of malnourished patients according to MAC cut-off values: ≤ 28 cm for women and ≤ 30 cm for men and mortality in each group. The data analysis was performed in SPSS 20.0 (SPSS, Inc, Chicago, IL, USA).

Ethical approval

This study was conducted according to the Declaration of Helsinki guidelines and the local ethics committee approved the protocol (grant number 160655). All included patients or their legally responsible provided written informed consent.

General Characteristics of the Population

This study included 100 patients with a mean age of 60.1 ± 10.3 years. Of these, 63% were men. The majority of the participants were Caucasians (80%), had ≤ 8 years of schooling (65%), and were not working or retired (78%). The most common etiology of cirrhosis was hepatitis C (32%), followed by chronic alcohol consumption (23%), hepatitis C plus chronic alcohol consumption (18%), and nonalcoholic steatohepatitis (13%). Other causes of cirrhosis (14%) included primary biliary cholangitis, hemochromatosis, autoimmune hepatitis, and cryptogenic cirrhosis. The prevalence of coexistent hepatocellular carcinoma (HCC) was 32%. Regarding comorbidities, hypertension and diabetes were the most frequent (35% and 33%, respectively). Ascites was the most common complication, with a prevalence of 68%. Of these, 64.7% (n = 44) were moderate or severe grade. Other prevalent complications were variceal bleeding (24%) and HE (22%). Upon physical exam, 49% of patients had some degree of lower limb edema. No patient had edema in the upper limbs. **Table 1** presented the demographic and clinical characteristics of these patients and their association with survival.

Nutritional Screening and Assessment

The majority of the sample was classified as high nutritional risk according to the RFH-NPT (78%). The prevalence of malnutrition was 69% according to SGA (SGA A: 31%, SGA B: 45%, SGA C: 24%). Substantial agreement was found between the RFH-NPT and SGA ($k = 0.670$, $p < 0.001$). On the other hand, the frequency of malnutrition was lower for anthropometric measures related to body weight, such as BMI and BMI cirrhosis: 13% and 18%, respectively. **Table 2** presented the nutritional characteristics of these patients and their association with survival.

The MAC Cut-off Values for Detecting Malnutrition

Considering malnutrition assessed by SGA as the reference standard, the AUC of MAC for women and men was 0.947 (95% CI 0.878 – 1.000, $p < 0.001$) and 0.813 (95% CI 0.694 – 0.932, $p < 0.001$), respectively **(Figure 1)**. The MAC cut-off values: ≤ 28 cm for women and ≤ 30 cm for men reached sensitivity and specificity of 85.5% and 71% for detecting malnutrition, respectively. Considering the MAC cut-off values, 51.4% (n = 19) of women and 77.8% (n = 49) of men had low MAC.

Mortality

Overall mortality was 60%, and all deaths were directly related to liver disease complications. The median follow-up time from hospital admission to death was 3.4 months (IQR: 1–8.8). The median follow-up time of the remaining patients (40%) was 21.4 months (IQR: 19.2–24.7). **Table 1 and Table 2** presented the association between the demographic, clinical, and nutritional data with survival.

The MAC Cut-off Values and Mortality

Non-surviving patients had lower values than survivors for MAC (26.9 ± 4.4 vs. 29.5 ± 3.6, p = 0.003). The AUC of MAC to predict mortality was 0.681 (95%CI 0.576–0.786, p = 0.002), and the MAC cut-off values: ≤ 28 cm for women and ≤ 30 cm for men reached sensitivity and specificity of 78.3% and 47.5%, respectively. A significantly higher mortality rate was observed among patients with MAC cut-off values: ≤ 28 cm for women and ≤ 30 cm for men (69.1% vs 40.6%, p = 0.007). In the Kaplan–Meier curve survival analysis, patients with low MAC were significantly more likely to die in overall follow-up **(Figure 2)**. According to multivariate analysis, adjusted for age, sex, Child-Pugh score, and HCC, low MAC and malnutrition by the SGA were significantly associated with mortality, as demonstrated in **Table 3.** Considering a significance level of 5%, outcome proportions of 69.1% and 40.6%, a sample size of 68 and 32 in groups A and B, respectively, and applying continuity correction, a power of 70.7% was reached.

Discussion

This study suggested MAC cut-off values for the first step of the nutritional assessment of patients with decompensated cirrhosis and demonstrated that proposed MAC cut-off values had satisfactory accuracy for men and women for predicting malnutrition. Additionally, our study demonstrates the association between low MAC and mortality.

Considering that compensated and decompensated cirrhosis are two different clinical states of the disease and those patients with compensated cirrhosis are more likely to be similar to the general population, we intended to test the performance of MAC in patients with more advanced-stage disease, as most conventional methods may have some limitations. The presence of ascites and edema is a very common complication and can mask body weight and BMI values, leading to misclassification of nutritional status.[25] Other measurements, such as calf and waist circumference, are also highly impacted by fluid overload and are not reliable as indicators of nutritional status. In our study, BMI and BMI cirrhosis found the lowest prevalence of malnutrition. These findings can be explained by the high prevalence of fluid overload in our population and the fact that there are no well-validated means of adjusting body weight for the fluid retention that occurs in cirrhosis, making BMI an inaccurate measure.[5,10,11]

Anthropometric measurements that evaluate areas less prone to accumulating extravascular fluids appear to be more adequate for nutritional assessment. Our study has demonstrated that non-surviving patients had significantly lower MAC values, which indicates a decline in muscle mass and fat mass.[26] Currently indicated techniques for assessing skeletal muscle mass and adipose tissue depots, such as computed tomography (CT) or magnetic resonance imaging,[27,28] are not always available and are still expensive in clinical settings. Furthermore, it is also important to underscore the limited access to these methods and the radiation exposure that may limit their use, except when exams are required for other purposes. For instance, only 10 patients in our sample underwent computed tomography (data not shown). In this sense, anthropometric measurements are accessible and may be an available option in daily clinical practice. In this regard, Santos et al.[29] reported that MAC was the most accurate anthropometric measure for predicting sarcopenia (assessed by muscle strength and appendicular muscle mass index) in Brazilian cirrhotic outpatients.

In our study, malnutrition assessed by SGA was an independent predictor of mortality, and our findings are consistent with other studies in cirrhotic patients.[30,31] SGA is a simple, non-invasive, and inexpensive bedside tool that includes information such as the history of weight loss, dietary intake change, gastrointestinal symptoms, functional capacity, metabolic demand related to the underlying disease, and physical exam (loss of subcutaneous fat, muscle wasting, ankle edema, sacral edema, and ascites), providing a global assessment of nutritional status.[23] SGA has been validated in several patient populations; however, implementation in clinical practice in cirrhotic patients remains unclear. Patients with HE may have cognitive impairment and drowsiness. Therefore, tools that require personal information and patient cooperation can be difficult to perform.[32] However, if possible, relatives or caregivers can assist in providing information. SGA may not be able to detect malnutrition in overweight/obese patients and compensated cirrhotic patients and may underestimate the prevalence of sarcopenia.[12,33] However, in most hospitalized decompensated cirrhotic patients, malnutrition becomes more evident, and SGA seems to be able to identify these changes in nutritional status.

We proposed MAC cut-off values for women (≤ 28 cm) and men (≤ 30 cm) considering the SGA as the reference standard. A similar MAC cut-off value (< 28.2 cm) has been proposed for male cirrhotic patients. However, the authors point out that no tool could detect malnutrition (SGA A vs. B and C) in the female cohort with reasonable accuracy.[34] In our study, the accuracy of the MAC cut-off values seemed better for women, although it had satisfactory accuracy for men and women. Recently, Endo et al[35] proposed MAC cut-off values (< 22.7 cm for women and < 25 cm for men) for screening sarcopenia in Japanese patients with chronic liver disease diagnosed by CT and handgrip strength. However, the association with clinical outcomes was not evaluated. Thus, these MAC cut-off values proposed in this study can be used as the first step of the nutritional assessment to prioritize patients who need a more detailed assessment. If the MAC is under these cut-off values, further look for the classification in percentiles ought to be investigated and other nutritional assessment methods must be used to confirm the presence and severity of malnutrition.

In the present study, low MAC was an independent predictor of mortality. Similar to the present study, Ribeiro et al.[12] reported that MAC < 5^{th} percentile was an independent predictor of mortality in a sample of seventy-three Brazilian cirrhotic outpatients. Several mechanisms may explain the relationship between MAC and mortality. The deterioration of muscle mass, as well as fat mass, may contribute to reduced MAC values, and these conditions have been linked to higher mortality in patients with cirrhosis.[27,28] Physical inactivity, systemic inflammation, hypermetabolism, alterations in amino acid profiles, hyperammonemia, low serum leptin levels, and low phase angle values may contribute to skeletal muscle loss with or without loss of fat mass and increased risk of mortality.[36,37,38] Moreover, the following factors may also contribute to lower MAC values: impaired dietary intake due to gastrointestinal symptoms, anorexia, dysgeusia, the prescription of unpalatable diets, nausea, vomiting, and early satiety, which is often related to intraabdominal pressure secondary to ascites, nutrient malabsorption, and altered macronutrient metabolism.[5] However, a randomized trial demonstrated that MAC is responsive to nutrition intervention, which indicates that the nutritional status of cirrhotic patients improves after nutritional therapy.[39]

Compared to other nutritional assessment tools and considering the limited health care resources of public hospitals in low and middle-income countries, MAC has several advantages for the daily clinical practice: it is an accessible, quick, and inexpensive measurement; it can be performed at the bedside with only a measuring tape, even in patients with lower limb edema and ascites; it requires minimal patient cooperation, and requires no formula to interpret the values. Since the basic approach to the diagnosis of malnutrition should be as simple as possible to promote broad adoption across the global health care settings, and malnutrition diagnosis should be equally relevant for all health care professionals[40], the MAC appears as a practical and simple tool to be performed.

There were some strengths of our research that should be highlighted. The MAC cut-off values suggested in the present study showed good sensitivity and specificity for men and women. Therefore, the results are extremely clinically relevant, indicating the practical applicability of a minimally invasive, inexpensive, and accessible nutritional assessment tool to predict mortality in patients with decompensated cirrhosis. In addition, the same-trained researcher performed all nutritional assessment tools, and self-reported measures were not needed. Nevertheless, some limitations remain. First, the study was conducted in a single medical center exclusively with decompensated patients, and may not represent the entire spectrum of patients with cirrhosis. Therefore, subsequent studies are required with another profile of cirrhotic patients to validate the MAC cut-off values suggested in this study for its use in compensated cirrhotic patients. Second, although less frequent, edema in the upper limbs would limit the performance of MAC and other anthropometric measurements. In this case, alternative methods should be performed (e.g., phase angle, image techniques). Third, malnutrition assessed by SGA is, theoretically, an imperfect reference standard. However, no approach has proved to be universally efficacious, and the absence of this validated gold standard for diagnosing malnutrition is a barrier in studies with cirrhotic patients. Moreover, in our study, SGA was an independent predictor of overall mortality and seems to be an appropriate nutritional assessment tool for hospitalized decompensated cirrhotic patients.

In conclusion, the results of this study demonstrate that proposed MAC cut-off values had satisfactory accuracy for men and women in predicting malnutrition. Additionally, low MAC and malnutrition by the SGA were independent predictors of mortality. Nutritional assessment at the patient's bed can be a challenge, even for trained professionals. Based on these results, we suggest that the starting point is the measurement of MAC, an extremely simple measure, whose result, in addition to being an indicator of nutritional status, can predict mortality. In addition to helping to diagnose malnutrition, MAC can be used as an objective parameter to monitor nutritional status during hospitalization. Subsequently, SGA can be performed to check other parameters and provide a global diagnosis of nutritional status.

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Table 1 – Demographic and clinical characteristics of hospitalized patients with decompensated cirrhosis* in the first 72h after hospital admission, and mortality rates according to these characteristics (n = 100).

Variable	Sample Characteristics (n = 100)	Survival Rate (n = 40)	Mortality Rate (n = 60)	p-value
Age, years, mean ± SD	60.1 ± 10.3	57.6 ± 10.7	61.8 ± 9.8	**0.045**
Sex, n (%)				
Female	37 (37)	13 (35.1)	24 (64.9)	0.447
Male	63 (63)	27 (42.9)	36 (57.1)	
Child-Pugh score, n (%)				
A	9 (9)	7 (77.8)	2 (22.2)	**0.022**
B	61 (61)	25 (41)	36 (59)	
C	30 (30)	8 (26.7)	22 (73.3)	
MELD score, median (range)	14 (12 – 18)	14 (11 – 18)	15 (13 – 18)	0.262
HCC, n (%)				
No	68 (68)	34 (50)	34 (50)	**0.003**
Yes	32 (32)	6 (18.8)	26 (81.2)	
Comorbidities, n (%)				
Hypertension				
No	65 (65)	24 (36.9)	41 (63.1)	0.392
Yes	35 (35)	16 (45.7)	19 (54.3)	
Diabetes				
No	67 (67)	26 (38.8)	41 (61.2)	0.728
Yes	33 (33)	14 (42.4)	19 (57.6)	
Length of hospital stay, median (range)	8 (12.5 – 18)	10 (7 – 17.5)	12 (8 – 18.7)	0.554

Notes: categorical variables data were expressed as absolute frequency (n) and relative frequency (%) and quantitative variables are expressed as mean and standard deviation (mean ± SD) or median and interquartile ranges (IQR: 25^{th}-75^{th} percentile). *Decompensated cirrhosis: patients with ascites and/or HE, variceal bleeding, spontaneous bacterial peritonitis, hepatorenal syndrome, or Child-Pugh score B or C. Patients with Child-Pugh score A were included considering that they presented other criteria for decompensated cirrhosis, e.g., variceal bleeding. Abbreviations: HCC: hepatocellular carcinoma.

Table 2 – Nutritional characteristics of hospitalized patients with decompensated cirrhosis in the first 72h after hospital admission, and mortality rates according to these characteristics (n = 100).

Variable	Sample Characteristics (n = 100)	Survival Rate (n = 40)	Mortality Rate (n = 60)	p-value
RFH-NPT, n (%)				
Low risk	8 (8)	5 (62.5)	3 (37.5)	0.114
Moderate risk	14 (14)	8 (57.1)	6 (42.9)	
High risk	78 (78)	27 (34.6)	51 (65.4)	
BMI, kg/m²	25.1 ± 4.2	26.1 ± 4.1	24.4 ± 4.1	0.151
BMI, n (%)				
No malnutrition	13 (13)	37 (42.5)	50 (57.5)	0.182
Malnutrition	87 (87)	3 (23.1)	10 (76.9)	
BMI cirrhosis, kg/m²	27.4 ± 4.8	28.1 ± 4.9	26.9 ± 4.7	0.243
BMI cirrhosis, n (%)				
No malnutrition	18 (18)	35 (42.7)	47 (57.3)	0.242
Malnutrition	82 (82)	5 (27.8)	13 (72.2)	
MAC, cm	27.9 ± 4.3	29.5 ± 3.6	26.9 ± 4.4	**0.003**
MAC, n (%)				
Non-low MAC	32 (32)	19 (59.4)	13 (40.6)	**0.007**
Low MAC	68 (68)	21 (30.9)	47 (69.1)	
SGA (%)				
No malnutrition	31 (31)	20 (64.5)	11 (35.5)	**0.001**
Malnutrition	69 (69)	20 (29)	49 (71)	

Notes: categorical variables data were expressed as absolute frequency (n) and relative frequency (%) and quantitative variables are expressed as mean and standard deviation (mean ± SD) or median and interquartile ranges (IQR: 25^{th}-75^{th} percentile).

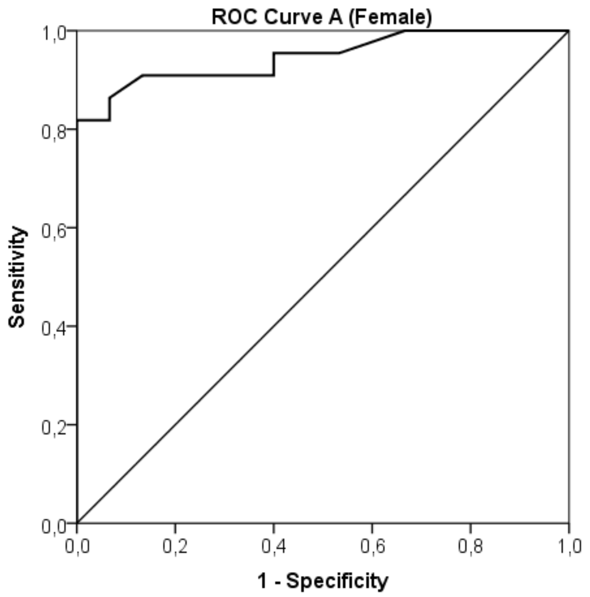
Abbreviations: BMI: body mass index, MAC: mid-arm circumference, RFH-NPT: Royal Free Hospital – Nutritional Prioritizing Tool, SGA: Subjective Global Assessment.

Table 3 - Association between nutritional assessment tools and mortality in patients with decompensated cirrhosis: Multivariate analysis.

Variable	Mortality HR (95%CI)	p-value
Crude model		
Malnutrition (SGA B or C)	2.88 (1.49 – 5.55)	**0.002**
Low MAC	2.28 (1.23 – 4.22)	**0.009**
Age	1.03 (0.99 – 1.05)	0.055
Sex	0.79 (0.47 – 1.33)	0.379
Child-Pugh score	1.95 (1.25 – 3.05)	**0.003**
HCC	2.20 (1.32 – 3.68)	**0.003**
Adjusted model A		
Low MAC	2.41 (1.20 – 4.84)	**0.014**
Age	1.02 (0.99 – 1.05)	0.134
Sex	0.53 (0.29 – 0.97)	**0.039**
Child-Pugh score	2.01 (1.26 – 3.21)	**0.004**
HCC	2.94 (1.68 – 5.14)	**< 0.001**
Adjusted model B		
Malnutrition (SGA B or C)	3.73 (1.73 – 8.01)	**0.001**
Age	1.01 (0.98 – 1.04)	0.434
Sex	0.48 (0.27 – 0.87)	**0.016**
Child-Pugh score	1.84 (1.15 – 2.95)	**0.011**
HCC	3.89 (2.16 – 7.01)	**< 0.001**

Notes: Model A and B are alternative parallel models, adjusted for age, sex, Child-Pugh score, and HCC.

Abbreviations: HCC: hepatocellular carcinoma, HR: Hazard ratio, MAC: mid-arm circumference, SGA: Subjective Global Assessment.



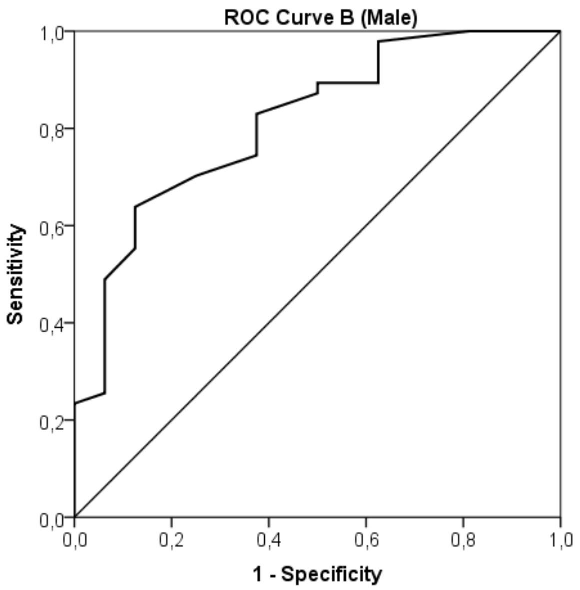


Figure 1 – ROC curves to determine the accuracy and the best MAC cut-off values for screening malnutrition, considering SGA as the reference standard for nutritional diagnosis in decompensated cirrhotic patients, stratified into a female group A (AUC: 0.947 (95% CI 0.878 – 1.000, $p < 0.001$) and a male group B (AUC: 0.813 (95% CI 0.694 – 0.932, $p < 0.001$), n = 100. SGA: Subjective Global Assessment, AUC: area under the curve.

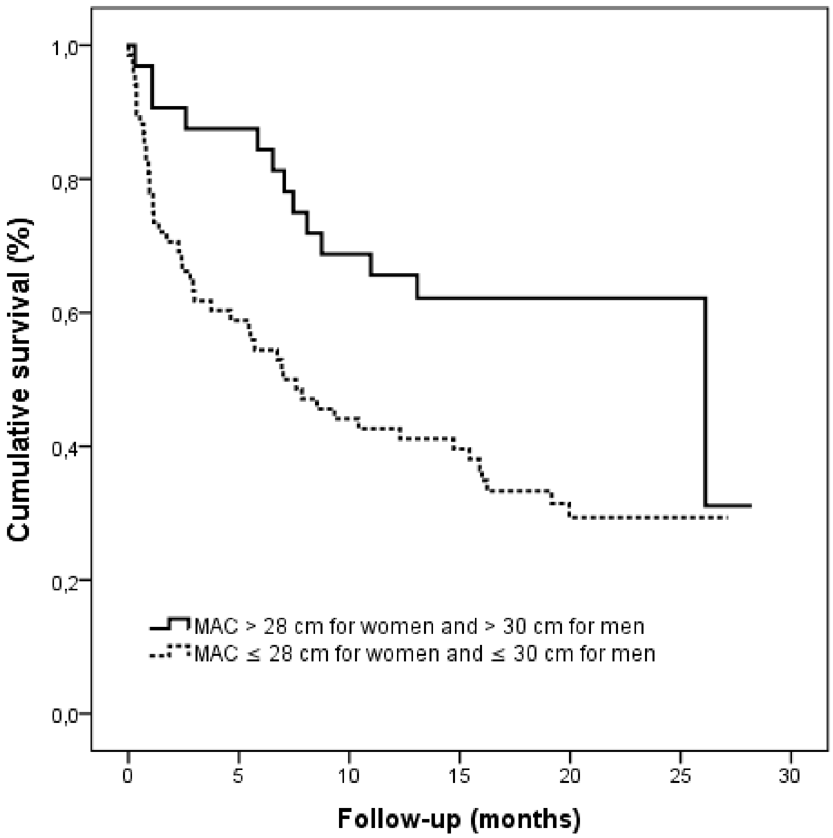


Figure 2 – Survival curves for patients with decompensated cirrhosis with malnutrition groups according to MAC (yes or no). There was a statistically significant difference between the groups ($p = 0.007$). MAC: mid-arm circumference.

5.4 Artigo 4 - Food Intake Visual Scale - A practical tool for assessing the dietary intake of hospitalized patients with decompensated cirrhosis.

Artigo publicado no periódico Nutrition in Clinical Practice: Nutr Clin Pract. 2023 Feb;38(1):187-198. doi: 10.1002/ncp.10840. Epub 2022 Feb 4.

Escala visual de ingestão alimentar em português (APÊNDICE 1)

Abstract

Background: The aim of this study was to whether the Food Intake Visual Scale (FIVS) can be used in clinical practice to measure food intake in patients with decompensated cirrhosis. **Methods*:*** A cross-sectional study was performed with patients with cirrhosis between April 2017 and July 2019. The food intake was assessed through the one-day diet record (DR) and according to FIVS, which consists of pictures of four plates of food at different levels of consumption: "about all", "half", "a quarter", or "nothing". The ANOVA test with Bonferroni multiple comparison analysis was used to compare the mean energy intake through the DR according to the FIVS categories. **Results:** This study included 94 patients with a mean age of 60.29 ± 9.33 years. Patients with lower food intake according to the FIVS categories also had lower mean energy and macronutrient intake according to the DR: patients eating "about all" (n = 49, 52.1%) consumed a mean of 1526.58 ± 428.27 kcal/day, "half" (n = 16, 17%) a mean of 1282.08 ± 302.83 kcal/day, "a quarter" (n = 25, 26.6%) a mean of 978.96 ± 468.81 kcal/day, and "nothing" (n = 4, 4.3%) a mean of 353.59 ± 113.16 kcal/day (p < 0.001). **Conclusion:** The results of this study demonstrate that FIVS can be implemented in clinical practice to measure food intake in patients with decompensated cirrhosis as a substitute for the DR since it is a non-invasive, low-cost, quick, reliable, and easy bedside method for obtaining data.

Introduction

Cirrhosis is a chronic liver disease, and your clinical course has been typically described by a compensated and a decompensated state based on the absence or, respectively, the presence of complications such as variceal bleeding, ascites, and hepatic encephalopathy (HE). These marked clinical differences have brought about the concept that compensated and decompensated cirrhosis are two different clinical states of the disease.[1] Malnutrition is common in patients with advanced liver disease, and the prevalence is reported in more than 50% among these patients. The etiology of malnutrition is multifactorial and primarily related to reduced liver function, poor oral intake, and complications of decompensated cirrhosis such as ascites and HE.[2,3]

Most patients with decompensated cirrhosis have inadequate dietary intake, which contributes to overall poor outcomes.[4,5] One of the main reasons for reduced food intake is appetite loss, which is attributed to proinflammatory cytokines, early satiety due to decreased gastric expansion capacity secondary to ascites, and altered taste perception.[6] Other factors that can also result in decreased food intake include nausea, vomiting, aversion to certain foods, prescription of unpalatable diets, hospitalization with periods of fasting for diagnostic and therapeutic procedures, gastrointestinal pain, diarrhea or constipation, and HE.[7,8]

Dietary therapy is an essential part of the multidisciplinary treatment for cirrhosis.[9] Treatment goals with dietary intervention revolve around minimizing and correcting malnutrition, preventing progression to liver failure, and managing complications arising from the disease.[10] However, food intake assessment and dietary management are often neglected step in patients with cirrhosis.[11] Assessment of dietary intake in hospitalized patients is complex, and there is still an open debate on which tool can be considered the most accurate due to the limitations related to misreporting, reproducibility, and the availability of resources.[11,12]

Obtaining data about patient food intake can contribute to all stages of nutritional care, from admission to hospital discharge.[13] Furthermore, barriers to adequate food intake are also important to identify and address. However, obtaining accurate information about patient food intake is a difficult and resource-intensive task. A simple, easy to use, quick, and reliable tool for screening and monitoring food intake and barriers to eating in hospital settings would seem essential in daily clinical practice.

Therefore, this study aimed to evaluate the food intake through the one-day diet record (DR) and according to the Food Intake Visual Scale (FIVS), as well the reasons why the patients did not eat their full meal, and to whether the FIVS can be used in clinical practice to measure food intake as a substitute for the DR. Furthermore, we evaluated the prescribed nutrition and compared it with the dietary intake of hospitalized patients with decompensated cirrhosis.

Methods

Study and Sample Design

This cross-sectional study was performed with patients ≥ 19 years of age with decompensated cirrhosis (ascites and/or HE, variceal bleeding, spontaneous bacterial peritonitis, hepatorenal syndrome, or Child-Pugh score B or C) who were hospitalized at the Gastroenterology and Hepatology Division in a Public Hospital. Patients with bowel disease and intestinal malabsorption, human immunodeficiency virus, degenerative neurological diseases (with psychological and/or cognitive impairment that could compromise participation), patients with enteral and/or parenteral nutrition, and pregnant women were not included. Patients who did not correctly fill out the DR or who were required to fast for some portion of the assessment day were excluded. Data were collected within 72 hours of hospital admission between April 2017 and July 2019. All patients hospitalized during this period who met the established eligibility criteria were invited to participate in the study.

Demographic, Clinical, and Laboratory Assessment

Demographic, clinical data, and biochemical markers (serum albumin, serum creatinine, serum urea, serum sodium, serum potassium, total bilirubin, international normalized ratio, alanine aminotransferase [ALT], aspartate aminotransferase [AST], gamma-glutamyl transferase [GGT], and alkaline phosphatase [ALP]) were collected from electronic medical records. The severity of liver disease was assessed by Child-Pugh score[14,15] and Model for End-Stage Liver Disease (MELD) score.[16] The Child-Pugh score has been widely used to assess the severity of liver dysfunction in the clinical setting, while the MELD score has been widely used to rank the priority of liver transplantation candidates. Both scores have been widely used to predict the clinical outcomes of patients with cirrhosis.[17] Ascites grade was determined through a physical exam by the physician or through ultrasound and the presence of edema was assessed through a physical exam.

Nutrition and Dietary Assessment

A trained registered dietitian performed detailed nutrition and dietary assessment that included the following measurements:

Nutrition Risk Screening

Royal Free Hospital – Nutritional Prioritizing Tool

Nutritional risk was evaluated using the Royal Free Hospital – Nutritional Prioritizing Tool (RFH-NPT), a tool for nutritional risk assessment in patients with cirrhosis. First, the presence of acute alcoholic hepatitis or tube feeding is assessed. These conditions automatically classify a patient as high risk. The second step distinguishes the patients with or without ascites or edema. The score is then computed, and the patients are classified into one of the following risk groups: low (0 points), moderate (1 point), or high nutritional risk (2-7 points).[18]

Weight, Height, and Body Mass Index

Body weight was measured on a Filizola digital upright scale, a Lider portable electronic scale at the bedside, or an Eleve hoist scale for patients that are unable to stand or bedridden patients. Estimated dry body weight (kilograms) was calculated using the current weight minus ascites weight based on severity (mild, 5%; moderate, 10%; severe, 15%). An additional 5% was subtracted if bilateral ankle edema was present.[19] Height was measured with a stadiometer attached to the wall, while recumbent height was measured for patients that are unable to stand or bedridden patients.[20] BMI was calculated as estimated dry body weight divided by height squared (kg/m2), and malnutrition was considered < 18.5 kg/m² for adults or < 22 kg/m² for older adults.[21,22]

Subjective Global Assessment

The nutritional status was diagnosed by combining clinical and physical measurements, such as weight changes, dietary intake, gastrointestinal symptoms, functional capacity, and physical exam. The patients were classified as well-nourished (A), moderately or suspected of being malnourished (B), or severely malnourished (C).[23] Individuals classified as B or C were considered malnourished.

Food Intake Assessment

Requirements

The individual nutrition requirements were determined through the registered dietitian considering 35-40 kcal and 1.2-1.5 g of protein for the actual dry body weight.[24] The patient's nutrition prescription was checked in the electronic medical records for comparison between prescription and dietary intake.

Diet record

The DR consists of self-recording all food and drinks consumed throughout the evaluated day. Five hospital meals, standardized according to the type of diet prescribed and according to nutrition requirements, were provided: breakfast (8:00 AM), lunch (12:00 PM), afternoon snack (03:30 PM), dinner (6:00 PM), and late evening snack (08:00 PM). In addition to water, other beverages are not provided with main meals (lunch and dinner). A one-day DR was applied to all participants, who received prior guidance on how to properly report their meals. The registration was done either by the patients themselves whenever possible or by the caregivers depending on the patient's abilities. Subsequently, a trained dietitian checked all recorded information, and the day's consumption was estimated by calculating energy and macronutrient intake through software routinely used in clinical practice by the Institution's Nutrition and Dietetic Department. The software nutritional information is derived from a national food table.[25] Some foods or preparations that were not available in the software were calculated based on the hospital's previously established preparation datasheets. A total of 57 new preparations were calculated and added to the software.

Food Intake Visual Scale

The nutritionDay (ND) worldwide is a daylong cross-sectional survey performed annually in health care institutions that aim to evaluate the nutrition care processes and nutrition care-related structures, including the food intake at a single meal as an indicator of total daily food intake.[26] In the present study, the FIVS was adapted from the ND questionnaires by a group of professors and dietitians from the Nutrition and Dietetic Department.

The FIVS consists of pictures of four plates of food at different levels of consumption: "about all", "half", "a quarter", or "nothing". After the patients finished the meal, they were instructed to identify which image on the tool best represented their food intake. In the present study, lunch was evaluated for practical and logistical reasons. Patients who reported that they ate “a quarter” or “nothing” were further asked to report the reasons for their reduced intake and were presented with a list of 17 possible responses on the reverse of the tool (**Figure 1) (Figure S1, Figure S2**). Through direct observation of the food plate, the researcher also classified the patient’s intake on the FIVS. Interobserver agreement was determined for the researcher and patient classification of food intake. Both dietary intake assessments (DR and FIVS) were performed on the same day.

Statistical Analysis

Quantitative variables were described as mean and standard deviation or median and interquartile range (IQR: 25^{th}-75^{th} percentile), while the categorical variables were expressed as absolute frequency (n) and relative frequency (%). The χ^2 or Fisher’s exact test was performed to compare proportions. The Kolmogorov-Smirnov test was used to evaluate the normality of continuous variables. Paired student’s t-test or ANOVA test with Bonferroni multiple comparisons was used to compare variables with a parametric distribution and the Mann-Whitney or Kruskal-Wallis test was used for those with a non-parametric distribution. Pearson’s correlation was used to assess lunch calories and total daily calories. Interobserver FIVS agreement was calculated with the Kappa test. The difference between mean energy intake and nutrition prescription was demonstrated with a Bland-Altman plot. $P < 0.05$ was considered statistically significant. The data analysis was performed in SPSS 20.0 (SPSS, Inc, Chicago, IL, USA). $P < 0.05$ was considered statistically significant. The data analysis was performed in SPSS 20.0 (SPSS, Inc, Chicago, IL, USA).

Ethical approval

This study was conducted according to the Declaration of Helsinki guidelines and the local ethics committee approved the protocol. All included patients or their responsible caregivers provided written informed consent.

Results

Patient's General Characteristics

This study included 106 patients in the sample. However, 12 were excluded due to insufficient dietary data (e.g., not completing the DR and fasting for medical reasons on the day of the evaluation). A total of 94 patients were included in the final analysis, with a mean age of 60.29 ± 9.33 years. Of these, 64.9% (n = 61) were men and the majority of the participants were Caucasians (83%, n = 78). The main etiology of cirrhosis was hepatitis C (27.6%, n = 26), followed by chronic alcohol consumption (25.5%, n = 24), hepatitis C plus chronic alcohol consumption (16%, n = 15), nonalcoholic steatohepatitis (NASH) (16%, n = 15), and NASH plus chronic alcohol consumption (2.1%, n = 2). Other causes of cirrhosis (12.8%, n = 12) included: primary biliary cholangitis, hemochromatosis, autoimmune hepatitis, and cryptogenic cirrhosis. Ascites was the most common complication, with a prevalence of 72.3% (n = 68), of which 62.3% (n = 43) were moderate or severe grades. Upon physical exam, 50% (n = 47) of patients had some degree of lower limb edema. The median hospital stay was 11.5 days (IQR: 8–18). **Table 1** presented the clinical, demographic, and nutritional characteristics of these patients.

Nutrition Screening and Assessment

Seventy-eight (83%) of the patients were classified as high nutritional risk according to the RFH-NPT. The prevalence of malnutrition was 74.5% (n = 70) according to the SGA. On the other hand, the frequency of malnutrition was lower considering the

BMI (9.6%, n = 9), an anthropometric measure that almost exclusively involves body weight **(Table 1).** There was no statistically significant difference between nutritional status and food intake according to the DR method, being that patients with SGA-A classification consumed a mean of 1376.30 ± 545.40 kcal/day, SGA-B classification consumed a mean of 1263.16 ± 528.77 kcal/day, and SGA-C classification consumed a mean of 1249.35 ± 406.93 kcal/day ($p > 0.05$). There was also no statistically significant difference between nutritional status and FIVS categories (between the four categories and the dichotomized categories [food intake responses as “a quarter” or "nothing", representing < 50%, and “half" or "about all", representing ≥ 50% meal intake], $p > 0.05$), as well as there was no statistically significant difference with the etiology of cirrhosis, the severity of liver disease, and presence of complications ($p > 0.05$).

Food Intake Assessment - Nutrition Prescription and Diet record

The patients consumed a mean of 1289.41 ± 509.72 kcal/day (18.61 ± 7.94 kcal/kg/day) from the five main meals provided by the hospital, while the mean nutrition prescription was 2191.25 ± 295.78 kcal/day (31.25 ± 7.70 kcal/kg/day). The breakfast represented 21.43% (15.97-27.19) of the food intake of the day; lunch represented 24.14% (14.32-28.74); and dinner 23.55% (14.98-29.98). Other meals (afternoon snack and late evening snack) totaled 30.88% of the food intake of the day. Therefore, the majority of patients (96.8%, n = 91) had lower mean energy intake than the nutrition prescription, as illustrated in **Figure 2.** In addition, the Bland–Altman plot illustrates the differences between mean daily energy intake and nutrition prescription, with a difference of – 901.84 kcal/day and a 95% limit of agreement ranging from –1831.01 kcal/day to 27.33 kcal/day **(Figure 3).** There was a statistically significant difference between mean daily macronutrient intake and nutrition prescription being that 92 (97.8%) of patients had lower protein intake than the nutrition prescription **(Table 2)**. Although most patients had an inadequate dietary intake, the proportion of daily macronutrients remained within the nutrition recommendations: total carbohydrates (55.33 ± 6.35%), total lipids (28.90 ± 5.68%), and protein (15.77 ± 3.05%).

As for the types of diet prescribed, 7.4% (n = 7) had a prescription for a diet with a modified texture, 17% (n = 16) had a regular standard diet, and 75.5% (n = 71) had a prescription for other dietary patterns. The other dietary patterns than the regular most frequently prescribed were severely restricted sodium diet (food prepared without additional salt, containing approximately 1200 mg of intrinsic sodium per day, being able to have a 1-2g of additional salt or not with the meal - lunch and dinner, according to the diet prescription) [25.5%, n = 24], and diabetes diet (no sugar and whole foods) [22.3%, n = 21]. Patients who received a regular standard diet, other dietary patterns, and diet with modified texture consumed a mean of 1574.26 ± 162.53 kcal/day, 1253.93 ± 50.34 kcal/day, and 998.13 ± 278.01, respectively. Patients with a diet with modified texture had lower mean daily energy intake compared with patients who received a regular standard diet ($p = 0.035$). Regarding oral nutritional supplements (ONS), 2% (n = 2) of patients had a prescription on the day of assessment.

Food Intake Assessment - Food Intake Visual Scale

According to the patients' classification, 52.1% (n = 49) claimed ate “about all”, 17% (n = 16) ate “half”, 26.6% (n = 25) ate “a quarter”, and 4.3% (n = 4) ate “nothing” at lunch. Regarding patient and researcher responses, there was disagreement for three answers in the “about all” category, two in the “half” category, and three in the “a quarter” category. Of these, five patients overestimated their intake. There was a strong agreement between patient and researcher responses on the FIVS ($k = 0.869$, $p < 0.001$). Of the patients eating “a quarter” or “nothing” at lunch, the most frequent reason was “I was not hungry at the time”, reported by 23.4% (n = 22) of the patients. The other most frequently stated reasons for not completing the meal are presented in **Table 3.** Of the patients eating "nothing" at lunch, the stated reasons for not completing the meal were "I was not hungry at the time", "I do not have my usual appetite", and "I had nausea/vomiting". Of the 29 patients who ate "a quarter" or "nothing", 34.5% (n = 10) had one reason to reduce food intake, 41.4% (n = 12) had two reasons, 20.7% (n = 6) had three reasons, and 3.4% (n = 1) had four reasons.

Association between Diet record and Food Intake Visual Scale

A statistically significant association was found between the two assessment methods: patients with lower food intake according to the FIVS categories also had lower mean energy and macronutrient intake according to the DR, as demonstrated in **Figure 4** and **Table 4.** To verify whether lunch was representative of the entire day's intake, a correlation was performed between lunch calorie intake and total daily calorie intake. The mean lunch calorie intake was 309.27 ± 169.41 kcal/day, while in the full-day DR it was 1289.41 ± 509.72 kcal/day. There was a strong positive correlation between lunch calorie intake and total daily calorie intake ($r = 0.719$, $p < 0.001$) **(Figure 5).**

Discussion

This study investigated the food intake of hospitalized patients with decompensated cirrhosis. Our study demonstrates that patients with decompensated cirrhosis had an insufficient dietary intake, much lower than the nutritional prescription. Additionally, demonstrated through the FIVS that almost half of the sample indicated eating half or less of the evaluated meal, and the most frequent reason for eating a quarter or nothing of the meal was not hungry at the time.

The difference between the prescribed nutrition and patient food intake is relevant since such patients are not reaching caloric and protein goals, which could contribute to malnutrition and a worse prognosis.[4,5] In this sense, the mean protein intake in our sample was 0.73 g/kg/d, much lower than the protein recommendations in cirrhosis. Despite this fact, the proportion of daily macronutrients remained within the nutrition recommendations, which shows us that the intake was lower as a whole, and not only for specific items. Ney et al.[4] reported that insufficient protein intake (< 0.8 g/kg/d) was prevalent and independently associated with malnutrition and mortality in patients with cirrhosis awaiting liver transplantation. The authors highlighted, unlike many other prognostic factors, protein intake is potentially modifiable. In this sense, investigating the difficulties that affect food consumption can help to elucidate the problem of reduced intake. This data can be easily obtained through the FIVS since the instrument asks patients why they ate less than half of the meal. Similar to the present study, other studies with hospitalized patients also was found that the main reason for eating a quarter or nothing was not being hungry at the time.[26,27]

In the present study, 52.1% of patients ate their entire meal, and the prevalence was higher than that observed in other studies performed in different regions. Results From nutritionDay in the 245 U.S. hospitals showed that 36.5% of patients from different specialties ate their entire meal.[29] Kontogianni et al.[27] evaluated data from 113.930 adult patients (from 4519 units, 1358 hospitals, 54 countries) and showed that only 41.6% of patients reported having consumed all their served meal. However, considering only the South American patient's data, 48% ate their entire meal, similar to observed in the present study.[30]

The causes of insufficient dietary intake are likely to be multifactorial, and the patients may be afflicted with one or all of these etiological factors. Considering the reduced food intake, prescription of unpalatable diets (e.g., a low-sodium diet) has a negative impact on intake as it negatively affects the acceptance and palatability of the diet. In addition to the etiological factors already mentioned, it is also important to highlight that patients are admitted to the hospital because they are with severe liver disease. Sickness itself reduces appetite, the ability to digest and absorb food, and influences the metabolic utilization of food.[28] It must be emphasized that disease severity can also impair the assessment of food intake through methods that require broad patient participation in assessing food intake, such as instruments involving the DR or a 24-hour recall.

Although these are widely used methods, they require a long time to obtain the data, up to three days for diet records, plus the time needed to transfer it to software and perform the energy and macronutrient calculations. Furthermore, the reliability and quality of the data may not be as good because it depends on the patient's memory and collaboration.[12] On the other hand, the FIVS has the advantage of quick application and data collection, expediting dietary intake evaluation in the hospital setting.

The FIVS was used to evaluate lunch because it is normally the main meal of the day in the evaluated country and there is consensus about its importance due to the considerable energy supply it provides. Moreover, in a multivariate analysis in the nutritionDay study[26], essentially the same results were obtained when lunch food intake was replaced by breakfast or dinner intake. The food intake at a single meal was used as an indicator of total intake because the effect on outcome was similar in all three meals, and there was a significant positive correlation with overall food intake.

In the present study, we did not observe an association between the presence of malnutrition risk or malnutrition and dietary intake. On the other hand, Sharma et al.[31] reported that well-nourished patients (SGA A) consumed significantly more calories than malnourished patients (SGA B and C) in a sample of 251 outpatients with cirrhosis. However, it is important to underscore the fact that we evaluated hospitalized patients with severe liver disease associated with several complications that may have contributed to the patients having an inadequate dietary intake in general, independently from nutritional status.

Regarding complications, it should be noted that for patients with high-grade HE, the FIVS might be unreliable due to the patient's condition. This study included only patients with initial grades (I and II) of HE, i.e. who had the neurological capacity to answer the questions. These patients were included because HE is one of the main and most prevalent complications of decompensated cirrhosis and these patients should also be evaluated. In addition, there was excellent agreement between patient and evaluator responses, even when patients with HE were included.

Concerning the low use of ONS on the day of evaluation, this fact can be explained due to data were collected within 72 hours of hospital admission, an observation period of food intake. However, if the energy and/or protein of a regular diet are not enough, they should be supplemented with ONS when appropriate, since ONS are ideally suited to provide high-quality nutrition when diet alone is insufficient to meet nutritional needs.[32] In our opinion, including ONS between larger meals would be the best strategy, especially at night, after dinner. However, for patients who do not tolerate lunch and dinner, the ONS could be used as a meal replacement until appetite is restored.

As for the strengths of the study, we highlight the adaptation of a practical, easy-to-implement, low-cost instrument for use in patients with cirrhosis in a hospital setting, a population that is often overlooked. Furthermore, to our knowledge, our study was the first to use a visual scale to assess the food intake in these patients. This instrument could be an effective alternative to currently used methods. Another strength is that local food data and composition tables were used to calculate DR, thus approximating more realistic intake estimates. In addition, the same-trained researcher performed all nutritional assessment tools, and self-reported measures were not needed. Nevertheless, some limitations remain. First, although we did not use food weighing, which is considered the gold standard method, all meals served had standardized portioning. Weighing all the foods served to patients is not feasible in the clinical practice of a large hospital, as was our case. Second, food intake data were obtained for only a short period due to the patient's illness severity and for not always having the assistance of caregivers. Furthermore, many had fasted for some time for exams, which impeded data collection. Therefore, it was possible to perform only one-day DR. Third, the FIVS only assesses the amount consumed and not the quality of the meal. If identified reduced intake, and to assess the quality, other methods should be used for a more detailed evaluation.

In conclusion, the results of this study demonstrate that FIVS can be implemented in clinical practice to measure food intake in patients with decompensated cirrhosis as a substitute for the DR since it is a non-invasive, low-cost, quick, and easy bedside method for obtaining data. Hospitalized patients with decompensated cirrhosis are profoundly affected by reduced food intake. They present a significant caloric and protein deficit, which contributes to a worsening nutritional status and disease progression. Thus, we suggest individualized nutritional assessment and early intervention with ONS for nutritional support of hospitalized patients with decompensated cirrhosis.

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Table 1 – Demographic, clinical, and nutritional characteristics of hospitalized patients with decompensated cirrhosis (n = 94).

Variable	**N (%) / Mean ± SD / Median (P25-75)**
Age (years)	60.29 ± 9.33
Sex	
Male	61 (64.9%)
Complications at admission	
Ascites	68 (72.3%)
Mild	25 (36.8%)
Moderate	42 (61.7%)
Severe	1 (1.5%)
Variceal bleeding	24 (25.5%)
Hepatic encephalopathy	17 (18.1%)
Coexistent HCC	27 (28.7%)
Diabetes	37 (39.4%)
Hypertension	35 (37.2%)
Child-Pugh score	
A	8 (8.5%)
B	57 (60.6%)
C	29 (30.9%)
MELD score	14 (12 - 18)
ALT, n=92 (U/L)	31.5 (20.25 – 55.5)
AST, n=93 (U/L)	53 (36.5 – 95)
GGT, n=80 (U/L)	106 (66.25 – 206.75)
ALP, n=91 (U/L)	127 (84 – 191)
Albumin (g/dL)	3 ± 0.58
Creatinine (mg/dL)	0.89 (0.71 – 1.35)
Urea (mg/dL)	39 (28 – 73.5)
Sodium (mEq/L)	138 ± 4.3
Potassium (mEq/L)	4.27 ± 0.67
RFH-NPT	
Low risk	4 (4.3%)
Moderate risk	12 (12.8%)
High risk	78 (83%)
BMI (kg/m²)	26.08 ± 4.51
BMI	
Malnutrition	9 (9.6%)
SGA	
A	24 (25.5%)
B	52 (55.3%)
C	18 (19.1%)

Categorical variables data were expressed as absolute frequency (n) and relative frequency (%) and quantitative variables are expressed as mean and standard deviation (mean ± SD) or median and interquartile ranges (IQR: 25^{th}-75^{th} percentile). HCC: Hepatocellular carcinoma, RFH-NPT: Royal Free Hospital – Nutritional Prioritizing Tool, BMI: Body mass index, SGA: Subjective

Global Assessment. ALP: alkaline phosphatase, ALT: alanine aminotransferase, AST: aspartate aminotransferase, GGT: gamma-glutamyl transferase, HCC: Hepatocellular carcinoma, RFH-NPT: Royal Free Hospital – Nutritional Prioritizing Tool, BMI: Body mass index, SGA: Subjective Global Assessment.

Table 2 – The difference in nutrition prescription and mean daily energy and macronutrient intake using DR method (n = 94).

	Nutrition prescription	**Dietary intake**	**Difference**	**p-value**
Kcal/d	2191.25 ± 295.78	1289.41 ± 509.72	- 901.84 ± 474.07	< **0.001**
Kcal/kg/d	31.25 ± 7.70	18.61 ± 7.94	- 12.64 ± 7.65	< **0.001**
Protein(g)	100.76 ± 17.13	50.80 ± 21.42	- 49.96 ± 20.43	< **0.001**
Protein g/kg/d	1.44 ± 0.38	0.73 ± 0.34	- 0.70 ± 0.35	< **0.001**
Carbohydrate(g)	297.47 ± 42.41	179.50 ± 71.96	- 117.97 ± 74.54	< **0.001**
Lipid(g)	66.66 ± 12.93	42.32 ± 17.51	- 24.33 ± 17.65	< **0.001**

Quantitative variables are expressed as mean and standard deviation (mean ± SD) and were compared with paired Student's t-test. P-values < 0.05 were considered statistically significant.

Table 3 - Reasons for reduced meal consumption[a] (n = 94).

Reasons	N (%)
"I was not hungry at the time"	22 (23.4%)
"I do not have my usual appetite"	11 (11.7%)
"I did not like the smell/taste of the food"	8 (8.5%)
"I did not like the type of food offered"	4 (4.3%)
"I had nausea/vomiting"	4 (4.3%)
"I normally eat less than what was served"	2 (2.1%)
"I was too tired"	2 (2.1%)

[a] Reduced food intake was defined as consuming "a quarter" or "nothing" of the meal.

Table 4 – Mean daily energy and macronutrient intake using DR method according to the FIVS categories (n = 94).

	About all (n = 49)	**Half (n = 16)**	**A quarter (n = 25)**	**Nothing (n = 4)**
Kcal/d	1526.58 ± 428.27	1282.08 ± 302.83	978.96 ± 468.81	353.59 ± 113.16
Kcal/kg/d	21.28 ± 6.37	19.52 ± 5.68	15.01 ± 9.03	4.65 ± 0.96
Protein(g)	61.72 ± 17.80	48.46 ± 14.59	37.40 ± 17.30	10.01 ± 1.47
Protein g/kg/d	0.86 ± 0.37	0.73 ± 0.26	0.57 ± 0.34	0.13 ± 0.02
Carbohydrate(g)	212.64 ± 60.63	179.36 ± 49.94	137.07 ± 69.55	42.82 ± 13.55
Lipid(g)	48.78 ± 16.70	42.62 ± 9.59	32.72 ± 17.04	16.00 ± 6.47

Quantitative variables are expressed as mean and standard deviation (mean ± SD) and were compared with ANOVA test with Bonferroni multiple comparison analysis.

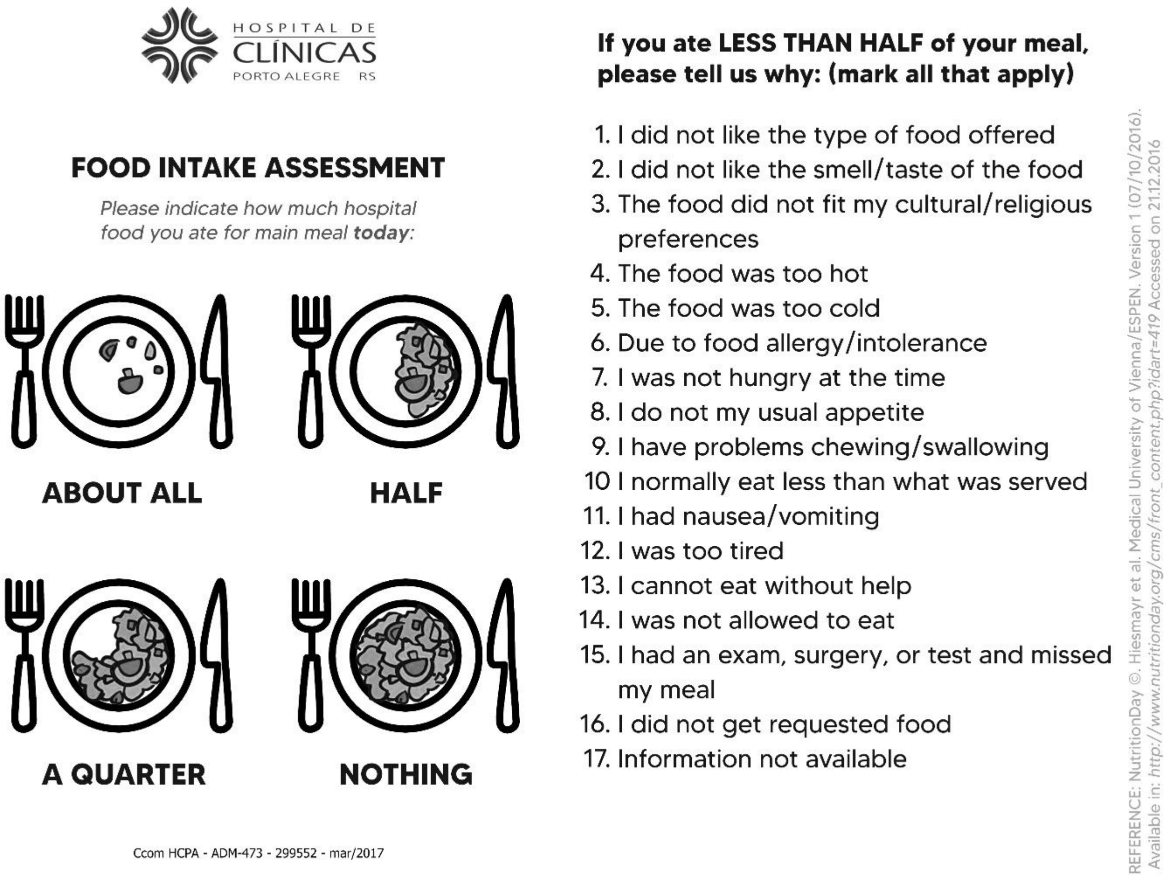

Figure 1 – The Food Intake Visual Scale to assess food intake of hospitalized patients with decompensated cirrhosis.

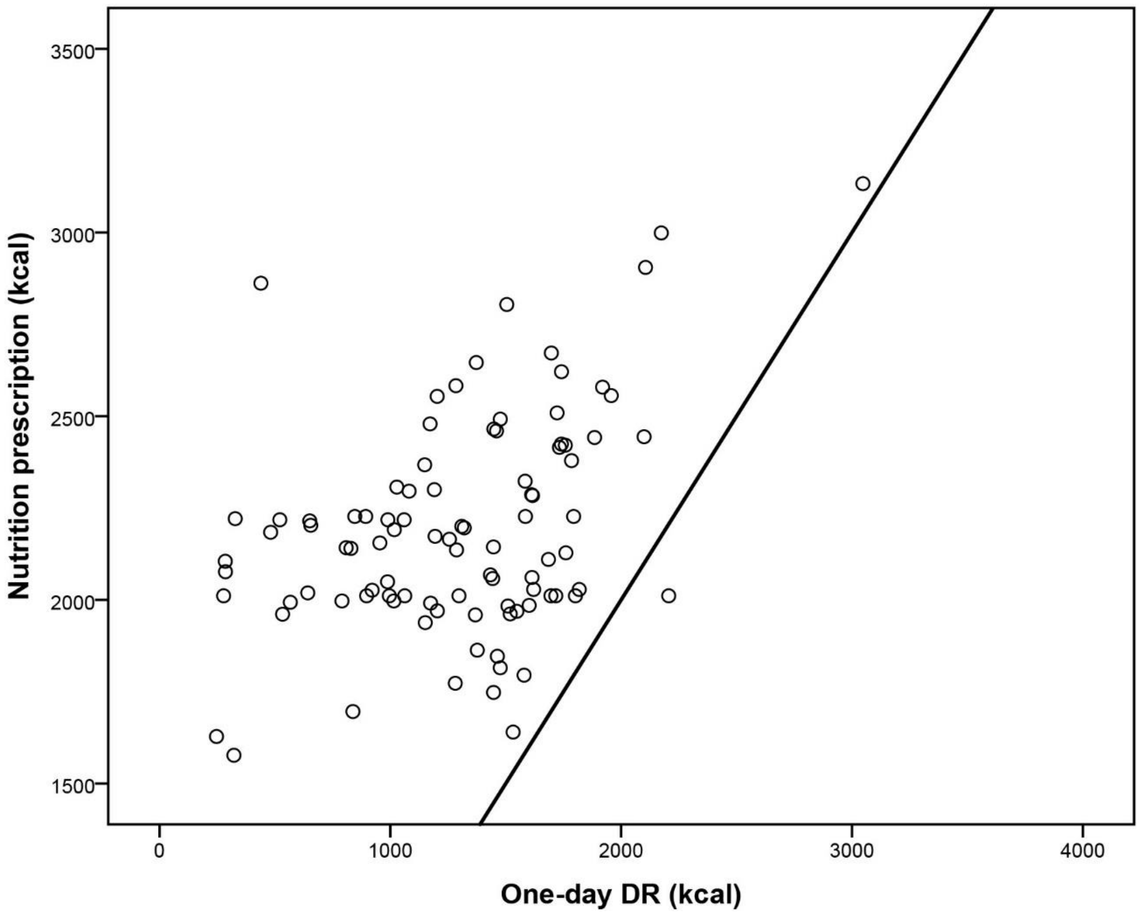

Figure 2 – Dispersion plot of the mean daily energy intake using DR method and the nutrition prescription.

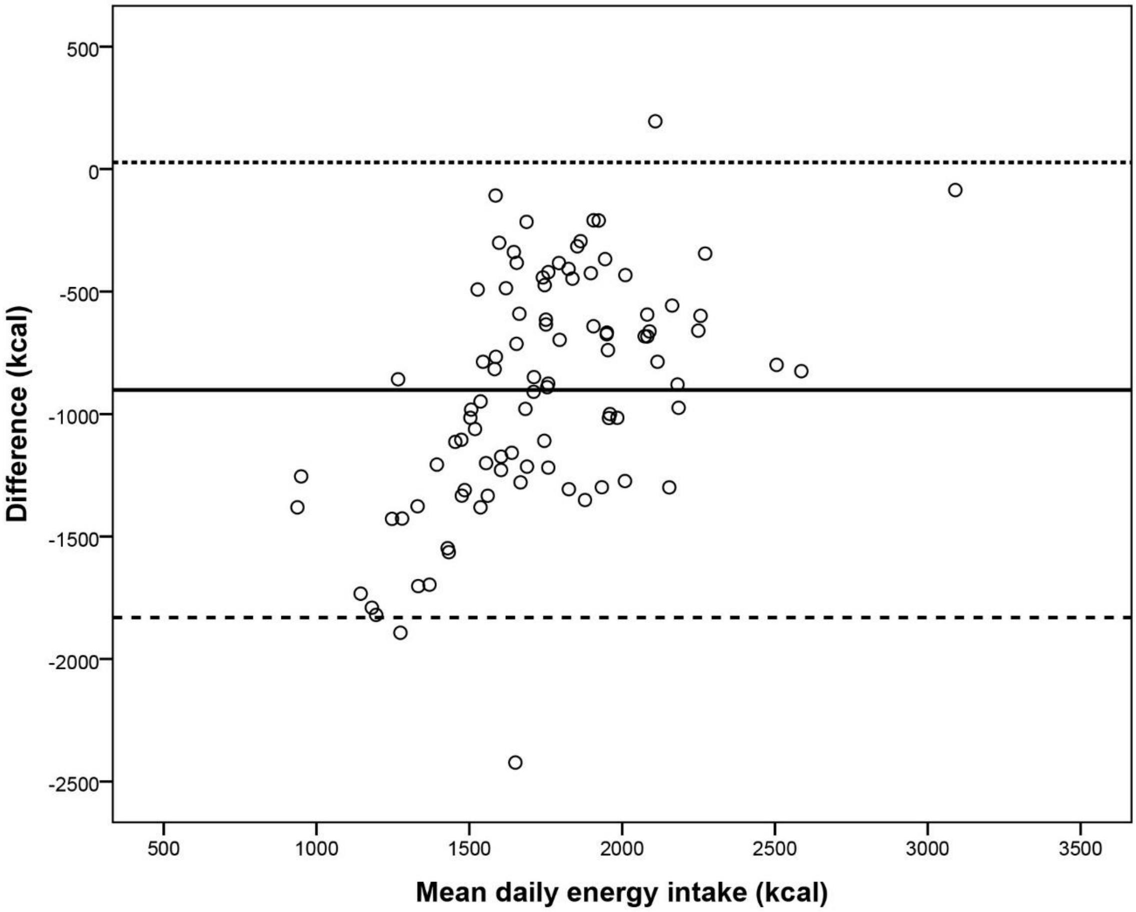

Figure 3 – Bland-Altman analysis of the differences between mean daily energy intake using DR method compared to the nutrition prescription. The solid line represents the mean value of the difference between the energy of the food intake and nutrition prescription. Dotted lines represent each limit of agreement.

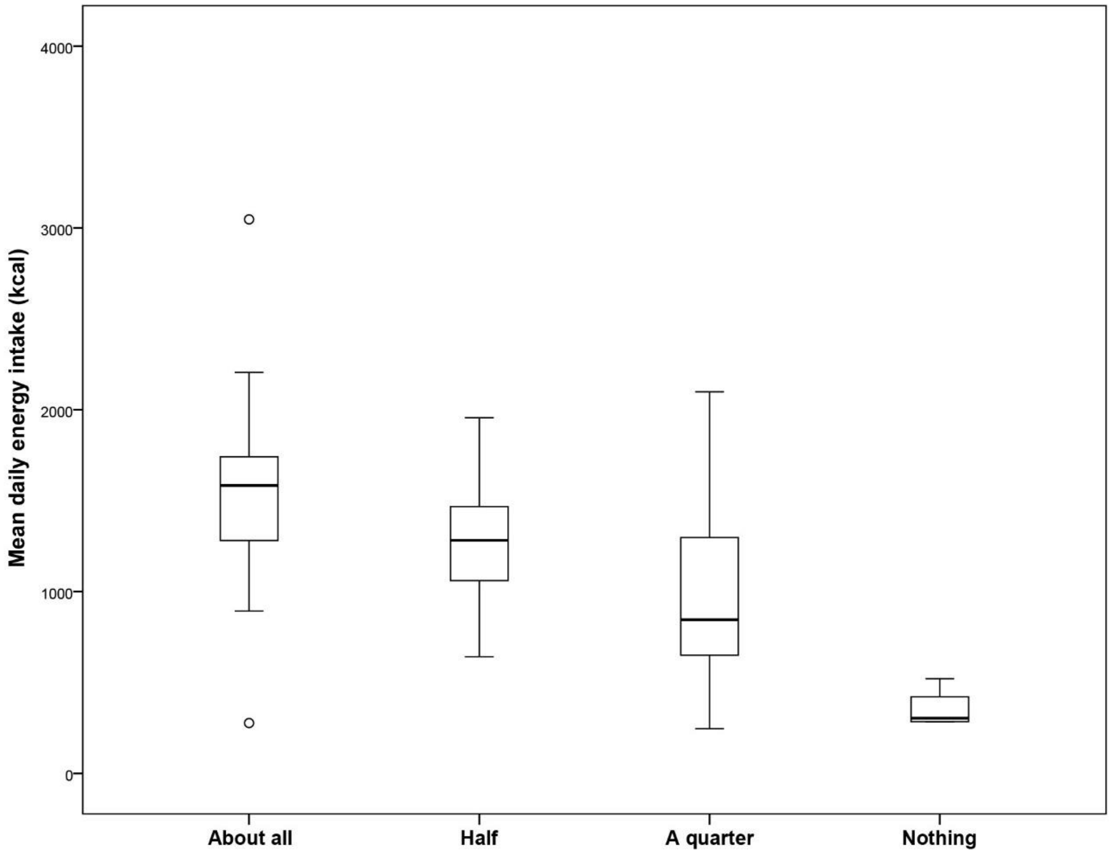

Figure 4 - Boxplot chart of mean daily energy intake using DR method according to FIVS categories. There were no statistically significant differences in the "about all" and "half" categories (p = 0.262), as well as "half" and "a quarter" categories (p = 0.149). There were statistically significant differences in “a quarter” and “nothing” categories (p = 0.038), “about all” and “a quarter” categories (p <0.001), and "nothing" with "about all" and "half" categories (p <0.001). ANOVA test with Bonferroni multiple comparison analysis.

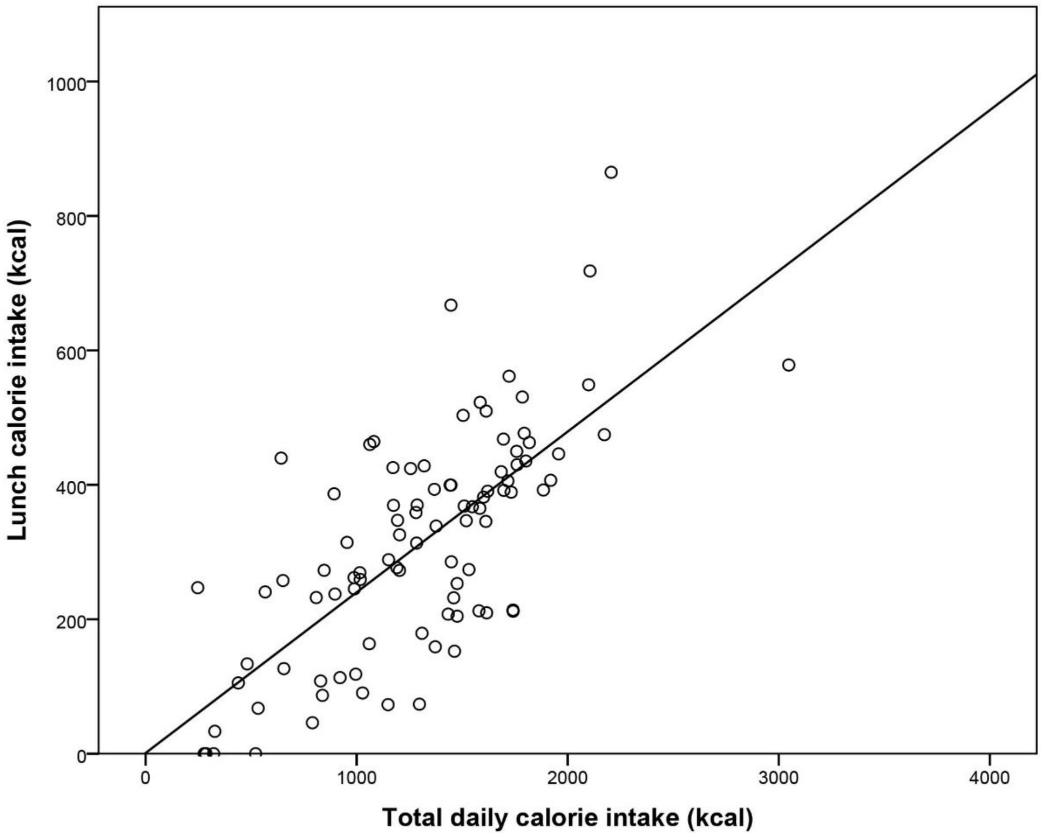

Figure 5 - Correlation between lunch calorie intake and total daily calorie intake using DR method (r = 0.719, p <0.001).

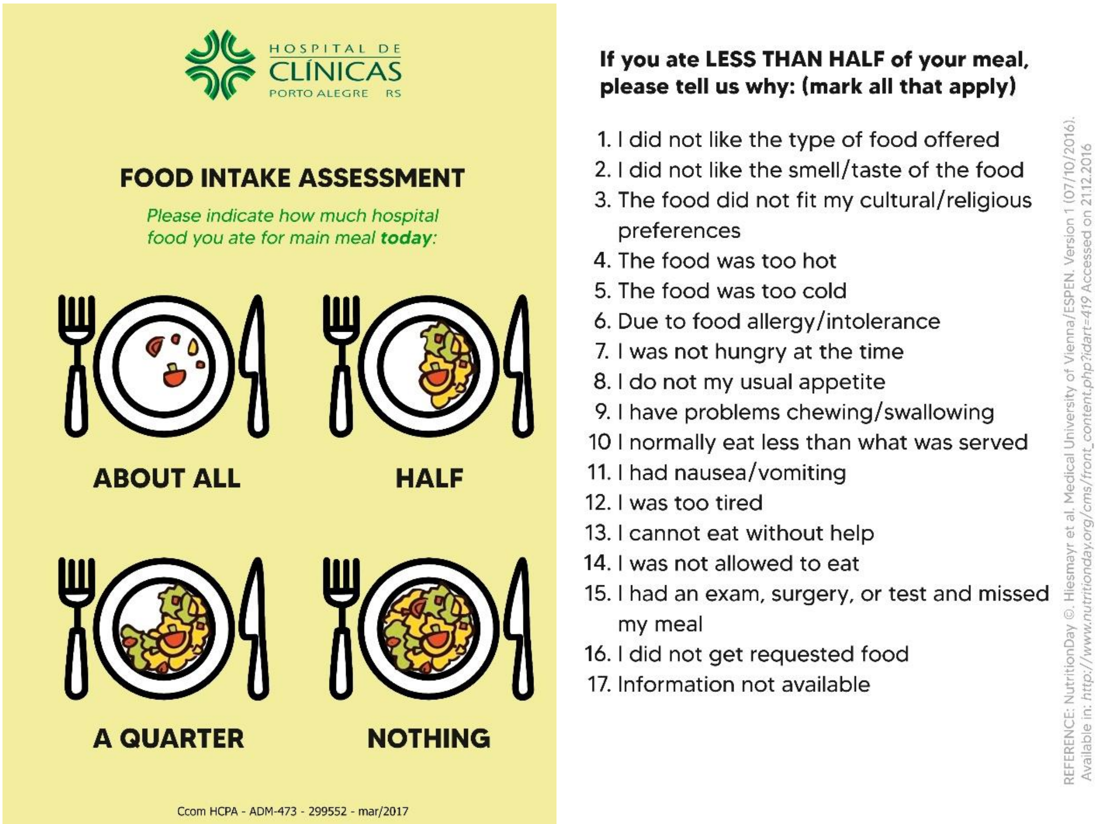

Figure S1 – The Food Intake Visual Scale to assess food intake of hospitalized patients with decompensated cirrhosis.

Figure S2 – The Food Intake Visual Scale to assess food intake of hospitalized patients with decompensated cirrhosis in Portuguese.

6. CONCLUSÕES

A identificação de marcadores de desnutrição e de baixa massa muscular como ponto de partida da avaliação nutricional através dos pontos de corte sugeridos foi associado com o aumento do risco de mortalidade entre 1,71 e 3,44 vezes em pacientes com cirrose, independente da gravidade da doença. Nesse sentido, e por serem ferramentas simples, acessíveis e com baixo custo, sugerimos o uso dos pontos de corte na prática clínica diária como marcadores do estado nutricional de pacientes com cirrose e para identificar pacientes com maior risco de desfechos negativos. A Escala Visual de Ingestão Alimentar pode ser utilizada na prática clínica diária por ser um instrumento rápido, simples e fácil de ser aplicado na beiro do leito.

7. PERSPECTIVAS / CONSIDERAÇÕES FINAIS

Pretendemos continuar trabalhando no banco de dados do Consórcio de Estudos em Nutrição e Doença Hepática, considerando a importância e a relevância de estudos multicêntricos. Temos disponíveis dados de DXA de alguns pacientes, e pretendemos avaliar e comparar estes dados com métodos antropométricos simples e acessíveis na prática clínica diária, como CB e CMB. Também pretendemos sugerir propostas para o GLIM, como o uso da CB e da força do aperto de mão (FAM) na ferramenta.

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9. OUTRAS PRODUÇÕES

Artigo – Utilização de métodos indiretos para estimativa de peso corporal e estatura e sua correlação com os valores aferidos em pacientes hospitalizados.

Artigo publicado no periódico Braspen Journal: Disponível em: https://www.braspen.org/_files/ugd/6ae90a_17108901bc57484fb09e95acecc7e836.pdf.

RESUMO

INTRODUÇÃO: O peso e a estatura são parâmetros amplamente utilizados para avaliação nutricional. Entretanto, no ambiente hospitalar, nem sempre é possível realizar a aferição de forma objetiva, sobretudo em pacientes com dificuldade de locomoção, críticos ou acamados. Diante disso, equações preditivas são alternativas para pacientes hospitalizados. **OBJETIVO:** Avaliar a correlação entre o peso e a estatura aferidos e estimados em pacientes hospitalizados. **MÉTODOS:** Estudo transversal, realizado com pacientes internados nas unidades de Gastroenterologia e Emergência do Hospital de Clínicas de Porto Alegre. O peso foi aferido em balança digital ou guincho de transferência hidráulico e, nos casos de sobrecarga hídrica, o peso foi corrigido. A estatura foi aferida através de estadiômetro ou recumbente. As equações preditivas utilizadas foram as propostas por Chumlea, a partir dos valores da altura do joelho e circunferência do braço. A comparação entre as médias foi realizada pelo teste T de Student e a correlação pelo coeficiente de correlação de Pearson. **RESULTADOS:** 374 pacientes foram avaliados (idade=56,8 ± 14,9 anos e 51,6% homens). A média da estatura aferida e estimada foi de 165,2 ± 9,9 cm e 164,5 ± 9,7 cm, respectivamente (diferença de – 0,72 cm, $p = 0.141$, $r = 0,877$). O valor médio do peso aferido e estimado foi de 71,8 ± 18,5 kg e 70,9 ± 16,2 kg, respectivamente (diferença de – 0,9 kg, $p = 0,076$, $r = 0,882$). Em relação aos pacientes com sobrecarga hídrica, as diferenças observadas foram de – 7,34 kg ($p < 0,001$) e – 4,75 kg ($p < 0,001$), conforme critérios de desconto. **CONCLUSÃO:** A equação preditiva de estatura é adequada para pacientes hospitalizados. Em relação à equação preditiva para a estimativa do peso de pacientes sem sobrecarga hídrica, os valores encontrados foram muito similares e a fórmula mostrou-se adequada, configurando-se uma boa alternativa na impossibilidade de aferir o peso.

Palavras-Chave: Avaliação nutricional; antropometria; peso corporal; estatura.

ABSTRACT

INTRODUCTION: Weight and height are widely used parameters for nutritional assessment. However, in the hospital environment, it is not always possible to perform the measurement objectively, especially in patients with limited mobility, and critical or bedridden patients. Therefore, predictive equations are alternatives for hospitalized patients. **OBJECTIVE:** To evaluate the correlation between measured and estimated weight and height in hospitalized patients. **METHODS:** Cross-sectional study, carried out with patients admitted to the Gastroenterology and Emergency units of Hospital de Clínicas de Porto Alegre. Weight was measured using a digital or hoist scale and, in cases of fluid overload, the weight was corrected. Height was measured using a stadiometer or recumbent. The predictive equations used were those proposed by Chumlea, based on values for knee height and arm circumference. Comparison between means was performed using Student's t-test and correlation using Pearson's correlation coefficient. **RESULTS:** 374 patients were evaluated (age=56.8 ± 14.9 years and 51.6% men). The mean measured and estimated height was 165.2 ± 9.9 cm and 164.5 ± 9.7 cm, respectively (difference of – 0.72 cm, $p = 0.141$, $r = 0.877$). The average value of measured and estimated weight was 71.8 ± 18.5 kg and 70.9 ± 16.2 kg, respectively (difference of – 0.9 kg, $p = 0.076$, $r = 0.882$). Regarding patients with fluid overload, the differences observed were – 7.34 kg ($p < 0.001$) and – 4.75 kg ($p < 0.001$), according to discount criteria. **CONCLUSION:** The height predictive equation is suitable for hospitalized patients. Regarding the predictive equation for estimating the weight of patients without fluid overload, the values found were very similar and the formula proved to be adequate, configuring a good alternative when it is impossible to measure weight.

Keywords: Nutritional assessment; anthropometry; body weight; body height.

INTRODUÇÃO

Alterações no estado nutricional durante internações hospitalares atribuídas à gravidade da doença de base são comuns no ambiente hospitalar, influenciando na ingestão alimentar, absorção de nutrientes e disfunções orgânicas. Sabe-se que a deterioração do estado nutricional tem influência direta na evolução clínica do paciente, ocasionando a redução da imunidade, aumentando o risco e incidência de infecções, complicações nos pós-operatórios, tempo de internação hospitalar e mortalidade.[1] Na América Latina, a prevalência estimada de desnutrição hospitalar é entre 40-60% no momento da admissão, com aumento da prevalência durante a internação hospitalar.[2]

A avaliação antropométrica é frequentemente utilizada para avaliação do estado nutricional e monitoramento de pacientes hospitalizados. É realizada através de equipamentos baratos, simples e acessíveis. Além disso, deve fornecer valores precisos, que sejam de fácil mensuração por diferentes avaliadores através de técnicas minimamente invasivas e que possam ser realizadas à beira do leito.[3]

O peso corporal e a estatura são métodos amplamente utilizados para avaliação do estado nutricional. Contudo, pacientes acamados e impossibilitados de deambular demandam equipamentos e alternativas tecnológicas capazes de atender a necessidade de realizar pesagem no leito. A exemplo, pode-se citar as balanças integradas às camas hospitalares e os guinchos de transferência com balança acoplada. Entretanto, apresentam custo elevado, não sendo uma realidade na maioria dos hospitais.[4]

Neste sentido, métodos indiretos para estimativa do peso corporal e estatura surgem como alternativas no ambiente hospitalar. Dentre as equações mais utilizadas, estão as propostas por Chumlea et al.[5,6], que utilizam medidas simples como altura do joelho (AJ) e circunferência do braço (CB). Contudo, essas equações foram criadas tendo como referência indivíduos norte-americanos, portanto, diante da distinção de populações, torna-se necessário que as fórmulas propostas sejam analisadas.

Sendo assim, o objetivo do presente estudo é avaliar a correlação entre o peso corporal e a estatura aferidos com os valores obtidos através de fórmulas de estimativa em pacientes hospitalizados.

MÉTODOS

Trata-se de um estudo transversal, realizado com indivíduos com idade ≥ 19 anos, de ambos os sexos, internados nas unidades de Gastroenterologia e Emergência do Hospital de Clínicas de Porto Alegre, no período de abril/2017 a dezembro/2019, avaliados em até 72h após a admissão hospitalar. Todos os pacientes hospitalizados no período que preencheram os critérios estabelecidos foram convidados a participar do estudo.

Não foram incluídos pacientes com doença intestinal com má absorção; doenças neurológicas degenerativas; HIV+; sem condições psíquicas e/ou cognitivas suficientes para participação; gestantes e lactantes; indivíduos com amputação de membros; ou aqueles em que não fosse possível aferir as medidas antropométricas.

Avaliação antropométrica

Estatura

A estatura foi aferida através de estadiômetro fixo na parede, com o paciente descalço, de costas para o estadiômetro, com os calcanhares juntos, em posição ereta, olhando para frente e com os braços estendidos ao longo do corpo.[7] No caso de impossibilidade, foi realizada a estatura recumbente, que é a medida de comprimento do indivíduo do topo da cabeça até a planta do pé, na posição supina e com o leito em posição horizontal completa.[8]

Peso corporal

O peso atual foi aferido em balança digital de plataforma da marca Filizola® com capacidade para 180 kg, com o paciente descalço, com roupa leve e livre de adereço.[7] No caso de impossibilidade, o peso foi aferido através de balança digital portátil na beira do leito da marca Líder® ou então através de guincho de transferência hidráulico da marca Eleve®. Em caso de sobrecarga hídrica, o peso seco foi estimado conforme critérios de desconto disponíveis na literatura: através de desconto absoluto (– 1 kg edema leve, – 5 kg edema moderado e – 10 kg edema grave / – 2,2 kg ascite leve, – 6 kg ascite moderada e – 14 kg ascite grave) e através de desconto percentual (– 5% ascite leve, – 10% ascite moderada, – 15% ascite grave e – 5% adicional com a presença de edema).[9,10]

Altura do joelho

A AJ foi aferida com o indivíduo em posição supina, com a perna formando um ângulo de noventa graus com o joelho e o tornozelo. Utilizou-se uma fita métrica flexível da marca Cescorf®, posicionada na superfície plantar do pé (calcanhar), e traçada até a cabeça da patela (rótula).[5]

Circunferência do braço

A CB foi aferida no ponto médio do braço entre o acrômio e o olécrano, com o indivíduo preferencialmente em pé ou sentado, utilizando-se fita métrica flexível da marca Cescorf®. O ponto médio foi definido com o braço flexionado em direção ao tórax formando um ângulo de 90º e as medidas foram registradas em centímetros.[6]

Fórmulas de estimativa

As equações preditivas utilizadas no estudo estão demonstradas no **Quadro 1**.

Quadro 1 – Equações preditivas de peso corporal e estatura utilizadas no estudo.

Equações preditivas de peso corporal
Feminino

Idade	Brancos	Negros
19-59	(AJ x 1,01) + (CB x 2,81) – 66,04	(AJ x 1,24) + (CB x 2,97) – 82,48
60-80	(AJ x 1,09) + (CB x 2,68) – 65,51	(AJ x 1,50) + (CB x 2,58) – 84,22
Masculino		
Idade	**Brancos**	**Negros**
19-59	(AJ x 1,19) + (CB x 3,21) – 86,82	(AJ x 1,09) + (CB x 3,14) – 83,72
60-80	(AJ x 1,10) + (CB x 3,07) – 75,81	(AJ x 0,44) + (CB x 2,86) – 39,21
Equações preditivas de estatura		
Feminino		
Brancos		**Negros**
A (cm) = 70,25 + [1,87 x AJ (cm)]-[0,06 x I (anos)]		A (cm) = 68,1 + [1,86 x AJ (cm)]-[0,06 x I (anos)]
Masculino		
Brancos		**Negros**
A (cm) = 71,85 + [1,88 x AJ (cm)]		A (cm) = 73,42 + [1,79 x AJ (cm)]

Fonte: Chumlea et al.[5,6]
AJ: altura do joelho, CB: circunferência do braço.

Análise Estatística

Realizada análise descritiva para as variáveis quantitativas através de média e desvio padrão, conforme distribuição, enquanto as variáveis categóricas foram expressas em frequência absoluta (n) e relativa (%). A comparação entre as médias foi realizada através do teste T de Student e a correlação entre as medidas diretas e estimadas através do coeficiente de correlação de Pearson. Valores de $p < 0,05$ foram considerados estatisticamente significativos. As análises foram realizadas no programa SPSS (Statistical Package for the Social Sciences), v.20 (SPSS Inc. Chicago, IL, USA).

Aspectos éticos

Todos os participantes ou responsáveis foram informados sobre os procedimentos da coleta e aceitaram participar do estudo através da assinatura do Termo de Consentimento Livre e Esclarecido. Os projetos foram aprovados pelo Comitê de Ética em Pesquisa da instituição sob os pareceres de nº 2016-0655 e 2019-0070.

RESULTADOS

Foram avaliados 374 pacientes, com idade média de 56,8 ± 14,9 anos, dos quais 51,6% eram homens. Os principais motivos de internação foram por descompensação da cirrose (26,7%, n = 100), distúrbios gastrointestinais (25,4%, n = 95) e doenças respiratórias (18,9%, n = 71). A **Tabela 1** apresenta os valores médios de peso corporal e estatura aferidos e estimados da amostra avaliada.

Tabela 1 – Valores de peso corporal e estatura aferidos e estimados em pacientes hospitalizados (n = 374).

Variáveis	**Média ± DP**
Peso aferido	71,7 ± 17,5 kg
Peso estimado	69,2 ± 16,1 kg
Estatura aferida (n = 100)*	165,2 ± 9,9 cm
Estatura estimada (n = 100)*	164,5 ± 9,7 cm

* 100 pacientes tiveram a estatura aferida através de estadiômetro ou recumbente.

A correlação entre o peso aferido e o peso estimado foi de r = 0,857 (correlação forte) e entre a estatura aferida e estimada foi de r = 0,877 (correlação forte), conforme demonstrado na **Figura 1**. A diferença entre o peso aferido e estimado foi de – 2,42 kg (p < 0,001), já a diferença entre a estatura aferida e estimada foi de – 0,72 cm (p = 0.141).

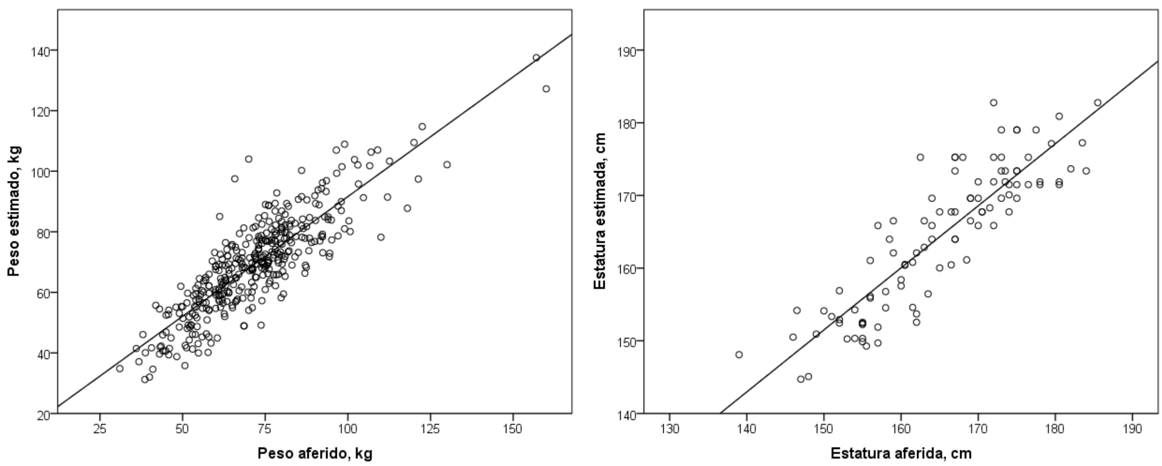

Figura 1 – Correlação entre o peso corporal e estatura aferidos com os dados estimados através de equações preditivas.

Dos 374 pacientes que tiveram o peso aferido, 22,7% (n = 85) apresentou sobrecarga hídrica. Excluindo estes pacientes da amostra (n = 289), a média encontrada de peso aferido e estimado foi de 71,8 ± 18,5 kg e 70,9 ± 16,2 kg, respectivamente. A diferença observada entre as médias foi de – 0,9 kg (p = 0,076) e a correlação foi de r = 0,882 (correlação forte), conforme demonstrado na **Figura 2**. Os dados dos pacientes com sobrecarga hídrica (n = 85) estão apresentados na **Tabela 2.**

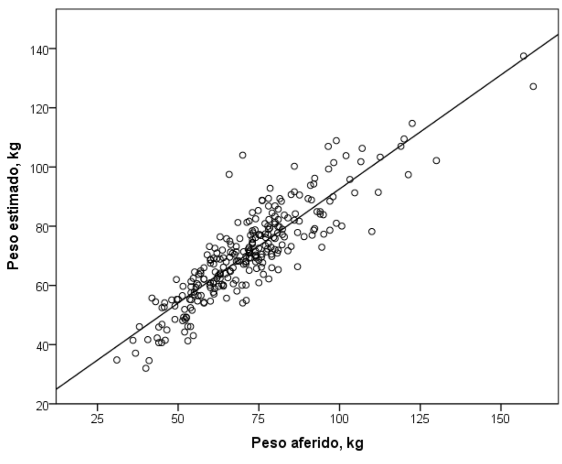

Figura 2 – Correlação entre o peso aferido e estimado através de equação preditiva em pacientes sem sobrecarga hídrica.

Tabela 2 - Valores de peso aferido e estimado em pacientes hospitalizados com sobrecarga hídrica (n = 85).

Variáveis	**Média ± DP**
Peso aferido (desconto absoluto)	70,6 ± 13,8 kg
Peso aferido (desconto percentual)	68,1 ± 12,5 kg
Peso estimado	63,3 ± 13,8 kg

A diferença entre o peso aferido com desconto absoluto e percentual em relação ao peso estimado foi de – 7,34 kg ($p < 0,001$) e – 4,75 kg ($p < 0,001$), respectivamente. A correlação entre o peso aferido (desconto absoluto) com o peso estimado foi de r = 0,805 (correlação forte) e entre o peso aferido (desconto percentual) com o peso estimado foi de r = 0,808 (correlação forte), conforme demonstrado na **Figura 3.**

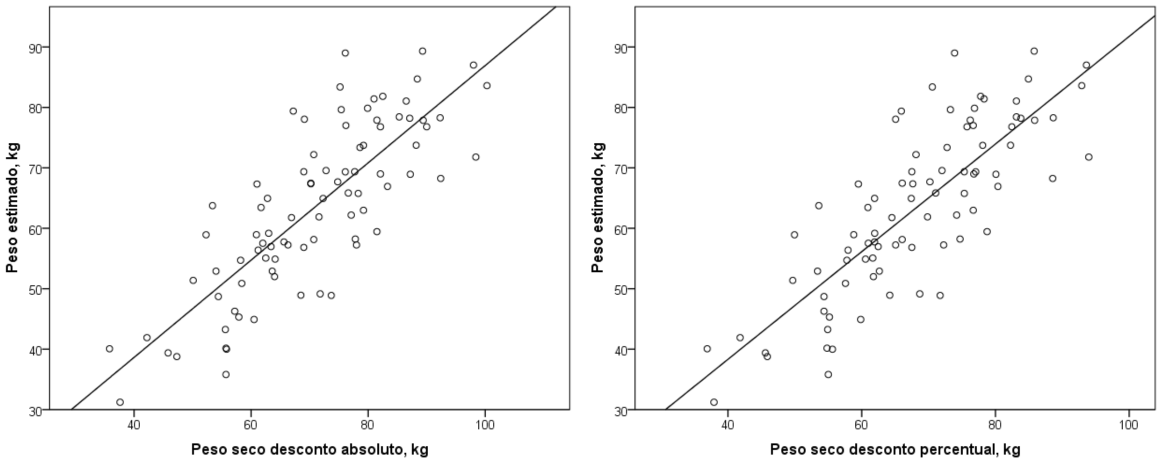

Figura 3 - Correlação entre o peso seco com desconto absoluto e percentual com o peso estimado através de equação preditiva em pacientes com sobrecarga hídrica.

DISCUSSÃO

O presente estudo avaliou a correlação entre o peso corporal e a estatura aferidos com os dados estimados através de equações preditivas em pacientes hospitalizados. Foi observado que a estatura estimada apresenta forte correlação com a estatura aferida e que a diferença observada entre as médias não foi estatisticamente significativa. Em relação ao peso corporal, apesar da forte correlação, as médias diferiram de forma significativa na população geral. Entretanto, não foi observada diferença estatisticamente significativa entre as médias após exclusão dos pacientes com sobrecarga hídrica da amostra.

Estudos prévios demonstram que a estatura foi superestimada através da fórmula de estimativa na maioria dos indivíduos[11,12,13], dado não observado no presente estudo. A altura do corpo é melhor determinada com o indivíduo em pé, descalço, com as costas contra um estadiômetro. No entanto, a medição da estatura utilizando um método padrão e direto pode ser difícil em alguns pacientes hospitalizados, como em pacientes acamados, idosos ou frágeis, ou em pacientes com deformidade de membro e/ou coluna vertebral.[13] Neste sentido, a fórmula para estimar a altura surge como uma opção no ambiente hospitalar. Ainda, o uso da AJ pode justificar a melhor aproximação com a estatura aferida, visto que as medidas dos ossos longos não sofrem interferências posturais com o envelhecimento e que, por esta razão, são melhores preditoras do valor real da estatura em comparação com outros segmentos ósseos.[3] Todavia, é importante ressaltar que seu uso também pode ser limitado, principalmente em pacientes acamados, onde o posicionamento correto da perna pode ser difícil, ou em indivíduos com amputação de membros inferiores. Nestes casos, equações que utilizam valores de meia envergadura e comprimento do braço podem ser opções.[14]

Sobre o peso corporal, estudos prévios observaram diferença entre os valores aferidos e estimados.[15,16,17] No presente estudo, a fórmula de estimativa subestimou os valores de peso corporal na população geral. Entretanto, não foi observada diferença estatisticamente significativa após exclusão dos pacientes com sobrecarga hídrica da amostra. Sendo assim, essa diferença inicialmente observada pode ser explicada por essa razão, bem como pelas alterações de composição corporal decorrentes do avanço da idade e da própria doença, visto que a medida antropométrica utilizada na fórmula evidencia o declínio da musculatura esquelética e a redução do tecido adiposo local, que não ocorrem de maneira uniforme no corpo, bem como pelo fato de a fórmula ter sido elaborada a partir de indivíduos norte-americanos

Há outras fórmulas disponíveis na literatura, como a de Rabito et al.[18], que além da CB, utiliza os valores da circunferência abdominal (CA) e da circunferência da panturrilha (CP). Entretanto, seu uso é contestável no ambiente hospitalar devido à dificuldade de aferição da CA e CP em pacientes acamados, em pós-operatório abdominal, bem como na presença de ascite e edema de membros inferiores. Ainda, há fórmulas que utilizam valores de dobras cutâneas, entretanto, a aferição requer a disponibilidade de adipômetro, treinamento do avaliador e o posicionamento adequado do paciente.[3]

Considerando os pacientes com sobrecarga hídrica, houve uma diferença clínica relevante entre o peso aferido e estimado. É importante ressaltar que não há métodos bem validados para ajuste do peso corporal em pacientes com cirrose com sobrecarga hídrica.[19] Sendo assim, a fórmula pode estar subestimando os valores ou, mesmo com os descontos, o peso seco permanece superior ao peso real. Devido às dificuldades no ajuste do peso corporal desses pacientes na prática clínica, Alves et al.[20] desenvolveu uma equação para estimar o peso seco em pacientes cirróticos com ascite, apresentando forte correlação com o peso aferido.

Como limitação do presente estudo, salientamos o menor número de pacientes que tiveram a estatura aferida. Entretanto, considerando que um dos locais em que foi realizado o estudo é a unidade de Emergência, devemos levar em consideração a limitação do espaço físico, a dificuldade de posicionar adequadamente os pacientes para utilizar a estatura recumbente, bem como aferir a estatura em pé através de estadiômetro. Contudo, como pontos fortes do presente estudo, ressaltamos que não foram utilizados valores de peso e estatura autorreferidos, sendo todas as medidas realizadas por avaliadores treinados.

Diante dos resultados apresentados, conclui-se que a equação preditiva para estimativa da altura é adequada para pacientes hospitalizados. Em relação à equação preditiva para a estimativa do peso de pacientes sem sobrecarga hídrica, os valores encontrados foram muito similares e a fórmula mostrou-se adequada, configurando-se uma boa alternativa na impossibilidade de aferir o peso de forma objetiva. Considerando a especificidade de pacientes com sobrecarga hídrica, houve uma diferença clínica relevante entre o peso aferido e o estimado, o qual foi bastante subestimado. Nesse sentido, sugerimos o uso de fórmulas específicas para essa população e ressaltamos a importância de avaliadores treinados para realização das medidas utilizadas nas fórmulas. Sendo assim, na ausência de balança eletrônica, balanças integradas às camas hospitalares ou guincho de transferência hidráulico ou na impossibilidade de utilizá-los, a fórmula de estimativa é uma opção para pacientes hospitalizados, porém a mesma deve ser utilizada com cautela para alguns grupos de pacientes a fim de evitar condutas equivocadas.

Conflito de interesse

Os autores não possuem conflito de interesse.

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Participação em outros trabalhos do grupo de pesquisa:

- Colaboração e participação no artigo intitulado: "Predicting dry weight in patients with cirrhotic ascites undergoing large-volume paracentesis." Autoria principal de Bruna Cherubini Alves. https://doi.org/10.1016/j.clnesp.2023.01.002.
- Coorientação do TCC intitulado: "Ângulo de fase como ferramenta de avaliação de desnutrição em pacientes com cirrose descompensada." TCC do curso de nutrição da UFRGS, da aluna Joana Hoch Glasennap.
- Coorientação do TCC intitulado: "Cuidados nutricionais da doença hepática gordurosa não alcoólica: manual de orientações nutricionais para pacientes com doença hepática gordurosa não alcoólica." TCC do curso de nutrição da UFRGS, da aluna Maitara Cardoso Machado de Oliveira.
- Coorientação do TCC intitulado: "Correlação entre circunferência do braço, músculo adutor do polegar e circunferência da panturrilha: análise da similaridade nos resultados." TCC do curso de nutrição da UFRGS, da aluna Jéssica Correa dos Santos.
- Coorientação do TCC intitulado: "Avaliação da prevalência de desnutrição em pacientes admitidos em um serviço de emergência através do critério GLIM (Global Leadership Initiative on Malnutrition)." TCC do curso de nutrição da UFRGS, da aluna Renata Wolf.
- Coorientação do TCR intitulado: "Adaptação transcultural do instrumento Liver Disease Undernutrition Screening Tool para a língua portuguesa do Brasil." TCR da Residência Integrada Multiprofissional em Saúde do Hospital de Clínicas de Porto Alegre, área de concentração: Programa de Atenção Integral ao Paciente Adulto Cirúrgico, da aluna Nairane Pinto Boaventura.
- Participação no projeto de mestrado intitulado: Utilização de instrumentos de triagem nutricional em um serviço de emergência: factibilidade e validade preditiva." Programa

de Pós-Graduação em Nutrição, Alimentação e Saúde da UFRGS, do aluno Johnny Galhano dos Santos.

10. APÊNDICE

Escala Visual de Ingestão Alimentar em português

If you ate LESS THAN HALF of your meal, please tell us why: (mark all that apply)

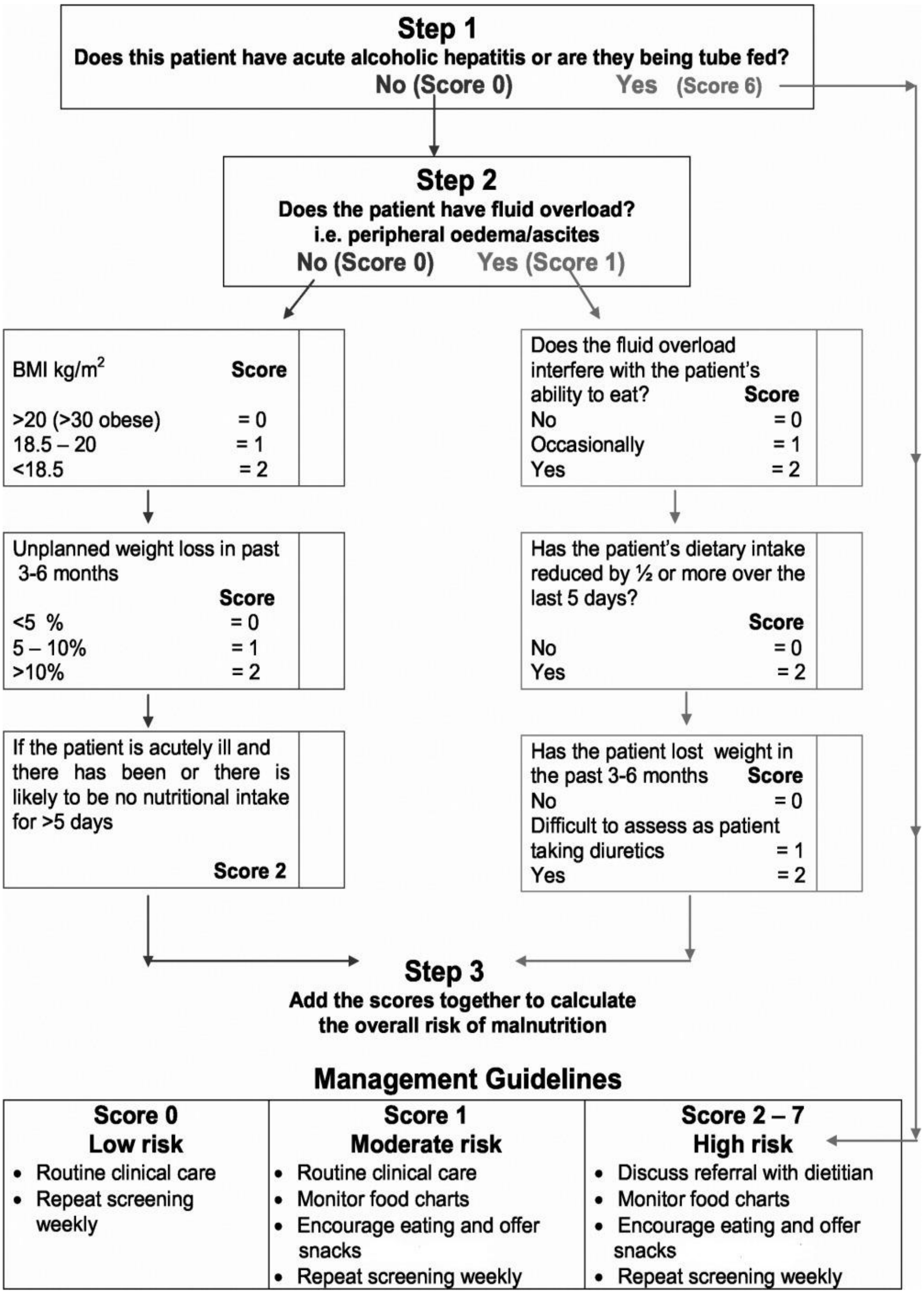
1. I did not like the type of food offered
2. I did not like the smell/taste of the food
3. The food did not fit my cultural/religious preferences
4. The food was too hot
5. The food was too cold
6. Due to food allergy/intolerance
7. I was not hungry at the time
8. I do not my usual appetite
9. I have problems chewing/swallowing
10 I normally eat less than what was served
11. I had nausea/vomiting
12. I was too tired
13. I cannot eat without help
14. I was not allowed to eat
15. I had an exam, surgery, or test and missed my meal
16. I did not get requested food
17. Information not available

REFERENCE: NutritionDay ©. Hiesmayr et al. Medical University of Vienna/ESPEN. Version 1 (07/10/2016).
Available in: *http://www.nutritionday.org/cms/front_content.php?idart=419* Accessed on 21.12.2016

11. ANEXOS

Anexo 1

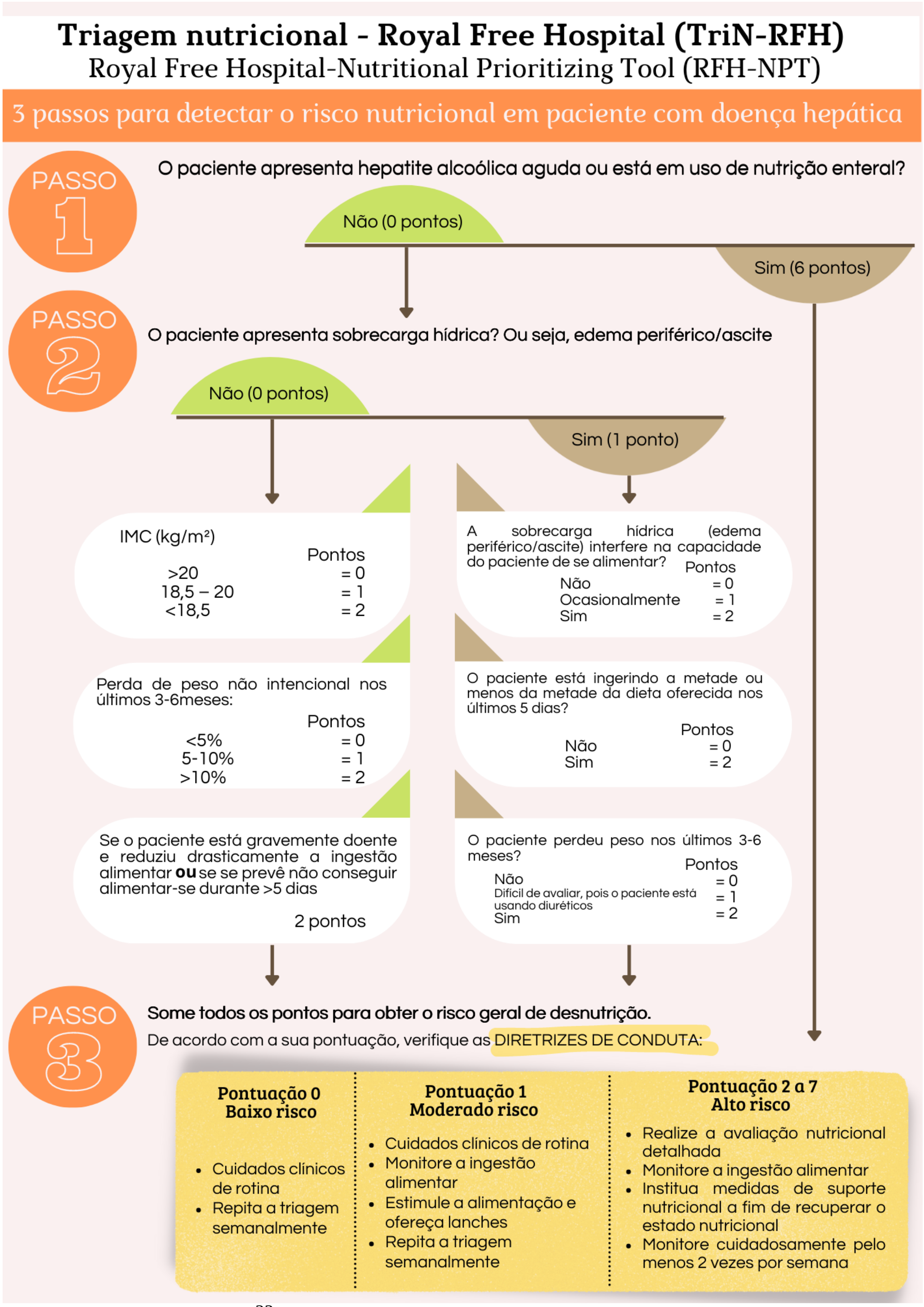
Royal Free Hospital – Nutritional Prioritizing Tool (RFH-NPT)



Fonte: Amodio et al.[32]

Anexo 2

Royal Free Hospital – Nutritional Prioritizing Tool (RFH-NPT) adaptada para o português.



Fonte: Glasenapp et al.[33]

Anexo 3

Avaliação Subjetiva Global (ASG)

Avaliação subjetiva global do estado nutricional

(Selecione a categoria apropriada com um X ou entre com valor numérico onde indicado por "#")

A. História

1. Alteração no peso

Perda total nos últimos 6 meses: total = # ____________________kg; % perda = #________________

Alteração nas últimas duas semanas: _____aumento _____sem alteração _____diminuição.

2. Alteração na ingestão alimentar

_____ sem alteração

_____alterada _____duração = # _____semanas.

_____tipo: _____dieta sólida sub-ótima _____dieta líquida completa _____líquidos hipocalóricos _____inanição.

3. Sintomas gastrintestinais (que persistam por > 2 semanas)

_____nenhum _____náusea _____vômitos _____diarréia _____anorexia.

4. Capacidade funcional

_____sem disfunção (capacidade completa)

_____disfunção _____duração = # _____semanas.

_____tipo: _____trabalho sub-ótimo _____ambulatório _____acamado.

5. Doença e sua relação com necessidades nutricionais

Diagnóstico primário

(especificar)____

Demanda metabólica (stress): _____sem stress _____baixo stress _____stress moderado _____stress elevado.

B. Exame Físico (para cada categoria, especificar: 0 = normal, 1+ = leve, 2+ = moderada, 3+ = grave).

_____perda de gordura subcutânea (tríceps, tórax)

_____perda muscular (quadriceps, deltóide)

_____edema tornozelo

_____edema sacral

_____ascite

C. Avaliação subjetiva global (selecione uma)

_____A = bem nutrido

_____B = moderadamente (ou suspeita de ser) desnutrido

_____C = gravemente desnutrido

Fonte: Detsky et al.[42]