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Aline Graziele do Nascimento

SUBNOTIFICAÇÃO DE INGESTÃO CALÓRICA, AVALIADA POR INSTRUMENTOS DE CONSUMO ALIMENTAR, EM PACIENTES COM DIABETES MELITO TIPO 2.

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Coorientadora: M.ª Nut. Thaiciane Grassi

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RESUMO

Introdução: O Diabetes Melito (DM) do tipo 2 é a forma mais comum de diabetes e está associado à obesidade na maioria dos casos. A avaliação do consumo alimentar é de extrema importância, sendo necessário a utilização de métodos válidos e que forneçam informações confiáveis, pois uma prescrição dietética apropriada, com o objetivo de reduzir o peso corporal em pessoas com DM tipo 2, que estejam com sobrepeso ou obesidade, levando-se em consideração a avaliação dos hábitos alimentares de cada paciente, é essencial. Métodos como o Questionário de Frequência Alimentar (QFA) e o Recordatório Alimentar de 24 horas (RA24h) permitem identificar o consumo alimentar. Entretanto, é possível que esses instrumentos apresentem erros de notificação na avaliação da ingestão, em particular, de calorias.

Objetivos: Avaliar em pacientes ambulatoriais com DM tipo 2: (1) ingestão calórica através do QFA e RA24h; (2) qualidade dos relatos de ingestão calórica; (3) concordância entre os instrumentos QFA e RA24h; (4) correlação da ingestão calórica estimada pelo QFA e RA24h com a taxa metabólica basal (TMB) medida por calorimetria indireta (CI).

Materiais e Métodos: Estudo transversal em pacientes ambulatoriais com DM tipo 2. A ingestão calórica foi avaliada pelos instrumentos QFA e RA24h (média de 3 dias não consecutivos). A TMB foi medida por CI. Foram analisadas variáveis clínicas e laboratoriais. A atividade física foi avaliada através do número de passos/dia com o uso do pedômetro por sete dias. Para avaliar a concordância entre os instrumentos se utilizou coeficiente *Kappa* e, para as correlações o coeficiente de *Spearman.* Para o controle de qualidade da ingestão calórica, se utilizou o ponto de corte sugerido por *Goldberg* cuja razão é representada pela ingestão calórica (avaliada pelos instrumentos) / TMB (avaliada pela CI). Pacientes que apresentaram razão <1,18 e <1,10 para o QFA e RA24h, respectivamente, foram considerados subnotificadores.

Resultados: Foram avaliados 55 pacientes ambulatoriais com DM tipo 2, idade de 62,7 ± 5,3 anos, 11,2 ± 7,3 anos de duração do DM, A1C 7,6% (5,2% – 12,0%), e 52,7% eram do sexo feminino. Os pacientes apresentaram Índice de Massa Corporal (IMC) de 29,9 ± 4,1 kg/m² e 56,4% foram classificados como pouco ativos. A ingestão calórica avaliada pelo QFA foi de 1797,7 ± 641,3 Kcal/dia, e pelo RA24h 1624 ± 484,8 Kcal/dia. A média da TMB, medida por CI, foi de 1641,3 ± 322,3 Kcal/dia. A média da

razão QFA/TMB foi 1,11 ± 0,38 e RA24h/TMB 1,01 ± 0,30. Os instrumentos apresentaram concordância moderada e significativa para avaliação da subnotificação da ingestão calórica (*Kappa* = 0,404; *P* = 0,003). Correlações positivas e significativas foram observadas entre a TMB e o QFA (r = 0,321; *P* = 0,017) e RA24h (r = 0,364; *P* = 0,006). Em relação a qualidade dos relatos de consumo alimentar, 65,5% e 63,6% dos pacientes subnotificaram a ingestão calórica através do QFA e do RA24h, respectivamente.

Conclusão: A subnotificação da ingestão de calorias, avaliada pelo QFA e RA24h, foi observada em aproximadamente 65% dos pacientes com DM tipo 2, em ambos os instrumentos. Ainda, a TMB, medida por CI, se correlacionou positivamente com ambos os instrumentos.

Palavras-chave: Ingestão Energética; Avaliação Dietética; Subnotificação; Diabetes Melito Tipo 2; Diabetes Mellitus Tipo 2.

ABSTRACT

Introduction: Type 2 Diabetes Mellitus (DM) is the most common form of diabetes and is associated with obesity. The assessment of food intake is of utmost importance and valid methods must be used to provide reliable information, as appropriate dietary prescription as the goal of reducing body weight in overweight or obese people with type 2 diabetes, leading to taking into account the assessment of each patients eating habits is essential. Methods such as the Food Frequency Questionnaire (FFQ) and 24-hour dietary recall (24HR) allow the identification of food intake. However, it is possible that these tools have reporting errors in assessing food intake, particularly energy intake (EI).

Objectives: To evaluate in type 2 diabetes mellitus outpatients: (1) EI through FFQ and 24HR; (2) quality of reports of EI; (3) agreement of the instruments; (4) correlation of EI estimated by FFQ and 24HR with basal metabolic rate (BMR) measured by indirect calorimetry (IC).

Materials and Methods: Cross-sectional study in type 2 diabetes mellitus outpatients. EI was assessed by the instruments FFQ and 24HR (mean of 3 non-consecutive days). BMR was measured by IC. Clinical and laboratory variables were analyzed. Physical activity was assessed by the number of steps/day using the pedometer for seven days. To evaluate the agreement between the instruments, the *Kappa* coefficient was used, and for the correlations, the *Spearman's* coefficient. For the quality control of EI, we used the cutoff point suggested by *Goldberg* whose ratio is represented by the EI (evaluated by the instruments) / BMR (evaluated by the IC). Patients with a ratio <1.18 and <1.10 for the FFQ and 24HR, respectively, were considered underreporting.

Results: We evaluated 55 outpatients with type 2 diabetes, age 62.7 ± 5.3 years, 11.2 ± 7.3 years of DM duration, A1C 7.6% (5.2% – 12.0%), and 52.7% were female. The patients presented Body Mass Index (BMI) of 29.9 ± 4.1 kg/m² and 56.4% were classified as little active. The EI evaluated by the FFQ was 1797.7 ± 641.3 Kcal/day and the 24HR 1624 ± 484.8 Kcal/day. The mean BMR, measured by IC, was 1641.3 ± 322.3 Kcal/day. The mean FFQ/BMR ratio was 1.11 ± 0.38 and 24HR/BMR 1.01 ± 0.30. The instruments showed moderate and significant agreement to assess underreporting of EI (*Kappa* = 0.404; *P* = 0.003). Positively and significant correlations were observed between BMR and FFQ (r = 0.321; *P* = 0.017) and 24HR (r = 0.364; *P*

= 0.006). Regarding the quality of food intake reactions, 65.5% and 63.6% of patients underreported EI through FFQ and 24HR, respectively.

Conclusions: Underreporting of calorie intake, assessed by FFQ and 24HR, was observed in approximately 65% of patients with type 2 diabetes in both instruments. Still, the BMR, as measured by IC, correlated positively with both instruments.

Keywods: Energy Intake; Dietary Assessment; Underreporting; Type 2 Diabetes.

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A1C	Hemoglobina Glicada
ADA	*American Diabetes Association*
BMI	Body Mass Index
BMR	Basal Metabolic Rate
CI	Calorimetria Indireta
DM	Diabetes Melito
DM tipo 2	Diabetes Melito tipo 2
EI	Energy Intake
FAO	*Food and Agriculture Organization*
FFQ	Food Frequency Questionnaire
GET	Gasto Energético Total
IC	Indirect Calorimetry
IDF	*International Diabetes Federation*
IMC	Índice de Massa Corporal
NAF	Nível de Atividade Física
QFA	Questionário de Frequência Alimentar
RA24h	Recordatório Alimentar de 24 horas
SBD	*Sociedade Brasileira de Diabetes*
TMB	Taxa Metabólica Basal
WHO	*World Health Organization*
VCO_2	Dióxido de Carbono Produzido
VO_2	Oxigênio Consumido
24HR	24-hour dietary recall

1 REVISÃO DA LITERATURA

1.1 Diabetes Melito

Aspectos gerais e importância da avaliação dos hábitos alimentares:

O Diabetes Melito (DM) consiste em um distúrbio metabólico caracterizado por hiperglicemia persistente, decorrente de deficiência na produção ou ação da insulina, ou em ambos os mecanismos, ocasionando complicações em longo prazo. A hiperglicemia persistente está associada a complicações crônicas, aumento de morbidade, redução da qualidade de vida e elevação da taxa de mortalidade (WHO, 2016).

O DM acomete parte significativa da população mundial - aproximadamente 425 milhões de pessoas com DM (8,8%) no mundo -, e esse número vem aumentando significativamente, principalmente o DM tipo 2, podendo chegar, no ano de 2045, a 629 milhões de pessoas com DM (IDF, 2017). No Brasil, a doença também representa um problema de saúde de grande magnitude. Em 2017, o Brasil ocupou a quarta posição entre os 10 países com maiores taxas de diabetes na população adulta e, estima-se que permanecerá entre os cinco países com maiores prevalências no ano de 2045 (IDF, 2017).

O DM tipo 2 é a forma mais comum da doença, que ocorre geralmente na vida adulta e corresponde de 90% a 95% de todos os casos de DM, sendo caracterizada pela resistência à insulina, condição na qual a hiperglicemia persistente é o resultado da incapacidade do organismo em responder totalmente à ação da insulina, e da incapacidade pancreática em suplantar essa resistência (ADA, 2019). A hiperglicemia persistente é uma das principais responsáveis pelas complicações crônicas micro e macrovasculares, redução da qualidade de vida e aumento da morbimortalidade em pacientes com DM tipo 2 (SBD, 2017).

Ainda, o DM tipo 2 possui uma etiologia complexa e multifatorial, por se tratar de uma doença poligênica, com forte herança familiar, ainda não completamente esclarecida, cuja ocorrência tem contribuição significativa de fatores ambientais. Dentre eles, hábitos dietéticos inadequados e inatividade física, que contribuem para a obesidade, destacam-se como os principais fatores de risco (SBD, 2017; ADA, 2019). De fato, a presença da obesidade é observada em cerca de 80% dos casos da doença (SBD, 2017; ADA, 2019).

Em indivíduos com DM tipo 2, com sobrepeso ou obesidade, as medidas não farmacológicas como mudanças no estilo de vida, que inclui perda de peso (>5%), associada a uma redução na ingestão de calorias, beneficia estes pacientes no controle da glicemia (ADA, 2019). Além disso, a escolha de alimentos saudáveis, com a quantidade e a qualidade correta de nutrientes também contribui para o controle glicêmico e pode garantir ao indivíduo com DM tipo 2, uma melhor qualidade de vida (ADA, 2013).

De fato, a dieta tem papel fundamental no manejo do DM tipo 2, podendo retardar ou mesmo evitar o desenvolvimento das complicações crônicas associadas ao diabetes (ADA, 2019). Neste sentido, se torna essencial que o planejamento dietético de pacientes com diabetes, tenha como base o cálculo da necessidade energética de forma correta (LEVINE, 2005), e ainda, o devido conhecimento dos seus hábitos alimentares para que seja possível a elaboração de uma conduta dietoterápica especifica e individualizada a este grupo de pacientes (ADA, 2019).

1.2 Instrumentos de avaliação de hábitos e/ou consumo alimentar

Os instrumentos de avaliação de consumo alimentar são métodos que permitem identificar o padrão de ingestão alimentar, além de ter a finalidade de fornecer subsídios para o desenvolvimento e a implantação de planos nutricionais de acordo com a realidade de cada indivíduo (FISBERG; MARCHIONI; COLUCCI, 2009). Atualmente, os métodos Questionário de Frequência Alimentar (QFA) e o Recordatório Alimentar de 24 horas (RA24h) são instrumentos comumente utilizados para coleta de dados dietéticos e de padrão de consumo alimentar (NASKA; LAGIOU; LAGIOU*,* 2017).

O RA24h avalia o consumo alimentar atual, e consiste em o paciente recordar, descrever e quantificar detalhadamente todos os alimentos e bebidas ingeridos no dia anterior, ou nas 24horas precedentes à entrevista, e para que represente o padrão de consumo alimentar individual, considerando a variabilidade diária e sazonal, é necessário que seja realizado mais de uma vez no mesmo indivíduo, durante o período de avaliação (NASKA; LAGIOU; LAGIOU*,* 2017). É recomendada a aplicação de três RA24h não consecutivos, sendo dois dias de semana e um de final de semana, pois é reconhecido que a ingestão tende a ser maior nos finais de semana (MA *et al.,* 2009). No entanto, se o objetivo da pesquisa for avaliar a ingestão média de um grupo

ou população, especialmente quando o tamanho da amostra é suficientemente grande, pode ser realizado um único RA24h por entrevistado, quando todos os dias da semana são contemplados no período de avaliação (FAO, 2018). O instrumento deve ser aplicado por um entrevistador bem treinado com o fim de coletar informações precisas e detalhadas, sem julgamentos, nem influência durante a entrevista. Além disso, é considerado um instrumento útil para selecionar os itens alimentares do QFA (FAO, 2018).

Já o QFA é um instrumento que avalia o consumo alimentar habitual, sendo composto por uma lista de alimentos e bebidas, cuja frequência e quantidade de consumo são questionadas ao indivíduo, podendo ser uma entrevista ou auto aplicado, e que engloba a sazonalidade por conter determinado período de tempo na avaliação (FAO, 2018). Este instrumento pode ser quantitativo ou semi-quantitativo (NASKA; LAGIOU; LAGIOU*,* 2017) e é uma ferramenta que requer estudo de desenvolvimento e validação para a população especifica (FAO, 2018). Em pacientes com DM tipo 2, um QFA quantitativo foi previamente validado para esta população de acordo com os hábitos alimentares regionais (SARMENTO *et al.,* 2014).

Entretanto, a avaliação precisa do consumo alimentar ainda é difícil e é considerada um dos principais problemas em estudos epidemiológicos, visto que os métodos possuem limitações, sendo possível que exista relato impreciso acerca do consumo alimentar, podendo ter a interpretação dos dados encontrados comprometida (SCAGLIUSI; LANCHA JÚNIOR, 2003). No **Quadro 1**, estão descritas as vantagens e limitações dos instrumentos: RA24h e QFA.

1.3 Estudos de avaliação de consumo alimentar na população geral e em pacientes com DM tipo 2: identificação de relatos imprecisos

O relato impreciso do consumo alimentar é uma limitação amplamente reconhecida dos métodos de avaliação da dieta, que pode ocorrer por super ou sub-relato de alimentos ou refeições, sendo mais prevalente o relato de ingestão calórica inferior às quantidades mínimas de energia necessárias para a manutenção do peso corporal do indivíduo, conhecido como subnotificação da ingestão calórica (SCAGLIUSI; LANCHA JÚNIOR, 2003). Assim, um sub-relato de consumo alimentar pode ocorrer por subnotificação, quando o indivíduo se mantém em estabilidade de peso e seu relato é inferior à ingestão verdadeira, ou por subconsumo alimentar,

quando há perda de peso durante o período de avaliação e o indivíduo ingere a menos do que seu habitual, durante este tempo de observação (GORIS; WESTERTERP-PLANTENGA; WESTERTERP, 2000).

De acordo com a literatura cientifica, baseando-se no pressuposto que o indivíduo esteja em balanço energético neutro, ou seja, em estabilidade de peso, a ingestão calórica deve ser igual ao gasto energético total (GET), e o desequilíbrio no balanço energético gera perda ou ganho de peso corporal (HALL *et al*., 2012). A taxa metabólica basal (TMB) representa a energia mínima necessária para a manutenção das funções vitais do organismo, e constitui o principal componente do GET (PINHEIRO VOLP *et al*., 2011). A TMB pode ser mensurada através de fórmulas preditivas, ou por calorimetria indireta (CI) que é considerada critério de referência (PINHEIRO VOLP *et al*., 2011). A CI é um método não invasivo e muito preciso de mensuração da TMB, que consiste em quantificar o volume de ar inspirado e expirado, de acordo com a concentração do volume de O_2 (oxigênio) consumido e do volume de CO_2 (gás carbonônico) produzido, permitindo assim mensurar a TMB por meio da análise desta troca de gases (PINHEIRO VOLP *et al*., 2011).

Segundo Goldberg *et al.* (1991), a razão entre ingestão calórica (estimada pelo QFA ou RA24h) e a TMB (estimada através das equações de predição ou medida por CI) permite classificar relatos implausíveis de ingestão calórica. Os pontos de corte estipulados pelo autor, variam de acordo com o tamanho da amostra, tempo da avaliação do consumo alimentar, que depende do instrumento utilizado (RA24h e/ou QFA) e gasto energético que são expressos em valores de TMB (GOLDBERG *et al.*, 1991). Referentes à subnotificação, os pontos de corte sugeridos por Goldberg seriam <1,18 para o QFA e <1,10 para o RA24h, para razões que utilizem a TMB medida, considerando a variabilidade da ingestão alimentar, em um limite de confiança de 95% (GOLDBERG *et al.*, 1991). Razões abaixo desses valores, o relato é considerado como incompatível com a ingestão durante o período de medição real ou uma ingestão aleatoriamente baixa, pois seria inviável a manutenção das funções vitais básicas, e do balanço energético neutro, a longo prazo (GOLDBERG *et al.*, 1991).

De fato, Black (2000) descreve a importância do conhecimento acerca do nível de atividade física (NAF) de cada indivíduo para melhor acurácia de identificação correta de subnotificadores de ingestão calórica pelo método de Goldberg, uma vez que seu uso em indivíduos cujo NAF superior ao de sedentarismo levaria à subestimação da prevalência de subnotificação. Em 2012, um estudo realizado em

451 indivíduos, utilizando água duplamente marcada, demonstrou que a sensibilidade dos pontos de corte de Goldberg foi maior no QFA (92%), enquanto que a especificidade foi maior para a média de dois RA24h (99%). Neste estudo, os autores reforçam a ideia que, apesar das limitações e na ausência da medida objetiva do GET, o método proposto por Goldberg é uma técnica que pode ser utilizada para caracterizar indivíduos como subnotificadores de ingestão calórica (TOOZE *et al*., 2012).

A subnotificação do consumo alimentar, e consequentemente calórico, é frequentemente influenciada por maior índice de massa corporal (IMC), desejabilidade social, e fatores psicossociais como medo de avaliação negativa (TOOZE *et al*. 2004). Ainda, fatores como lapsos de memória ou dificuldade em quantificar o tamanho das porções, ou quando o indivíduo não se sente à vontade para relatar grandes quantidades de alimentos consumidos ou o consumo de alimentos percebidos como “não-saudáveis”, bem como os ricos em gorduras e carboidratos podem influenciar na subnotificação dos hábitos alimentares usuais (SCAGLIUSI; LANCHA JÚNIOR, 2003; MAURER *et al*., 2006).

Na população em geral, estudos vêm descrevendo em homens e mulheres, com e sem obesidade, a presença da subnotificação, independente do instrumento utilizado na avaliação do consumo alimentar.

Em um estudo transversal em 351 homens e 539 mulheres adultos jamaicanos que utilizou um QFA para avaliar o consumo alimentar, demonstrou que mulheres, quando comparadas aos homens, subnotificaram em maior proporção a ingestão de calorias (38,6% vs. 22,5%) e, a subnotificação foi associada positivamente à obesidade, dietas especiais, tabagismo e idade (MENDEZ *et al*., 2004). Em 65 mulheres brasileiras também foi encontrada uma alta prevalência de subnotificação, na qual a obesidade foi positivamente associada à subnotificação nos instrumentos RA24h e registros alimentares de três dias, além de ter sido observado que o instrumento que mais apresentou erros de notificação de calorias foi o QFA, sugerindo que esse último pode levar a erros de notificação independente das características dos indivíduos (SCAGLIUSI *et al*., 2008). Mais recentemente, em estudo transversal com 118 adultos iranianos, foi demonstrada uma alta taxa de subnotificação de ingestão calórica, avaliada pelo RA24h, que foi associado ao IMC elevado, porém o método que obteve maior precisão de relatos aceitáveis de ingestão calórica foi o QFA (MORADI *et al*., 2018).

A obesidade tem sido descrita como o maior indicador de subnotificação, mas não exclusivamente, e o comportamento envolvido é um processo complexo que envolve múltiplos fatores (SCAGLIUSI; LANCHA JÚNIOR, 2003). A influência da gordura corporal na subnotificação de ingestão calórica, foi observada em um estudo com 41 indivíduos idosos (média de 67 e 68 anos de idade, mulheres e homens respectivamente), na qual foi observada maior prevalência de subnotificação em mulheres com maior percentual de gordura corporal (PFRIMER *et al*. 2015). Ainda, o QFA demonstrou maior proporção de subnotificação comparado ao RA24h (40,5% vs. 31%) (PFRIMER *et al*. 2015). Estudo prévio, de Avelino *et al*. (2014) realizado em 331 indivíduos brasileiros, demonstrou uma prevalência de 15,1% de subnotificação da ingestão calórica utilizando média de dois RA24h, e a probabilidade de subnotificar a ingestão de calorias aumentou com o excesso de peso e fator psicológico como insatisfação com o peso corporal (AVELINO *et al*., 2014).

Assim como a obesidade, a TMB também é uma variável importante na avaliação de subnotificação de ingestão de calorias. Um estudo transversal, com 1726 indivíduos adultos brasileiros teve por objetivo identificar a subnotificação de ingestão calórica através de um RA24h e TMB estimada (SOUZA *et al*. 2015). Neste estudo, a subnotificação foi maior nos indivíduos com sobrepeso e obesidade, e o relato de ingestão foi subnotificado mesmo quando utilizadas equações, de predição para TMB, específicas para a população objeto de estudo, sendo mais prevalente nas mulheres, do que nos homens (SOUZA *et al*. 2015). Esses dados corroboram com estudo desenvolvido em 215 latinos do Caribe com alto risco de desenvolver DM tipo 2, que determinou a extensão da subnotificação de ingestão calórica através da média de três RA24h (OLENDZKI *et al*., 2008). Neste estudo foi demonstrada uma associação entre a subnotificação de ingestão calórica e o maior IMC, sugerindo que indivíduos obesos tendem a subnotificar seu consumo alimentar (OLENDZKI *et al*., 2008).

Pacientes com DM tipo 2, em sua maioria são obesos (ADA, 2019). Alguns estudos demonstraram uma maior prevalência de subnotificações de ingestão calórica em mulheres, e a obesidade foi um fator importante para a subnotificação, entretanto, os dados ainda são escassos nesta população (ADAMS, 1998; SAMUEL-HODGE *et al*., 2004; SALLÉ; RYAN; RITZ, 2006; AMEND *et al*., 2007).

O gênero, assim como na população geral, parece ser uma variável importante na avaliação de consumo alimentar em pacientes com DM tipo 2. Um estudo com 185 pacientes com DM tipo 2, avaliou a validade dos registros alimentares, e observou que

os pacientes diabéticos obesos, comparados aos não obesos, em especial do sexo feminino, eram mais propensos a subnotificar a ingestão calórica, e que provavelmente os relatos de ingestão obedeciam mais à prescrição recomendada para o tratamento, do que ao verdadeiro consumo usual (ADAMS, 1998). Em concordância com esses achados, um estudo com 185 mulheres afro-americanas com DM tipo 2, avaliou a validade dos relatos alimentares utilizando a média de três RA24h, no qual foi observado 58% de subnotificação de calorias, que aumentou com graus crescentes de excesso de peso, sugerindo que as mulheres que subnotificaram, tinham maior probabilidade de relatar o que deveriam comer e não a sua ingestão real (SAMUEL-HODGE *et al*., 2004). Em um estudo transversal com 21 pacientes obesos, sendo 12 destes com DM tipo 2, foi demonstrado que todos os indivíduos obesos com diabetes, subnotificaram sua ingestão de calorias em aproximadamente 22% a menos que o necessário de energia para manter suas funções vitais básicas, utilizando registro alimentar de três dias (SALLÉ; RYAN; RITZ, 2006). Ainda, a prevalência da subnotificação foi maior no gênero feminino, em ambos os grupos (SALLÉ; RYAN; RITZ, 2006). Em um estudo com 109 mulheres negras com DM tipo 2, que avaliou o consumo alimentar a partir de uma combinação de recordatório alimentar com QFA, também foi observado erros de notificação, onde 46,8% das mulheres avaliadas subnotificaram a ingestão de calorias, que foi significativamente associado ao maior IMC (AMEND *et al*., 2007).

2 JUSTIFICATIVA E OBJETIVOS

Os instrumentos de avaliação de consumo alimentar, como o QFA e o RA24h, permitem identificar os hábitos alimentares e de ingestão calórica. Entretanto, os métodos de avaliação do consumo alimentar são passíveis de erros, e podem levar a relatos imprecisos acerca do consumo alimentar, em particular de calorias.

O equilíbrio entre o gasto energético e a ingestão calórica é o que promove a homeostase do peso corporal, manutenção e/ou promoção do estado nutricional adequado. Para o conhecimento do gasto energético é necessário a avaliação da taxa metabólica basal (TMB), a qual pode ser medida pela calorimetria indireta (CI), considerada um critério de referência.

Em estudos desenvolvidos na população geral, obesos e não obesos, a subnotificação do consumo alimentar é frequentemente encontrada. Já em pacientes com DM tipo 2 os dados ainda são escassos.

Desta forma, sendo a maioria dos pacientes com DM tipo 2 obesos, avaliar a subnotificação de ingestão calórica através dos principais instrumentos de avaliação do consumo alimentar, junto à CI, se torna essencial para promover uma prescrição dietoterápica específica e individualizada, contribuindo na perda de peso, melhora do controle glicêmico e da qualidade de vida destes pacientes.

Nesse sentido, os objetivos deste estudo em pacientes ambulatoriais com DM tipo 2 são: (1) avaliar a ingestão calórica através do QFA e RA24h; (2) a qualidade dos relatos de ingestão calórica; (3) a concordância destes instrumentos; e (4) a correlação da ingestão calórica estimada pelo QFA e RA24h com a TMB medida por CI.

Quadro 1 - Vantagens e limitações dos métodos de avaliação do consumo alimentar:

	Vantagens	Limitações
RA24h	-Estimativa quantitativa e qualitativa do consumo alimentar atual; -Pode ser aplicado em qualquer população; -Pode ser utilizado em qualquer faixa etária e em analfabetos; -Rápida aplicação; -Baixo custo.	-Depende da memória do entrevistado; -Pode haver omissão ou esquecimento no relato de certos alimentos; -A ingestão relatada pode ser atípica; -Depende da capacidade do entrevistador de estabelecer comunicação com o entrevistado.
QFA	-Estima o consumo alimentar habitual; -Classifica os indivíduos em categorias de consumo; -A digitação e a análise do inquérito são relativamente simples, comparado a outros métodos; -Baixo custo.	-Dificuldades para a aplicação conforme o número e a complexidade da lista de alimentos; -Depende da memória dos hábitos alimentares para estimar o consumo médio em tempo pregresso; -Pode não haver todos os alimentos de consumo habitual na lista; -Não classifica ingestão de nutrientes como adequada ou inadequada.

RA24h: recordatório alimentar de 24 horas; QFA: questionário de frequência alimentar.
Fonte: Adaptado de FISBERG; MARCHIONI; COLUCCI, 2009.

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APÊNDICE A - ARTIGO ORIGINAL

Esse artigo será enviado para apreciação visando publicação na revista *Nutrition & Dietetics* *(*Qualis *B2).*

UNDERREPORTING OF THEENERGY INTAKE IN PATIENTS WITH TYPE 2 DIABETES

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ABSTRACT

Aim: In patients with type 2 diabetes, an accurate assessment of food intake is essential for clinical nutritional management. Tools such as the Food Frequency Questionnaire (FFQ) and 24-hour dietary recall (24HR) identify dietary habits, and support in dietary planning. However, it is possible that these tools have reporting errors in assessing food intake, particularly energy intake (EI).

Methods: Cross-sectional study in outpatients with type 2 diabetes. EI was assessed by the FFQ and 24HR tools. Basal metabolic rate (BMR) was measured by indirect calorimetry (IC). Data were analyzed using *Kappa* test, t-test, and *Spearman's* correlation coefficients. Underreporting was assessed using the EI/BMR ratio. Patients with values <1.18 and <1.10 for FFQ and 24HR, respectively, were considered as underreporting.

Results: This study evaluated 55 outpatients (62.7 ± 5.3 years old, 11.2 ± 7.3 years duration of diabetes, 52.7% female). The EI assessed by FFQ was 1797.7 ± 641.3 and by 24HR 1624 ± 484.8 Kcal/day. The BMR was 1641.3 ± 322.3 Kcal/day. The ratios FFQ/BMR and 24HR/BMR were 1.11 ± 0.38 and 1.01 ± 0.30, respectively. The tools showed a moderate agreement for underreporting of EI (Kappa = 0.404; *P* = 0.003). Positively and significant correlations were observed between BMR and FFQ (r = 0.321; *P* = 0.017) and 24HR (r = 0.364; *P* = 0.006). According to tools the underreporting was observed in approximately 65% of patients.

Conclusions: The majority patients with type 2 diabetes underreported their calorie intake, assessed by FFQ and 24HR. Still, BMR showed a positive correlation with both tools.

Keywords: energy intake; underreporting; dietary assessment; dietary assessment methods; type 2 diabetes.

1. | INTRODUCTION

Diabetes mellitus (DM) type 2 is the most prevalent form of diabetes and obesity associated with about 80% of cases.[1] The main strategy for the treatment of type 2 diabetes in overweight or obese patients is weight loss through changes in lifestyle[2] which includes reducing energy intake (EI) and adequate choice of food with the quantity and quality of nutrients that will contribute to improved glycemic control leading to reduction of chronic complications of diabetes.[3] Thus, knowledge of eating habits is essential for individualized dietary planning in this group of patients.

The assessment tools identifying food consumption habits and patterns provide subsidies for a adequacy of nutritional recommendations to the reality of each patient.[4] The instruments most utilized to collect dietary data are the 24-hour dietary recall (24HR) and the food frequency questionnaire (FFQ).[5] However, the limitations of these tools can induce an inaccurate estimate of food intake leading to reporting errors.[6] In fact, it has been described that individuals tend to report values lower than their EI, which does not match their current nutritional status.[7] However, it is also possible to minimize underreporting errors, as already explained by Goldberg *et al*.,[8] where the ratio of EI, as assessed by tools, with basal metabolic rate (BMR) may identify underreporting.

The most commonly identified characteristics associated with underreporting of EI are obesity[9-11], gender[12-14] and the presence of diabetes.[15 - 16] In obese, in different populations, previous studies have shown that this group of individuals tend to underreport their EI, and the underreporting is associated with lifestyle factors as well as consumption of unhealthy food groups.[9,10] More

recently, a study in Iranians that assessed underreporting through three food consumption instruments found that reporting errors were higher in overweight and/or obese individuals.[11]

Gender is also an important variable in food intake reporting studies. A study conducted in Brazil showed that women under and overreported their EI assessed by the FFQ.[12] These data contributed to a previous study conducted on African American women who also demonstrated underreporting errors in their EI.[13] A Latin study found a high prevalence of underreporting of female food intake, and the risk of developing diabetes was also associated with the group with the highest energy intake reporting errors.[14]

In patients with diabetes, underreporting of food intake also seems to be frequent, however, data are still scarce in this population. A previous study in obese Caucasians with type 2 diabetes showed underreporting of EI by approximately 22% and this proportion was higher in women.[15] In black women with type 2 diabetes, underreporting errors were also observed, where 46.8% of the evaluated women underreported their EI and this underreporting was significantly associated with higher BMI.[16]

Given that most patients with type 2 diabetes are overweight and obese, and that obesity as well as diabetes are factors associated with EI reporting errors, the objectives of this study were to evaluated the EI in patients with type 2 diabetes, through the FFQ and 24HR; the agreement of the tools, the correlations with BMR and, finally, the underreporting of EI evaluated by these instruments.

2. | METHODS

Study Design and Patients: This cross-sectional study included 55 patients with type 2 diabetes treated at the outpatient clinic of the Hospital de Clínicas in Porto Alegre, Brazil. The diabetes was defined as subjects over 30 years of age at onset of diabetes, no previous episode of ketoacidosis or documented ketonuria and treatment with insulin only after five years of diagnosis. The patients were included according to the following criteria: not having received dietary counseling by nutritionist in the last six months, age <70 years, serum creatinine <2 mg/dL, normal thyroid function tests, do not carry other diseases, severe liver disease, uncompensated heart failure or any acute and/or consumptive disease. The study protocol was approved by the Ethics Commission of Hospital de Clínicas de Porto Alegre (number 15.0625) and all subjects signed a written consent form.

Clinical Evaluation: Patients were classified as current smokers or not. Usual physical activity was objectively measured by step counting with a pedometer (HJ-321, Omron® Health Care Co.) and was classified into five levels: sedentary (< 5.000 step/day), low active (5.000 - 7.499 step/day), somewhat active (7.500 – 9.999 step/day), active (> or = 10.000 – 12.499 step/day) and highly active (> or = 12.500 step/day).[17] Participants wore pedometer for seven days, attached to the waistband of their clothing during waking hours, except when bathing or swimming. Participants were encouraged not to alter their usual physical habits during protocol.

Blood pressure was measured twice to the nearest 2 mmHg, after a 10 minutes rest, using an Omron HEM-705CP digital sphygmomanometer (Omron

Healthcare, Inc., Bamockburn, IL, USA). Hypertension was defined as blood pressure ≥ 140/90 mmHg measured on two occasions or the use of antihypertensive drugs.[18]

The body weight and height of patients (without shoes and coats) were obtained using a calibrated and anthropometric scale (Filizola®). Measurements were recorded to the nearest 100g for weight and to the nearest 0.1 cm for height. Body mass index (BMI) was calculated as weight in kilograms divided by the square of the height in meters. The body composition was performed by means of the electrical bioimpedance (InBody® 230, Seoul, South Korea) for the determination of fat mass (FM) (kg) and fat-free mass (FFM) (kg).

Dietary Assessment, Evaluation of Energy Intake and Quality of Diet: Two methods of food intake assessment were used: food frequency questionnaire (FFQ) and three 24-hour dietary recalls (24HR). The usual diet was evaluated by the quantitative FFQ previously validated for patients with diabetes which details 80 items divided into 10 food groups.[19] The 24HR was assessed by 3-day diet recall (two weekdays and one weekend day) through phone contact.[20] Reported intake of food groups were converted into daily consumption. The Brazilian food composition table was used to evaluate the nutritional composition of the FFQ items.[21] The evaluation of the energy intake from diet records were analyzed using the DietBox® *software.* Data from food intake were expressed as a Kcal/day.

The quality of diet was evaluated by the Goldberg cut-off: ratio between EI and BMR (FFQ or 24HR/BMR). Patients with a ratio <1.18 for FFQ and <1.10 for 24HR were considered as underreporting, respectively.[8]

Laboratory Evaluation: Blood samples were obtained after a fasting period of 12 hours. The plasma glucose level was determined by the glucose-peroxidase-biodiagnostic Kit enzymatic colorimetric method, the A1C test by high-precision liquid chromatography (MerckHitachi L-9100 With reference values of 4.8-6.0%; Merck Diagnostica, Darmstadt, Germany), total cholesterol and triglycerides by colorimetric enzymatic methods (Merck; Boeringher Mannheim, Buenos Aires, Argentina) and high-density lipoprotein (HDL) by a homogeneous direct method (Auto Analyzer, ADVIA 1650). Low-density lipoprotein (LDL) was calculated using the Friedewald formula: LDL cholesterol = total Cholesterol – HDL cholesterol – triglycerides/5.

Basal Metabolic Rate Measurement: The measurement of BMR was performed by indirect calorimetry (IC). The IC protocol consisted of 10 min of rest on a gurney in dorsal decubitus, followed by 30 minutes of collection of exhaled gases using the canopy dilution technique and a coupled collection device. An open circuit calorimeter (QUARK RMR, Cosmed, Rome, Italy) was used for determining VO_2 (oxygen consumption) and VCO_2 (carbon dioxide production). To calibrate the equipment, the volume of the turbine flowmeter was first calibrated electronically by the system, followed by calibration of the collector plates using a known gas concentration. This process was repeated for each test to standardize the measurement. The first 10 min of gas collection were excluded from the analysis; thus, VO_2 and VCO_2 (L/min) obtained during the final 20 min of each collection (mean value of the period) were used for the calculation of BMR. The equation proposed by Weir[22] was used to obtain values in kcal/min, which does not require the use of protein metabolism by incorporating a

correction factor: [(3.9 x VO_2) + (1.1 x VCO_2)]. The result in kcal/min was multiplied by 1,440 min to obtain the value for 24 hours. The subjects were asked not to perform any type of physical activity of moderate or high intensity during the 24 hours preceding the test, and not to consume alcohol or caffeine. The smoking patients were instructed not to smoke 12 hours before the day of BMR measurement. Additionally, the subjects were instructed to fast for 12 hours prior to the test, with only the ad libitum intake of water being permitted, and to have a good night's sleep of at least 8 hours. Finally, all subjects came to the test site using a motor vehicle to avoid energy expenditure before the determination of BMR. All tests were performed between 06:30 and 08:00 in a temperature-controlled (20 ºC to 25 ºC) and sound-controlled room under low luminosity. All medications in use were maintained during the study period and patients received their usual medication after the IC.

Statistical Analysis: Results were expressed as median (25th - 75th). percentage (%) or mean ± standard deviation. *Spearman's* correlation coefficient was used to assess the correlation between EI estimated by FFQ and 24HR with measured BMR. The underreporting agreement between the FFQ and 24HR instruments was calculated using the *Kappa* coefficient. *Kappa* varies from 0 - 1: a value <0.2 indicates poor agreement; 0.2 - 0.4 fair agreement; 0.4 - 0.6 moderate agreement; 0.6 - 0.8 substantial agreement; and > 0.8 almost perfect agreement.[23] The differences among the ratio EI/BMR according to BMI categories were analyzed used *Student's* t-test. *Pearson's* chi-square test was used to evaluate the proportion of underreporting by the estimated by FFQ or 24HR/BMR ratio according to BMI in both instruments. Calculations were

performed with the Statistical Package for The Social Sciences (SPSS) 23.0 (Chicago, IL) and *P*- values ≤ 0.05 were considered statistically significant.

3. | **RESULTS**

A total of fifty-five outpatients with type 2 diabetes was evaluated (62.7 ± 5.3 years of age; 11.2 ± 7.3 years of diabetes duration and 52.7% was women). The selection process is illustrated in **Figure 1.** Most patients in the study were sedentary 56.4%, and 83.6% were overweight/obese. Also, the presence of hypertension was observed in all patients (100%). The lipid profile was within normal limits; however, the glycemic control expressed by fasting glucose and A1c test showed altered levels, as expected in patients type 2 diabetes mellitus. With regard to drug treatment, all patients used oral antihyperglycemic agents. The characteristics of the patients are described in **Table 1**.

Table 2 shows anthropometric characteristics, body composition, and evaluation of diet quality. The mean weight was 81.3 ± 15.2 kg, height 164.3 ± 10.6 cm, BMI 29.9 ± 4.1 kg/m², body composition composed of 34.8 ± 11.9 kg of fat-free mass and 29.0 ± 9.2 kg of fat mass. The mean BMR (kcal/day) verified by IC was 1641.3 ± 322.3 Kcal/day. The mean total EI by the FFQ was 1797.7 ± 641.3 kcal/day and by 24HR was 1624 ± 484.8 Kcal/day. The ratios FFQ/BMR and 24HR/BMR were 1.11 ± 0.38 and 1.01 ± 0.30, respectively. A percentage of underreporting of 65.5% and 63.6% was observed according to FFQ and 24HR, respectively. In, addition, the tools showed moderate and significant agreement to assess underreporting of EI (*Kappa* = 0.404; *P* = 0.003).

When we evaluated the underreporting according to the gender, we found that women had more reporting errors than men evaluated by FFQ (69% vs.

61.5%; *P* = 0.563). In the assessment by 24HR, men were more underreported when compared to women (69.2% vs. 58.6%; *P* = 0.414).

The **Figure 2** shows the correlation between the EI estimated by the FFQ and 24HR with the BMR measured by IC. Was observed a positive and significant correlation between BMR with FFQ (r = 0.321; *P* = 0.017) and 24HR (r = 0.364; *P* = 0.006).

The **Figure 3** demonstrates differences among the ratio EI (estimated by FFQ or 24HR) / BMR according to BMI categories. EI/BMR ratios <1.18 in FFQ and <1.10 in 24HR were considered as underreporting. When assessing underreporting according to BMI, patients type 2 diabetes with BMI ≥ 30 kg/m² had a higher proportion of underreporting by FFQ (69.2% vs. 62.1%; *P* = 0.577) and 24HR (69.2 % vs. 58.6%; *P* = 0.414), but without statistical significance. Still, patients with BMI ≥ 30kg/m² had lower EI/BMR ratio compared to patients with BMI <30kg/m², in both tools, however, the differences were not significant.

4. | **DISCUSSION**

Underreporting of EI has been reported as a problem in food intake assessment studies and may have errors interpreted these data.[6] In our study in type 2 diabetes patients, underreporting of EI were high and similar according to with the FFQ assessment (65.5%) and the average of the three 24HR (63.6%). Studies conducted in the general population, which compared different food consumption assessment instruments, showed variations in their results regarding the underreporting rates of EI.[11,12,24] A recent study of 118 Iranian adults, which evaluated three methods of food consumption, showed that the highest underreporting rate was observed in the 24HR instrument and this was

associated with the highest BMI.[11] The FFQ showed lower rates of underreporting of EI.[11] However, a study conducted in 65 Brazilian women, which also evaluated the reports of EI from three instruments, showed that 24HR had lower rates of underreporting, compared to FFQ, further suggesting that FFQ has limitations that can lead to underreporting, regardless of individual characteristics.[12] In fact, a previous study in American adults had also shown a lower prevalence of underreporting in the 24HR method when compared to FFQ.[24] In our study, the food intake assessment tools, FFQ and 24HR, showed a moderate and significant agreement for the occurrence of underreporting of EI.

Reporting errors are also been associated with other variables such as obesity, diets, unhealthy food groups and conditions such as smoking and age, as shown in a study of Jamaican adults.[9] In this study it was also observed that women tend to underreporting more than men (38.6% vs. 22.5%).[9]

Gender is also an important variable in food intake assessment. Studies in different ethnicities that assessed EI errors in both genders showed that women underreport a higher and more significant proportion than males.[9, 15, 25, 27] In our study, when we stratified according to gender, we observed that women were more likely to underreport in the FFQ, but without significant difference between genders.

Age, presence of obesity and diabetes have also been showing associations with calorie notification errors, assessed by different food consumption instruments. A study of 41 healthy elderly subjects (mean age 67 and 68 years for women and men, respectively) showed underreporting of calories as assessed by 24HR (31%) and FFQ (40.5%).[25] Still, underreporting

was more frequent in older women with higher body fat percentage.[25] In our study, no association was observed between age and underreporting of EI (data not shown).

Obesity has been the factor most negatively related to the accuracy of the intake report, regardless of the food intake assessment instrument used. Also, the fear of a negative assessment has also been reported as a predictor of underreporting of EI.[26] In our study, type 2 diabetes patients had a mean BMI of 29.9 ± 4.1kg/m², demonstrating that most of the patients evaluated were overweight and/or obese. When evaluating notification errors according to BMI, we observed a tendency for underreporting in type 2 diabetes patients with BMI ≥ 30kg/m², however, these differences were not significant with diabetic patients with BMI <30kg/m². The association between overweight and underreporting was demonstrated in a cross-sectional study of 331 Brazilian non-diabetic subjects, who assessed EI through the average of two 24HR and demonstrated that 15.1% underreporting was associated with overweight and dissatisfaction with body weight were more likely to underreport their intake.[10] In Latin individuals at high risk of developing type 2 diabetes, who used the average of 24HR to assess EI, an association between underreporting and higher BMI was observed.[14]

Type 2 diabetes, due to its important association with obesity[1] proves to be a component in underreporting errors, however, studies are scarce in individuals with diabetes.[13, 15, 16, 27] A study of 185 African American women with type 2 diabetes showed that 58% of underreporting of EI, assessed by the average of three 24HR, was associated with higher BMI.[13] In 21 obese patients (12 patients with type 2 diabetes), it has been shown that diabetic patients

underreported their EI, as assessed by the 3-day dietary record, with values much lower than those for BMR.[15] In addition, sub-reports were significantly lower in obese diabetic patients compared to non-diabetic patients, and women, with and without DM, underestimated more in both groups.[15] A study in black women with type 2 diabetes, who assessed EI from a combination of dietary recall with modified FFQ, showed caloric underreporting in 46.8% and association with higher BMI.[16] These data support the classic study of underreporting in patients with type 2 diabetes, who assessed food intake by three-day dietary records, which observed that obese diabetic patients reported lower EI compared to non-obese, particularly females, and that reports of diets obeyed the recommended treatment prescription rather than their actual usual intake.[27]

The BMR assessment is relevant in food consumption studies, as its measurement or estimate allows us to identify notification errors through cutoffs obtained by the ratio between EI (measured by the instruments) and the BMR.[8] In our In this study, the ratios found for FFQ and 24HR were 1.11 and 1.01, respectively, demonstrating underreporting EI in this group of type 2 diabetes patients. When we evaluated the correlation of the instruments with BMR, we observed that both instruments demonstrated a positive and significant correlation with BMR, as measured by IC. In this sense, from the data found in the present study we believe that any of the instruments can be used to assess food intake in patients with type 2 diabetes, however, the results of dietary data should be interpreted with caution, considering that this population showed a large proportion of underreporting of EI.

Our study had some limitations. We did not follow weight changes during the dietary data collection period. The FFQ was applied on the day of clinical evaluation and the three days of 24HR by telephone. However, no significant weight loss was reported by patients in telephone contacts. In the assessment of BMR, we did not consider the physical activity factor, since most of our patients according to the number of steps/weeks are considered as little active. In fact, if we consider the activity factor, we could lead to even greater underreporting errors, which might not portray the reality of this group of patients. Another limitation of the study may be the small sample size. However, this is a study that collaborates with the few studies developed in patients witch type 2 diabetes, which evaluated food intake notifications errors. In addition, we evaluated BMR by reference criterion, IC, and not by prediction equations, which reinforces the relevance of the study and the data presented.

In conclusion, in this study the majority patients with type 2 diabetes underreported their EI, assessed by FFQ and 24HR. Studies in patients with type 2 diabetes with a larger sample size and stratified according to gender are necessary and relevant for a better evaluation of which food consumption instrument is the best to be used in this population.

Conflict of interest

The authors declare no potential conflict of interest.

Author's contribution

This paper was written by Aline Graziele do Nascimento, Thaiciane Grassi and Thais Steemburgo. Data were collected, organized and tabulated by Aline Graziele do Nascimento and Thaiciane Grassi. The statistical analysis was written by Thaiciane Grassi and Aline Graziele do Nascimento. Data were analyzed by Aline Graziele do Nascimento, Thaiciane Grassi and, reviewed by Thais Steemburgo.

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Table 1. Clinical and laboratory characteristics of the patients with type 2 diabetes (n = 55):

Variable	**Characteristics[(a)]**
Age (years)	62.7 ± 5.3
Duration of diabetes (years)	11.2 ± 7.3
Sex (female)	29 (52.7%)
Physical activity (steps/day)	5324 (1560 – 18097)
Hypertension (%)	55 (100%)
Fasting plasma glucose (mg/dL)	153.4 ± 46.8
A1C test (%)	7.6 (5.2 – 12.0)
Total cholesterol (mg/dL)	161.6 ± 38.7
LDL cholesterol (mg/dL)	83.4 ± 29.3
HDL cholesterol (mg/dl)	45.8 ± 12.2
Triglycerides (mg/dL)	145 (111.2 – 191.0)
Medications	55 (100%)
Oral antihyperglycemic	55 (100%)
Antihypertensive agents	38 (69.1%)
Hypolipidemic agents	

[(a)]Data are presented as median (25th - 75th), percentage (%) or mean ± standard deviation.

Note: A1C, glycated hemoglobin; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

Table 2. Nutritional characteristics and evaluation of energy intake of the patients with type 2 diabetes (n = 55):

Variable	Characteristics[(a)]
Weight (Kg)	81.3 ± 15.2
Height (cm)	164.3 ± 10.6
BMI (Kg/m²)	29.9 ± 4.1
Fat-free mass (Kg)	34.8 ± 11.9
Fat mass (Kg)	29.0 ± 9.2
BMR by IC (Kcal/day)	1641.3 ± 322.3
EI by FFQ (Kcal/day)	1797.7 ± 641.3
FFQ / BMR (ratio)	1.11 ± 0.38
EI by 24HR (Kcal/day)	1624.0 ± 484.8
24HR / BMR (ratio)	1.01 ± 0.30
Underreporting by FFQ	36 (65.5%)
Underreporting by 24HR	35 (63.6%)

[(a)]Data are presented as median (25th - 75th), percentage (%) or mean ± standard deviation.

Note: BMI, body mass index; BMR, basal metabolic rate; IC, indirect calorimetry; EI, energy intake; FFQ, food frequency questionnaire; 24HR, 24-hour dietary recalls.

Figure 1. Flowchart of patient's selection

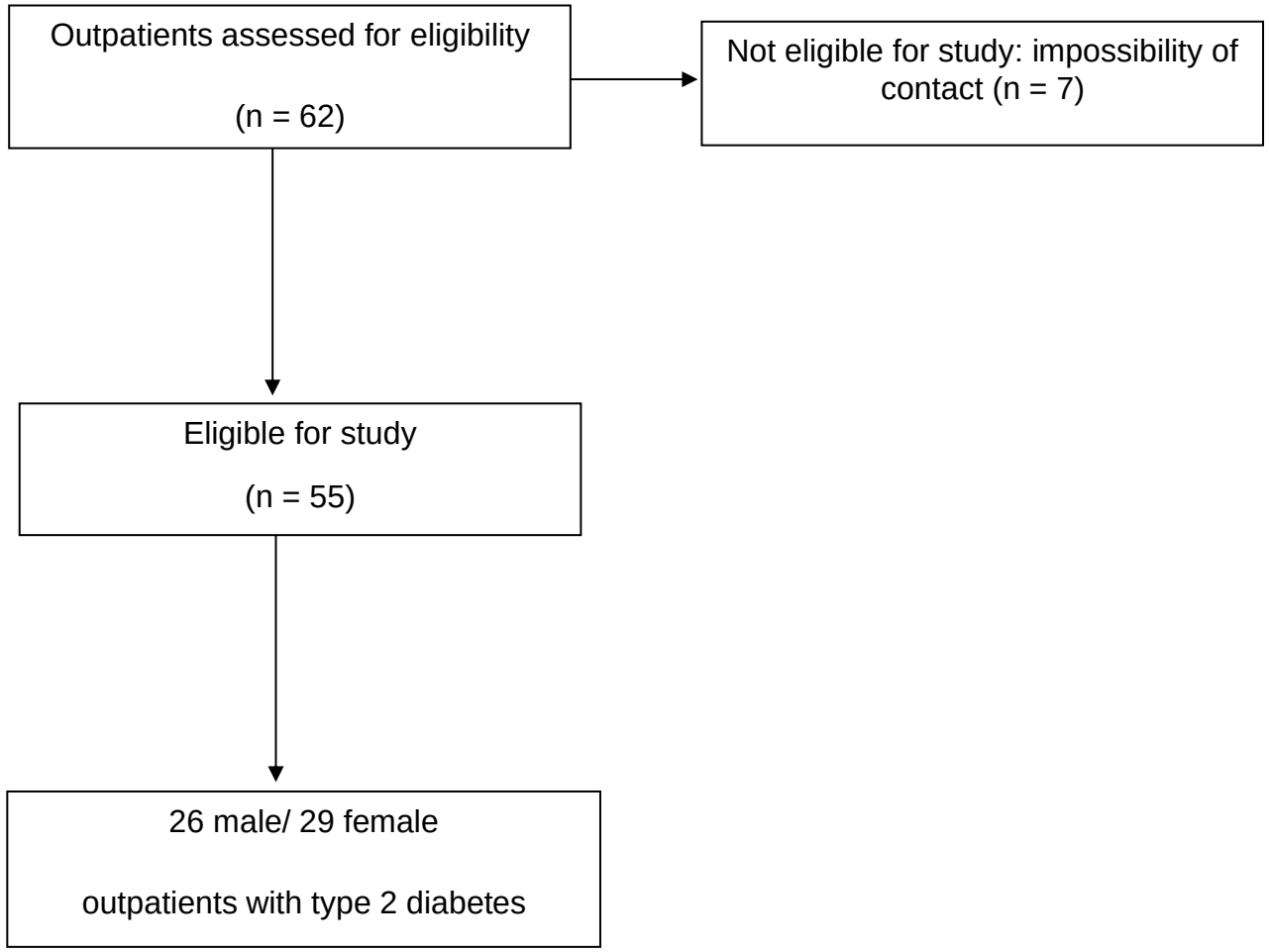
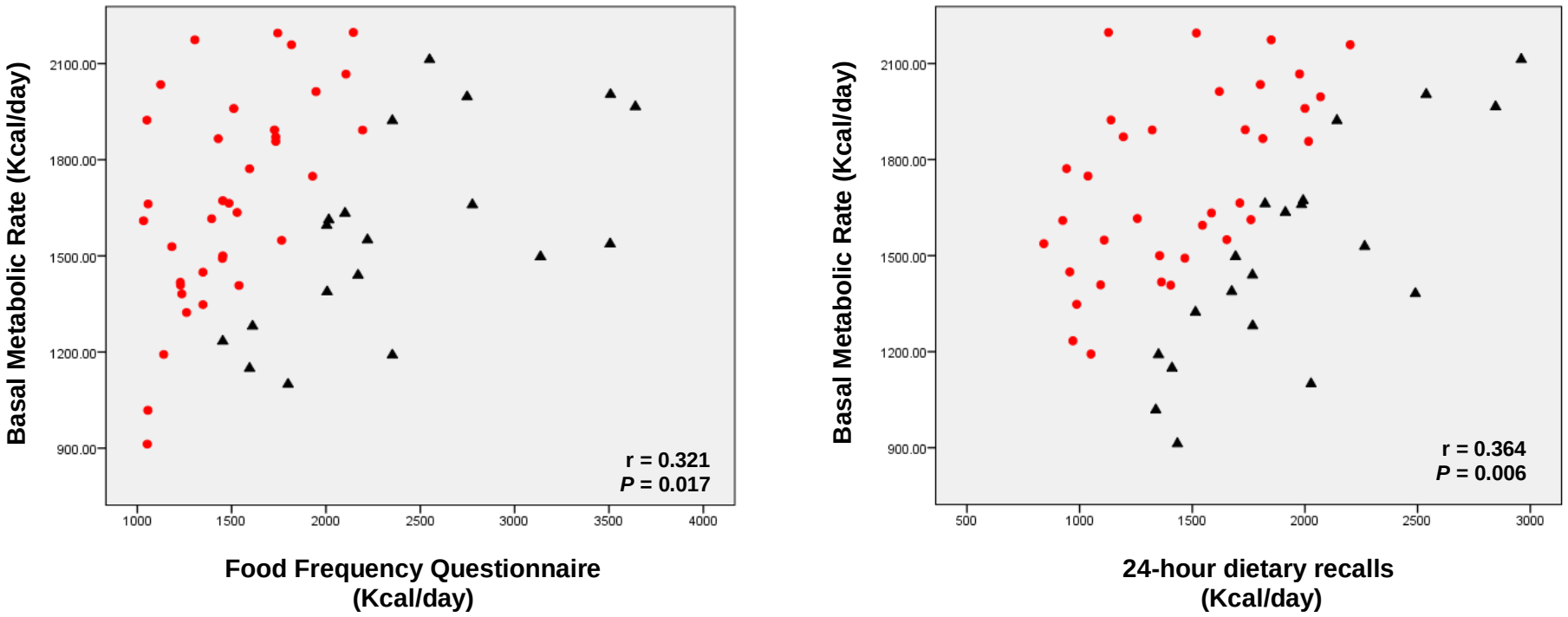


Figure 2. Correlation of energy intake estimated by FFQ and 24HR with BMR by IC:

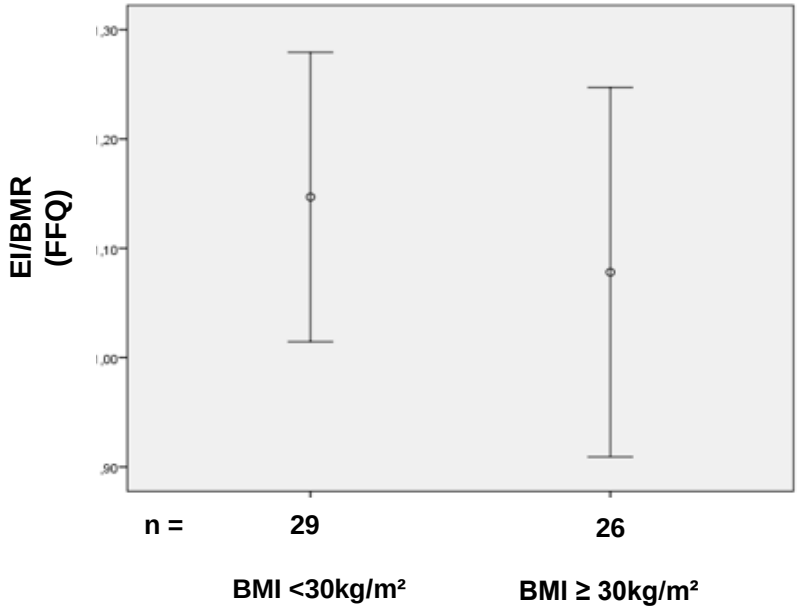


Note: FFQ, food frequency questionnaire; 24HR, 24-hour dietary recalls; BMR, basal metabolic rate; IC, indirect calorimetry.

r: *Spearman's* correlation. Statistical significance: *P*-value ≤ 0.05.

Symbols: ●underreporting of EI; ▲ acceptable notification of EI.

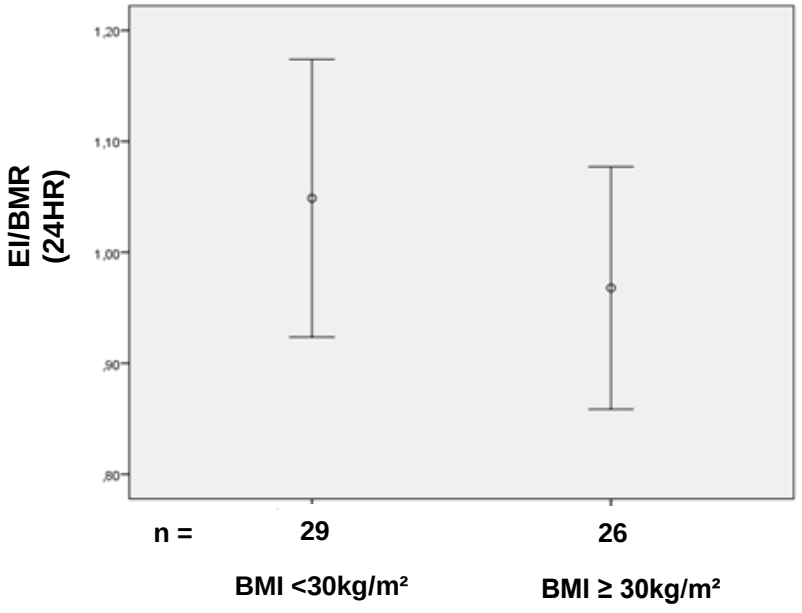
Figure 3. Differences among the ratio EI (estimated by FFQ or 24HR) / BMR according to BMI categories:



BMI < 30 Kg/m² (n=29): mean 1.14 CI95% (1.01 – 1.27)

BMI ≥ 30 Kg/m² (n=26): mean 1.07 CI95% (0.90 – 1.24)

***t*-test *P* = 0.509**



BMI < 30 Kg/m² (n=29): mean 1.04 CI95% (0.92 – 1.17)

BMI ≥ 30 Kg/m² (n=26): mean 0.96 CI95% (0.85 – 1.07)

***t*-test *P* = 0.327**

Note: EI, energy intake; BMR, basal metabolic rate; FFQ, food frequency questionnaire; 24HR, 24-hour dietary recalls; BMI, body mass index; CI, confidence interval. Statistical significance: *P*-value ≤ 0.05.

ANEXO A - NORMAS DA REVISTA DE INTERESSE DE SUBMISSÃO

Nutrition & Dietetics

Author Guidelines

1. SUBMISSION

Authors should kindly note that submission implies that the content has not been published or submitted for publication elsewhere except as a brief abstract in the proceedings of a scientific meeting or symposium.

Once you have prepared your submission in accordance with the Guidelines, manuscripts should be submitted online at **http://mc.manuscriptcentral.com/nd**.

Queries can be addressed to the Editorial Assistant at: **ndi.eo@wiley.com**.

2. AIMS AND SCOPE

Nutrition & Dietetics is the official journal of the Dietitians Association of Australia. Covering all aspects of food, nutrition and dietetics, the Journal provides a basic forum for the reporting, discussion and development of scientifically credible knowledge related to human nutrition and dietetics.

Widely respected in the region and around the world, *Nutrition & Dietetics* is Australia's leading peer-reviewed Journal in its field. The journal publishes original research, systematic review papers, and letters (often as case studies).

3. MANUSCRIPT CATEGORIES AND REQUIREMENTS

Original research papers: Presenting original research.

Systematic review papers: A systematic review of Literature

Letters to the Editor: Brief reports on case studies or practice-based analysis.

Word length: Manuscripts should be no longer than 4000 words (inclusive of abstract, main text, references). Tables and figures are not included in this word count, however a total limit of five tables and figures applies. Manuscripts reporting social research that uses qualitative methods to report data rather than tables and figures are limited to 5000 words. Review papers presenting systematic forms of review research are also limited to 5000 words (excluding references), and Letters to the Editor must not be over 800 words. Manuscripts that do not follow these guidelines will be unsubmitted and the author will be asked to meet the limitations and resubmit.

4. PREPARATION OF THE MANUSCRIPT

Format

The main text file should be prepared using Microsoft Word, doubled-spaced. The top, bottom and side margins should be 30 mm. **Page numbers should appear at the top right hand corner of each page. Please also include continuous line numbering.**

Style

Manuscripts should follow the style of the Vancouver agreement detailed in the International Committee of Medical Journal Editors' revised 'Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication', as presented at **http://www.ICMJE.org/**.

Spelling. The journal uses Australian spelling and authors should therefore follow the latest edition of the *Macquarie Dictionary*.

Units. Measurements must be given in SI or SI-derived units. Please go to the Bureau International des Poidset Mesures (BIPM) website at **http://www.bipm.fr** for more information about SI units.

Abbreviations. Abbreviations should be used sparingly – only where they ease the reader's task by reducing repetition of long, technical terms. Initially use the word in full, followed by the abbreviation in parentheses. Thereafter use the abbreviation only.

The following abbreviations can be used without definition: ACT, ADP, AIDS, ATP, CI, CV, df, DNA, EDTA, EGTA, e.g., GDP, GTP, HDL, HEPES, HIV, HPLC, i.e., LDL, NAD, NADH, NADP, NADPH, NS, NSW, NT, RNA, SA, SE, SEE, SEM, SD, tris, VLDL, vol : vol, wt : vol, UK, USA, WA.

Trade names. Drugs should be referred to by their generic names. If proprietary drugs have been used in the study, refer to these by their generic name, mentioning the proprietary name, and the name and location of the manufacturer, in parentheses.

Names of vitamins and related compounds should be those recommended by the International Union of Nutritional Sciences Committee on Nomenclature (reprinted in J Nutr 1990; 120: 12–19). Generic names, however, may be used

where appropriate, e.g. vitamin A deficiency. Authors using RDIs, RDAs, RNIs, NRV or similar dietary allowances to estimate nutrient adequacy should specify and cite the authority for the cutoff point used.

Parts of the Manuscript

The manuscript should be submitted in separate files: title page; main text file; figures.

Title page

The title page should contain:

(i) A short informative title that contains the major key words. The title should not contain abbreviations.

(ii) The full names of the authors and each author's highest abbreviated qualification(s) and APD or NZRD status,

(iii) The addresses of the author’s affiliated institutions at which the work was carried out and the author’s position title

(iv) Anauthorshipdeclaration

(v) The full postal and email address, plus telephone numbers, of the author to whom correspondence about the manuscript should be sent

(vi) Funding and Conflicts of interest statements

(vii) A short running title (less than 50 characters)

(viii) word count, excluding title page, figures and tables

The present address of any author, if different from that where the work was carried out, should be supplied in a footnote.

Authors are requested to provide the following in the title page. On acceptance these will need to be added at proof stage.

Authorship Declaration

The contribution of each author should be stated. The statement must also acknowledge that all authors are in agreement with the manuscript and declare that the content has not been published elsewhere.

Funding statement

All sources of financial grants and other funding must be disclosed.

Conflicts of Interest statement

This must include a frank declaration of the authors' industrial links and affiliations.

The absence of funding or a conflict of interest must also be stated.

Main text file

The Main Text file should be presented in the following order: (i) title abstract and key words, (iii) text, (iv) references, (v) appendices, (vi) figure legends, (vii) tables (each table complete with title and footnotes) and (viii) figure legends. Footnotes to the text are not allowed and any such material should be incorporated into the text as parenthetical matter.

Abstract and key words

All articles (original research, reviews) require a structured abstract that states in 250 words or fewer the purpose, basic procedures for conducting the analysis, main findings and principal conclusions of the study. Divide the abstract with the headings: Aim, Methods, Results, Conclusions. The abstract should contain full sentences and not contain abbreviations or references.

Between three and six key words, for the purposes of indexing, should be supplied below the abstract, in alphabetical order. It is preferable that they are taken from those recommended by the US National Library of Medicine's Medical Subject Headings (MeSH) browser list at **http:/www.nlm.nih.gov/mesh/meshhome.html**.

Text

All manuscripts should use the following headings to divide the sections of the manuscript: Introduction, Methods, Results, Discussion. Subheadings should not be used in these sections. Ethics approval must be stated in the methods section.

References

All references should be numbered consecutively in order of appearance and should be as complete as possible. In text citations should cite references in consecutive order using Arabic superscript numerals. Sample references follow:

Journal article:

1. King VM, Armstrong DM, Apps R, Trott JR. Numerical aspects of pontine, lateral reticular, and inferior olivary projections to two paravermal cortical zones of the cat cerebellum. *J Comp Neurol* 1998; 390:537-551.

Book:

2. Voet D, Voet JG. *Biochemistry*. New York: John Wiley & Sons; 1990. 1223 p.

Please note that journal title abbreviations should conform to the practices of Chemical Abstracts.

For more information about AMA reference style - AMA Manual of Style

Tables and statistics

Tables should be self-contained and complement, but not duplicate, information contained in the text. Number tables consecutively in the text in Arabic numerals. Type tables on a separate page with the legend above. Legends should be concise but comprehensive – the table, legend and footnotes (including statistical tests) must be understandable without reference to the text. Vertical lines should not be used to separate columns. Column headings should be brief, with units of measurement in parentheses; all abbreviations must be defined in footnotes. Footnote symbols: [(a)], [(b)], [(c)], onwards should be used and *, **, *** should be reserved for *P*-values. Statistical measures such as SD or SEM should be identified in the headings. After statistical testing, the value of the test statistic should be reported. Give the actual *P*-value, to two significant digits, whether or not the value is statistically significant. *P*-values less than 0.001 should be reported as $P<0.001$ rather than $P=0.000$. Abbreviations used in the text must be redefined in tables and figures with a few exceptions: ANOVA (analysis of variance), BMI (body mass index), F (female), M (male).

Appendices

These should be placed at the end of the paper, numbered in Roman numerals and referred to in the text. If written by a person other than the author of the main text, the writer’s name should be included below the title.

Figure legends

Type figure legends on a separate page. Legends should be concise but comprehensive – the figure and its legend must be understandable without reference to the text. Include definitions of any symbols used and define/explain all abbreviations and units of measurement.

Figures

All illustrations (line drawings and photographs) are classified as figures. Figures should be cited in consecutive order in the text using Arabic numerals.

Although authors are encouraged to send the highest-quality figures possible, for peer-review purposes, a wide variety of formats, sizes, and resolutions are accepted.

Author Services

Prior to submission, we encourage you to browse the 'Author Resources' section of the Wiley 'Author Services'website: http:/authorservices.wiley.com/bauthor/author.asp. This site includes useful information covering such topics as copyright matters, ethics and electronic artwork guidelines.

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5. EDITORIAL POLICIES AND CONTENT CONSIDERATIONS

Editorial Review and Acceptance

The acceptance criteria for all papers are the quality and originality of the research and its significance to our readership. Except where otherwise stated, all research, review and short papers (letters) will be double-blind peer reviewed by two anonymous reviewers and, and managed by one Associate Editor and the Editor in Chief. Authors are welcome to provide the names of up to three unbiased and qualified referees from outside their institution. Assignment of referees, however, will be at the discretion of the Editors. Final acceptance or rejection rests with the Editor, who reserves the right to refuse any material for publication.

Rejected manuscripts are ineligible for resubmission.

Manuscripts should be written in a clear, concise, direct style. Where contributions are judged as acceptable for publication on the basis of content, the Editor and the Publisher reserve the right to modify typescripts to eliminate ambiguity and repetition and improve communication between author and reader.

Principles for Publication of Research Involving Human Subjects

Manuscripts must contain a statement to the effect that all human studies have been reviewed by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in an appropriate version of the **Declaration of Helsinki** (as revised in Brazil 2013). This statement must contain the name of the ethics committee and the approval number allocated. It should also state clearly in the text that all persons gave their informed consent prior to their inclusion in the study. Details that might disclose the identity of the subjects under the study should be omitted.

In general, submission of a case report (in letters) should be accompanied by the written consent of the subject (or parent/guardian) before publication; this is particularly important where photographs are to be used or in cases where the unique nature of the incident reported makes it possible for the patient to be identified. While the Editors recognize that it might not always be possible or appropriate to seek such consent, the onus will be on the authors to demonstrate that this exception applies in their case.

Confidentiality

Where reviews of health services or hospitals have been made, it is recommended that a generic term is used in order to not identify the health service or hospital.

Data Sharing and Data Accessibility

The journal encourages authors to share the data and other artefacts supporting the results in the paper by archiving it in an appropriate public repository. Authors should include a data accessibility statement, including a link to the repository they have used, in order that this statement can be published alongside their paper.

Publication Ethics

This journal is a member of the **Committee on Publication Ethics (COPE).** Note this journal uses iThenticate'sCrossCheck software to detect instances of overlapping and similar text in submitted manuscripts. Read the **Top 10 Publishing Ethics Tips for Authors here**. Wiley's Publication Ethics Guidelines can be found at **authorservices.wiley.com/ethics-guidelines/index.html**.

REPORTING GUIDELINES FOR AUTHORS

To improve the quality of reporting health research, *Nutrition & Dietetics* require authors to follow appropriate reporting guidelines for their study type. A database containing a list of reporting guidelines can be found on the EQUATOR Network (Enhancing the Quality and Transparency of Health Research; **http://www.equator-network.org**).

Clinical Trials

All clinical trials must be registered and need to conform to CONSORT (**http://www.consort-statement.org/**). All clinical trial manuscripts must include a CONSORT statement and flow diagram.

Observational Studies

Observational studies, such as cohort and case-control studies, are acceptable but are vulnerable to bias and selective reporting. When an observational study is submitted to *Nutrition &Dietetics* you need to provide:

• The registration details, if the study has been registered.

• The protocol, if one exists (supplied as an appendix).

• A completed STROBE checklist - uploaded as a separate file to the submitted paper.

• A statement in the methods section that compliance with STROBE has been addressed.

Information about STROBE can be found at **http://www.strobe-statement.org/**

Systematic reviews

Nutrition & Dietetics publishes systematic reviews and meta-analyses. Prospective registration of review protocols with PROSPERO is required (accessed at: **http://www.crd.york.ac.uk/PROSPERO/**). All systematic reviews should follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement, a guideline for reporting of systematic reviews and meta-analyses. Each submission should be submitted with a completed PRISMA checklist, indicating where each of the PRISMA recommendations are addressed (accessed at: **http://www.equator-network.org/reporting-guidelines/prisma/**). When submitting a systematic review, the checklist should be uploaded as a separate file to the main document.

Qualitative studies

Nutrition & Dietetics make the following recommendations for reporting Qualitative studies:

Sample Selection: Sample selection should justify why and how respondents were selected and clearly articulate the rationale for data sources. In cases where data sources were atypical, justification should be provided. Authors should clearly outline any limitations in data, including but not limited to those who did not respond or complete the research.

Data collection: Where appropriate, papers should consider how and when the data was collected and recorded. Personnel involved in the collection of data should be identified and how the research was explained to respondents/participants should also be included.

Analysis Methodology: Analysis methodology should be transparent, including how concepts, themes and categories were created. Personnel involved in the analysis of data should be identified, including their roles. Details regarding the use of computer software for analysis should be declared, if used.

Analytic Rigour: Authors need to ensure their analysis has been thorough by detailing any steps taken to minimise possible data selectivity, and they have considered things such as inter-rater reliability, triangulation, expert and member checking. The position of the author should be declared including any possible bias or influence on the research.

Settings and Contexts: Relevant information about the settings of the research and participants/respondents should be clear. The subject of the research should be integrated into the relevant social context, abstracting or de-contextualising should be avoided. Any distinctive influences on the research should be recognised and discussed.

Data presentation: The range of evidence used should be clear, use of any quotations, field notes and other data should be identified where appropriate. Distinctions between the data and the interpretation, explanation or theorising of the data should be clear. Satisfactory original evidence should be presented to satisfy any relationships declared between the evidence and the conclusions made. Any evidence which might contest the conclusions should be considered.

Protocol paper guidelines

Nutrition and Dietetics publishes high quality funded protocols of original research that are consistent with the journal's Aims and Scope. Only protocols for registered clinical trials and population surveys will be considered. Authors should submit a completed **SPIRIT** statement for clinical trial protocols. Where the study design is a randomised controlled trial, evidence must be provided that the **CONSORT** guidelines have been followed, and a trial registration number must be included. A copy of the letter from the funding agency including the total amount of funds awarded should be submitted with your cover letter.

Recommended format:

Abstract: 250 words, including: Background; Aim; Methods; Discussion.

Trial registrations: including the name of the trial registry and the unique identifying number.

Keywords: A maximum of 6.

The main text should include the following headings to divide sections of the manuscript: Introduction, Methods, Results, Discussion, References. Subheadings should not be used in these sections. Ethical approval should be stated in the methods section.

Methods may address the following aspects: study design and research methods (including commentary on validity and reliability of methods/instrumentation), study setting, participants, sample size calculation, randomisation and group allocation, blinding, control and intervention procedures, primary outcomes, secondary outcomes, planned analyses, primary outcomes data analysis, ethical considerations.

Results should include data on recruitment, randomisation and baseline measurements.

Discussion should include commentary on timeline and expected study completion.

6. AUTHOR LICENSING

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8. POST PUBLICATION

Access and Sharing

When the article is published online:

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9. EDITORIAL OFFICE CONTACT DETAILS

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