Universidade Federal do Rio Grande do Sul
Faculdade de Medicina
Programa de Pós-Graduação de Ciências Médicas: Endocrinologia
Área de Concentração: Nutrição e Metabolismo

Tese de Doutorado

Fatores associados à perda de peso após cirurgia bariátrica

NATÁLIA LUIZA KOPS

Porto Alegre, maio de 2020

Fatores associados à perda de peso após cirurgia bariátrica

Natália Luiza Kops

Tese de Doutorado apresentada ao Programa de Pós-Graduação de Ciências Médicas: Endocrinologia da Universidade Federal do Rio Grande do Sul, como parte dos requisitos para a obtenção do título de Doutor em Ciências Médicas: Endocrinologia com ênfase em obesidade.

Orientador: Prof. Dr. Rogério Friedman

Comissão Examinadora:

Prof. Dra Lisiane Bizarro Araujo

Prof Beatriz D'Agord Schaan

Prof Ana Paula Trussardi Fayh

Porto Alegre, maio de 2020

CIP - Catalogação na Publicação

Kops, Natália Luiza
Fatores associados à perda de peso após cirurgia bariátrica / Natália Luiza Kops. -- 2020.
109 f.
Orientador: Rogério Friedman.

Tese (Doutorado) -- Universidade Federal do Rio Grande do Sul, Faculdade de Medicina, Programa de Pós-Graduação em Ciências Médicas: Endocrinologia, Porto Alegre, BR-RS, 2020.

1. Cirurgia bariátrica. 2. Obesidade grave. 3. Perda de peso. 4. Polimorfismo de nucleotídeo único. 5. Transtorno da compulsão alimentar. I. Friedman, Rogério, orient. II. Título.

Elaborada pelo Sistema de Geração Automática de Ficha Catalográfica da UFRGS com os dados fornecidos pelo(a) autor(a).

"Without ambition, one starts nothing. Without work, one finishes nothing. The prize will not be sent to you. You have to win it."

– Ralph Waldo Emerson

“A goal without a plan is just a wish.”

- Antonie de Saint Exupéry

Agradecimentos

Desde a iniciação científica, depois o trabalho de conclusão de curso, a dissertação de mestrado e enfim esta tese de doutorado, foram quase 10 anos de aprendizado contigo, Rogério. Como orientador, tu me mostraste o caminho, estando sempre por perto, mas deixando seguir minha própria caminhada com autonomia. Além da orientação acadêmica, te agradeço a cada conversa amiga, que muito me engrandeceu como pessoa.

Nesse período, aprendi também com cada um dos alunos: Manu, Elisa, Gian, Anderson, Marco, Dillan e Julia. Atarefados, mas sempre dispostos e interessados em aprender. Agradeço muito à Jaque e à Mari, que desde o início compatilharam minha trajetória acadêmica. Os primeiros pacientes, as primeiras extrações e os primeiros artigos foram com vocês!

Me orgulho em dizer que tive o privilégio de concluir uma pós-graduação em um Programa tão renomado como este, com conceito CAPES 6, na melhor universidade do Brasil. Isto se deve à dedicação de cada um dos professores que tive.

A pesquisa me trouxe uma visão mais crítica do mundo. Hoje analiso cada resultado antes da conclusão final. A pesquisa também me trouxe oportunidades de emprego logo após formada. Agradeço aos colegas e amigos do Hospital Moinhos de Vento pelo incentivo e colaboração durante esse período. Obrigada por continuar aprendendo e crescendo profissionalmente.

Agradeço também aos meus familiares, especialmente aos meus pais, Mário e Vera, pelo amor, apoio e carinho de sempre. Em todos os passos até aqui, vocês apoiaram cada um deles. Ao meu irmão, Daniel, pela sintonia e parceria. Ao meu marido, Lucas, pelo amor e cumplicidade, pela construção e realização de sonhos durante este período. Aos primos e amigos que de alguma forma contribuíram para a realização deste trabalho, o meu muito obrigada!

RESUMO

O objetivo desta tese foi verificar os fatores que, presentes antes da cirurgia bariátrica, se associam a perda de peso pós cirurgia. Nesse sentido, três objetivos específicos foram definidos: 1) Avaliar polimorfismos genéticos e a perda de peso pós cirurgia; 2) Verificar se compulsão alimentar antes da cirurgia bariátrica interfere na perda de peso após a cirurgia; 3) Sumarizar os resultados encontrados no objetivo acima através de uma revisão sistemática com metanálise. Para responder aos dois primeiros objetivos, foram utilizados dados de um estudo prospectivo com mais de 100 pacientes submetidos à derivação gástrica no Hospital de Clínicas de Porto Alegre. No período pré operatório, os pacientes foram clinicamente avaliados e uma amostra de sangue foi coletada para genotipagem de polimorfismos associados à obesidade. A perda de peso após a cirurgia foi analisada com dados de prontuário. Para contemplar o terceiro objetivo, uma revisão sistemática com metanálise foi realizada. Estudos observacionais e ensaios clínicos que avaliaram a presença de transtorno de compulsão alimentar pré-cirurgia e pelo menos uma medida de peso no pós operatório foram selecionados. Os resultados dos dois primeiros estudos demonstraram que a perda de peso foi significativa até os 12 meses pós operatórios. Apenas o genótipo *LEP223* foi associado com diferente perda de peso. Depressão, idade e maior pontuação na escala de compulsão alimentar não foram associados com perda de peso aos 24 e 60 meses pós cirurgia. A ausência de associação entre perda de peso e compulsão alimentar também foi encontrada na metanálise, apesar de os estudos mostrarem grande heterogeneidade entre eles. Em conclusão, os fatores que contribuem para o sucesso cirúrgico são inúmeros, complexos e mediados por interações biológicas. Uma associação significativa entre o genótipo *LEP223* e maior perda do excesso de peso pós cirurgia foi encontrada. Em relação aos fatores psicológicos, pacientes com uma maior pontuação na escala de compulsão alimentar parecem ter maior perda de peso logo após a cirurgia (6 meses), mas não a longo prazo.

PALAVRAS-CHAVE: Cirurgia bariátrica, obesidade grave, perda de peso, polimorfismo de nucleotídeo único, transtorno da compulsão alimentar.

Formato da Tese

Esta tese de doutorado segue o formato do Programa de Pós-Graduação em Ciências Médicas: Endocrinologia da Universidade Federal do Rio Grande do Sul, sendo apresentada por uma breve revisão da literatura e três manuscritos referentes ao tema estudado:

PARTE I: Referencial teórico.

PARTE II: Artigos originais:
1) publicado no *Obesity Surgery*, redigido conforme as normas do periódico;
2) publicado no *Clinical Nutrition ESPEN*, redigido conforme as normas do periódico;
3) submetido no *The Journal of Nutrition*, redigido conforme as normas do periódico.

PARTE III: Considerações finais.

Sumário

PARTE I

1. INTRODUÇÃO

1.1 Obesidade

As grandes modificações políticas, econômicas e sociais influenciaram no modo de vida e repercutiram na saúde das populações, sendo a obesidade um dos mais proeminentes problemas de saúde pública do século XXI (1). A prevalência global da obesidade dobrou em mais de 70 países desde 1980 e está projetada para continuar aumentando (2), especialmente em populações com maior grau de pobreza e menor nível educacional (3,4). A Organização Mundial da Saúde (OMS) estima que existam 2,3 bilhões de pessoas com excesso de peso no mundo, das quais 700 milhões são obesas, representando aproximadamente 13% da população adulta (5). Nos Estados Unidos, este número chegou a 36,2% da população (5). No Brasil, os dados também são preocupantes: a prevalência da obesidade passou de 11,8% em 2006 para 19,8% em 2018, e o excesso de peso de 42,6% para 55,7% (6). Um dos dezesete Objetivos do Desenvolvimento Sustentável (ODS), lançado pela Organização das Nações Unidas, em 2015, foi reduzir as formas de má-nutrição relacionadas ao sobrepeso e/ou obesidade até 2025 (7).

A obesidade representa um grande risco para doenças não transmissíveis, incluindo diabetes mellitus, doenças cardiovasculares, hipertensão, acidente vascular cerebral e certos tipos de câncer (1). Na prática clínica é diagnosticada por um índice de massa corporal (IMC = peso (kg) / [altura (m)]^2) maior do que 30 kg/m^2 e pode ainda ser subdividida em categorias, de acordo com sua gravidade: obesidade classes I, II e III (IMC $\geq$ 30 kg/m^2, 35 kg/m^2 e 40,0 kg/m^2, respectivamente) (5). Suas consequências para a saúde variam do risco aumentado de morte prematura a condições crônicas graves que reduzem a qualidade de vida geral (8). Indivíduos com IMC $\geq$ 45 kg/m^2 apresentam uma diminuição da expectativa de vida e um aumento da mortalidade por causas cardiovasculares (3).

Promover comportamentos de vida saudáveis, como atividade física e exercício, redução de álcool, juntamente com escolhas alimentares saudáveis, pode modificar o risco de obesidade e melhorar a saúde das gerações futuras (9). O manejo conservador deve necessariamente incluir mudanças no estilo de vida do paciente e, em casos individuais, a associação de farmacoterapia pode ser adotada. Quando estas medidas não implicam melhora da obesidade grave e das doenças associadas, a cirurgia bariátrica é uma opção consistente (3).

1.2 Cirurgia bariátrica

Com o aumento da obesidade, o número de cirurgias bariátricas também vem aumentando (10). A cirurgia é considerada uma efetiva opção terapêutica para o tratamento da obesidade grave, podendo levar a uma perda de peso em média 26 kg maior do que o tratamento não cirúrgico (11) e, como consequência da perda de peso, proporciona melhora das comorbidades relacionadas (12). No entanto, os desfechos, embora expressivos, não são universais, variando entre pacientes e tipos de procedimentos cirúrgicos. O Brasil oferece a cirurgia no Sistema Único de Saúde (SUS) desde 2000 (13), sendo atualmente o segundo país no mundo que mais realiza procedimentos deste tipo (14).

Relatos históricos afirmam que a primeira cirurgia bariátrica foi realizada na Espanha, no século X (15). Dom Sancho, rei de Leon, perdeu seu trono porque a obesidade lhe impedia de andar, cavalgar ou pegar uma espada. Ele foi então escoltado por sua avó para Córdoba para ser tratado por um médico que suturou seus lábios. Assim, a sua alimentação seria somente através de uma dieta líquida por meio de um canudo, o que fez com que o rei perdesse peso e recuperasse o trono (15). Já a primeira cirurgia metabólica (bypass jejuno-ileal), é atribuída a Kremen (1954) e trouxe grandes consequências metabólicas, levando à diarreia grave e desidratação. Em 1966, Mason propôs o primeiro bypass gástrico e, desde então, várias modificações foram propostas nessa técnica (16). Apenas na década de 1990, quando a epidemia da obesidade foi reconhecida, é que as abordagens cirúrgicas começaram a ser mais discutidas (15).

A cirurgia está indicada para pacientes entre 18 e 65 (em casos selecionados, até os 70) anos de idade, com IMC ≥ 40 kg/m², independente da presença de comorbidades, ou com IMC ≥ 35 kg/m² associado a alguma comorbidade (3). Por outro lado, são contraindicações: causas endócrinas tratáveis (por exemplo, síndrome de Cushing), dependência de álcool ou drogas ilícitas, doenças psiquiátricas graves sem controle, risco anestésico e cirúrgico, dificuldade de compreensão de riscos e mudanças no estilo de vida após o procedimento (3). As complicações pós-operatórias variam conforme o procedimento cirúrgico; entretanto, as mais comuns são tromboembolismo pulmonar, deiscência da sutura, fístulas, estenoses, infecções, hemorragia, hérnia interna e obstrução intestinal (3).

Atualmente, diferentes técnicas cirúrgicas podem ser empregadas. Estas promovem a restrição da ingestão e retardo do esvaziamento gástrico (devido à diminuição do volume gástrico) ou uma associação de restrição da ingestão e diminuição da absorção de nutrientes (obtida através da redução da área absortiva do intestino) (17). O procedimento mais realizado no mundo segue sendo a derivação gástrica ("bypass", 49,4%), seguido por gastrectomia vertical (40,7%) e banda gástrica ajustável (5,5%) (10).

A derivação gástrica em Y-de-Roux (RYGB) é um procedimento restritivo-malabsortivo (18). O redirecionamento do fluxo alimentar produz alterações nos hormônios intestinais que promovem a saciedade, suprimem a fome e revertem um dos principais mecanismos pelos quais a obesidade induz o diabetes tipo 2, produzindo perda de peso significativa a longo prazo (19). Apesar de ser o procedimento de referência (20), o RYGB é o procedimento mais complexo e, potencialmente, pode resultar em maiores taxas de complicações, como deficiências de longo prazo de vitaminas e minerais, particularmente B12, ferro, cálcio e folato (21).

A gastrectomia vertical (*sleeve*) é outro procedimento restritivo em que a remoção do fundo gástrico reduz os níveis de grelina, cuja principal função é a indução do apetite (3). Já a derivação biliopancreática com gastrectomia horizontal (técnica de Scopinaro) causa uma perda de peso secundária à má absorção lipídica e calórica; por isso, essa técnica possui maior incidência de efeitos adversos como diarreia, flatus fétidos, desnutrição e deficiência de vitaminas lipossolúveis (3). Já a derivação biliopancreática com *duodenal switch* é uma gastrectomia vertical com desvio intestinal. Estes procedimentos são realizados com menor frequência devido à maior incidência de complicações (a curto e longo prazo) (23).

O conhecimento do procedimento realizado em cada paciente é fundamental, por determinar o acompanhamento pós cirúrgico. Estes devem ser regularmente acompanhados por meio de consultas ambulatoriais, orientações nutricionais e exames laboratoriais para detectar precocemente alterações metabólicas e nutricionais (3). A frequência do acompanhamento deve ser individualizada e baseada no tipo de cirurgia e nas comorbidades do paciente (3).

1.3 Perda de peso e fatores envolvidos

Embora a perda de peso não seja o desfecho mais importante da cirurgia, visto que o objetivo é também apoiar a resolução de doenças associadas, esta é um importante fator da eficácia cirúrgica. A perda de peso nos pacientes após cirurgia ocorre por complexos mecanismos que levam ao balanço energético negativo (24). Estes envolvem múltiplas áreas centrais e tecidos periféricos, que se comunicam através de conexões neurais, hormônios e metabólitos.

Sinais provenientes de órgãos sensoriais, como visão, olfato e paladar, e de tecidos periféricos, como trato gastrointestinal e tecido adiposo, além de sinais provenientes de outras áreas centrais, como córtex e sistema de recompensa (que determinarão, por exemplo, o valor atribuído a alimentos específicos e a motivação para buscá-los) convergem para o hipotálamo (25). No hipotálamo, há dois grupos de neuropeptídios envolvidos nos processos orexígenos (que aumentam a sensação de fome) e anorexígenos (que suprimem o apetite), que tem como função controlar as sensações de fome ou saciedade e desencadear respostas endócrinas, autonômicas e comportamentais a fim de manter a homeostase (24). Os neuropeptídeos orexígenos são o neuropeptídeo Y (NPY) e o peptídeo agouti (AgRP). Já os neuropeptídios anorexígenos são o hormônio alfa-melanócito estimulador (α-MSH) e o transcrito relacionado à cocaína e à anfetamina (CART). Após a cirurgia, os nutrientes ingeridos ignoram a maior parte do estômago e do intestino delgado superior, entrando diretamente no jejuno, sem se misturarem com enzimas pancreáticas ou ácidos biliares (26). As modificações anatômicas também resultam em uma maior secreção de NPY e GLP-1, responsáveis pela menor ingestão alimentar e aumento da saciedade. Outras alterações incluem modificação na microbiota intestinal e sinalização do nervo vagal alterado (26).

Os conceitos de sucesso ou falha cirúrgica são controversos, mas frequentemente associados à perda de peso, que possui diferentes formas de avaliação (Tabela 1) (27). O %PEP (percentual de excesso de peso perdido) foi introduzido para complementar a forma de avaliação, pois proporciona uma melhor estimativa da quantidade de perda de peso alcançada em relação a uma meta definida (20). Essa meta é, muitas vezes, a perda de no mínimo 50% do excesso de peso, além de o paciente deixar de ser obeso grave. Conforme diretrizes brasileiras de obesidade, essa condição deve ser mantida pelo período de cinco anos (3).

A perda ponderal estabiliza-se em média 18 meses após a cirurgia, época em que geralmente ocorre perda de peso máxima (podendo chegar a mais de 80% do excesso de peso) (3). A perda média de 61% do excesso de peso parece estar relacionada à melhora de diabetes, hipertensão, síndrome de apneia obstrutiva do sono e dislipidemia (3).

Apesar da eficácia da cirurgia bariátrica, a recuperação do peso pode ocorrer com o passar do tempo. A estabilização do peso a longo prazo é ainda um dos grandes desafios, pois sabe-se que apenas 76% dos pacientes com RYGB mantiveram 20% ou mais de sua perda total de peso corporal aos 6 anos após a cirurgia (28). As razões para isso não são totalmente compreendidas, mas provavelmente envolvem tanto processos fisiológicos e comportamentais como psicológicos.

Tipo de procedimento cirúrgico

Embora todas as técnicas mostrem-se efetivas, as taxas de redução de peso e de melhora de comorbidades clínicas são diferentes entre elas. O *Swedish Obese Subjects Study*, iniciado em 1987, foi o primeiro estudo de longo prazo sobre os efeitos da cirurgia bariátrica. No grupo controle (não cirúrgico, n = 2.037), a mudança de peso médio permaneceu dentro de ± 3% durante todo o período de observação, já nos três subgrupos de cirurgia (n = 2.010), a perda de peso máxima foi entre 1 a 2 anos após a cirurgia (RYGB 32 ± 8% de mudança do peso, gastrectomia vertical 25 ± 9% e banda gástrica 20 ± 10%) (12). Nos anos subsequentes, o aumento de peso foi observado em todos os subgrupos de cirurgias, embora o aumento de peso tenha se estabilizado entre 8 a 10 anos. Após 10 anos, as perdas de peso foram em média de 25 ± 11% (RYGB), 16 ± 11% (gastrectomia vertical) e 14 ± 14% (banda gástrica). Após 15 anos, foram de 27 ± 12%, 18 ± 11% e 13 ± 14%, respectivamente. Poucos estudos têm avaliado as mudanças de peso de 20 anos, por isso ainda devem ser interpretadas com cautela (29).

Diversas revisões sistemáticas com metanálises também foram realizadas para comparar a eficácia dos procedimentos cirúrgicos (Tabela 2). De modo geral, pode-se dizer que o procedimento com menor %PEP é o balão intragástrico, seguido da banda gástrica ajustável. Na derivação biliopancreática o %PEP oscila em torno de 75-80%. O RYGB resulta em significativa perda de peso a longo prazo (60 a 80%) e manutenção de mais de 50% do excesso de peso perdido (19).

Apesar de os estudos variarem em termos de tempo de acompanhamento e forma de avaliação da perda de peso, parece haver uma concordância de que o RYGB é um procedimento eficaz em pacientes com obesidade mórbida que leva à perda de peso sustentável em períodos de longo prazo em comparação com os outros tipos cirúrgicos (30).

Fatores clínicos

Além do tipo de procedimento cirúrgico, diversos outros fatores vêm sendo associados como preditores da perda de peso pós cirurgia bariátrica. Mais de 200 potenciais fatores clínicos foram estudados (31), mas apenas alguns desses já estão bem estabelecidos.

Aproximadamente, 80% dos procedimentos são realizados no sexo feminino (73,3%). A idade média global dos pacientes no momento da cirurgia é de 42 anos (IQR: 33–51) (10), mas a obesidade afeta praticamente todas as faixas etárias (1) e o aumento de comorbidades graves relacionadas à obesidade tem resultado em maior aceitação da cirurgia durante a adolescência (33). O estudo Teen–LABS (*Teen–Longitudinal Assessment of Bariatric Surgery)* incluiu jovens menores de 19 anos entre 2006 e 2012 e não encontrou diferença significativa no %PEP entre adolescentes (-26%; IC 95% -29, -23) e adultos (-29%; IC 95% -31, -27) em 5 anos após a cirurgia (p = 0,08) (34). A falta de associação entre idade e %PEP aos 5 e 10 anos pós cirurgia também foi confirmada em uma metanálise com 80 ensaios clínicos randomizados, prospectivos ou retrospectivos (2017) (30). Por outro lado, Benotti e colaboradores (2014) encontraram uma relação "dose-resposta" entre aumento da idade com risco de mortalidade após 30 dias de cirurgia (35) e complicações cirúrgicas (36), sugerindo que uma intervenção cirúrgica mais precoce possa proporcionar melhores resultados por um período mais longo.

Em relação ao sexo biológico, parece haver uma associação positiva entre gênero e %PEP após RYGB (β = 1,24) (30). Os homens normalmente apresentam maior IMC pré-operatório, mais comorbidades e maiores complicações no pós cirúrgico, o que pode estar associado a menor perda de peso pós cirurgia (37). A diferença nos resultados de perda de peso entre os sexos também pode ser em função da maior dificuldade pelos homens em aderir às recomendações de restrição energética e ingestão de macronutrientes após a cirurgia (38).

O IMC pré-operatório é outro fator que pode estar associado à perda de peso (39–41). Entre 62 estudos (24.326 participantes) incluídos em uma revisão sistemática com metanálise, 37 (59,7%) reportaram uma associação negativa entre IMC basal e perda percentual do excesso de peso pós cirurgia, especialmente entre pacientes após derivação gástrica (41). Além disso, a perda de peso no período que antecede a cirurgia prediz positivamente uma perda de peso (41). Em 6 meses pós cirurgia, o %PEP foi maior nos pacientes que perderam mais de 5% do peso corporal (32,4% vs. 30,0%, p = 0.009) (42). Em 12 meses, pacientes com uma perda de peso basal maior do que 10% também tiveram uma chance maior em atingir 70% do PEP quando comparado àqueles com perda de 0% a 5% (2,1 IC 95% 1,5–3,0) (43). Apesar de os estudos variarem em termos de tempo de acompanhamento e formas de avaliação da perda de peso, os resultados parecem se manter a longo prazo (44,45).

Outro fator relacionado a perda de peso é o comparecimento aos atendimentos pré-operatórios. Os pacientes comparecem mais nos atendimentos pré-operatórios do que pós-operatórios (67,4% vs. 37,5%, p < 0,001), sendo que qualquer não atendimento pré-operatório é preditivo de menor perda de peso aos 2 anos pós cirúrgicos (32,5% vs. 26,8%, p = 0,019) (46). Em uma revisão sistemática com 7.371 estudos observacionais, apenas 29 (7.971 pacientes) tiveram retenção de pelo menos 80% dos pacientes em 2 anos de acompanhamento. Esse número reduziu para 4 estudos em 5 anos ou mais de acompanhamento (47).

Há evidências suficientes de que o aumento da atividade física no pré e no pós operatório estão associados à maior perda de peso, melhor composição corporal e melhor condicionamento após a cirurgia. Um programa de exercícios físicos como uma terapia adjuvante para pacientes bariátricos mostrou ter benefícios adicionais em comparação a um grupo controle sem o acompanhamento (48). O exercício aumenta o gasto energético total e melhora a energia mitocondrial do músculo esquelético, a oxidação da gordura e a sensibilidade à insulina (49). No estudo *Longitudinal Assessment of Bariatric Surgery*, a maioria dos adultos aumentou o nível de atividade física de 7.563 para 8.788 passos por dia após um ano de cirurgia bariátrica (50). No entanto, a grande maioria dos pacientes não pratica atividade física em níveis recomendados para obter benefícios gerais à saúde no momento pré-operatório e apenas uma minoria atinge essa recomendação no pós-operatório (50).

As complicações pré-operatórias mais prevalentes parecem ser hipertensão arterial (31,9%), refluxo gastroesofágico (29,6%), dor musculoesquelética (27,8%), diabetes mellitus tipo 2 (22%), apneia (18,9%) e depressão (17.6%) (10). Diabetes tipo 2 pode estar associado a menor perda de peso no pós operatório (41). O ganho de peso ocorre com o tratamento de hipoglicemiantes (12), no entanto, na revisão de Wood e colaboradores (2016), o uso de medicação pré-operatória foi significativamente associada à perda de peso após cirurgia bariátrica (51). Uma possível explicação para esse achado é a maior interação com os profissionais de saúde (51).

Assim, sexo feminino, maior perda de peso e atividade física são alguns do fatores pré-operatórios associados a maior mudança de peso. Investigações abrangentes de potenciais fatores modificáveis que podem influenciar o peso especialmente a longo prazo podem ajudar a identificar pacientes em risco de resultados abaixo do ideal.

Fatores genéticos

Entende-se que a obesidade decorre da superposição de fatores ambientais e alimentares deletérios sobre um arcabouço genético. Estudos disponíveis encontram polimorfismos/mutações prevalentes no cenário da obesidade já instalada (52). A compreensão dos mecanismos moleculares da obesidade progrediu enormemente nos últimos anos graças ao desenvolvimento de ferramentas de triagem genética mais rápidas e mais precisas, aplicadas em estudos de coorte ou em exames com foco nos indivíduos e suas famílias (52). No entanto, a influência de mutações relacionadas a perda de peso após a cirurgia bariátrica ainda não está clara.

O sequenciamento total do genoma possibilitou a identificação de novas síndromes associadas à obesidade devido a uma única mutação (52). A obesidade monogênica é rara e envolve a mutação em um único gene crítico para a homeostase metabólica. Quase todas as mutações de um único gene descritas estão envolvidos no controle homeostático do balanço energético (53). Essas formas raras de obesidade distinguem-se da obesidade com herança poligênica, que é a mais comum, onde cada gene considerado suscetível causa apenas um leve efeito no peso. Mais de 100 loci já foram associados ao IMC e à obesidade em grandes populações (54). Curiosamente, quase todos os genes e SNPs (*single nucleotide polymorphism*, polimorfismo de nucleotídeo único) envolvidos em formas monogênicas da obesidade contribuem com variantes comuns associadas com obesidade poligênica (54). Alguns desses genes incluem *MC3R* e *MC4R (*receptor da melanocortina 3 e 4*)*, *LEP* (leptina), *LEPR* (receptor da leptina)*, PC1(* prohormone convertase 1), *POMC* (pró-opiomelanocortina) *e SIM1* (proteína single-minded 1) (52). Outro gene comumente associado à obesidade é o *FTO* (fat mass and obesity-associated), cujo mecanismo de ação não está claro, embora seu RNA seja altamente expresso em áreas cerebrais importantes para a regulação do consumo de energia e do sistema de recompensa (55).

A mobilização das reservas de energia armazenada como lipídios durante o jejum desencadeia uma série de sinais que diminuem os níveis de leptina, aumentando a sensação de fome (56). A leptina, produzida nos adipócitos, age pelo receptor de membrana LEPR B (codificado pelo gene *LEPR)* no sistema nervoso central, ativando diversos mediadores, especialmente os neurônios do núcleo arqueado do hipotálamo que expressam a POMC (56,57). Este pró-hormônio, sob a ação das pró-hormônio convertases (PC1 e PC2), dá origem a peptídeos bioativos, incluindo a corticotrofina (ACTH), as melanocortinas (MSH) e a β-endorfina (56,57).

Variantes genéticos que predispõem à obesidade também poderiam estar relacionados a uma maior resistência à perda de peso após intervenções cirúrgicas. Um estudo recente (2019) com 131 pacientes (adultos chineses) submetidos a gastrectomia vertical mostrou que 8,4% dos casos de obesidade foram causados por alterações em diferentes genes (*LEP, LEPR, MC3R, MC4R, PCSK1, SIM1* e *POMC*). Após ajuste para sexo, idade e IMC, os pacientes com mutações tiveram %PEP significativamente menor do que pacientes sem mutações, em 6 anos após a cirurgia (β 0.297, 95%IC -0.383, -0.210) (53). O mesmo foi encontrado por Still e colaboradores (2011) em um estudo com 1.001 pacientes genotipados para SNPs de *INSIG2, FTO, MC4R* e *PCSK1.* A perda de peso após 30 meses de derivação gástrica foi significativamente diferente entre pacientes sem nenhum alelo de risco do que entre os portadores de um ou mais alelos de risco (58). Por outro lado, o SNP rs16945088 do gene FTO foi associado à perda de peso máxima após banda gástrica em 293 indivíduos do estudo *Swedish Obese Subjects*. Portadores dos alelos de interesse perderam aproximadamente 3 kg a menos em comparação com os homozigotos comuns (59). Esta associação não foi encontrada com os outros SNPs analisados (*ADIPOQ, BDNF, GNB3, LEP, LEPR, MC4R, NR3C1, PPARG, PPARGC1A* e *TNF*), nem entre indivíduos submetidos a outros procedimentos bariátricos (RYGB e gastroplastia vertical) (59).

Os dados indicam que variantes comuns de suscetibilidade à obesidade podem estar associadas a diferentes resultados de perda de peso após a cirurgia bariátrica. No entanto, mais estudos prospectivos, com grande tamanho amostral e de longo prazo são necessários para confirmar o efeito das diferentes mutações na perda de peso pós cirurgia.

Fatores psicossociais

Sintomas de estresse, ansiedade, depressão, nervosismo e o comer quando estão com problemas emocionais são comuns em pacientes com obesidade. Existem associações robustas entre obesidade e uma série de transtornos mentais, como transtornos depressivo e bipolar, esquizofrenia e transtorno de compulsão alimentar periódica (TCAP) (60), especialmente em pacientes candidatos à cirurgia bariátrica (61,62). Já a relação entre psicopatologias antes da cirurgia bariátrica e resultados pós-operatórios é menos robusta (63).

Entre diversos fatores como compulsão alimentar, hábitos alimentares inadequados, depressão, ansiedade, histórico de abuso sexual, autoestima, uso de álcool e outros transtornos psiquiátricos, na revisão de Livhits M e colaboradores (2012), o transtorno de personalidade foi o único fator psicossocial pré-operatório associado a perda de peso sub-ótima (41). Na revisão de Bordignon e colaboradores (2017), com 16 artigos analisados, os autores sugeriram que alterações externalizantes (comportamentos que se expressam em relação a outras pessoas) podem estar associadas à menor perda de peso, enquanto que alterações internalizantes (sintomas emocionais e comportamentais, que pressupõem condições psicopatológicas) estão associadas a maior perda de peso (64).

Transtornos do humor e do uso de substâncias, bem como compulsão alimentar, partilham características comuns de impulsividade, que se refere à incapacidade de inibir um comportamento automático e à tendência de descontar consequências futuras em favor de resultados mais imediatos (61). A falta de controle pode reduzir a capacidade de inibir um comportamento automático (como o consumo de alimentos altamente palatáveis, por exemplo) e pode aumentar a preferência por recompensas imediatas em detrimento das de longo prazo (como uma opção mais saudável), afetando os resultados da cirurgia bariátrica (61).

Apesar de uma série de aspectos psicológicos e comportamentais comuns, os transtornos diferem em termos de curso clínico, desfecho e necessidade de tratamento (65). Para construtos mais transitórios e variáveis, a duração e o tempo podem ser importantes a considerar, o que pode ser problemático se as avaliações não abordarem a cronicidade ou se concentrarem apenas em experiências recentes. Os efeitos do TCAP na mudança de peso podem diferir se ocorrerem por um período de tempo limitado ou prolongado. Da mesma forma, um episódio breve depressivo em comparação com um período prolongado de depressão (66).

Transtorno de Compulsão Alimentar

A compulsão alimentar foi descrita há mais de 50 anos por Stunkard (1959), no entanto, apenas na quinta edição do *Diagnostic and Statistical Manual of Mental Disorders* (DSM-V) (65), publicada em maio de 2013, que o TCAP deixou de ser listado como um "transtorno alimentar sem outra especificação". No DSM-V, os critérios diagnósticos foram consistentes com a edição anterior, mas reduziu-se tanto a frequência dos episódios quanto a duração dos comportamentos alimentares. O TCAP é caracterizado por sofrimento marcante e por pelo menos três dos seguintes aspectos: comer muito mais rapidamente do que o normal; comer até se sentir desconfortavelmente cheio; ingerir grandes quantidades de alimento sem estar com sensação física de fome; comer sozinho por vergonha do quanto se come; e sentir-se desgostoso de si mesmo, deprimido ou muito culpado depois da compulsão.

Existem evidências mistas para sugerir que *grazing* (geralmente definido como o consumo de pequenas quantidades de alimentos por um período prolongado de tempo) está associado a piores resultados no tratamento da perda de peso (67) e maior reganho de peso (68). Após 10 anos de acompanhamento dos pacientes incluídos no estudo *Swedish Obese Subjects*, os comportamentos alimentares pré-cirurgia não foram relacionados às subsequentes alterações de peso (69). Incluindo 26 estudos, a prevalência de *grazing* pré cirurgia foi de 33,2% (95% CI, 27,5 – 39,1), 28,2% (95% CI, 17,9 – 39,7) pós cirurgia e 23,3% (95% CI 3,1 - 52,0]) na população geral (67). O estudo *Longitudinal Assessment of Bariatric Surgery-2 (LABS-2)* também mostrou que *grazing* e TCAP reduziram logo após banda gástrica ou RYGB, mas depois aumentaram novamente, com um notável número de casos novos (25.6% e 4.8%, respectivamente) (70).

Apesar de o efeito preditivo de TCAP pré-cirurgia ser controverso, a literatura que aborda o efeito da presença do transtorno no período pós operatório é mais consistente (71). Ainda assim, não se sabe por que o transtorno ressurge em algumas pessoas, mas outras não. De qualquer forma, as intervenções psicossociais podem melhorar o transtorno e o funcionamento psicossocial entre pacientes de cirurgia bariátrica, e o momento ideal para iniciar o tratamento parece ser logo após a cirurgia (72).

Sanmiguel e colaboradores (2016) mostraram que a gastrectomia vertical diminuiu o tanto o apetite como a alimentação hedônica, causando alterações estruturais em várias regiões do sistema de recompensa do cérebro. Tais alterações anatômicas e fisiológicas sugerem um papel importante na eficácia da perda de peso (73). No entanto, a cirurgia por si só não melhorará os comportamentos compulsivos e comportamentais, por isso os pacientes devem entender a necessidade de alterar esses comportamentos.

Em geral, a cirurgia está associada a uma melhora significativa nos transtornos afetivos, depressivos e de ansiedade (74). Por outro lado, a cirurgia parece não afetar os transtornos de personalidade, uma vez que estes transtornos geralmente começam na adolescência e persistem na idade adulta (74). Já a associação entre os transtornos psicossociais e a perda de peso segue sendo um vasto campo de pesquisa, com diversas questões a serem investigadas.

Referências

1. Obesity [Internet]. 2018 [cited 2018 Apr 22]. Available from: http://www.euro.who.int/en/health-topics/noncommunicable-diseases/obesity

2. The GBD 2015 Obesity Collaborators. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. N Engl J Med. 2017 Jul 6;377(1):13–27.

3. Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica Diretrizes brasileiras de obesidade 2016 / ABESO - Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. – 4.ed. - São Paulo, SP.

4. Devaux M, Sassi F. Social inequalities in obesity and overweight in 11 OECD countries. Eur J Public Health. 2013 Jun;23(3):464–9.

5. Obesity and overweight [Internet]. [cited 2020 Jan 29]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

6. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças não Transmissíveis. Vigitel Brasil 2018: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico : estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2018 / Ministério da Saúde, Secretaria de Vigilância em Saúde, Departamento de Análise em Saúde e Vigilância de Doenças não Transmissíveis. – Brasília: Ministério da Saúde, 2019. 132.: il.

7. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases: 2013-2020. [Internet]. 2013 [cited 2018 Oct 19]. Available from: http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf

8. NICE. Obesity: identification, assessment and management | Guidance and guidelines [Internet]. 2014 [cited 2018 Apr 21]. Available from: https://www.nice.org.uk/guidance/cg189/chapter/1-recommendations#follow-up-care

9. Brazil, editor. Plano de ações estratégicas para o enfrentamento das doenças crônicas não transmissíveis (DCNT) no Brasil: 2011-2022. 1a edição. Brasília, DF: Ministério da Saúde; 2011. 154 p. (Série B. Textos básicos de saúde).

10. Welbourn R, Pournaras DJ, Dixon J, Higa K, Kinsman R, Ottosson J, et al. Bariatric Surgery Worldwide: Baseline Demographic Description and One-Year Outcomes from the Second IFSO Global Registry Report 2013-2015. Obes Surg. 2018 Feb;28(2):313–22.

11. Finkelstein EA, Trogdon JG, Cohen JW, Dietz W. Annual Medical Spending Attributable To Obesity: Payer-And Service-Specific Estimates: Amid calls for health reform,

real cost savings are more likely to be achieved through reducing obesity and related risk factors. Health Affairs. 2009 Jan;28(Supplement 1):w822–31.

12. Sjöström L. Review of the key results from the Swedish Obese Subjects (SOS) trial – a prospective controlled intervention study of bariatric surgery. Journal of Internal Medicine. 2018 Jun 2;273(3):219–34.

13. Kelles SMB, Machado CJ, Barreto SM, Kelles SMB, Machado CJ, Barreto SM. Dez anos de cirurgia bariátrica no Brasil: mortalidade intra-hopitalar em pacientes atendidos pelo sistema único de saúde ou por operadora da saúde suplementar. ABCD Arquivos Brasileiros de Cirurgia Digestiva (São Paulo). 2014 Dec;27(4):261–7.

14. História da Cirurgia Bariátrica no Brasil [Internet]. SBCBM. [cited 2018 Apr 22]. Available from: https://www.sbcbm.org.br/historia-da-cirurgia-bariatrica-no-brasil/

15. Faria GR. A brief history of bariatric surgery. Porto Biomedical Journal. 2017 May 1;2(3):90–2.

16. Mason EE, Ito C. Gastric bypass in obesity. Surg Clin North Am. 1967 Dec;47(6):1345–51.

17. Naik RD, Choksi YA, Vaezi MF. Consequences of bariatric surgery on oesophageal function in health and disease. Nat Rev Gastroenterol Hepatol. 2016 Feb;13(2):111–9.

18. Mitchell BG, Gupta N. Roux-en-Y Gastric Bypass. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 [cited 2020 Jan 29]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK553157/

19. Bariatric Surgery Procedures – ASMBS [Internet]. American Society for Metabolic and Bariatric Surgery. [cited 2018 Apr 22]. Available from: https://asmbs.org/patients/bariatric-surgery-procedures

20. Landecho MF, Valentí V, Moncada R, Frühbeck G. Eligibility and Success Criteria for Bariatric/Metabolic Surgery. In: Engin AB, Engin A, editors. Obesity and Lipotoxicity [Internet]. Cham: Springer International Publishing; 2017 [cited 2019 Jun 2]. p. 529–43. (Advances in Experimental Medicine and Biology). Available from: https://doi.org/10.1007/978-3-319-48382-5_23

21. Chang S-H, Stoll CRT, Song J, Varela JE, Eagon CJ, Colditz GA. Bariatric surgery: an updated systematic review and meta-analysis, 2003–2012. JAMA Surg. 2014 Mar 1;149(3):275–87.

22. Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica Diretrizes brasileiras de obesidade 2016 / ABESO - Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. – 4.ed. - São Paulo, SP.

23. Wolfe BM, Kvach E, Eckel RH. Treatment of Obesity: Weight Loss and Bariatric Surgery. Circ Res. 2016 May 27;118(11):1844–55.

24. Hartmann IB. Avaliação de fatores clínicos e biológicos associados ao prognóstico da cirurgia bariátrica. 2016.

25. Korner J, Bessler M, Cirilo LJ, Conwell IM, Daud A, Restuccia NL, et al. Effects of Roux-en-Y gastric bypass surgery on fasting and postprandial concentrations of plasma ghrelin, peptide YY, and insulin. J Clin Endocrinol Metab. 2005 Jan;90(1):359–65.

26. Manning S, Pucci A, Batterham RL. Roux-en-Y gastric bypass: effects on feeding behavior and underlying mechanisms. J Clin Invest. 2015 Mar 2;125(3):939–48.

27. Brethauer SA, Kim J, Chaar M el, Papasavas P, Eisenberg D, Rogers A, et al. Standardized outcomes reporting in metabolic and bariatric surgery. Surgery for Obesity and Related Diseases. 2015 May 1;11(3):489–506.

28. Adams TD, Davidson LE, Litwin SE, Kolotkin RL, LaMonte MJ, Pendleton RC, et al. Health Benefits of Gastric Bypass Surgery After 6 Years. JAMA. 2012 Sep 19;308(11):1122.

29. Sjöström L, Peltonen M, Jacobson P, Sjöström CD, Karason K, Wedel H, et al. Bariatric Surgery and Long-term Cardiovascular Events. JAMA. 2012 Jan 4;307(1):56–65.

30. Golzarand M, Toolabi K, Farid R. The bariatric surgery and weight losing: a meta-analysis in the long- and very long-term effects of laparoscopic adjustable gastric banding, laparoscopic Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy on weight loss in adults. Surg Endosc. 2017 Nov 1;31(11):4331–45.

31. Furtado MCMB, Vermeulen KM, Bellot PENR, Godoy CM de A, Coelho D, Godoy EP de, et al. Evaluation of factors that may influence in the insufficient weight loss in patients after two years of Roux-en-Y gastric bypass. Nutr Hosp. 2018 Oct 5;35(5):1100–6.

32. Welbourn R, Pournaras DJ, Dixon J, Higa K, Kinsman R, Ottosson J, et al. Bariatric Surgery Worldwide: Baseline Demographic Description and One-Year Outcomes from the Second IFSO Global Registry Report 2013-2015. Obes Surg. 2018 Feb;28(2):313–22.

33. O’Brien PE, Sawyer SM, Laurie C, Brown WA, Skinner S, Veit F, et al. Laparoscopic Adjustable Gastric Banding in Severely Obese Adolescents: A Randomized Trial. JAMA. 2010 Feb 10;303(6):519.

34. Inge TH, Courcoulas AP, Jenkins TM, Michalsky MP, Brandt ML, Xanthakos SA, et al. Five-Year Outcomes of Gastric Bypass in Adolescents as Compared with Adults. N Engl J Med. 2019 30;380(22):2136–45.

35. Benotti P, Wood GC, Winegar DA, Petrick AT, Still CD, Argyropoulos G, et al. Risk factors associated with mortality after Roux-en-Y gastric bypass surgery. Ann Surg. 2014 Jan;259(1):123–30.

36. Gribben JL, Ilonzo N, Neifert S, Michael Leitman I. Predictors of Reoperation and Failure to Rescue in Bariatric Surgery. JSLS [Internet]. 2018 [cited 2019 Jun 2];22(1). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5814103/

37. Kochkodan J, Telem DA, Ghaferi AA. Physiologic and psychological gender differences in bariatric surgery. Surgical Endoscopy. 2018 Mar;32(3):1382–8.

38. Kanerva N, Larsson I, Peltonen M, Lindroos A-K, Carlsson. LM. Sociodemographic and lifestyle factors as determinants of energy intake and macronutrient composition: a 10-year follow-up after bariatric surgery. Surg Obes Relat Dis. 2017 Sep;13(9):1572–83.

39. Still CD, Wood GC, Chu X, Manney C, Strodel W, Petrick A, et al. Clinical factors associated with weight loss outcomes after Roux-en-Y gastric bypass surgery. Obesity (Silver Spring). 2014 Mar;22(3):888–94.

40. de Hollanda A, Ruiz T, Jiménez A, Flores L, Lacy A, Vidal J. Patterns of Weight Loss Response Following Gastric Bypass and Sleeve Gastrectomy. Obes Surg. 2015 Jul;25(7):1177–83.

41. Livhits M, Mercado C, Yermilov I, Parikh JA, Dutson E, Mehran A, et al. Preoperative predictors of weight loss following bariatric surgery: systematic review. Obes Surg [Internet]. 201200 [cited 2019 May 17];22. Available from: http://dx.doi.org/10.1007/s11695-011-0472-4

42. Stefura T, Droś J, Kacprzyk A, Wierdak M, Proczko-Stepaniak M, Szymański M, et al. Influence of Preoperative Weight Loss on Outcomes of Bariatric Surgery for Patients Under the Enhanced Recovery After Surgery Protocol. Obes Surg. 2019 Apr;29(4):1134–41.

43. Still CD. Outcomes of Preoperative Weight Loss in High-Risk Patients Undergoing Gastric Bypass Surgery. Arch Surg. 2007 Oct 1;142(10):994.

44. Alger-Mayer S, Polimeni JM, Malone M. Preoperative Weight Loss as a Predictor of Long-term Success Following Roux-en-Y Gastric Bypass. OBES SURG. 2008 Jul;18(7):772–5.

45. Pekkarinen T, Mustonen H, Sane T, Jaser N, Juuti A, Leivonen M. Long-Term Effect of Gastric Bypass and Sleeve Gastrectomy on Severe Obesity: Do Preoperative Weight Loss and Binge Eating Behavior Predict the Outcome of Bariatric Surgery? OBES SURG. 2016 Sep;26(9):2161–7.

46. Shilton H, Gao Y, Nerlekar N, Evennett N, Ram R, Beban G. Pre-operative Bariatric Clinic Attendance Is a Predictor of Post-operative Clinic Attendance and Weight Loss Outcomes. Obes Surg. 2019 Mar 23;

47. Puzziferri N, Roshek TB, Mayo HG, Gallagher R, Belle SH, Livingston EH. Long-term Follow-up After Bariatric Surgery: A Systematic Review. JAMA. 2014 Sep 3;312(9):934–42.

48. Carnero EA, Dubis GS, Hames KC, Jakicic JM, Houmard JA, Coen PM, et al. Randomized trial reveals that physical activity and energy expenditure are associated with weight and body composition after RYGB. Obesity (Silver Spring). 2017;25(7):1206–16.

49. Coen PM, Carnero EA, Goodpaster BH. Exercise and Bariatric Surgery: An Effective Therapeutic Strategy. Exerc Sport Sci Rev. 2018 Oct;46(4):262–70.

50. King WC, Hsu JY, Belle SH, Courcoulas AP, Eid GM, Flum DR, et al. Pre- to postoperative changes in physical activity: report from the longitudinal assessment of bariatric surgery-2 (LABS-2). Surg Obes Relat Dis. 2012 Oct;8(5):522–32.

51. Wood GC, Benotti PN, Lee CJ, Mirshahi T, Still CD, Gerhard GS, et al. Evaluation of the Association Between Preoperative Clinical Factors and Long-term Weight Loss After Roux-en-Y Gastric Bypass. JAMA Surg. 2016 Nov 1;151(11):1056–62.

52. Huvenne H, Dubern B, Clément K, Poitou C. Rare Genetic Forms of Obesity: Clinical Approach and Current Treatments in 2016. Obes Facts. 2016;9(3):158–73.

53. Li Y, Zhang H, Tu Y, Wang C, Di J, Yu H, et al. Monogenic Obesity Mutations Lead to Less Weight Loss After Bariatric Surgery: a 6-Year Follow-Up Study. Obes Surg. 2019 Apr;29(4):1169–73.

54. Yazdi FT, Clee SM, Meyre D. Obesity genetics in mouse and human: back and forth, and back again. PeerJ [Internet]. 2015 Mar 24 [cited 2020 Feb 16];3. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4375971/

55. Livingstone KM, Celis-Morales C, Papandonatos GD, Erar B, Florez JC, Jablonski KA, et al. FTO genotype and weight loss: systematic review and meta-analysis of 9563 individual participant data from eight randomised controlled trials. BMJ [Internet]. 2016 Sep 20 [cited 2020 Feb 16];354. Available from: https://www.bmj.com/content/354/bmj.i4707

56. Halpern ZSC, Rodrigues MDB, Costa RF da. Determinantes fisiológicos do controle do peso e apetite. Archives of Clinical Psychiatry (São Paulo). 2004;31(4):150–3.

57. Rodrigues AM, Suplicy HL, Radominski RB. Controle neuroendócrino do peso corporal: implicações na gênese da obesidade. Arquivos Brasileiros de Endocrinologia & Metabologia. 2003 Aug;47(4):398–409.

58. Still CD, Wood GC, Chu X, Erdman R, Manney CH, Benotti PN, et al. High allelic burden of four obesity SNPs is associated with poorer weight loss outcomes following gastric bypass surgery. Obesity (Silver Spring). 2011 Aug;19(8):1676–83.

59. Sarzynski MA, Jacobson P, Rankinen T, Carlsson B, Sjöström L, Bouchard C, et al. Associations of markers in 11 obesity candidate genes with maximal weight loss and weight regain in the SOS bariatric surgery cases. Int J Obes (Lond). 2011 May;35(5):676–83.

60. American Psychiatric Association. Diagnostic and Statistical Manual of mental Misorders. 4th ed. Washington (DC): American Psychiatric Association; 1994. 1–550 p.

61. Sarwer DB, Allison KC, Wadden TA, Ashare R, Spitzer JC, McCuen-Wurst C, et al. Psychopathology, disordered eating, and impulsivity as predictors of outcomes of bariatric surgery. Surgery for Obesity and Related Diseases. 2019 Feb;S1550728918304489.

62. Horvath JDC, Kops NL, de Castro MLD, Friedman R. Food consumption in patients referred for bariatric surgery with and without binge eating disorder. Eat Behav. 2015 Dec;19:173–6.

63. Dawes AJ, Maggard-Gibbons M, Maher AR, Booth MJ, Miake-Lye I, Beroes JM, et al. Mental Health Conditions Among Patients Seeking and Undergoing Bariatric Surgery: A Meta-analysis. JAMA. 2016 Jan 12;315(2):150–63.

64. Bordignon S, Aparício MJG, Bertoletti J, Trentini CM. Personality characteristics and bariatric surgery outcomes: a systematic review. Trends in Psychiatry and Psychotherapy. 2017 Jun;39(2):124–34.

65. Manual diagnóstico e estatístico de transtornos mentais [recurso eletrônico] : DSM-5. 5th ed. Porto Alegre: Artmed; 2014.

66. Lavender JM, King WC, Kalarchian MA, Devlin MJ, Hinerman A, Gunstad J, et al. Examining emotion-, personality-, and reward-related dispositional tendencies in relation to eating pathology and weight change over seven years in the Longitudinal Assessment of Bariatric Surgery (LABS) study. Journal of Psychiatric Research. 2020 Jan 1;120:124–30.

67. Heriseanu AI, Hay P, Corbit L, Touyz S. Grazing in adults with obesity and eating disorders: A systematic review of associated clinical features and meta-analysis of prevalence. Clin Psychol Rev. 2017 Dec;58:16–32.

68. Pizato N, Botelho P, Gonçalves V, Dutra E, de Carvalho K. Effect of Grazing Behavior on Weight Regain Post-Bariatric Surgery: A Systematic Review. Nutrients. 2017 Dec 5;9(12):1322.

69. Konttinen H, Peltonen M, Sjöström L, Carlsson L, Karlsson J. Psychological aspects of eating behavior as predictors of 10-y weight changes after surgical and conventional treatment of severe obesity: results from the Swedish Obese Subjects intervention study. The American Journal of Clinical Nutrition. 2015 Jan 1;101(1):16–24.

70. Smith KE, Orcutt M, Steffen KJ, Crosby RD, Cao L, Garcia L, et al. Loss of Control Eating and Binge Eating in the 7 Years Following Bariatric Surgery. Obes Surg. 2019;29(6):1773–80.

71. Meany G, Conceição E, Mitchell JE. Binge eating, binge eating disorder and loss of control eating: effects on weight outcomes after bariatric surgery. Eur Eat Disord Rev. 2014 Mar;22(2):87–91.

72. David LA, Sijercic I, Cassin SE. Preoperative and post-operative psychosocial interventions for bariatric surgery patients: A systematic review. Obesity Reviews. 2020 Jan 22;obr.12926.

73. Sanmiguel C, Labus JS, Gupta A, Love AD, Paydar CJ, Herdon C, et al. Mo1948 Bariatric Surgery Is Associated With Changes in the Brain's Reward System Architecture and Eating Behaviors. Gastroenterology. 2016 Apr;150(4):S824.

74. Wimmelmann CL, Dela F, Mortensen EL. Psychological predictors of weight loss after bariatric surgery: a review of the recent research. Obes Res Clin Pract. 2014 Aug;8(4):e299-313.

75. Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W, Fahrbach K, et al. Bariatric surgery: a systematic review and meta-analysis. JAMA. 2004 Oct 13;292(14):1724–37.

76. Maggard MA, Shugarman LR, Suttorp M, Maglione M, Sugerman HJ, Sugarman HJ, et al. Meta-analysis: surgical treatment of obesity. Ann Intern Med. 2005 Apr 5;142(7):547–59.

77. Garb J, Welch G, Zagarins S, Kuhn J, Romanelli J. Bariatric surgery for the treatment of morbid obesity: a meta-analysis of weight loss outcomes for laparoscopic adjustable gastric banding and laparoscopic gastric bypass. Obes Surg. 2009 Oct;19(10):1447–55.

78. Padwal R, Klarenbach S, Wiebe N, Birch D, Karmali S, Manns B, et al. Bariatric surgery: a systematic review and network meta-analysis of randomized trials. Obes Rev. 2011 Aug;12(8):602–21.

79. Kang JH, Le QA. Effectiveness of bariatric surgical procedures. Medicine (Baltimore) [Internet]. 2017 Nov 17 [cited 2019 May 18];96(46). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5704829/

Tabela 1. Diferentes formas de avaliação de perda de peso.

Definição	**Abreviação**	**Fórmula**
Peso perdido (kg ou libras)	ΔPeso	Peso inicial - Peso final
IMC perdido	ΔIMC	IMC inicial - IMC final
Percentual total de perda de peso	%PP	$\frac{\text{Peso inicial - peso final}}{\text{Peso inicial}} \times 100$
Percentual de excesso de peso perdido	%PEP	$\frac{\text{Peso inicial - peso final}}{\text{Peso inicial - peso ideal}} \times 100$
Percentual de excesso de IMC perdido	%EBL	$\frac{\text{IMC inicial – IMC final}}{\text{IMC inicial – IMC ideal}} \times 100$

Legenda: IMC: índice de massa corporal; PP: perda de peso; PEP: perda de excesso de peso; EBL: perde de excesso de IMC.

Tabela 2. Dados de revisões sistemáticas com metanálises que avaliaram a perda de peso após diferentes tipos de procedimentos bariátricos.

Autor / ano	Tipo de estudo	Tempo (meses)	Nº estudos / Nº participantes	Banda gástrica	RYGB	Gastroplastia	Derivação biliopancreática	Gastrectomia vertical
Buchwald (2004) (75)	ECR, OBS, estudo de caso	-	91 / 22.094	47,5 (40,7-54,2)*	61,6 (56,7-66,5)*	68,2 (61,5-74,8)*	70,1 (66,3-73,9)*	-
Maggard (2005) (76)	ECR, OBS, estudo de caso	≥ 36	21 / -	34,8 (29,5-40.1) kg	41.46 (37,36–45,56) kg	-	53,1 (47,4-58,8) kg	32,0 (27,7-36,4) kg
Garb (2009) (77)	ECR, OBS, estudo de caso	< 12	28 / 7.383	49,4 (44,9–54,0)*	62,6 (58,6–66,6)*	-	-	-
Padwal (2011) (78)	ECR	12	15 ECR / 1103	-2.4 kg/m^2	-9.0 kg/m^2	-5.0 kg/m^2	-11,2 kg/m^2	-10,1 kg/m^2
Chang (2014) (21)	ECR, OBS	12	9 ECT	33,4 (22,6-44,2)*	72,3 (64,6-80,0)*	-	-	69,7 (41,1-98,3)*
Golzarand (2017) (30)	ECR, OBS	≥ 60 e ≥ 120	80 / -	47,9* (≥5 anos) 47,4* (≥10 anos)	62,58* (≥5 anos) 63,52* (≥10 anos)	- -	- -	53,3* (≥ 5 anos) -
Kang (2017) (79)	ECR	12	11 ECR/ -	40,6*	67,3*	-	-	71,2*

Legenda: ECR: ensaios clínicos randomizados; OBS: estudos observacionais; RYGB: derivação gástrica em Y-de-Roux. *Percentual de excesso de perda de peso.

2. JUSTIFICATIVA

O impacto positivo da cirurgia bariátrica sobre o metabolismo e o apetite não parece se justificar simplesmente pela redução da ingestão e da absorção. Apesar de sua eficácia comprovada, nem todos os pacientes apresentam perda de peso igualmente satisfatória após a cirurgia. A possibilidade de que estas diferenças nos desfechos de perda de peso possam estar relacionadas a características pré-operatórias individuais tem sido investigada. Até o momento, porém, apesar de algumas características clínicas e psiquiátricas terem sido identificadas como possíveis preditores de sucesso, a literatura a este respeito permanece largamente inconclusiva.

Evidências sugerem que o estado clínico e psicossocial pré-operatório pode contribuir para perdas de peso abaixo do ideal no pós-operatório. A identificação destes fatores que podem influenciar na perda de peso de pacientes após a cirurgia bariátrica, em um esforço para maximizar as chances de sucesso a longo prazo são importantes.

3. OBJETIVOS

3.1 Objetivo geral

Investigar fatores clínicos e biológicos associados a perda de peso após da cirurgia bariátrica.

3.2 Objetivos específicos

1. Avaliar polimorfismos genéticos e a perda de peso pós cirurgia;
2. Verificar se a presença de compulsão alimentar pré cirurgia bariátrica interfere na perda de peso pós cirurgia;
3. Através de uma revisão sistemática e metanálise, sumarizar os resultados encontrados no objetivo a cima.

PARTE II

4.1 Artigo 1

FABP2, LEPR223, LEP656 and *FTO* Polymorphisms: Effect on Weight Loss 2 Years After Bariatric Surgery

Short Title: Polymorphisms: weight loss after bariatric surgery

Natalia L Kops, MSc[a,b]

Manoela A Vivan, BM[c]

Jaqueline D C Horvath, PhD[a,b]

Mariana L D de Castro, MSc[a]

Rogério Friedman, MD PhD[a,d]

[a]Post-Graduate Program in Endocrinology, Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil

[b]Hospital Moinhos de Vento, Porto Alegre, RS, Brazil

[c]Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil

[d]Endocrinology Division, Hospital de Clínicas de Porto Alegre, Porto Alegre, RS, Brazil

Artigo publicado na revista *Obesity Surgery* (doi: 10.1007/s11695-018-3213-0)

Impact Factor: 3.603

Abstract

Purpose: Differences in weight loss outcomes after bariatric surgery may be related to individual preoperative characteristics. The aim of this study was to evaluate the potential effect of fatty acid binding protein-*2 (*rs1799883), leptin receptor (*LEP223*, rs1137101 and *LEP656,* rs1805094), and fat mass and obesity related (rs9939609) genotypes on weight loss 2 years after bariatric surgery in Brazilian patients. *Materials and Methods:* Prospective observational study involving 105 patients (lost to follow-up: 25.7%). In the preoperative period, patients were clinically evaluated and a fasting blood sample for genetic analysis (by real-time DNA amplification technique) was collected. From the patient's medical records, follow-up weight loss (3, 6, 12, 24 months) was obtained. Percentage of excess weight loss (%EWL) was examined by pairwise comparison across the polymorphisms. *Results:* At baseline, the mean weight was 127.5 (23.3) kg and age 43.1 (10.9) years old. The %EWL was significant over time ($p < 0.01$). Only the *LEP223* genotype showed association ($p < 0.01$). Up to 6 months after surgery, no differences were observed. At 12 months, a significant difference ($p = 0.03$) between AA (n = 19) and GG (n = 34) groups was observed, with 76.5% EWL versus 52.0%, respectively. This difference remained at 24 months. Other genotypes did not present any significant association. *Conclusions:* There is a different evolution of weight loss in carriers of the *LEP223* after bariatric surgery. The AA genotype seems to be associated with a higher weight loss. However, this pattern was evident only at 12 months after surgery.

Keywords: Bariatric surgery; Weight loss; Polymorphism; Genotype.

Introduction

Obesity is a challenging public health problem [1]. The prevalence has been increasing in most countries, almost doubling in recent years [1]. In 2016, 53.8% of Brazilians were with overweight [2] and the number of bariatric surgeries increased 7.5% in 2016 [3].

Bariatric surgery has been shown to be the most effective treatment for severe obesity, resulting in significant improvement of multiple weight-related comorbidities and a reduction in a person's risk for premature death [4]. However, the weight loss after bariatric surgery varies depending on procedure type, age, and comorbid conditions [4]. The possibility that these differences in weight loss outcomes may be related to individual preoperative characteristics has been investigated. Although some clinical and psychiatric features have been identified as possible predictors of success [5], the literature in this regard remains largely inconclusive [6].

Genome-wide association studies have had a huge impact on the field of human genetics [7]; an increasing number of genetic variables have been confirmed to be associated with obesity and weight loss [7]. In this way, this study hypotheses that obesity-related genes have cumulative effects on weight loss after bariatric surgery. Therefore, the present study evaluated the effect of four single nucleotide polymorphisms (SNP) which had shown associations with obesity.

The fatty acid binding protein-2 (FABP-2) gene encodes an intracellular protein of the intestinal mucosa, responsible for the absorption and intracellular transport of fatty acids [8]. The G to A transition of codon 54 results in a threonine (Thr) for alanine (Ala) substitution (rs1799883) [9].

Leptin and its signaling pathways have aided in understanding the mechanisms of body weight regulation and energy homeostasis [10]. Several SNPs of leptin receptor (LEPR) already been identified, but three variants are potentially functional. These variants are located in the coding region of the receptor [Lys109Arg (A > G; 55 rs1137100), Gln223Arg (A > G; rs1137101) and Lys656Asn (G > C; rs1805094)] and the last two have a charge change, which makes them more likely to lead significant functional changes [11].

Another important gene in relation to obesity genetics is the fat mass and obesity related [FTO (A > T; rs9939609)]. This was the first obesity-susceptibility gene identified through genome-wide association study [12] and continues to be the locus with the largest effect on body mass index (BMI) and obesity risk [13].

Considering the importance of these genotypes, the aim of this study was to evaluate the effect of fatty acid binding protein-2 (FABP2, rs1799883), leptin receptor (LEP223, rs1137101 and LEP656, rs1805094), and fat mass and obesity related (FTO, rs9939609) genotypes on weight loss 2 years after bariatric surgery in Brazilian patients.

Material and Methods

Subjects and Surgical Procedure

This is a prospective observational study involving 105 Brazilian patients operated on from March 2010 to December 2014. In the preoperative period, patients were evaluated consecutively through the application of a research protocol in the Bariatric Surgery and Endocrinology outpatient units of Hospital de Clínicas de Porto Alegre (HCPA). The surgical procedure was then carried out according to the Brazilian guidelines [14]. In all cases, the surgical technique employed was the Roux-en-Y gastric bypass.

Exclusion criteria were under 18 years old, presence of current suicide risk, indication of psychiatric hospitalization, diagnosis of intellectual disability or dementia. Pregnant and lactating women during the 5 years postoperatively were not included.

At the postoperative period, a follow-up of weight loss was obtained from medical records. Follow-up visits were carried out at standard intervals (3, 6, 12 and 24 months). The following variables were specifically recorded: weight, circumferences and laboratory evaluations.

The study was approved by the HCPA Research Ethics Committee (nº. 17-0635) and received financial support from Fundo de Incentivo à Pesquisa e Eventos (FIPE).

Socio-economic and lifestyle factors

The criteria of Associação Brasileira de Empresas de Pesquisa (2012) were used to stratify the participants according to their purchasing power, income and educational level [15]. Skin color was self-reported.

Confirmation of comorbidities was obtained from the medical history, current medications and medical records. Participants were considered smokers if they had smoked at least one cigarette in the last 30 days. Otherwise, they were considered as former smokers or nonsmokers. Physical activity was analyzed by the International Questionnaire of Physical Activity, short version [16].

Anthropometric assessment

All measurements were performed in accordance with the recommendations of the Brazilian Ministry of Health's Food and Dietary Surveillance System [17]. Weight (kg) was measured with a digital physician scale (Filizola, Brazil) while barefoot and wearing lightweight clothes. Height was measured with a wall-mounted stadiometer (Sanny, Brazil), with the subject standing and the head aligned in the Frankfurt plane. Body mass index [weight (kg)/height^2 (m)], percentage total body weight loss (%TWL) [(preoperative weight – weight at the follow-up visit) / (preoperative weight), multiplied by 100] and percentage of excess weight loss (%EWL) [(preoperative weight – weight at the follow-up visit) / (preoperative weight – ideal body weight), multiplied by 100] were calculated. The ideal body weight was taken as the weight in kilograms corresponding to the BMI of 25.0 kg/m2.

All circumferences were measured using non-stretch fiberglass measuring tapes (Wiso, Brazil). Mid-upper arm circumference (MUAC) was measured at the midpoint between the acromion and olecranon, over the posterior aspect of the relaxed arm on the non-dominant side. Waist circumference (WC) was measured at the midpoint between the lowest rib and the iliac crest. Hip circumference was measured at the level of the greatest protrusion of the gluteal area. The waist–to–hip ratio was then calculated.

Food consumption

Assessment of dietary intake included three 24-hour dietary records in the preoperative period. Digital kitchen scales (with graduated scales from 1 g) and a measuring cup were provided. Patients were instructed by a trained dietitian on the handling of the digital kitchen scales and measuring cups, and on how to record the measured food consumption over three days in appropriate forms. Later, the notes were reviewed in order to resolve incomplete or incorrect data. From the records, an average of the food consumed in three days was calculated obtaining the energy, macronutrients, micronutrients and dietary fiber actually ingested. Nutritional calculations were carried out with Nutribase 7.18 software® (CyberSoft, USA). To assess the adequacy of food records, protein intake was assessed by urinary urea [18]. This assessment has been described in detail elsewhere [19]. The basal metabolic rate was calculated for overweight adult men and women according to the Dietary Reference Intakes [20].

Genetic Evaluation

The polymorphisms were analyzed by real time DNA amplification (Applied Biosystems, Foster City, CA; TaqMan® SNP genotyping Assays, Applied Biosystems, CA, USA), in the ABI PRISM 7000 Real-Time PCR system (Applied Biosystems, CA, USA). SNP genotyping was performed using manufacturer's reagents (FTO, rs9939609, Assay, ID: C__30090620_10; *FABP2,* rs1799883, C__761961_10; *LEPR*, rs1137101, C___8722581_10; *LEP656*, rs1805094, C___11874781_10). The thermocycler conditions were as follows: 50°C for 2 minutes, 95°C for 10 minutes, and 40 cycles at 95°C for 15 seconds and at 60°C for 60 seconds. The reaction was then analyzed using Applied Biosystems Sequence Detection Software.

Statistical Analysis

Descriptive data are presented as frequencies (%) or means and standard deviations (SD). Chi-squared, Student's t test, or Mann–Whitney's U test were used to compare clinical and laboratory values in the genotype groups. Hardy-Weinberg Equilibrium was calculated using allele frequencies and the χ^2 test. BMI, weight, %EWL and %TWL after bariatric surgery were examined by means of generalized estimating equations model using all available observations. The factors used in the model were: time, genotype, and interaction time*genotype. The Bonferroni test was utilized for all post hoc comparisons between genotypes. Statistical significance was accepted at $p < 0.05$. Statistical analysis were performed using the Statistical Package for the Social Sciences, version 20.0® (Cary, EUA).

Results

A total of 105 Brazilian patients (87.6% female), aged between 21 and 71 years (mean 43.1 ± 10.9 years) were included in the study. Table 1 shows the preoperative characteristics of the sample. Most of the sample had low economic classification and self-reported their skin color as white. Mean baseline BMI was 48.2 ± 7.2 kg/m². No differences of these characteristics (data not shown) were found between the genotypes.

The genotype frequencies for each polymorphism are shown in Table 2. There was no statistically significant deviation from the Hardy–Weinberg Equilibrium for the polymorphisms.

Of the 105 patients initially included, 78 patients completed 2 years of follow-up (lost to follow-up: 25.7%). Evolution of anthropometric characteristics from baseline through the post-operative period revealed BMI, weight, %EWL and %TWL were changing over time; however, these differences were only evident at 12 months after bariatric surgery (from 12 months to 24 months, $p = 1.00$ - data not shown). The average percentage of excess weight loss at 24 months was 70.4% in the whole sample (Table 3).

Using the generalized estimating equations model, the interaction between time and the LEP223 genotypes was found to be statistically significant ($p < 0.01$) for %EWL. FTO, FABP2 and LEPR656 genotypes did not present any significant association (Table 4).

The percentage of weight loss was higher for LEP223 AA genotype as compared to GG and AG, but this only became significant at 12 months, when AA had lost 12.1% more %EWL than GG ($p = 0.02$). At 24 months, the significance was maintained with a 12.6% higher %EWL for AA in comparison with GG ($p = 0.04$) and 11.6% in comparison to AG ($p = 0.03$). Figure 1 also suggests that the AA genotype might continue to lose weight beyond 24 months whereas the two other variants would tend to stall.

Discussion

The major finding of this study is the association between AA genotype of LEP223 (rs1137101) with more marked weight loss after bariatric surgery. Differences were not found in relation to FTO, FABP and LEP656. All patients had significant weight loss in the first 12 months irrespective of genotype. Between 12 and 24 months, there was no statistically additional %EWL in any of the genotypes.

Leptin is a hormone specifically produced by adipocytes, and its serum concentration is proportional to body fat mass which, in turn, has its amount regulated by the hypothalamic effects of leptin [10]. Its action occurs through the leptin receptor, which is encoded by the LEPR gene. LEPR is a single-transmembrane-domain receptor of the cytokine-receptor family with widespread tissue distribution and several alternatively spliced isoforms. Few published studies have examined LEPR genotype with weight loss after bariatric surgery. However, these studies were convergent and have not found significant differences in relation to LEP223 [12,21] and LEP656 [12]. Our findings are in contrast to previous studies since the wild homozygote allele (AA) of LEP223 showed higher weight loss after bariatric surgery.

On the other hand, several LEPR polymorphisms have been described in patients with early-onset of severe obesity and hyperphagic eating behavior [22], which could explain the lower weight loss in mutant alleles carriers, as found in the present study.

Some studies have investigated the effect of FTO gene variants on weight loss undergoing bariatric surgery. One study suggested that the TT variant of FTO gene has a higher initial weight loss at 3 months. This study had a shorter follow-up (12 months) and a small sample size [23]. Another study showed there a different evolution of weight loss in people with obesity carriers of the FTO variant would be seen only 2 years after bariatric surgery [24]. On the other hand, Liou et al. [25] have demonstrated that obese people with risk genotype AA (rs9939609) had greater decrease in BMI than patients with TT/AT genotype in the sixth month after undergoing laparoscopic minigastric bypass [25]. Other studies were in agreement with our findings [21,26], and one of them evaluated weight loss and weight regain over 6 years of follow-up and did not find any difference [26].

We only found one study about FABP2 and weight loss after bariatric surgery. It had a rather small sample size and a 12 months follow-up, and did not find any effect of the polymorphism weight loss or clinical outcomes after bariatric surgery. This is in agreement with our study [27].

In the literature, there is no consensus on the definition of bariatric surgery success, and the same result is considered favorable by one author and unfavorable by another [28,29]. For this reason, long-term (3- to 5-y) follow-up is necessary to establish the success of the surgery. In our sample, the percentage of excess weight loss and the mean BMI at 24 months would be considered satisfactory by most definitions [70.4% and 32.4 (5.1) kg/m^2, respectively].

The effects of different polymorphisms after bariatric surgery are a recent and interesting area of investigation. Outcomes with respect to weight loss vary considerably among patients. The possibility that genetic factors affect the success of bariatric surgery remains unsettled [26]. The reasons for the high variability in body weight response to bariatric surgery are unknown, and the failure of surgical techniques may be somewhat attributed to poor compliance with dietary instructions [26], presurgical BMI of patients, ratio of sex distribution, ethnicity, amount of final weight loss, duration of follow-up and type of bariatric surgery [23]. Thus, the current evidence is mixed and inconclusive, and it is possible that the genes involved in weight loss and regain are different from those identified as obesity genes in cross-sectional studies [26].

The limitations of the present study include the small sample size and the rates of loss to follow-up (25.7%). However, even with a small sample, our study found significant differences in weight loss after bariatric surgery. Anyway, it is important to emphasize that further studies are needed on multiple candidate and novel genes, as well as environmental factors predictive of the surgical outcomes in large numbers of bariatric surgery patients.

There is a different evolution of weight loss in people with obesity carriers of the LEP223 variant after bariatric surgery. The AA genotype of LEP223 seems to be associated with a more marked weight loss. It is necessary to confirm this result in a larger number of patients and longer follow-up time.

Author Contribution

The manuscript has been read and approved by all authors.

Funding Information

This work was supported by Fundo de Incentivo à Pesquisa e Eventos do Hospital de Clínicas de Porto Alegre (no. 12-0232), Conselho Nacional de Desenvolvimento Científico e Tecnológico (N. L. K., no. 119697, 2012), and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (J. D. C. H., no.118907, 2008).

Compliance with Ethical Standards

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent was obtained from all individual participants included in the study.

References

[1] Abarca-Gómez L, Abdeen ZA, Hamid ZA, Abu-Rmeileh NM, Acosta-Cazares B, Acuin C, et al. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. The Lancet 2017;390:2627–42. doi:10.1016/S0140-6736(17)32129-3.

[2] Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Vigitel Brasil 2016: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico : estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2016 – Brasília: Ministério da Saúde, 2017. n.d.

[3] Número de cirurgias bariátricas no Brasil cresce 7,5% em 2016 | n.d. http://www.sbcbm.org.br/wordpress/numero-de-cirurgias-bariatricas-no-brasil-cresce-75-em-2016/# (accessed October 13, 2017).

[4] Albaugh VL, Flynn CR, Tamboli RA, Abumrad NN. Recent advances in metabolic and bariatric surgery. F1000Research 2016;5. doi:10.12688/f1000research.7240.1.

[5] Wimmelmann CL, Dela F, Mortensen EL. Psychological predictors of weight loss after bariatric surgery: a review of the recent research. Obes Res Clin Pract 2014;8:e299-313. doi:10.1016/j.orcp.2013.09.003.

[6] Melton GB, Steele KE, Schweitzer MA, Lidor AO, Magnuson TH. Suboptimal weight loss after gastric bypass surgery: correlation of demographics, comorbidities, and insurance status with outcomes. J Gastrointest Surg Off J Soc Surg Aliment Tract 2008;12:250–5. doi:10.1007/s11605-007-0427-1.

[7] Kronenberg F, Paulweber B, Lamina C. [Genomwide association studies on obesity: what can we learn from these studies]. Wien Med Wochenschr 1946 2016;166:88–94. doi:10.1007/s10354-015-0429-7.

[8] Ockner RK, Manning JA, Poppenhausen RB, Ho WK. A binding protein for fatty acids in cytosol of intestinal mucosa, liver, myocardium, and other tissues. Science 1972;177:56–8.

[9] Thumser AE, Moore JB, Plant NJ. Fatty acid binding proteins: tissue-specific functions in health and disease. Curr Opin Clin Nutr Metab Care 2014;17:124–9. doi:10.1097/MCO.0000000000000031.

[10] Kolaczynski JW, Ohannesian JP, Considine RV, Marco CC, Caro JF. Response of leptin to short-term and prolonged overfeeding in humans. J Clin Endocrinol Metab 1996;81:4162–5. doi:10.1210/jcem.81.11.8923877.

[11] Reference SNP (refSNP) Cluster Report: rs1137101 ** With Benign allele ** n.d. https://www.ncbi.nlm.nih.gov/projects/SNP/snp_ref.cgi?rs=1137101 (accessed October 13, 2017).

[12] Scuteri A, Sanna S, Chen W-M, Uda M, Albai G, Strait J, et al. Genome-wide association scan shows genetic variants in the FTO gene are associated with obesity-related traits. PLoS Genet 2007;3:e115. doi:10.1371/journal.pgen.0030115.

[13] Lu Y, Loos RJ. Obesity genomics: assessing the transferability of susceptibility loci across diverse populations. Genome Med 2013;5:55. doi:10.1186/gm459.

[14] Sociedade Brasileira de Cirurgia Bariátrica e Metabólica. Consenso Brasileiro Multissocietário em Cirurgia da Obesidade. 2006. < http://www.sbcb.org.br/imagens/pdf/consenso_baraitrico_brasileiro.pdf> (accessed January 7, 2018).

[15] Associação Brasileira de Empresas de Pesquisa (ABEP). Critério de Classificação Econômica Brasil 2012. http://www.abep.org/criterio-brasil (accessed September 7, 2017).

[16] Validação do Questionário Internacional de Nível de Atividade Física (IPAQ - Versão 6): Estudo Piloto em Adultos Jovens Brasileiros n.d. http://www.bibliotekevirtual.org/index.php/2013-02-07-03-02-35/2013-02-07-03-03-11/1543-rbcm/v09n03/16369-validacao-do-questionario-internacional-de-nivel-de-atividade-fisica-ipaq-versao-6-estudo-piloto-em-adultos-jovens-brasileiros.html (accessed September 30, 2017).

[17] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Orientações para a coleta e análise de dados antropométricos em serviços de saúde : Norma Técnica do Sistema de Vigilância Alimentar e Nutricional - SISVAN / Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Atenção Básica. – Brasília : Ministério da Saúde, 2011. 76 p. : il. – (Série G. Estatística e Informação em Saúde) n.d.

[18] Moulin CC, Tiskievicz F, Zelmanovitz T, de Oliveira J, Azevedo MJ, Gross JL. Use of weighed diet records in the evaluation of diets with different protein contents in patients with type 2 diabetes. Am J Clin Nutr 1998;67:853–7.

[19] Kops NL, Correia Horvath JD, de Castro MLD, Friedman R. Anthropometric and lipid profile of individuals with severe obesity carrying the fatty acid-binding protein-2 Thr54 allele. Nutr Burbank Los Angel Cty Calif 2017;41:45–50. doi:10.1016/j.nut.2017.01.013.

[20] Medicine I of. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. 2002. doi:10.17226/10490.

[21] Novais PFS, Weber TK, Lemke N, Verlengia R, Crisp AH, Rasera-Junior I, et al. Gene polymorphisms as a predictor of body weight loss after Roux-en-Y gastric bypass surgery among obese women. Obes Res Clin Pract 2016;10:724–7. doi:10.1016/j.orcp.2016.07.002.

[22] Clément K, Vaisse C, Lahlou N, Cabrol S, Pelloux V, Cassuto D, et al. A mutation in the human leptin receptor gene causes obesity and pituitary dysfunction. Nature 1998;392:398–401. doi:10.1038/32911.

[23] de Luis DA, Aller R, Conde R, Izaola O, Pacheco D, Sagrado MG, et al. Effects of RS9939609 gene variant in FTO gene on weight loss and cardiovascular risk factors after biliopancreatic diversion surgery. J Gastrointest Surg Off J Soc Surg Aliment Tract 2012;16:1194–8. doi:10.1007/s11605-012-1829-2.

[24] Rodrigues GK, Resende CMM, Durso DF, Rodrigues LAA, Silva JLP, Reis RC, et al. A single FTO gene variant rs9939609 is associated with body weight evolution in a multiethnic extremely obese population that underwent bariatric surgery. Nutr Burbank Los Angel Cty Calif 2015;31:1344–50. doi:10.1016/j.nut.2015.05.020.

[25] Liou T-H, Chen H-H, Wang W, Wu S-F, Lee Y-C, Yang W-S, et al. ESR1, FTO, and UCP2 genes interact with bariatric surgery affecting weight loss and glycemic control in severely obese patients. Obes Surg 2011;21:1758–65. doi:10.1007/s11695-011-0457-3.

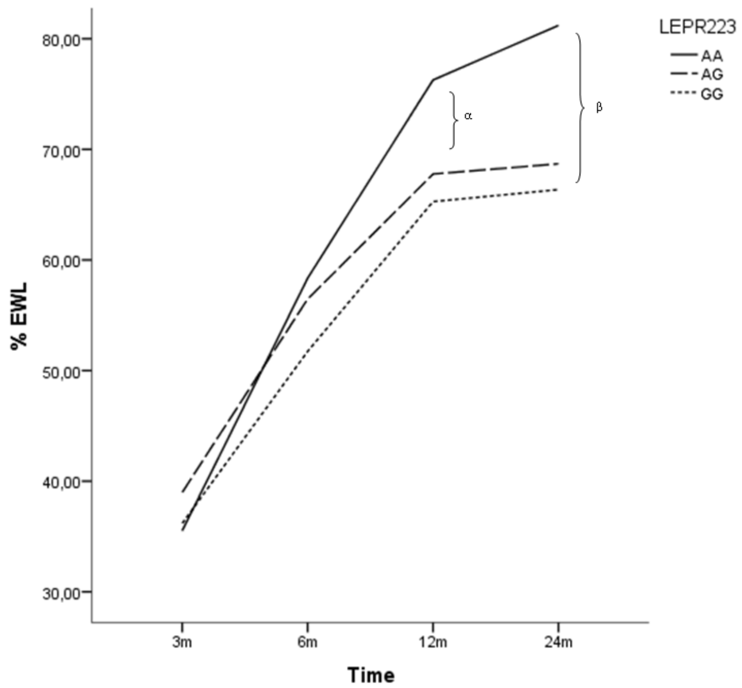
[26] Sarzynski MA, Jacobson P, Rankinen T, Carlsson B, Sjöström L, Bouchard C, et al. Associations of markers in 11 obesity candidate genes with maximal weight loss and weight regain in the SOS bariatric surgery cases. Int J Obes 2011;35:676. doi:10.1038/ijo.2010.166.

[27] de Luis DA, Sagrado MG, Izaola O, Terroba MC, Cuellar L, Conde R, et al. Influence of Ala54Thr polymorphism of fatty acid-binding protein-2 on clinical results of biliopancreatic diversion. Nutr Burbank Los Angel Cty Calif 2008;24:300–4. doi:10.1016/j.nut.2007.12.009.

[28] Berti LV, Campos J, Ramos A, Rossi M, Szego T, Cohen R. Position of the SBCBM - nomenclature and definition of outcomes of bariatric and metabolic surgery. ABCD Arq Bras Cir Dig São Paulo 2015;28:2–2. doi:10.1590/S0102-6720201500S100002.

[29] Laar AWJM van de, Acherman YIZ. Weight Loss Percentile Charts of Large Representative Series: a Benchmark Defining Sufficient Weight Loss Challenging Current Criteria for Success of Bariatric Surgery. Obes Surg 2014;24:727–34. doi:10.1007/s11695-013-1130-9.

Fig. 1. Pairwise comparison of percentage of excess weight loss between follow-up times in different genotypes of *LEPR223*



LEP223: leptin receptor. Post hoc test: Bonferroni. Times: 3 months (n = 98), 6 months (n = 92), 12 months (n = 85), and 24 months (n = 73). [α]Significant difference in percentage of excess weight loss between AA and GG genotypes at 12 months (p=0.02). [β]Significant difference in percentage of excess weight loss between AA vs. GG (p = 0.04) and AA vs. AG (p = 0.03) genotypes at 24 months

Table 1. Preoperative characteristics of the 105 patients

	n (%)
Age (years)	43.1 (10.9)
Female (%)	92 (87.6)
Skin color (%)	
White	85 (81.7)
Others	19 (18.3)
Economic classification (%)	
A and B1	8 (7.7)
B2	52 (50.0)
C1, C2 and D	44 (42.3)
Educational level (%)	
Elementary school	44 (43.1)
High school	34 (33.3)
University degree (complete or incomplete)	24 (23.6)
History of smoking (%)	
Smoker	4 (3.8)
Former smoker	40 (38.5)
Never smoked	60 (57.7)
Physical activity (%)	
Active	43 (41.3)
Sedentary	61 (58.7)
Anthropometric assessment	
Weight (kg)	127.5 (23.3)
Excess weight (%)*	61.5 (20.6)
Height (m)	1.62 (0.1)
Body mass index (kg/m²)	48.2 (7.2)
MUAC (cm)	43.1 (6.1)
Waist circumference (cm)	135.3 (15.4)
Hip circumference (cm)	140.4 (15.4)
Waist–to–hip ratio	0.9 (0.1)
Basal metabolic rate (kcal/day)	2179.8 (301.6)
Comorbidities (yes)	
Hypertension	69 (66.3)
OSAHS	29 (39.2)
Diabetes mellitus type 2	26 (24.8)
Depressive disorder	25 (27.2)
Dyslipidemia	14 (13.3)
Food consumption	
Total calorie intake (kcal)	2643.5 (1110.3)
Protein (g/kg/day)	0.9 (0.4)
Carbohydrate (g/kg/day)	2.8 (1.2)
Lipids (g/day)	85.7 (42.4)
% Saturated	9.0 (5.6)
Fiber (g/day)	27.1 (13.7)

Data described as the mean (standard deviation) or absolute numbers (percentages) MUAC, mid-upper arm circumference; OSAHS, obstructive sleep apnea / hypopnea syndrome. Data described as the mean (standard deviation) or absolute numbers (percentages)

*Calculation of ideal body weight as that equivalent to a BMI of 25 kg/m^2

Table 2. Genotype and allele frequencies among patients submitted to bariatric surgery

Gene	rs number	Genotype	n (%)	Alleles	n (%)
FTO	rs9939609	AA	33 (35.1)	A	0.57
		TA	42 (44.7)	T	0.42
		TT	19 (20.2)		
LEP223	rs1137101	AA	19 (19.4)	G	0.42
(Gln223Arg)		AG	45 (45.9)	A	0.58
		GG	34 (34.7)		
LEP656	rs8179183/	GG	41 (41.4)	G	0.61
(Lys656Asn)	rs1805094	CG	39 (39.4)	C	0.39
		CC	19 (19.2)		
FABP2	rs1799883	AA	37 (52.9)	A	0.71
(Ala54Thr)		AT	26 (37.1)	T	0.29
		TT	7 (10.0)		

Data described as absolute numbers (percentages) *FTO*, fat mass and obesity related; *LEP223* and *LEP656, l*eptin receptor; *FABP-2*, fatty acid binding protein-2

Table 3. Evolution of anthropometric characteristics from baseline through the post-operative period

Characteristic	Baseline (n = 105)	3 months (n = 105)	6 months (n = 100)	12 months (n = 93)	24 months (n = 78)
BMI (kg/m²)	48.2 (7.2)	39.9 (6.3)*	35.8 (5.7)*	32.8 (5.3)*	32.4 (5.1)
Weight (kg)	127.5 (23.3)	105.3 (20.0)*	94.2 (17.9)*	86.4 (15.7)*	84.7 (14.9)
%EWL	-	39.3 (1.7)	55.5 (2.1)*	68.8 (2.1)*	70.4 (2.4)
%TWL	-	17.3 (5.7)	25.7 (6.4)*	31.9 (7.6)*	32.8 (9.0)

BMI, Body Mass Index; %EWL, percentage of excess weight loss; %TWL, percentage total body weight loss. Data described as the mean (standard deviation). $^{*}p < 0.05$ (statistical significance between follow-up times).

Table 4. Association among genotypes and percentage of excess weight loss at 3, 6, 12 and 24 months after bariatric surgery

SNP	Genotype	%EWL 3 months	%EWL 6 months	%EWL 12 months	%EWL 24 months	*p* value
FTO	AA	36.6 (1.7)	54.4 (2.6)	66.5 (3.6)	68.9 (4.0)	0.98
	T/A	38.5 (2.1)	56.1 (2.2)	67.9 (2.5)	70.3 (2.6)	
	TT	37.5 (4.9)	57.4 (5.4)	71.2 (4.8)	72.8 (4.7)	
LEP223	AA	35.5 (2.5)	60.0 (3.2)	76.5 (3.2)	80.2 (3.3)	< 0.01*
	A/G	38.9 (2.2)	56.3 (2.5)	67.8 (3.0)	68.6 (3.0)	
	GG	36.2 (2.6)	52.4 (2.9)	64.4 (3.2)	67.6 (3.6)	
LEP656	GG	38.5 (2.6)	57.4 (2.7)	69.8 (2.9)	73.9 (2.6)	0.66
	CG	35.3 (2.3)	53.3 (2.3)	65.2 (3.0)	67.4 (3.2)	
	CC	38.7 (2.5)	57.5 (3.6)	71.0 (4.6)	70.4 (5.6)	
FABP2	AA	38.5 (2.7)	57.5 (3.0)	69.2 (3.2)	71.2 (3.1)	0.65
	AT	37.2 (1.8)	55.3 (2.3)	70.0 (3.4)	75.4 (3.4)	
	TT	39.5 (4.0)	54.9 (6.8)	65.3 (7.1)	65.3 (9.2)	

FTO, fat mass and obesity related; LEP223 and LEP656, leptin receptor; FABP-2, fatty acid binding protein-2; %EWL, percentage of excess weight loss. Times: 3 months (n = 105); 6 months (n = 100); 12 months (n = 93) and 24 months (n = 78). Data described as mean (standard deviation). *p < 0.05 (statistical significance between groups' follow-up times).

4.2 Artigo 2

Binge eating scores pre-bariatric surgery and subsequent weight loss: a prospective, 5 years follow-up study

Natalia Luiza Kops[a,b], MSc, nataliakops@hotmail.com

Manoela Astolfi Vivan[c], MD, manoelavivan@gmail.com

Mariana L. Dias de Castro[a], PhD, maridiasdecastro@gmail.com

Jaqueline D. Correia Horvath[a,b], PhD, nut.jaquelinehorvath@gmail.com

Fabiana Silva Costa[a], PhD, fabianascosta@gmail.com

Rogério Friedman[a,d], MD, PhD, rogeriofriedman@gmail.com

[a]Post-Graduate Program in Endocrinology, Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil

[b]Hospital Moinhos de Vento, Porto Alegre, RS, Brazil

[c]Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil

[d]Endocrinology Division, Hospital de Clínicas de Porto Alegre, Porto Alegre, RS, Brazil

Publicado na revista *Clinical Nutrition ESPEN* - doi.org/10.1016/j.clnesp.2020.05.013.

ABSTRACT

Background & Aims: To compare groups of bariatric patients with preoperative scores of Binge Eating Scale (BES) above and below the clinical cut off value on weight outcomes up to 60 months following surgery. **Methods:** This is a prospective observational study involving 108 Brazilian patients (follow-up rate: 48.1%) operated by Roux-en-Y gastric bypass. In the preoperative period, they were clinically evaluated, and BES was applied. Based on the scores, patients were categorized as high or low according to established cut off 17 for binge eaters. Follow-up weight loss was obtained (3, 6, 12, 24, 36, 48, and 60 months) using data from medical records. The percentage of total weight loss (%TWL) was examined by generalized linear model. **Results:** 41.7% of patients had BES scores higher than 17 at baseline. Weight loss was significant up to 12 months. The greatest weight loss was at 24 months of follow-up, ranging from 2.7 to 110.4kg (mean 42.9 ± 17.8 kg). In the short postoperative period (3, 24, and 36 months), %TWL was significantly different between groups. At 24 months, patients with higher scores lost more %TWL than those with lower scores (35.1 ± 0.8% vs 31.6 ± 0.7%, p = 0.029). However, this difference was not fount at 60 months postoperatively (mean 28.9 ± 9.6%). In a multivariate analysis, the presence of depression, age, and BES score were not associated with %TWL at 24 and 60 months. **Conclusions:** The results suggest that preoperative BES scores point to a similar weight loss after bariatric surgery. Further studies with long-term follow-up are necessary to evaluate this finding.

Keywords: Bariatric surgery; Weight loss; Obesity; Binge Eating Disorder.

Introduction

Roux-en-Y gastric bypass is a favorable option for the treatment of severe obesity [body mass index (BMI) > 40 kg/m^2 or 35-39.9 kg/m^2 with significant co-morbidities], resulting in long-term weight loss in most patients [1]. Even so, the percentage of weight loss and treatment success rates are variable [2]. The factors contributing to successful outcomes after surgery are complex and time-related [3,4]. Thus, the identification of clinical issues that may benefit and maximize the chances of patients' long-term success after surgery are important. A number of factors predict weight loss and they may be either patient-related or anatomical such as nutritional nonadherence, mental health problems, metabolic and surgical factors [4,5].

Psychiatric problems are frequent conditions among patients undergoing weight reduction surgery [6]. Depression, binge eating disorder (BED), and anxiety seem to be the most common single disorders in individuals looking for bariatric surgery, observed in 19%, 17%, and 12% of the patients, respectively [7]. As eating behavior may be related to the response to surgery, several research groups are investigating BED in bariatric surgery individuals [7].

A diagnosis of BED was introduced in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) and it is characterized by the consumption of a large amount of food in a discrete period (i.e., 2 hours) while experiencing a sense of lack-of-control over eating [8]. Binge eating episodes are associated with eating until feeling uncomfortably full and occur, on average, at least once a week for three months [8]. This pattern of loss-of-control and the ingestion of a considerable amount of calories seen in BED could influence post-operative weight loss. However, after the surgery, the large amounts of food decreases dramatically likely because of a mechanical restriction, taste preferences, and food liking [9].

Prior studies have yielded conflicting findings as to whether the presence of BED preoperatively would be associated with less weight loss (or weight regain) postoperatively [7,10]. A meta-analysis (2012) with 4 studies revealed an increase of 5.9% (95% CI 1.9-9.8) excess weight loss (EWL) for patients with BED at 12 months after surgery [11]. After that, other studies indicated that a pre-surgical diagnosis of BED is associated with poorer weight loss outcomes at different follow-up times [12–16]. Nevertheless, some studies failed to find an association of BED pre-surgery and weight loss at three years [17,18] and 13-15 years [19] post-surgery.

Considering the lack of consensus on this issue, we aim to compare groups of bariatric patients with preoperative scores of Binge Eating Scale (BES) above and below the clinical cut off value on weight outcomes up to 5 years following surgery. Second, it aims to assess the factors predicting post-surgical weight loss, such as sex, age, and presence of comorbidities. We hypothesized that, high presurgical scores would be associated with higher weight loss in the short postoperative period (less than 2 years), but a similar total weight loss in long-term.

Methods

This is a prospective, observational study with 108 patients undergoing Roux-en-Y gastric bypass (between March 2010 and December 2014) in a single University hospital in Brazil. Among the 108 individuals, 106 (98.1%) had a weight assessment at 6 months post-operative, 103 (95.4%) had completed the 12-month assessment, 94 (87.0%) had completed 2 years of follow-up, 68 (63.0%) had completed the 36-month assessment, 52 (48.1%) had completed the 48-month assessment, and 52 had completed the 60-month assessment (follow-up rate: 48.1%). All patients underwent routine pre- and postoperative evaluations and treatments in the Bariatric Surgery and Endocrinology outpatient units of Hospital de Clínicas de Porto Alegre (HCPA). Details of the study’s procedures have been reported previously [20].

Exclusion criteria were age under 18 years, current suicide risk, psychiatric conditions requiring hospitalization, or a diagnosis of intellectual disability or dementia. Women becoming pregnant or lactating during the observation period were not included in the study.

All individuals answered a standardized questionnaire. Educational level [21] and race/skin color were self-reported (white, black, brown/pardo, or native – grouped as other). Confirmation of comorbidities (hypertension, type 2 diabetes mellitus, and obstructive sleep apnea / hypopnea syndrome) and use of medication were obtained from the medical records. Health-related quality of life was measured using the Short Form-12 Health Survey [22]. Mental disorders such as depressive and binge eating were identified in an interview using the Structured Clinical Interview for DSM IV Disorder (SCID), conducted by a psychologist [23]. For the evaluation of binge eating severity, a Portuguese, validated version [24] of the Binge Eating Scale (BES) [25] was administered. This instrument is widely used as a brief screening tool to assess the severity of behavioral, emotional, and cognitive symptoms associated with BED in individuals with obesity, and it is reliable in patients seeking surgical treatment for obesity [26]. BES is a 16-item self-report questionnaire, generating a score that classifies the subject in a range of severity (total score from 0 to 46, with higher scores representing more severe binging). Scores greater or equal to 17 is a frequent convention to classify the patients as “binge eaters” [26,27].

Anthropometric measurements were obtained by trained examiners, 1–2 weeks before surgery (baseline). Weight (kg) was measured with a digital physician scale (Filizola, Brazil) while barefoot and wearing lightweight clothes. Height was measured with a wall-mounted stadiometer (Sanny, Brazil), with the subject standing and the head aligned in the Frankfurt plane. All circumferences were measured using non-stretch fiberglass measuring tapes (Wiso, Brazil) [28]. After surgery, follow-up weight was obtained from medical records (3, 6, 12, 24, 36, 48, and 60 months post-operatively). BMI, percentage of total weight loss (%TWL, defined as [baseline weight − weight at follow-up visit] / baseline weight multiplied by 100), and %EWL: [preoperative weight – weight at follow-up visit] / [preoperative weight – ideal body weight), multiplied by 100] were calculated. The ideal body weight was taken as the weight in kilograms corresponding to the BMI of 25.0 kg/m2. Weight-loss between follow-up times were reported as %TWL. This measure facilitates the most sensitive identification of novel predictors of surgery-induced weight loss [29,30]. Weight regain was calculated using the formula (weight at follow-up visit – nadir weight) / (preoperative weight – nadir weight) x 100% and it was defined as gaining of at least 15% of the weight that was initially lost after surgery [31].

The project was approved by the Hospital's Research Ethics Committee (no. 17-0635). All participants provided written consent.

Statistical Analysis

Descriptive characteristics were used to summarize the participant characteristics prior to surgery. The data are presented as frequencies (%), means and standard deviations (SD), or median and range, as appropriate. The Shapiro–Wilk test was used to verify the normal distribution of data.

The Chi-squared test and the Fisher exact test were used to examine differences among categorical variables, and Student's t tests were used to compare differences in continuous variables. These tests were used to assess differences in the distributions of participant characteristics prior to surgery between those who were included in the analysis at 60 months post-surgery vs those who were excluded due to missing data were analyzed.

Means of generalized linear mixed model were used to examine the association of BES score (dichotomized as high or low based on cut off 17) with change in weight, BMI, %EWL, and %TWL over the 60 months follow-up, including examination of the presurgical score by time interaction. Bonferroni's test was employed for the post-hoc comparisons between follow-up times. Associations between preoperative factors and weight loss were determined with univariate and multivariate gamma regression analysis with robust error variance. Weight outcome was operationalized as continuous %TWL at 24- and 60-months post-operative. The models included age, presence of current and/or past depressive disorder and BES score (dichotomized) as predictors of %TWL. Results were presented as odds ratios, with 95% confidence intervals. All data analyses were conducted in SPSS software, version 18.0 (Statistical Package for the Social Sciences, Cary, N.C.). All reported p values are 2-sided, and statistical significance was defined as $p < 0.05$.

Results

Participants' Baseline Characteristics

A total of 108 patients (94 women), aged between 21 and 69 years (mean 43.1 ± 11.0 years) were included in the study. The baseline weight was 127.3 ± 23.8 kg, and the BMI was 48.2 ± 7.2 kg/m² (range = 34.9 – 75.3 kg/m²). Hypertension was the most common comorbidity, present in 65.7% of patients, followed by past depressive disorder (51.3%). Among 76 individuals with SCID evaluation, only six were diagnosed with BED (7.9%).

Participants were separated into two groups, according to their score in the Binge Eating Scale: 58.3% (n = 63) had lower score (BES between 0 and 17 - 8.7 ± 4.6; median 9), and 41.7% (n = 45) had higher score (between 18 and 40 points - 27.0 ± 5.8; median 27). The frequency of current depressive disorder was higher among patients with BES score higher than 17 (Table 1). No differences were found in relation to patients' medication: eight participants (24.2%)

with high scores reported using psychiatric medication compared to thirteen (28.9%) patients with low scores ($p = 0.424$) (data not shown).

Of 108 patients, 48.1% ($n = 52$) attended all post-operative clinics. Another 26 patients did not achieve 60 months postoperatively (one of these died from other cause) and 30 patients did not attend appointment after 60 months (Fig 1). When comparing the 52 patients with complete data with those 30 who did not attend, only the mean age was significantly different (attenders 45.3 ± 11.1 vs. 37.0 ± 9.5, $p = 0.001$). The two groups did not significantly differ with respect to sex, BMI, presence of BED, or other comorbidities (all $p > 0.05$).

Weight changes in different groups according to the BES score

Weight loss was significant up to 12 months as seen in Table 2. The weight seems to stabilize between 12 and 24 months ($p = 0.361$), although the greatest weight loss has been at 24 months of follow-up, ranging from 2.7 to 110.4 kg (mean 42.9 ± 17.8 kg). The nadir weight was 83.7 kg ± 15.4. Participants started gaining weight after 24 months, when 9.3% ($n = 9$) of patients gained more than 15% of nadir weight. This number increased to 43.4% ($n = 23$) at 60 months. At 5 years, mean BMI was 34.7 ± 6.2 kg ($n = 52$).

At 3, 24, and 36 months postoperatively, %TWL was significantly different between groups. The group with higher BES score lost 35.1 ± 0.8% at 24 months, and those with lower scores lost 31.6 ± 0.7% ($p = 0.029$) (Fig 2.a). At 48 and 60 months postoperatively, %TWL was similar in the two groups, mean 29.7 ± 7.6% and 28.9 ± 9.6%, respectively. When only the 52 individuals (16 with more than 17 scores and 36 with lower than 17 scores) who had completed 60 months postoperatively data were studied, no significant differences were found between follow-up times (Fig 2.b).

Preoperative factors of weight loss

In gamma regression, no preoperative factor predicts weight loss. The presence of current and/or past depression, age, and BES score were not associated with %TWL, at both 24- and 60 months postoperatively (Table 3 and 4).

Discussion

The present study compared the effect of groups of bariatric patients with preoperative scores of BES above and below the clinical cut off value on weight outcomes. The main finding was that patients with preoperative BES score higher than 17 had an increased %TWL in the short postoperative period but not at 60 months after surgery.

The anatomical and physiologic changes brought by bariatric surgery modify the ability of patients to ingest large portions of food, decreasing the caloric intake abruptly in the short postoperative period and, consequently, favoring weight loss. Due to this caloric restriction, binge eaters' patients, who had a high calorie intake before surgery, showed greater weight loss soon after the procedure. However, the results varied according to the time of postoperative follow-up. Weight regain after bariatric surgery is a known fact [32] and tends to begin between 18 and 24 months postoperatively [33] among all bariatric patients. From this moment, when food consumption is re-established, the influence of preoperatively BED was no longer found. As BED may increase over time after surgery, we believe that the presence of post-operative BED is a more important determinant than pre-operative BED. This could explain the lack of association in this study.

As bariatric surgery has a deep impact on many psychological factors, changes in patients' psychological profiles after bariatric surgery are expected [34,11]. There is no clear understanding of how BE courses over longer periods of time, and how it changes during the post-operative period [35]. This may limit the delivery of healthcare to those impacted by BED.

Data on the course of eating disorders post surgically are complex and depend on the surgical procedure of choice. Exclusively restrictive surgery (i.e. gastric banding or gastroplasty) has a different impact on eating behavior as do bypass procedures. Mitchell and colleagues noted that the hunger perception may change with gastric bypass, explaining why the majority of individuals who met criteria for BED did not meet such criteria after a long-term follow-up, even if the criterion for eating a large amount of food was excluded [19].

In the LABS (Longitudinal Assessment of Bariatric Surgery) study, Devlin and colleagues found that eating pathology was common before surgery, but improved markedly with surgery; moreover, eating pathology post-surgery was associated with suboptimal weight losses [36]. Literature to date indicates that bariatric surgery generally results in a decline in eating psychopathology within the first post-operative year. Nevertheless, between 24 and 60 months, there would be an increase in all indicators pointing to a worsening of symptoms of anxiety, depression, and BED [37]. The recurrence of BED could occur at any time beyond this initial year [38]. Conceição and colleagues suggest a growing trend of problematic eating behaviors and levels of impulsivity over time [39], and loss-of-control could be a more important feature of disordered eating than the quantity eaten [40]. Most authors would say that post-operative, but not pre-operative, BED is important prognostically [19,39,41,42].

In the current study, the characteristics of the participants were similar to the general bariatric surgery population (predominantly women, white, mean age 43 years prior to surgery, and a mean BMI of 48 kg/m^2) [43]. We found a high number of depressive disorders among patients with higher BES scores, but it was not associated with poorer postoperative outcomes, consistent with previous findings [7,44]. Patients with depressive disorders tend to have poor control of food intake, poor exercise adherence and consequently greater difficulty in maintaining a healthy weight. On the other hand, this difficult possibly contribute to further suffering, generating a vicious cycle.

The strength of this study is that it was possible to follow the participants for a long period of time. The majority of the published studies with BED pre-surgery included only up to 2 years after surgery, and the follow up time proved to be crucial when evaluating BED as a predictor of weight loss. However, our study has a few limitations. Interpretation of results comparing groups defined by BES scores requires caution. Although BES is a valid screener for binge eating in surgery candidates, BES is highly sensitive, but not very specific [26], and has good internal consistency (Cronbach's alpha 5 .90 [45])]. Importantly, the BES was created before BED was officially recognized as a psychiatric diagnosis and thus is not intended to detect the presence of this disorder. Therefore, it does not provide a definitive diagnosis of BED, that would require a more laborious clinical evaluation for this complex symptom [8]. Secondly, there is no information on rates of binge eating after surgery, which may have interfered with weight loss. In addition, our 5-year follow-up rate was only 48.1%. This figure is explained by the fact that 27.8% (30) of the participants had not yet reached the 5-year follow-up examination.

In conclusion, the results suggest that the weight loss was similar in patients with BES scores above 17 compared to those below the cutoff at 60 months after RYGB. Standardized research on predictors of weight loss after bariatric surgery with longer times of follow-up, and studies of how binge eating courses over longer periods of time are necessary.

Author statement

Natalia Luiza Kops: Writing - Original Draf, Conceptualization, Formal analysis. Manoela Astolfi Vivan, Mariana L. Dias de Castro, Jaqueline D. Correia Horvath, and Fabiana Silva Costa: Validation, Visualization, Investigation. Rogério Friedman: Supervision, Validation, Writing- Reviewing and Editing.

Conflict of Interest Statement

The authors declared no conflict of interest.

Funding sources

This work was supported by the Fundo de Incentivo à Pesquisa e Eventos do Hospital de Clínicas de Porto Alegre (nº 12-0232); Conselho Nacional de Desenvolvimento Científico e Tecnológico (N.L.K., nº 119697, 2012); and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (J.D.C.H., nº 118907, 2008).

References

[1] Karlsson J, Taft C, Rydén A, Sjöström L, Sullivan M. Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. Int J Obes 2007;31:1248–61. https://doi.org/10.1038/sj.ijo.0803573.

[2] Ryder JR, Gross AC, Fox CK, Kaizer AM, Rudser KD, Jenkins TM, et al. Factors associated with long-term weight-loss maintenance following bariatric surgery in adolescents with severe obesity. Int J Obes 2018;42:102–7. https://doi.org/10.1038/ijo.2017.193.

[3] Ghaferi AA, Varban OA. Setting appropriate expectations after bariatric surgery: evaluating weight regain and clinical outcomes. JAMA 2018;320:1543–4. https://doi.org/10.1001/jama.2018.14241.

[4] Karmali S, Brar B, Shi X, Sharma AM, de Gara C, Birch DW. Weight recidivism post-bariatric surgery: a systematic review. Obes Surg 2013;23:1922–33. https://doi.org/10.1007/s11695-013-1070-4.

[5] Júnior WS, do Amaral JL, Nonino-Borges CB. Factors related to weight loss up to 4 years after bariatric surgery. Obes Surg 2011;21:1724–30. https://doi.org/10.1007/s11695-011-0420-3.

[6] Duarte-Guerra LS, Coêlho BM, Santo MA, Lotufo-Neto F, Wang Y-P. Morbidity persistence and comorbidity of mood, anxiety, and eating disorders among preoperative bariatric patients. Psychiatry Res 2017;257:1–6. https://doi.org/10.1016/j.psychres.2017.07.020.

[7] Dawes AJ, Maggard-Gibbons M, Maher AR, Booth MJ, Miake-Lye I, Beroes JM, et al. Mental Health Conditions Among Patients Seeking and Undergoing Bariatric Surgery: A Meta-analysis. JAMA 2016;315:150–63. https://doi.org/10.1001/jama.2015.18118.

[8] American Psychiatric Association. Diagn. Stat. Man. Ment. Disord. 5th ed., American Psychiatric Association; 2013, p. 532–3. https://doi.org/10.1176/appi.books.9780890425596.

[9] le Roux CW, Bueter M. The physiology of altered eating behaviour after Roux-en-Y gastric bypass. Exp Physiol 2014;99:1128–32. https://doi.org/10.1113/expphysiol.2014.078378.

[10] Meany G, Conceição E, Mitchell JE. Binge eating, binge eating disorder and loss of control eating: effects on weight outcomes after bariatric surgery. Eur Eat Disord Rev J Eat Disord Assoc 2014;22:87–91. https://doi.org/10.1002/erv.2273.

[11] Livhits M, Mercado C, Yermilov I, Parikh JA, Dutson E, Mehran A, et al. Preoperative Predictors of Weight Loss Following Bariatric Surgery: Systematic Review. Obes Surg 2012;22:70–89. https://doi.org/10.1007/s11695-011-0472-4.

[12] Luiz LB, Brito CL de S, Debon LM, Brandalise LN, Azevedo JT de, Monbach KD, et al. Variation of binge eating one year after roux-en-Y gastric bypass and its relationship with excess weight loss. PLOS ONE 2016;11:e0167577. https://doi.org/10.1371/journal.pone.0167577.

[13] Chao AM, Wadden TA, Faulconbridge LF, Sarwer DB, Webb VL, Shaw JA, et al. Binge-eating disorder and the outcome of bariatric surgery in a prospective, observational study: Two-year results: BED and Bariatric Surgery. Obesity 2016;24:2327–33. https://doi.org/10.1002/oby.21648.

[14] Devlin MJ, King WC, Kalarchian MA, White GE, Marcus MD, Garcia L, et al. Eating pathology and experience and weight loss in a prospective study of bariatric surgery patients: 3-year follow-up. Int J Eat Disord 2016;49:1058–67. https://doi.org/10.1002/eat.22578.

[15] Sallet PC, Sallet JA, Dixon JB, Collis E, Pisani CE, Levy A, et al. Eating behavior as a prognostic factor for weight loss after gastric bypass. Obes Surg 2007;17:445–51. https://doi.org/10.1007/s11695-007-9077-3.

[16] Marek RJ, Ben-Porath YS, Dulmen MHM van, Ashton K, Heinberg LJ. Using the presurgical psychological evaluation to predict 5-year weight loss outcomes in bariatric surgery patients. Surg Obes Relat Dis Off J Am Soc Bariatr Surg 2017;13:514–21. https://doi.org/10.1016/j.soard.2016.11.008.

[17] Lapidoth J de M, Ghaderi A, Norring C. Binge eating in surgical weight-loss treatments. Long-term associations with weight loss, health related quality of life (HRQL), and psychopathology. Eat Weight Disord 2011;16:e263–9. https://doi.org/10.1007/BF03327470.

[18] Kalarchian MA, King WC, Devlin MJ, Marcus MD, Garcia L, Chen J-Y, et al. Psychiatric Disorders and Weight Change in a Prospective Study of Bariatric Surgery Patients: A 3-Year Follow-Up. Psychosom Med 2016;78:373–81. https://doi.org/10.1097/PSY.0000000000000277.

[19] Mitchell JE, Lancaster KL, Burgard MA, Howell LM, Krahn DD, Crosby RD, et al. Long-term follow-up of patients' status after gastric bypass. Obes Surg 2001;11:464–8. https://doi.org/10.1381/096089201321209341.

[20] Kops NL, Vivan MA, Horvath JDC, de Castro MLD, Friedman R. FABP2, LEPR223, LEP656, and FTO polymorphisms: effect on weight loss 2 years after bariatric surgery. Obes Surg 2018. https://doi.org/10.1007/s11695-018-3213-0.

[21] Critério Brasil. Associação Brasileira de Empresas de Pesquisa (ABEP), 2018, p. 1–6.

[22] Ware J, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Med Care 1996;34:220–33.

[23] Cooper J. Diagnostic and Statistical Manual of Mental Disorders (DSM–IV–TR). Br J Psychiatry 2001;179:85. https://doi.org/10.1192/bjp.179.1.85-a.

[24] Freitas S, Lopes CS, Coutinho W, Appolinario JC. Tradução e adaptação para o português da Escala de Compulsão Alimentar Periódica. Rev Bras Psiquiatr 2001;23:215–20. https://doi.org/10.1590/S1516-44462001000400008.

[25] Gormally J, Black S, Daston S, Rardin D. The assessment of binge eating severity among obese persons. Addict Behav 1982;7:47–55.

[26] Grupski AE, Hood MM, Hall BJ, Azarbad L, Fitzpatrick SL, Corsica JA. Examining the Binge Eating Scale in screening for binge eating disorder in bariatric surgery candidates. Obes Surg 2013;23:1–6. https://doi.org/10.1007/s11695-011-0537-4.

[27] Freitas SR, Lopes CS, Appolinario JC, Coutinho W. The assessment of binge eating disorder in obese women: A comparison of the binge eating scale with the structured clinical interview for the DSM-IV. Eat Behav 2006;7:282–9. https://doi.org/10.1016/j.eatbeh.2005.09.002.

[28] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Orientações para a coleta e análise de dados antropométricos em serviços de saúde: Norma Técnica do Sistema de Vigilância Alimentar e Nutricional - SISVAN, 2011, p. 76.

[29] Hatoum IJ, Kaplan LM. Advantages of Percent Weight Loss as a Method of Reporting Weight Loss after Roux-en-Y Gastric Bypass. Obes Silver Spring Md 2013;21:1519–25. https://doi.org/10.1002/oby.20186.

[30] Sanchez R, Guzman R, Apaez N, Gonzalez I, Gutierrez I, Romero G, et al. Comparison of the Total Weight loss measure against the use of the percentage of excess weight lost with the ideal weight variable and the percentage of excess BMI lost to measure the surgical success of bariatric surgery. Surg Obes Relat Dis 2017;13:S103. https://doi.org/10.1016/j.soard.2017.09.226.

[31] King WC, Hinerman AS, Belle SH, Wahed AS, Courcoulas AP. Comparison of the Performance of Common Measures of Weight Regain After Bariatric Surgery for Association With Clinical Outcomes. JAMA 2018;320:1560–9. https://doi.org/10.1001/jama.2018.14433.

[32] Shah M, Simha V, Garg A. Review: long-term impact of bariatric surgery on body weight, comorbidities, and nutritional status. J Clin Endocrinol Metab 2006;91:4223–31. https://doi.org/10.1210/jc.2006-0557.

[33] Karlsson J, Taft C, Rydén A, Sjöström L, Sullivan M. Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. Int J Obes 2007;31:1248–61. https://doi.org/10.1038/sj.ijo.0803573.

[34] Herpertz S, Kielmann R, Wolf AM, Langkafel M, Senf W, Hebebrand J. Does obesity surgery improve psychosocial functioning? A systematic review. Int J Obes Relat Metab Disord J Int Assoc Study Obes 2003;27:1300–14. https://doi.org/10.1038/sj.ijo.0802410.

[35] Conceição EM, Utzinger LM, Pisetsky EM. Eating disorders and problematic eating behaviours before and after bariatric surgery: characterization, assessment and association with treatment outcomes. Eur Eat Disord Rev 2015;23:417–25. https://doi.org/10.1002/erv.2397.

[36] Devlin MJ, King WC, Kalarchian MA, White GE, Marcus MD, Garcia L, et al. Eating pathology and experience and weight loss in a prospective study of bariatric surgery patients: 3-year follow-up. Int J Eat Disord 2016;49:1058–67. https://doi.org/10.1002/eat.22578.

[37] Ribeiro GAN de A, Giapietro HB, Belarmino LB, Salgado-Junior W. Depression, anxiety, and binge eating before and after bariatric surgery: problems that remain. Arq Bras Cir Dig ABCD 2018;31. https://doi.org/10.1590/0102-672020180001e1356.

[38] Luiz LB, Brito CL de S, Debon LM, Brandalise LN, Azevedo JT de, Monbach KD, et al. Variation of binge eating one year after roux-en-Y gastric bypass and its relationship with excess weight loss. PLOS ONE 2016;11:e0167577. https://doi.org/10.1371/journal.pone.0167577.

[39] Conceição EM, Mitchell JE, Pinto-Bastos A, Arrojado F, Brandão I, Machado PPP. Stability of problematic eating behaviors and weight loss trajectories after bariatric surgery: a longitudinal observational study. Surg Obes Relat Dis Off J Am Soc Bariatr Surg 2017;13:1063–70. https://doi.org/10.1016/j.soard.2016.12.006.

[40] Ivezaj V, Barnes RD, Cooper Z, Grilo CM. Loss-of-control eating after bariatric/sleeve gastrectomy surgery: Similar to binge-eating disorder despite differences in quantities. Gen Hosp Psychiatry 2018;54:25–30. https://doi.org/10.1016/j.genhosppsych.2018.07.002.

[41] White MA, Masheb RM, Rothschild BS, Burke-Martindale CH, Grilo CM. The prognostic significance of regular binge eating in extremely obese gastric bypass patients: 12-month postoperative outcomes. J Clin Psychiatry 2006;67:1928–35.

[42] White MA, Kalarchian MA, Masheb RM, Marcus MD, Grilo CM. Loss of control over eating predicts outcomes in bariatric surgery patients: a prospective, 24-month follow-up study. J Clin Psychiatry 2010;71:175–84. https://doi.org/10.4088/JCP.08m04328blu.

[43] Ghaferi AA, Varban OA. Setting appropriate expectations after bariatric surgery: evaluating weight regain and clinical outcomes. JAMA 2018;320:1543–4. https://doi.org/10.1001/jama.2018.14241.

[44] Schäfer L, Hübner C, Carus T, Herbig B, Seyfried F, Kaiser S, et al. Pre- and postbariatric subtypes and their predictive value for health-related outcomes measured 3 years after surgery. Obes Surg 2018;29:230–8. https://doi.org/10.1007/s11695-018-3524-1.

[45] Ashton K, Drerup M, Windover A, Heinberg L. Brief, four-session group CBT reduces binge eating behaviors among bariatric surgery candidates. Surg Obes Relat Dis Off J Am Soc Bariatr Surg 2009;5:257–62. https://doi.org/10.1016/j.soard.2009.01.005.

Table 1. Baseline characteristics of the patients according to the score in Binge Eating Scale (BES)

	BES ≤ 17 63 (58.3)	BES > 17 45 (41.7)	*P* value[*]
Age (years)	43.4 (11.7)	42.9 (10.4)	0.839
Women	52 (82.5)	42 (93.3)	0.147
Skin color/race			
White	49 (77.8)	38 (84.4)	0.863
Other	14 (22.2)	7 (15.6)	
Education level[a]			0.857
Elementary school	27 (43.6)	19 (44.2)	
High school	21 (33.8)	13 (30.2)	
University degree (complete or incomplete)	14 (22.6)	11 (25.6)	
Comorbidities			
Hypertension	46 (73.0)	27 (60.0)	0.211
Type 2 diabetes mellitus	13 (20.6)	13 (28.9)	0.366
OSAHS	20 (45.5)	10 (29.4)	0.352
Current depressive disorder	9 (16.1)	17 (43.6)	0.005
Past depressive disorder	29 (51.8)	28 (71.8)	0.058
Presence of binge eating (SCID)[a]			0.686
Yes	4 (9.5)	2 (5.9)	
No	38 (90.5)	32 (94.1)	
Short Form-12 score[b]	30.45 (2.9)	32.03 (3.3)	0.052
Anthropometric assessment			
Weight (kg)	126.77 (23.0)	128.06 (24.4)	0.782
Excess weight (%)[c]	60.49 (20.4)	62.40 (21.5)	0.644
Height (m)	1.63 (0.1)	1.62 (0.1)	0.637
Body mass index (kg/m^2)	47.82 (7.1)	48.68 (7.6)	0.549
Waist circumference (cm)	135.59 (15.3)	134.13 (15.9)	0.635
Hip circumference (cm)	139.20 (15.6)	140.70 (15.5)	0.625
Waist-hip ratio	0.97 (0.1)	0.95 (0.1)	0.239

Data are mean (standard deviation) or number of subjects (%). OSAHS: obstructive sleep apnea / hypopnea syndrome. SCID: Structured Clinical Interview for DSM IV Disorder. [a]Does not sum to 108 because some of the responses are missing. [b]High score indicates better health-related quality of life. [c]Calculation of ideal body weight as that equivalent to a body mass index of 25 kg/m^2. [*]$p < 0.05$.

Table 2. Evolution of anthropometric measurements from baseline through 5 years post-operative period

	BES score	Baseline (n = 108)	3 months (n = 108)	6 months (n = 106)	12 months (n = 103)	24 months (n = 94)	36 months (n = 68)	48 months (n = 52)	60 months (n = 52)	*P* value*
Weight (kg)	High	128.0 (2.7)[a]	104.0 (2.9)[a,b]	93.3 (2.9)[b,c]	84.5 (2.3)[c]	82.5 (2.2)	84.9 (2.4)	86.3 (2.3)	87.0 (3.4)	0.665
	Low	126.7 (2.6)[a]	106.1 (2.5)[a,b]	94.1 (2.1)[b,c]	87.0 (2.0)[c]	86.1 (1.9)	88.9 (2.2)	90.0 (2.5)	93.1 (2.9)	
BMI (kg/m²)	High	48.7 (0.9)[a]	39.6 (1.0)[a,b]	35.6 (1.0)[b,c]	32.3 (0.8)[c]	31.5 (0.8)	32.6 (0.7)	32.9 (0.8)	33.0 (1.1)	0.425
	Low	47.8 (0.8)[a]	40.0 (0.7)[a,b]	35.4 (0.6)[b,c]	32.9 (0.6)[c]	32.6 (0.6)	33.4 (0.7)	33.8 (0.7)	34.8 (0.9)	
%EWL	High	-	40.4 (2.2)[a]	58.4 (2.7)[a,b]	71.6 (2.7)[b]	74.8 (2.8)	72.1 (2.7)	68.9 (3.0)	56.1 (3.5)	0.747
	Low	-	34.9 (1.7)[a]	54.9 (1.8)[a,b]	66.7 (2.3)[b]	68.1 (2.4)	64.6 (2.6)	62.4 (2.7)	56.1 (3.5)	
%TWL	High	-	18.6 (0.8)[a]	26.9 (1.0)[a,b]	33.4 (1.1)[b]	35.1 (1.3)	33.5 (1.1)	31.1 (1.9)	29.7 (2.3)	0.890
	Low	-	16.2 (0.7)[a]	25.1 (0.8)[a,b]	30.7 (1.0)[b]	31.6 (1.1)	30.3 (1.2)	28.3 (1.3)	25.7 (1.6)	

BES, Binge Eating Scale; BMI, Body Mass Index; %EWL, percentage of excess weight loss; %TWL, percentage total body weight loss. Participants were separated into two groups, according to their score in the BES: lower score (between 0 and 17), and higher score (between 18 and 40). Pairwise comparison of anthropometric measurements between follow-up times in different groups. Post hoc test: Bonferroni. Data described as the mean (standard error).

[a,b,c]Significant differences between follow-up times ($p < 0.05$). *Differences between groups' follow-up times.

Table 3. Gamma regression correlating preoperative clinical factors for total weight loss at 24 months post-operative period

	N	Univariate analysis		Multivariate analysis	
		OR (95% CI)	p	OR (95% CI)	P
Age	94	0.99 (0.99 - 1.00)	0.253	0.99 (0.99 – 1.00)	0.345
Depressive disorder					
No	29	1		1	
Yes	56	0.93 (0.82 – 1.05)	0.321	0.90 (0.81 – 1.00)	0.226
BES score					
≤ 17	54	1		1	
> 17	40	1.10 (0.99 – 1.22)	0.169	1.14 (1.00 – 1.27)	0.080

OR: Odds ratio; CI: confidence interval; BES: binge eating scale. Does not sum to 94 because some of the responses are missing.

Table 4. Gamma regression correlating preoperative clinical factors for total weight loss at 60 months post-operative period

	N	Univariate analysis		Multivariate analysis	
		OR (95% CI)	P	OR (95% CI)	P
Age	52	1.00 (0.99 - 1.01)	0.621	1.00 (0.99 – 1.01)	0.463
Depressive disorder					
No	17	1		1	
Yes	32	1.02 (0.84 – 1.24)	0.863	0.93 (0.75 – 1.16)	0.561
Binge eating score					
≤ 17	35	1		1	
> 17	16	1.13 (0.97 – 1.30)	0.240	1.16 (0.98 – 1.38)	0.194

OR: Odds ratio; CI: confidence interval; BES: binge eating scale. Does not sum to 52 because some of the responses are missing.

Figure 1. Diagram

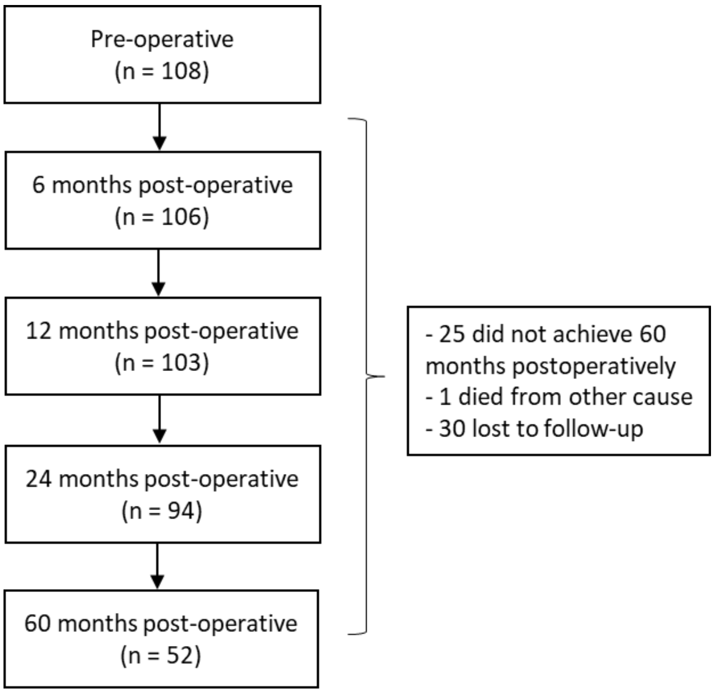
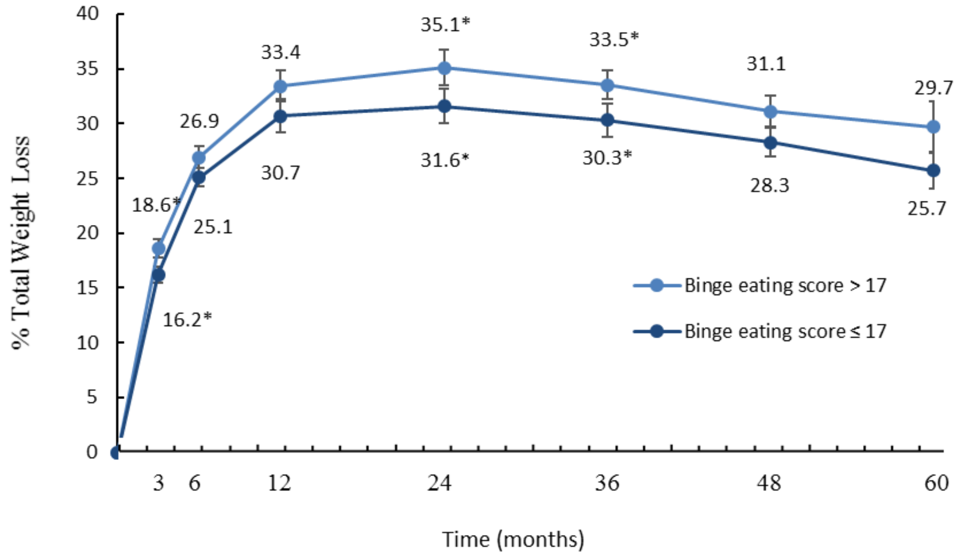
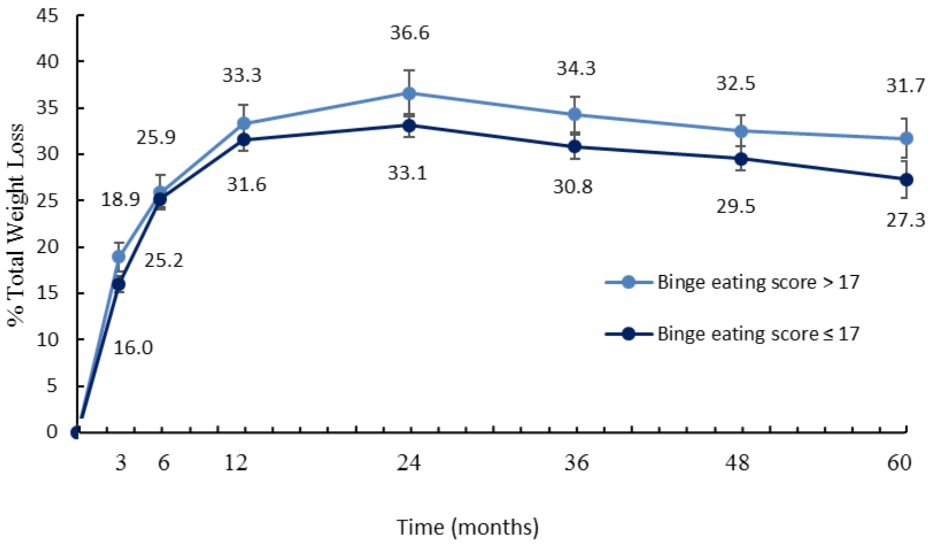


Figure 2. Percentage of total weight loss between follow-up times according to the score in Binge Eating Scale.

a)



b)



a) All participants. Times: 3 months (n = 108), 6 months (n = 106), 12 months (n = 103), 24 months (n = 94), 36 months (n = 68), 48 months (n = 52), and 60 months (n = 52). *$p < 0.05$.

b) Only participants who had completed 60 months postoperatively (n = 52). Error bars represent 95% confidence intervals.

4.3 Artigo 3

Pre-operative binge eating and weight loss after bariatric surgery: a systematic review and meta-analysis

Natália Luiza Kops[1,] Manoela Astolfi Vivan[2], Elisa Ruiz Fülber[2], Marco Fleuri[2], Rogério Friedman[1,3]

[1]Post-Graduate Program in Endocrinology, Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil.

[2]Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil.

[3]Endocrinology Division, Hospital de Clínicas de Porto Alegre (HCPA), Porto Alegre, RS, Brazil.

Artigo submetido para publicação na revista *The Journal of Nutrition*

Fator de impacto: 4.416

Abstract

Background: Previous studies have produced conflicting findings when examining if the presence of binge eating disorder (BED) in bariatric surgery candidates would be associated with less significant weight loss. *Objectives: T*o evaluate the association of binge eating diagnosed prior to bariatric surgery on weight loss after the surgery. *Methods:* In this systematic review and meta-analysis, MEDLINE, EMBASE, CENTRAL, LILACS, and specialized databases were searched on January 2020. Clinical trial and observational studies including individuals who have had any type of bariatric surgical treatment with evaluation of BED pre-surgery, and at least one post-measure of weight were initially selected. Four reviewers independently screened for eligibility. The included studies were assessed for quality using an adapted version of the NIH 'Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies'. The mean difference was calculated using the random-effects model. *Results:* Nineteen prospective, retrospective, and longitudinal studies met the inclusion criteria for metanalysis, comprising 3,223 subjects (80.25% women; median age of 41 years). At 6 months postoperative, weight loss was not significantly different between BED and non-BED groups [7 studies, 980 subjects; -1.95% (95%CI -4.30, 0.40; I^2=10%)]. However, analyzing only studies that included gold standard assessment tools, non-BED lost 3.12% more excess weight than BED group (95%CI -5.87, -0.38; I^2=0). No significant differences were found at 12, 24, 36 and 60 months. *Conclusions:* Pre-bariatric BED seems to have little or no influence on weight loss after surgery, regardless of the types of surgery. However, many questions remain unanswered in long-term outcomes. The heterogeneity amongst studies emphasizes the importance of standardizing instruments. PROSPERO: CRD42019143232.

Key words: Binge-Eating Disorder; Eating Disorders; Bariatric Surgery; Weight Loss; Meta-Analysis.

Introduction

Bariatric surgery is a well-established treatment for severe obesity after failure of more conservative weight loss therapies. There is ample evidence about the benefits of bariatric surgery, such as improvement of comorbidities and quality of life [1]. However, a subset of patients does not achieve successful postoperative outcome, defined as the loss of at least 50% of excess weight [2]. Furthermore, even among those that do achieve weight loss, weight regain following surgery is common after 1-2 years [3].

Several studies have examined psychological factors and weight change after bariatric surgery due to their important role in maintaining the surgically induced weight loss [4]. The prevalence of eating disorders is even higher in individuals undergoing weight reduction surgery than general population [5], , and binge eating disorder (BED) is the second most common single disorders (17%) [6].

Guidelines recommend a multidisciplinary assessment of bariatric surgery candidates to identify potential psychological factors that may compromise surgery outcomes [7]. However, previous studies have produced conflicting findings when examining if the presence of binge eating (BED) in bariatric surgery candidates would be associated with less weight loss (or weight regain). In 2012, a meta-analysis with only 4 studies (412 subjects) with different BED assessment forms revealed 5.9% (95%CI 1.9, 9.8) greater excess weight loss (EWL) for patients with BED at 12 months after surgery despite showing no significant difference at 17 months [8]. After that, many other studies investigated the association of pre-surgical binge eating and weight loss with different post-surgical follow-up times [9–16]. Among 2,156 participants (2019) of the multi-center Longitudinal Assessment of Bariatric Surgery-2 (LABS-2) study, there were no significant effects of prior loss of control eating on percent weight loss at 7 years after surgery [9].

A diagnosis of BED was included in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) and requires the occurrence of binge-eating episodes at least once a week for three months [17]. These binge-eating episodes are defined as eating an unusually large quantity of food in a small period while experiencing a subjective sense of loss-of-control and marked levels of distress, besides the absence of regular compensatory behaviors [17]. In addition, a diagnosis requires experiencing three of five associated symptoms: (1) eating much more rapidly than normal, (2) eating until feeling uncomfortably full, (3) eating large amounts of food when not feeling physically hungry, (4) eating alone due to embarrassment, and (5) feeling disgusted with oneself or very guilty after overeating [17].

A review about the methodology used to diagnose the disorder in pre-surgical assessments identified 147 articles presenting more than seventy different questionnaires and interviews [10]. The Questionnaire on Eating and Weight Patterns (QEWP-R), Three Factor Eating Questionnaire, and Eating Disorder Examination were the most frequently used instruments [10]. Furthermore, the use of different classification criteria, such as DSM-III, IV or 5 impact the variability of the studies [18]. These different assessment forms may be over- or underestimating the prevalence of BED and this should be considered.

Therefore, to clarify if individuals with BED are at risk for suboptimal post-operative weight loss, a systematic updated overview of binge eating and weight change after the surgery, complemented by a metanalysis, is relevant. This study aimed to evaluate the association of binge eating diagnosed prior to bariatric surgery on weight loss after the surgery. As secondaries objectives, we also aimed to assess the association of preoperative binge eating on different postoperative follow up times; to investigate if there is a variation in the postoperative weight loss amongst binge eating and non-binge eating patients undergoing different types of surgery; and to describe the prevalence of binge eating in the pre- and post-surgery.

Methods

This systematic review followed the model of the Cochrane Handbook for Systematic Reviews of Interventions [19]. This project was registered in the International Prospective Register of Systematic Reviews (PROSPERO), under registration number CRD42019143232 on 3 December 2019.

Eligibility Criteria

The present study included clinical trial and observational studies with individuals of all ages who have had any type of bariatric surgical treatment with evaluation of BED pre-surgery, and at least one post-measure of weight six months or beyond, post-surgery. BED was assessed by validated psychometric measures or diagnosed based on structured clinical interview [17]. The episodes commonly involve eating an amount of food in a discrete period that is larger than what other people would eat under similar circumstances, associated with a sense of loss of control [17]. In comparison with BED, the control group consists of patients without binge eating (non-BED).

Exclusion criteria include pregnant or lactating women, no evaluation of BED pre-surgery, no comparison or control group, and no pre and post-measure of weight change. Protocol studies, case reports, reviews, and letters will be excluded. Data from conference proceedings were included if the abstract provided enough information to assess its eligibility and to collect at least the weight change from baseline to the last available follow-up in BED and non-BED patients, as well as the number of participants. Studies examining multiple patient groups were included in case of separate data reports for patients with and without BED. No language or date restrictions were applied.

Outcome(s)

Weight change from baseline (pre-surgery evaluation) to the last available follow-up in BED and non-BED patients. We recorded the absolute weights, percentage of excess weight loss (%EWL), and BMIs at all follow-up periods over or equal to 6-month post-surgery. When data were presented in other ways such as percentage of total weight loss (%TWL), change in body mass index (ΔBMI) or percentage of excess BMI loss (%EBMIL), we chose to convert to the corresponding values.

The definitions and calculations of weight change were described by Brethauer and colleagues (2015) [20]: 1) %TWL = [(Initial weight) – (Postop weight)] / [(Initial weight)] x 100); 2) ΔBMI = (Initial BMI) - (Postop BMI); 3) %EWL = [(Initial Weight) – (Postop Weight)] / [(Initial Weight) – (Ideal Weight)] x 100 (in which ideal weight is defined by the weight corresponding to a BMI of 25 kg/m^2).

Search methods

We performed the search of the following databases through 28 August 2019 and updated on January 2020: MEDLINE, EMBASE, CENTRAL, and LILACS using key terms related to bariatric surgery combined with BED and body weight. For detailed search strategies see *Table S1*.

A search in specialized databases was also conducted such as PsycINFO, CINAHL, BVS–PSICO, and PubPsych. A complementary database in CRD (Centre for Reviews and Dissemination) and DARE (Database of Abstracts of Reviews of Effects) were performed. We scanned other potentially eligible trials or ancillary publications by searching the reference lists of retrieved included trials, (systematic) reviews, and meta-analyses. Additionally, we used the websites ISI of Knowledge, ProQuest Dissertations and Theses Database, Portal Capes, and Brazilian Digital Library of Theses and Dissertations to identify any thesis in the area. In addition, the study registries PROSPERO, Cochrane Database of Systematic Reviews (CDSR), International Clinical Trials Registry Platform, Clinical Trials, and Registro Brasileiro de Ensaios Clínicos were analyzed.

Study selection and data extraction

The evaluation of titles and abstracts for potentially eligible studies was conducted in pairs by four independent investigators (NLK and MF; ERF and MAV). Researchers were blinded to each other's' decisions. The studies were analyzed for full-text eligibility by the same reviewers. Disagreements and discrepancies over the eligibility were solved through consultation and consensus with a fifth reviewer (RF). The reviewers were not blinded to study authors, affiliations or journal name. The Zotero software was used to manage and select the research sources.

In the event of duplicate publications, companion documents or multiple reports of a primary study, we maximized yield of information by collating all available data and use the most complete dataset aggregated across all known publications. In case of doubt the publication reporting the longest follow-up associated with our primary outcome was given priority. Authors of incomplete studies were contacted.

A standard data extraction was performed to collect the following information in each study: author, year of publication, country, study design, study period, sample size, type of surgery, assessment tools used in the diagnosis of BED, diagnostic criterion (DSM III, IV or 5), length of follow-up, and loss to follow-up. Baseline characteristics of the population such as gender distribution, age, presence of comorbidities, weight and BMI, and prevalence of BED were also extracted. Sample size, weight change from baseline, and prevalence of BED were extracted at different follow-up times for both BED and non-BED groups.

Statistical analysis

A meta-analysis was performed to assess the association of binge eating with postoperative weight loss. The mean difference was calculated using the random-effects model due to the important heterogeneity evaluated by the statistics I^2 and chi-squared test for homogeneity. I^2 value of 0% to 40% was defined as "might not be important", 30% to 60% may represent moderate heterogeneity, 50% to 90% may represent substantial heterogeneity, and 75% to 100% as considerable heterogeneity [21]. Transformation methods were used as suggested by the Cochrane Handbook for systematic reviews of interventions [21]. A p-value < 0.05 was considered statistically significant. All analyses were carried out using Review Manager version 5.3.5 (RevMan <http://ims.cochrane.org/revman/download>).

Risk-of-bias (quality) assessment

Once all searches had been completed, the included studies were assessed for quality using an adapted version of the NIH 'Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies' [22]. The overall quality of included studies was rated as good, fair or poor. Those studies without sample size justification, sufficient timeframe to see an effect, without different levels of the exposure and no repeated exposure assessment were considered as poor. The small number of studies included in the meta-analysis did not allow the use of funnel plots to assess the risk of publication bias.

Analysis of subgroups

Subgroup analyses were performed to explore possible sources of heterogeneity whenever possible, based on the following: 1) Follow-up period; 2) Type of bariatric procedures (because the pattern of weight loss is different between the methods); 3) Diagnostic criteria of BED; 4) Assessment tools used for BED.

RESULTS

A total of 4,513 manuscripts were initially identified. Only one study was identified by manual search from the reference list of the fully read articles. After removing duplicates, and the initial screening, 466 articles were assessed for full-text reading. At the end, 19 articles were considered for meta-analysis [23–41] (Figure 1).

Descriptive overview

A total of 3,223 subjects were included in this study. The total sample size ranged widely from 42 to 872, with a median of 188 individuals (80.25% women). Age of participants was 13–70 years (median 41 years). Of these, 2,007 underwent gastric bypass, 300 underwent sleeve gastrectomy, 279 underwent adjustable gastric banding and 75 underwent BioEnteric Intragastric Balloon. Six studies included a variety of procedures [23,24,26,27,30,38]. The mean BMI at baseline was 47.78 kg/m^2 (ranged from 42.02 to 54.80 kg/m^2). The follow-up time intervals ranged from 6 to 70 months, but only four studies evaluated over more than 24 months postoperatively (Table 1).

All the 19 included studies were published between 2004 and 2019 with data collected since 1996, comprising 15 prospective studies, 2 retrospective studies, and 2 longitudinal studies. Some studies had outcomes published at multiple time points across separate publications. Ten studies were based in the United States, three in Brazil, two in Australia, and one each in Italy, Spain, Switzerland, and Israel.

The studies were heterogeneous in relation to quality rating. Half of them had good quality and five studies were considered as poor. Some questions were well defined by most authors: (1) explicit research question; (2) study population; (3) inclusion and exclusion criteria; (4) exposure assessed prior to outcome measurement; (5) standard criteria for measurement; and (4) follow-up. Other parameters such as sample size justification and different levels of the exposure of interest were less frequently considered across studies (*Table S2*).

Weight loss at different follow up times

Nine of 19 studies evaluated postoperative weight loss at 6 months [23,28,29,31,32,35,37,39,41]. However, Díaz and collaborators [31] presented the data in median and range and Goldschmidt [23] in ΔBMI, so they were not included in this analysis. In seven studies (980 participants), no significant postoperative %EWL was found between BED and non-BED groups [mean difference of -1.95% (95% CI -4.30,0.40; I2 = 10%)] (Figure 2). When we analyzed only the participants undergoing gastric bypass (n = 605), the results remained non-significant (-1.60% (95% CI -5.19, 2.0), I2 = 36% - data not shown).

Another analysis was performed observing the ΔBMI at this follow up time; therefore, other studies were included (6 studies in all) [23,28,29,32,35,39] and no significant difference was found (987 subjects, -0.53% EWL (95%CI, -1.27, 0.22; I^2 = 90%) even when stratified by surgical procedure.

At one year postoperative, despite thirteen studies presenting data, only eight evaluated the weight loss in %EWL (1,206 subjects, 1.41% (95%CI, -5.05, 7.87; I^2 = 87%) [28,29,34,36–38,40,41] (Figure 3). When we analyzed only the six studies that included participants undergoing RYGB, the results remained non-significant.

Three studies evaluated at 24 months (310 participants) and at 36 months (150 participants) [29,37,41], but the findings at both follow up times were not significant and showed high heterogeneity. At 60 months, only two studies were evaluated and the results were also not significant (Table 2) [37,41].

Diagnostic criteria of BE and assessment tools

With regard to BED, the prevalence ranged from 9.5% [31] to 40.6% [41] (clinical plus subclinical) (Table 3). However, the authors used different definitions for the disorder. The Questionnaire on Eating and Weight Patterns, Structured Clinical Interview (SCID), and Binge Eating Scale were the most employed eating disorder tools. Besides that, some studies categorize the disorder into clinical and subclinical, such as current and/or past disorder. Only four studies classified BED according to DSM 5, and two of the studies were with the same population. All the other articles were based on DSM-IV. The frequency of BED after surgery was assessed only by Goldshmitt [23] (15.4% at baseline to 11.1% at 1 or more of the follow-up assessments) and Hayden [25] (4.7%, n = 7).

It was possible to analyze the effect of BED on weight loss by different assessment tools only at 6 and 12 months. Observing only four studies that included the gold standard approaches (SCID and psychological evaluation) as assessment tools, the non-BED groups lost a mean 3.12% more EWL at 6 months than BED patients (95% CI, -5.87, -

0.38) [29,32,35,39]. There was no significant heterogeneity (p = 0.70) (Table 4). No significant difference was found among those evaluated by BES and other questionnaires (0.51% (95% CI, -4.46, 5.49; I^2 = 30%) [28,37,41]. At 12 months, no significant differences were found between assessment tools.

DISCUSSION

In this systematic review and metanalysis with 3,223 bariatric patients of different countries, the findings between preoperative BED and weight loss after bariatric surgery were inconsistent across studies regardless of follow up time and concepts applied to BED. These data suggest that the presence of the disorder preoperatively did not indicate success or failure of bariatric surgery regarding weight loss.

The Swedish Obese Subjects (SOS) study showed that baseline eating behaviors did not generally predict weight changes among bariatric surgery patients at 10 years of follow up [86]. With regard to BED, a majority of studies indicate that presurgical BED is unrelated to weight loss after the surgery. Some factors could be explaining the lack of association, including the follow up time. However, even examining the weight loss at different, selected, follow up times, no significant differences were found. Furthermore, heterogeneity was high, except at 6 months after surgery. Long term results remain controversial due to the limited number of included studies and high heterogeneity.

Binge eating disorder has been recognized for more than 60 years, but the exact diagnostic of BED has changed over time [18]. DSM-IV, the most widely used diagnostic criteria, required two binge eating episodes per week in the preceding 6 months for diagnosis; DSM-5 uses one episode per week over the preceding 3 months [17,89]. The impact of this new, less restrictive criterion on the prevalence of BED is clear. In a sample of 94 patients seeking bariatric surgery, 35.1% were diagnosed as being affected by BED following the new DSM-5 criteria [90]. In the present study, we found a wide range in the prevalence of BED and only the Bariatric Surgery Program at the Hospital of the University of Pennsylvania [26,27] evaluated BED through DSM-5, showing the highest rates of the disorder (40% and 37.9%).

Considerable variation between BED assessment measures was also evident in the present study, confirming a previous report [91]. Gold standard approaches, such as the Eating Disorders Examination (EDE), and the SCID [91] were used by only 57.9% of authors. Diagnostic concordance between clinical interviews and QEWP-R was low in an Australian study with 405 bariatric candidates, highlighting limited reliability and validity measures in bariatric surgery candidates [92]. While validated questionnaires and interview schedules such as the QEWP-R and SCID are available for use in research and practice [93], other tools that use the same diagnostic criteria may yield differing results. Binge eating scale (BES) is another valid screener of BED [94], used by three authors in this review. Besides being developed prior to the proposed diagnostic criteria in the DSM, some authors use different cutoff points as criteria for BED: Billodre [40] and Friedman [41] used the cut-score of 17, and Alger-Meyer [37] used the cut-score of 27.

In addition to different diagnostic criteria and instruments for assessing compulsion, many terms have been used to describe problematic eating behavior such as "binge eating", "hyperphagia", "craving for food", "nibbling", "picking", "grazing", and "frequent snacking", which may misreport the presence of BED [95]. Sometimes BED is confused with *grazing*, present in 67.77% of participants with BED [96], and "characterized by the repetitive eating (more than twice) of small/modest amounts of food in an unplanned manner, with what we characterize as compulsive and noncompulsive subtypes" as declared by Conceição and colleagues [97]. Among another systematic reviews and metanalyse, Pizato (2017) supported an association between grazing behavior and weight regain after bariatric surgery (5 clinical trial and observational studies; $t = 6.6$, $p < 0.01$) [98]. For this reason, our literature search was broad, but only studies that used validated instruments for assessment of BED were included.

Another source of inconsistency could be the surgery type reported. Some authors have said that malabsorptive procedures would be more appropriate to patients with "loss of control" [99], but this cannot be sustained by the current evidence. Another line of investigation defends that weight loss depends more on the compliance to behavioral changes, than exclusively on the surgical technique [99]. Undoubtedly, the physical change imposed in bariatric patients influences the ability to consume large quantities of food as well as what types of food can be consumed, especially in the short term after the surgery, when weight loss is the most impactful [44]. Nevertheless, besides reducing the volume of the stomach and inducing earlier satiety, the full mechanisms involved in post-surgical weight loss are much more complex, involving hormonal decreasing the ghrelin, increasing PYY and leptin, inflammatory, central nervous system and gut microbial factors [100].

In terms of diagnostic stability after surgery, the evidence is relatively unclear. Among LABS-2 study, 4.8% reported de novo BED, 3.8% reported recurrent BED, and 9.2% reported remitted BED [9]. Therefore, the postsurgical BED may be more important in this population. Many studies have shown a considerably smaller weight loss in postoperative patients with binge eating [23]. Mauro and collaborators (2019) suggested a positive association between post-bariatric surgery eating psychology (grazing, LOC, BE) and weight regain ($OR = 2.2$, 95%CI 1.54 - 3.15) in another recent systematic review and metanalysis [101].

The strengths of this study are the systematic review protocol, which allows the identification of good quality studies and the inclusion of studies covering multiple forms of bariatric surgery and postsurgical follow-up, representing a good scope of the studies evaluated. However, some limitations should be noted. Only a small number of studies was included in each follow up time; the wide range of questionnaires, with varying quality, made comparison between different studies and procedures difficult. The studies did not evaluate the severity of the disorder. High heterogeneity observed in our meta-analyses is likely to reflect the low quality of the included studies. Moreover, it was not possible to describe the prevalence of binge eating in the post-surgery nor to perform the analysis of subgroups according to patient characteristics as planned in the protocol study due to the lack of data. We focused only on weight loss, but other outcomes such as rehospitalization rates, substance use, quality of life or social behaviors could differ in those with or without BED and deserve to be investigated.

CONCLUSIONS

In conclusion, the presence of pre-bariatric surgery BED seems to have little or no influence on weight loss after surgery. However, many questions remain unanswered in long-term outcomes. Study heterogeneity accounted for the variability of the results from different assessments, highlighting the importance of standardizing instruments for the accuracy and comparability of the findings in future studies.

Acknowledgements

NLK wrote the protocol and designed the study. NLK and RF conducted literature searches, study selection, designed the method, and quality appraisal. MAV, ERF, and MF contributed to literature searches and quality appraisal. All authors contributed to and have approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Funding

None.

References

[1] Maggard MA, Shugarman LR, Suttorp M, Maglione M, Sugerman HJ, Sugarman HJ, et al. Meta-analysis: surgical treatment of obesity. Ann Intern Med 2005;142:547–59.

[2] Shantavasinkul PC, Omotosho P, Corsino L, Portenier D, Torquati A. Predictors of weight regain in patients who underwent Roux-en-Y gastric bypass surgery. Surg Obes Relat Dis 2016;12:1640–5. https://doi.org/10.1016/j.soard.2016.08.028.

[3] Amundsen T, Strømmen M, Martins C. Suboptimal Weight Loss and Weight Regain after Gastric Bypass Surgery—Postoperative Status of Energy Intake, Eating Behavior, Physical Activity, and Psychometrics. Obes Surg 2017;27:1316–23. https://doi.org/10.1007/s11695-016-2475-7.

[4] Goldschmidt AB, Conceição EM, Thomas JG, Mitchell JE, Raynor HA, Bond DS. Conceptualizing and studying binge and loss of control eating in bariatric surgery patients-time for a paradigm shift? Surg Obes Relat Dis Off J Am Soc Bariatr Surg 2016;12:1622–5. https://doi.org/10.1016/j.soard.2016.09.008.

[5] Duarte-Guerra LS, Coêlho BM, Santo MA, Lotufo-Neto F, Wang Y-P. Morbidity persistence and comorbidity of mood, anxiety, and eating disorders among preoperative bariatric patients. Psychiatry Res 2017;257:1–6. https://doi.org/10.1016/j.psychres.2017.07.020.

[6] Dawes AJ, Maggard-Gibbons M, Maher AR, Booth MJ, Miake-Lye I, Beroes JM, et al. Mental Health Conditions Among Patients Seeking and Undergoing Bariatric Surgery: A Meta-analysis. JAMA 2016;315:150–63. https://doi.org/10.1001/jama.2015.18118.

[7] Busetto L, Dicker D, Azran C, Batterham RL, Farpour-Lambert N, Fried M, et al. Practical Recommendations of the Obesity Management Task Force of the European Association for the Study of Obesity for the Post-Bariatric Surgery Medical Management. Obes Facts 2017;10:597–632. https://doi.org/10.1159/000481825.

[8] Livhits M, Mercado C, Yermilov I, Parikh JA, Dutson E, Mehran A, et al. Preoperative predictors of weight loss following bariatric surgery: systematic review. Obes Surg 201200;22.

[9] Smith K.E., Orcutt M., Steffen K.J., Crosby R.D., Cao L., Garcia L., et al. Loss of Control Eating and Binge Eating in the 7 Years Following Bariatric Surgery. Obes Surg 2019;29:1773–80. https://doi.org/10.1007/s11695-019-03791-x.

[10] Parker K, Brennan L. Measurement of disordered eating in bariatric surgery candidates: a systematic review of the literature. Obes Res Clin Pract 2015;9:12–25. https://doi.org/10.1016/j.orcp.2014.01.005.

[11] Marek R.J., Ben-Porath Y.S., Dulmen M.H.M.V., Ashton K., Heinberg L.J. Using the presurgical psychological evaluation to predict 5-year weight loss outcomes in bariatric surgery patients. Surg Obes Relat Dis 2017;13:514–21. https://doi.org/10.1016/j.soard.2016.11.008.

[12] Legenbauer T, Petrak F, de Zwaan M, Herpertz S. Influence of depressive and eating disorders on short- and long-term course of weight after surgical and nonsurgical weight loss treatment. Compr Psychiatry 2011;52:301–11. https://doi.org/10.1016/j.comppsych.2010.06.012.

[13] de Man Lapidoth J, Ghaderi A, Norring C. Binge eating in surgical weight-loss treatments. Long-term associations with weight loss, health related quality of life (HRQL), and psychopathology. Eat Weight Disord 2011;16:e263-9.

[14] Pinto-Bastos A, de Lourdes M, Brandao I, Machado PPP, Conceicao EM. Weight loss trajectories and psychobehavioral predictors of outcome of primary and reoperative bariatric surgery: a 2-year longitudinal study. Surg Obes Relat Dis Off J Am Soc Bariatr Surg 2019. https://doi.org/10.1016/j.soard.2019.04.018.

[15] Castellini G, Godini L, Amedei SG, Faravelli C, Lucchese M, Ricca V. Psychological effects and outcome predictors of three bariatric surgery interventions: a 1-year follow-up study. Eat Weight Disord EWD 2014;19:217–24. https://doi.org/10.1007/s40519-014-0123-6.

[16] Järvholm K, Bruze G, Peltonen M, Marcus C, Flodmark C-E, Henfridsson P, et al. 5-year mental health and eating pattern outcomes following bariatric surgery in adolescents: a prospective cohort study. Lancet Child Adolesc Health 2020;4:210–9. https://doi.org/10.1016/S2352-4642(20)30024-9.

[17] American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th ed. American Psychiatric Association; 2013. https://doi.org/10.1176/appi.books.9780890425596.

[18] Galmiche M, Déchelotte P, Lambert G, Tavolacci MP. Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. Am J Clin Nutr 2019;109:1402–13. https://doi.org/10.1093/ajcn/nqy342.

[19] Higgins JPT, Thomas J (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 6.0 (updated August 2019). The Cochrane Collaboration, 2019. Available from www.handbook.cochrane.org. 2020. www.handbook.cochrane.org. (accessed January 12, 2020).

[20] Brethauer SA, Kim J, el Chaar M, Papasavas P, Eisenberg D, Rogers A, et al. Standardized outcomes reporting in metabolic and bariatric surgery. Surg Obes Relat Dis Off J Am Soc Bariatr Surg 2015;11:489–506. https://doi.org/10.1016/j.soard.2015.02.003.

[21] Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.handbook.cochrane.org. n.d. www.handbook.cochrane.org. (accessed May 18, 2019).

[22] NIH NIoH. Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies 2014.

[23] Goldschmidt AB, Khoury J, Jenkins TM, Bond DS, Thomas JG, Utzinger LM, et al. Adolescent Loss-of-Control Eating and Weight Loss Maintenance After Bariatric Surgery. Pediatrics 2018;141. https://doi.org/10.1542/peds.2017-1659.

[24] Lavender JM, Alosco ML, Spitznagel MB, Strain G, Devlin M, Cohen R, et al. Association between binge eating disorder and changes in cognitive functioning following bariatric surgery. J Psychiatr Res 2014;59:148–54.

[25] Hayden M.J., Murphy K.D., Brown W.A., O'Brien P.E. Axis I disorders in adjustable gastric band patients: The relationship between psychopathology and weight loss. Obes Surg 2014;24:1469–75. https://doi.org/10.1007/s11695-014-1207-0.

[26] Wadden T.A., Faulconbridge L.F., Jones-Corneille L.R., Sarwer D.B., Fabricatore A.N., Thomas J.G., et al. Binge eating disorder and the outcome of bariatric surgery at one year: A prospective, observational study. Obesity 2011;19:1220–8. https://doi.org/10.1038/oby.2010.336.

[27] Chao A.M., Wadden T.A., Faulconbridge L.F., Sarwer D.B., Webb V.L., Shaw J.A., et al. Binge-eating disorder and the outcome of bariatric surgery in a prospective, observational study: Two-year results. Obesity 2016;24:2327–33. https://doi.org/10.1002/oby.21648.

[28] Susmallian S., Raziel A., Nikiforova I., Dagan S.S., Hershkovitz-Rokah O., Barnea R. Do pre-surgery eating habits affect weight loss one year following a sleeve gastrectomy? Clin Nutr ESPEN 2017;19:64–9. https://doi.org/10.1016/j.clnesp.2017.02.002.

[29] Sallet PC, Sallet JA, Dixon JB, Collis E, Pisani CE, Levy A, et al. Eating behavior as a prognostic factor for weight loss after gastric bypass. Obes Surg 2007;17:445–51. https://doi.org/10.1007/s11695-007-9077-3.

[30] Bonnefond A, Keller R, Meyre D, Stutzmann F, Thuillier D, Stefanov DG, et al. Eating Behavior, Low-Frequency Functional Mutations in the Melanocortin-4 Receptor (MC4R) Gene, and Outcomes of Bariatric Operations: A 6-Year Prospective Study. Diabetes Care 2016;39:1384–92.

[31] Garcia Diaz E, Jerez Arzola ME, Martin Folgueras T, Morcillo Herrera L, Jimenez Sosa A. Effect of binge eating disorder on the outcomes of laparoscopic gastric bypass in the treatment of morbid obesity. Nutr Hosp 2013;28:618–22. https://doi.org/10.3305/nh.2013.28.3.6251.

[32] Gorin A.A., Raftopoulos I. Effect of mood and eating disorders on the short-term outcome of laparoscopic roux-en-Y gastric bypass. Obes Surg 2009;19:1685–90. https://doi.org/10.1007/s11695-008-9685-6.

[33] Fujioka K., Yan E., Wang H.-J., Li Z. Evaluating preoperative weight loss, binge eating disorder, and sexual abuse history on Roux-en-Y gastric bypass outcome. Surg Obes Relat Dis 2008;4:137–43. https://doi.org/10.1016/j.soard.2008.01.005.

[34] Colles SL, Dixon JB, O'Brien PE. Grazing and loss of control related to eating: two high-risk factors following bariatric surgery. Obes Silver Spring 2008;16:615–22.

[35] Puglisi F., Antonucci N., Capuano P., Zavoianni L., Lobascio P., Martines G., et al. Intragastric balloon and binge eating. Obes Surg 2007;17:504–9. https://doi.org/10.1007/s11695-007-9088-0.

[36] Bocchieri-Ricciardi LE, Chen EY, Munoz D, Fischer S, Dymek-Valentine M, Alverdy JC, et al. Pre-surgery binge eating status: effect on eating behavior and weight outcome after

gastric bypass. Obes Surg 2006;16:1198–204. https://doi.org/10.1381/096089206778392194.

[37] Alger-Mayer S., Rosati C., Polimeni J.M., Malone M. Preoperative binge eating status and gastric bypass surgery: A long-term outcome study. Obes Surg 2009;19:139–45. https://doi.org/10.1007/s11695-008-9540-9.

[38] Miller-Matero L.R., Bryce K., Saulino C.K., Dykhuis K.E., Genaw J., Carlin A.M. Problematic eating behaviors predict outcomes after bariatric surgery. Obes Surg 2018;28:1910–5. https://doi.org/10.1007/s11695-018-3124-0.

[39] Green AE-C, Dymek-Valentine M, Pytluk S, Le Grange D, Alverdy J. Psychosocial outcome of gastric bypass surgery for patients with and without binge eating. Obes Surg 2004;14:975–85. https://doi.org/10.1381/0960892041719590.

[40] Luiz LB, Brito CL de S, Debon LM, Brandalise LN, Azevedo JT de, Monbach KD, et al. Variation of Binge Eating One Year after Roux-en-Y Gastric Bypass and Its Relationship with Excess Weight Loss. PloS One 2016;11:e0167577. https://doi.org/10.1371/journal.pone.0167577.

[41] Friedman R, Vivan M, Kops N. SAT-119 Effect of Binge Eating Diagnosed Prior to Bariatric Surgery on Weight Loss up to 2 Years after Surgery. J Endocr Soc 2019;3. https://doi.org/10.1210/js.2019-SAT-119.

[42] Bakr AA, Fahmy MH, Elward AS, Balamoun HA, Ibrahim MY, Eldahdoh RM. Analysis of Medium-Term Weight Regain 5 Years After Laparoscopic Sleeve Gastrectomy. Obes Surg 2019. https://doi.org/10.1007/s11695-019-04009-w.

[43] Livhits M., Mercado C., Yermilov I., Parikh J.A., Dutson E., Mehran A., et al. Behavioral factors associated with successful weight loss after gastric bypass. Am Surg 2010;76:1139–42.

[44] Subramaniam K, Low W-Y, Lau P-C, Chin K-F, Chinna K, Kosai NR, et al. Eating Behaviour Predicts Weight Loss Six Months after Bariatric Surgery: A Longitudinal Study. Nutrients 2018;10. https://doi.org/10.3390/nu10111616.

[45] Hsu LK, Sullivan SP, Benotti PN. Eating disturbances and outcome of gastric bypass surgery: a pilot study. Int J Eat Disord 1997;21:385–90.

[46] Novelli I.R., Fonseca L.G., Gomes D.L., Dutra E.S., Baiocchi de Carvalho K.M. Emotional eating behavior hinders body weight loss in women after Roux-en-Y gastric bypass surgery. Nutrition 2018;49:13–6. https://doi.org/10.1016/j.nut.2017.11.017.

[47] Brunault P., Jacobi D., Miknius V., Bourbao-Tournois C., Huten N., Gaillard P., et al. High Preoperative Depression, Phobic Anxiety, and Binge Eating Scores and Low Medium-Term Weight Loss in Sleeve Gastrectomy Obese Patients: A Preliminary Cohort Study. Psychosomatics 2012;53:363–70. https://doi.org/10.1016/j.psym.2011.12.008.

[48] Kofman M.D., Lent M.R., Swencionis C. Maladaptive eating patterns, quality of life, and weight outcomes following gastric bypass: Results of an internet survey. Obesity 2010;18:1938–43. https://doi.org/10.1038/oby.2010.27.

[49] Livhits M., Mercado C., Yermilov I., Parikh J.A., Dutson E., Mehran A., et al. Patient behaviors associated with weight regain after laparoscopic gastric bypass. Obes Res Clin Pract 2011;5:e258–65. https://doi.org/10.1016/j.orcp.2011.03.004.

[50] Crowley N, Budak A, Byrne TK, Thomas S. Patients who endorse more binge eating triggers before gastric bypass lose less weight at 6 months. Surg Obes Relat Dis Off J Am Soc Bariatr Surg 2011;7:55–9. https://doi.org/10.1016/j.soard.2010.10.016.

[51] Guisado Macias JA, Vaz Leal FJ. Psychopathological differences between morbidly obese binge eaters and non-binge eaters after bariatric surgery. Eat Weight Disord EWD 2003;8:315–8.

[52] Mack I., Ölschläger S., Sauer H., von Feilitzsch M., Weimer K., Junne F., et al. Does Laparoscopic Sleeve Gastrectomy Improve Depression, Stress and Eating Behaviour? A 4-Year Follow-up Study. Obes Surg 2016;26:2967–73. https://doi.org/10.1007/s11695-016-2219-8.

[53] Boan J, Kolotkin RL, Westman EC, McMahon RL, Grant JP. Binge eating, quality of life and physical activity improve after Roux-en-Y gastric bypass for morbid obesity. Obes Surg 2004;14:341–8. https://doi.org/10.1381/096089204322917864.

[54] Latner JD, Wetzler S, Goodman ER, Glinski J. Gastric bypass in a low-income, inner-city population: eating disturbances and weight loss. Obes Res 2004;12:956–61. https://doi.org/10.1038/oby.2004.117.

[55] Toussi R, Fujioka K, Coleman KJ. Pre- and postsurgery behavioral compliance, patient health, and postbariatric surgical weight loss. Obes Silver Spring Md 2009;17:996–1002. https://doi.org/10.1038/oby.2008.628.

[56] Brandão I., Ramalho S., Pinto-Bastos A., Arrojado F., Faria G., Calhau C., et al. Metabolic profile and psychological variables after bariatric surgery: association with weight outcomes. Eat Weight Disord 2015;20:513–8. https://doi.org/10.1007/s40519-015-0199-7.

[57] van Hout GCM, Jakimowicz JJ, Fortuin FAM, Pelle AJM, van Heck GL. Weight loss and eating behavior following vertical banded gastroplasty. Obes Surg 2007;17:1226–34.

[58] White M.A., Kalarchian M.A., Masheb R.M., Marcus M.D., Grilo C.M. Loss of control over eating predicts outcomes in bariatric surgery patients: A prospective, 24-month follow-up study. J Clin Psychiatry 2010;71:175–84. https://doi.org/10.4088/JCP.08m04328blu.

[59] Fielding A.A., Warren-Forward H., Baines S.K. A snapshot of eating behavior, food tolerance, and dietary intake after laparoscopic adjustable gastric banding. Bariatr Surg Patient Care 2013;8:99–107. https://doi.org/10.1089/bari.2013.9979.

[60] Vanoh D., Shahar S., Mahmood N.R. Association between nutrient adequacy and psychosocial factors with overall rate of weight loss after bariatric surgery. Asia Pac J Clin Nutr 2015;24:610–9. https://doi.org/10.6133/apjcn.2015.24.4.11.

[61] Nasirzadeh Y., Kantarovich K., Wnuk S., Okrainec A., Cassin S.E., Hawa R., et al. Binge eating, loss of control over eating, emotional eating, and night eating after bariatric surgery: Results from the Toronto Bari-PSYCH cohort study. Obes Surg 2018;28:2032–9. https://doi.org/10.1007/s11695-018-3137-8.

[62] Sellberg F, Ghaderi A, Willmer M, Tynelius P, Berglind D. Change in Children's Self-Concept, Body-Esteem, and Eating Attitudes Before and 4 Years After Maternal RYGB. Obes Surg 2018;28:3276–83. https://doi.org/10.1007/s11695-018-3348-z.

[63] De Panfilis C, Cero S, Torre M, Salvatore P, Dall'Aglio E, Adorni A, et al. Changes in body image disturbance in morbidly obese patients 1 year after laparoscopic adjustable gastric banding. Obes Surg 2007;17:792–9.

[64] Figura A., Rose M., Ordemann J., Klapp B.F., Ahnis A. Changes in self-reported eating patterns after laparoscopic sleeve gastrectomy: a pre-post analysis and comparison with conservatively treated patients with obesity. Surg Obes Relat Dis 2017;13:129–37. https://doi.org/10.1016/j.soard.2016.08.003.

[65] Fox B, Chen E, Suzo A, Jolles S, Greenberg JA, Campos GM, et al. Dietary and psych predictors of weight loss after gastric bypass. J Surg Res 2015;197:283–90. https://doi.org/10.1016/j.jss.2015.04.019.

[66] Rowston W.M., McCluskey S.E., Gazet J.-C., Lacey J.H., Franks G., Lynch D. Eating behaviour, physical symptoms and psychological factors associated with weight reduction following the Scopinaro operation as modified by Gazet. Obes Surg 1992;2:355–60. https://doi.org/10.1381/096089292765559954.

[67] George Hsu L.K., Betancourt S., Sullivan S.P. Eating disturbances before and after vertical banded gastroplasty: A pilot study. Int J Eat Disord 1996;19:23–34. https://doi.org/10.1002/(SICI)1098-108X(199601)19:1<23::AID-EAT4>3.0.CO;2-Y.

[68] Powers PS, Perez A, Boyd F, Rosemurgy A. Eating pathology before and after bariatric surgery: a prospective study. Int J Eat Disord 1999;25:293–300.

[69] Wolfe B.L., Terry M.L. Expectations and outcomes with gastric bypass surgery. Obes Surg 2006;16:1622–9. https://doi.org/10.1381/096089206779319473.

[70] Wood K.V., Ogden J. Explaining the role of binge eating behaviour in weight loss post bariatric surgery. Appetite 2012;59:177–80. https://doi.org/10.1016/j.appet.2012.04.019.

[71] Jirapinyo P., Dayyeh B.K.A., Thompson C.C. Gastrojejunal anastomotic reduction for weight regain in roux-en-y gastric bypass patients: physiological, behavioral, and anatomical effects of endoscopic suturing and sclerotherapy. Surg Obes Relat Dis 2016;12:1810–6. https://doi.org/10.1016/j.soard.2016.09.036.

[72] Ames G.E., Heckman M.G., Diehl N.N., Shepherd D.M., Holgerson A.A., Grothe K.B., et al. Guiding Patients Toward the Appropriate Surgical Treatment for Obesity: Should Presurgery Psychological Correlates Influence Choice Between Roux-en-Y Gastric Bypass and Vertical Sleeve Gastrectomy? Obes Surg 2017;27:2759–67. https://doi.org/10.1007/s11695-017-2876-2.

[73] Sioka E., Tzovaras G., Oikonomou K., Katsogridaki G., Zachari E., Papamargaritis D., et al. Influence of eating profile on the outcome of laparoscopic sleeve Gastrectomy. Obes Surg 2013;23:501–8. https://doi.org/10.1007/s11695-012-0831-9.

[74] Sabbioni M.E.E., Dickson M.H., Eychmüller S., Franke D., Goetz S., Hürny C., et al. Intermediate results of health related quality of life after vertical banded gastroplasty. Int J Obes 2002;26:277–80. https://doi.org/10.1038/sj/ijo/0801879.

[75] Pekkarinen T, Mustonen H, Sane T, Jaser N, Juuti A, Leivonen M. Long-Term Effect of Gastric Bypass and Sleeve Gastrectomy on Severe Obesity: Do Preoperative Weight Loss and Binge Eating Behavior Predict the Outcome of Bariatric Surgery? Obes Surg 2016;26:2161–7. https://doi.org/10.1007/s11695-016-2090-7.

[76] Holsen L.M., Davidson P., Cerit H., Hye T., Moondra P., Haimovici F., et al. Neural predictors of 12-month weight loss outcomes following bariatric surgery. Int J Obes 2018;42:785–93. https://doi.org/10.1038/ijo.2017.190.

[77] Buddeberg-Fischer B, Klaghofer R, Krug L, Buddeberg C, Muller MK, Schoeb O, et al. Physical and psychosocial outcome in morbidly obese patients with and without bariatric surgery: a 4 1/2-year follow-up. Obes Surg 2006;16:321–30. https://doi.org/10.1381/096089206776116471.

[78] Abu Dayyeh B.K., Jirapinyo P., Thompson C.C. Plasma Ghrelin Levels and Weight Regain After Roux-en-Y Gastric Bypass Surgery. Obes Surg 2017;27:1031–6. https://doi.org/10.1007/s11695-016-2418-3.

[79] Conceição E., Teixeira F., Rodrigues T., de LOURDES M., Bastos A.P., Vaz A., et al. Problematic eating behaviors after bariatric surgery: A national study with a Portuguese sample. Acta Med Port 2018;31:633–40. https://doi.org/10.20344/amp.9237.

[80] Miras A.D., Al-Najim W., Jackson S.N., McGirr J., Cotter L., Tharakan G., et al. Psychological characteristics, eating behavior, and quality of life assessment of obese patients undergoing weight loss interventions. Scand J Surg SJS Off Organ Finn Surg Soc Scand Surg Soc 2015;104:10–7. https://doi.org/10.1177/1457496914543977.

[81] Fuentes M., Gabler G., Koppmann A., Montane I., Feeder S. Relation between the presence of obesogenic behaviors and the outcome of bariatric surgery. Eur Neuropsychopharmacol 2015;25:S657–8.

[82] Bryant E.J., King N.A., Falkén Y., Hellström P.M., Juul Holst J., Blundell J.E., et al. Relationships among tonic and episodic aspects of motivation to eat, gut peptides, and weight before and after bariatric surgery. Surg Obes Relat Dis 2013;9:802–8. https://doi.org/10.1016/j.soard.2012.09.011.

[83] Bardal A.G., Ceccatto V., Mezzomo T.R. Risk factors for weight regain in the late postoperative of bariatric surgery. Sci Medica 2016;26:1–7. https://doi.org/10.15448/1980-6108.2016.4.24224.

[84] Morseth MS, Hanvold SE, Ro O, Risstad H, Mala T, Benth JS, et al. Self-Reported Eating Disorder Symptoms Before and After Gastric Bypass and Duodenal Switch for Super Obesity--a 5-Year Follow-Up Study. Obes Surg 2016;26:588–94. https://doi.org/10.1007/s11695-015-1790-8.

[85] Busetto L, Segato G, De Luca M, De Marchi F, Foletto M, Vianello M, et al. Weight loss and postoperative complications in morbidly obese patients with binge eating disorder treated by laparoscopic adjustable gastric banding. Obes Surg 2005;15:195–201. https://doi.org/10.1381/0960892053268327.

[86] Konttinen H., Peltonen M., Sjöström L., Carlsson L., Karlsson J. Psychological aspects of eating behavior as predictors of 10-y weight changes after surgical and conventional treatment of severe obesity: Results from the Swedish obese subjects intervention study. Am J Clin Nutr 2015;101:16–24. https://doi.org/10.3945/ajcn.114.095182.

[87] de Zwaan M., Hilbert A., Swan-Kremeier L., Simonich H., Lancaster K., Howell L.M., et al. Comprehensive interview assessment of eating behavior 18-35 months after gastric bypass surgery for morbid obesity. Surg Obes Relat Dis 2010;6:79–85. https://doi.org/10.1016/j.soard.2009.08.011.

[88] Kinzl J.F., Schrattenecker M., Traweger C., Mattesich M., Fiala M., Biebl W. Psychosocial predictors of weight loss after bariatric surgery. Obes Surg 2006;16:1609–14. https://doi.org/10.1381/096089206779319301.

[89] American Psychiatric Association. Diagnostic and Statistical Manual of mental Misorders. 4th ed. Washington (DC): American Psychiatric Association; 1994.

[90] Vinai P, Da Ros A, Cardetti S, Casey H, Studt S, Gentile N, et al. The DSM-5 effect: psychological characteristics of new patients affected by Binge Eating Disorder following the criteria of the DSM-5 in a sample of severe obese patients. Eat Weight Disord EWD 2016;21:107–13. https://doi.org/10.1007/s40519-015-0218-8.

[91] Tess BH, Maximiano-Ferreira L, Pajecki D, Wang Y-P. BARIATRIC SURGERY AND BINGE EATING DISORDER: SHOULD SURGEONS CARE ABOUT IT? A LITERATURE REVIEW OF PREVALENCE AND ASSESSMENT TOOLS. Arq Gastroenterol 2019;56:55–60. https://doi.org/10.1590/s0004-2803.201900000-10.

[92] Parker K, Mitchell S, O'Brien P, Brennan L. Psychometric Evaluation of Disordered Eating Measures in Bariatric Surgery Candidates. Obes Surg 2016;26:563–75. https://doi.org/10.1007/s11695-015-1780-x.

[93] Borges MBF, Morgan CM, Claudino AM, Silveira DX da. Validation of the portuguese version of the Questionnaire on Eating and Weight Patterns: revised (QEWP-R) for the screening of binge eating disorder. Rev Bras Psiquiatr 2005;27:319–22. https://doi.org/10.1590/S1516-44462005000400012.

[94] Grupski A E, Hood MM, Hall BJ, Azarbad L, Corsica J. Utility of the Binge Eating Scale in Screening for Binge Eating Disorder with Bariatric Surgery Candidates. Obes Surg 2013;23:1–6. https://doi.org/10.1007/s11695-011-0537-4.

[95] Conceição E, Mitchell JE, Vaz AR, Bastos AP, Ramalho S, Silva C, et al. The presence of maladaptive eating behaviors after bariatric surgery in a cross sectional study: importance of picking or nibbling on weight regain. Eat Behav 2014;15:558–62. https://doi.org/10.1016/j.eatbeh.2014.08.010.

[96] Heriseanu A.I., Hay P., Corbit L., Touyz S. Grazing in adults with obesity and eating disorders: A systematic review of associated clinical features and meta-analysis of prevalence. Clin Psychol Rev 2017;58:16–32. https://doi.org/10.1016/j.cpr.2017.09.004.

[97] Conceição E.M., Mitchell J.E., Engel S.G., Machado P.P.P., Lancaster K., Wonderlich S.A. What is "grazing"? Reviewing its definition, frequency, clinical characteristics, and impact on bariatric surgery outcomes, and proposing a standardized definition. Surg Obes Relat Dis 2014;10:973–82. https://doi.org/10.1016/j.soard.2014.05.002.

[98] Pizato N, Botelho PB, Gonçalves VSS, Dutra ES, de Carvalho KMB. Effect of Grazing Behavior on Weight Regain Post-Bariatric Surgery: A Systematic Review. Nutrients 2017;9. https://doi.org/10.3390/nu9121322.

[99] Silva A.C.D., Tan H.L., Norkute S. The Impact of Preoperative Eating Patterns on Weight Loss Outcomes after Different Types of Bariatric Surgery. Bariatr Surg Pract Patient Care 2018;13:75–9. https://doi.org/10.1089/bari.2018.0008.

[100] Burton P.R., Brown W.A. The mechanism of weight loss with laparoscopic adjustable gastric banding: Induction of satiety not restriction. Int J Obes 2011;35:S26–30. https://doi.org/10.1038/ijo.2011.144.

[101] Mauro MFFP, Papelbaum M, Brasil MAA, Carneiro JRI, Coutinho ESF, Coutinho W, et al. Is weight regain after bariatric surgery associated with psychiatric comorbidity? A systematic review and meta-analysis. Obes Rev 2019;20:1413–25. https://doi.org/10.1111/obr.12907.

Table 1. Characteristics of the included studies.

First author, year of publication	Location	Bariatric procedure	Time (months)	Sample size	Women (%)	Follow up (%)	Mean age (SD)	Mean BMI (SD)	Study quality rating
Alger-Mayer, 2008	EUA	Bypass	6, 12, 24, 36, 48, 60, 72	157	86.0	100-20 (at 72 months)	45 (10)	50.7 (8.0)	Good
Billodre, 2016	Brazil	Bypass	12	132	79.5	88.6	38.3 (10.1)	48.3 (7.9)	Fair
Bocchieri-Ricciardi, 2006[c]	EUA	Bypass	≈ 18	72	79.2	-	41.2 (9.5)	54 (9.3)	Poor
Bonnefond, 2016	Switzerland	628 LAGB, 173 bypass, 71 hybrid operation	72	872	77.5	67.0	42.0 (11)	44.7 (6.5)	Good
Chao, 2016[b]	EUA	Bypass, LAGB	24	92	79.3	60.2	-	49.4	Good
Colles, 2008[a]	Australia	LAGB	12	129	79.8	71.7	45.2 (11.5)	44.3 (6.8)	Good
Díaz, 2013	Spain	Bypass	6, 12, 24	42	71.4	93.3	40.0 (11)	44.4 (4.6)	Fair
Friedman, 2019	Brazil	Bypass	6, 12, 24, 36, 60	106	88.7	-	43.1 (11)	48.2 (7.2)	Fair
Fujioka, 2008	EUA	Bypass	12, 24	121	83.5	97.5	48.0		Good
Goldschmidt, 2018	EUA (Teen-LABS)	159 bypass, 63 VSG, 12 LAGB	6, 12, 24, 36, 48	234	75.6	79.5-87.2	17.1 (1.6)	51	Good
Gorin, 2008	EUA	Bypass	6	196	83.2	-	43.6 (10.9)	47.2 (7.4)	Poor
Green, 2004[c]	EUA	Bypass	6	65	74.8	90.8	39.3 (9.9)	54.8 (10.1)	Poor
Hayden, 2014[a]	Australia	LAGB	24	150	82.4	74.0	45.2 (11.5)	42.7 (6.1)	Good
Lavender, 2014	EUA (LABS)	67 bypass, 1 gastric banding	12	68	89.7	51.6	42.9 (10.7)	46.5 (6.1)	Fair
Miller-Matero, 2018	EUA	30 bypass, 71 SG	12	101	82.2	74.0	46 (11.8)	49.3 (8.0)	Poor
Sallet, 2007	Brazil	Bypass	6, 12, 24, 36	216	82.4	66.7	36.3 (9.6)	45.9 (6.0)	Fair
Susmallian, 2017	Israel	SG	6, 12	300	66.7	-	41.6 (11.0)	42.0	Good
Puglisi, 2007	Italy	BioEnteric Intragastric Balloon	6	75	84.0	84.3	39.5 (8.2)	BE: 44.7 (5.8), non-BE: 47.6 (7.3)	Poor
Wadden, 2011[b]	EUA	Bypass, LAGB	12	95	78.9	62.9	BE: 47.0 (1.6) non-BE: 43.8 (1.3)	BE: 48.9 (1.1) non-BE: 49.5 (1.0)	Good

[a,b,c] Same population. BE: Binge eating; BMI; Body Mass Index; EUA, United States; LAGB, Laparoscopic Adjustable Gastric Banding; SG, Sleeve Gastrectomy; VBG, Vertical Banded Gastroplasty.

Table 2. Meta-analyses of postoperative weight loss for preoperative binge eating and non-binge eating groups at different follow up times.

Follow up (months)	No. of studies	No. of subjects	Mean difference Random, 95% CI	P effect	I^2	Q statistic	P heterogeneity
24	3 [29,37,41]	310	-0.71 (-14.7, 13.27)	0.92	90%	20.66	<0.001
36	3 [29,37,41]	150	3.10 (-6.36, 12.57)	0.52	70%	6.58	0.04
60	2 [37,41]	71	-2.64 (-11.11, 5.83)	0.54	13%	1.15	0.28

I^2: Heterogeneity; Q statistic: chi-square statistic.

Table 3. Diagnostic criteria of BE and assessment tools in the included studies.

First author, year of publication	Method of assessment	Diagnostic criteria	Sample size	Baseline BED (%)	Stage of life
Bocchieri-Ricciardi, 2006[c]	QEWP-R	DSM-IV	72	23.6 clinical 9.7 subclinical	-
Chao, 2016[b]	QEWP, EDE	DSM-5	92	40.0	Current
Díaz, 2013	QEWP-R	DSM-IV	42	9.5 clinical, 11.9 subclinical	Current
Goldschmidt, 2018	QEWP-R	DSM-IV	234	15.4	Current
Green, 2004[c]	QEWP-R	DSM-IV	65	26.2 clinical 24.6 subclinical	Current
Wadden, 2011[b]	QEWP, EDE	DSM-5	95	37.9	Current
Colles, 2008[a]	SCID	DSM-IV	129	14.0	Current
Hayden, 2014[a]	SCID	DSM-IV	150	13.7	Current and Lifetime
Lavender, 2014	SCID	DSM-IV	68	29.4	Lifetime
Puglisi, 2007	SCID, ED-SCID, BSQ	DSM-IV	75	20.0 clinical 16.0 subclinical	-
Sallet, 2007	SCID	DSM-IV	216	20.4 clinical 59.7 subclinical	Current
Bonnefond, 2016	Spitzer's eating disorder questionnaire and semistructured interviews	DSM-5	872	27.2	-
Fujioka, 2008	Questionnaire	DSM-IV	121	38	Current and Lifetime
Gorin, 2008	Psychological evaluation	DSM-IV	196	36.7	Current and past
Miller-Matero, 2018	Semistructured interviews	DSM-IV	101	10.6 history, 4.9 current	Current and Lifetime
Susmallian, 2017	Questionnaire	DSM-5	300	14.0	-
Alger-Mayer, 2008	BES	-	157	23.6	
Billodre, 2016	BES	-	132	29.5	Current
Friedman, 2019	BES	-	106	40.6	Current

[a,b,c] Same population. BES: Binge Eating Scale; BSQ, Body Shape Questionnaire; EDE, Eating Disorder Examination; QEWP-R, Questionnaire on Eating and Weight Patterns Revised; SCID: Structured Clinical Interview for DSM disorders;

Table 4. Meta-analyses of postoperative weight loss for preoperative binge eating evaluated by different method of assessment

Subgroups	No. of studies	No. of subjects	Mean difference Random, 95% CI	P heterog	I^2	Q statistic	P effect
6 months							
SCID/QEWP	4[29,32,35,39]	459	-3.12 (-5.87, -0.38)	0.70	0%	1.43	0.03
BES/other	3[28,37,41]	531	0.51 (-4.46, 5.49)	0.19	39%	3.30	0.84
12 months							
SCID/QEWP	2[29,34,36]	374	-2.04 (-9.75, 5.66)	0.22	34%	3.02	0.60
BES/other	5[28,37,38,40,41]	832	2.62 (-5.76, 11.00)	< 0.01	92%	47.10	0.54

BES: Binge Eating Scale; I^2: Heterogeneity; Q statistic: chi-square statistic; QEWP, Questionnaire on Eating and Weight Patterns; SCID: Structured Clinical Interview for DSM disorders.

Figure 1. PRISMA flowchart of studies included.

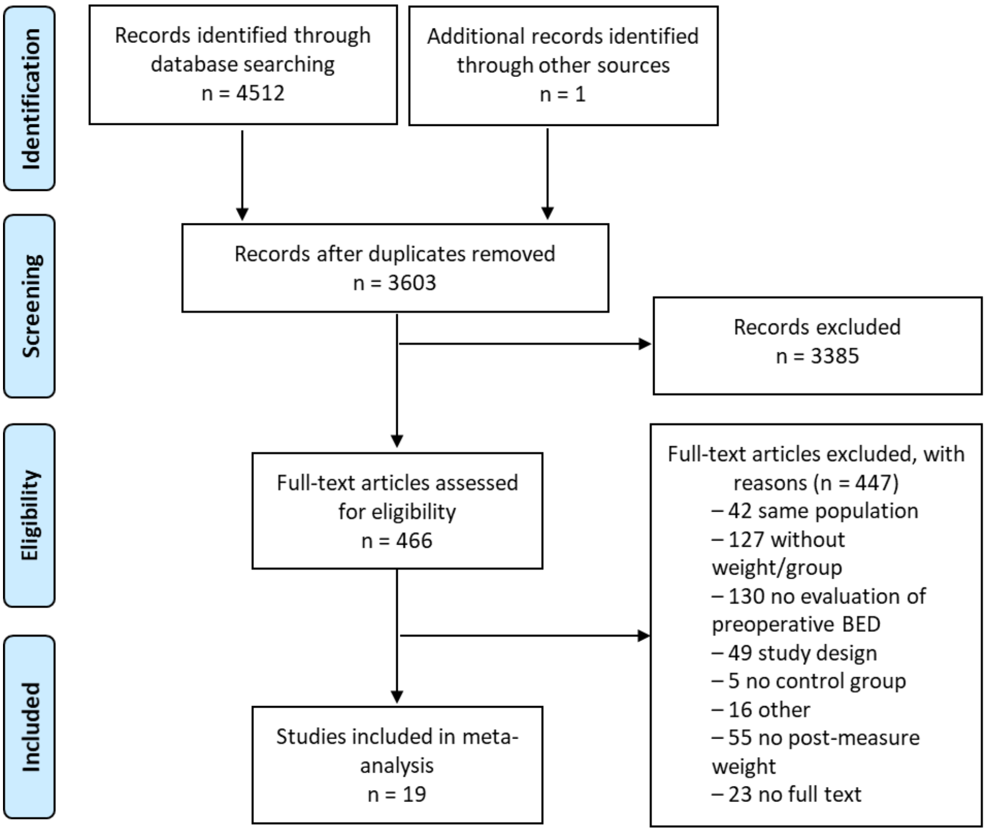


Figure 2. Meta-analyses of postoperative %EWL for preoperative binge eating and non-binge eating groups at 6 months.

	Binge eating			Non binge eating				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Alger-Mayer 2008	56.8	12.7	9	54.4	12.5	120	7.1%	2.40 [-6.19, 10.99]
Friedman 2019	58.4	18.2	44	54.4	14.1	58	12.0%	4.00 [-2.49, 10.49]
Gorin 2008	55.2	14.4	37	58.9	17.4	57	12.1%	-3.70 [-10.18, 2.78]
Green 2004	41.2	11.2	33	46.8	11.3	32	16.4%	-5.60 [-11.07, -0.13]
Puglisi 2007	29.3	9.8	27	30.59	10.1	48	21.5%	-1.29 [-5.96, 3.38]
Sallet 2007	57.4	14	172	60.1	18.1	43	14.7%	-2.70 [-8.50, 3.10]
Susmallian 2017	58.8	16.6	42	62.3	18.7	258	16.1%	-3.50 [-9.01, 2.01]
Total (95% CI)			**364**			**616**	**100.0%**	**-1.95 [-4.30, 0.40]**

Heterogeneity: Tau² = 0.99; Chi² = 6.65, df = 6 (P = 0.35); I² = 10%
Test for overall effect: Z = 1.63 (P = 0.10)

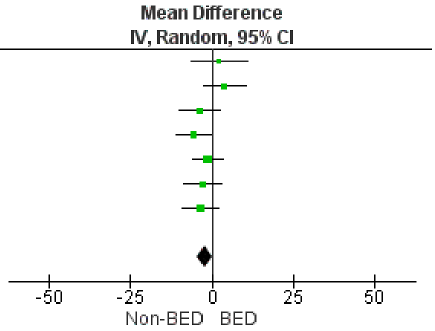


Figure 3. Meta-analyses of postoperative weight loss for preoperative binge eating and non-binge eating groups at 12 months.

	Binge eating			Non binge eating				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Alger-Mayer 2008	68	14.8	37	62.3	15	120	14.2%	5.70 [0.23, 11.17]
Billodre 2016	64.41	11.64	39	76.51	13.96	93	14.6%	-12.10 [-16.73, -7.47]
Bocchieri-Ricciardi 2006	60	18.16	24	57	18.65	48	12.1%	3.00 [-5.98, 11.98]
Colles 2008	52.5	25.8	4	49.6	19.8	125	4.6%	2.90 [-22.62, 28.42]
Friedman 2019	71.4	18.3	42	67.3	17.2	59	13.3%	4.10 [-2.96, 11.16]
Miller-Matero L.R. 2018	57.1	6.7	15	49.6	22.1	127	14.3%	7.50 [2.37, 12.63]
Sallet 2007	69.4	17.6	132	76.5	22.8	41	12.9%	-7.10 [-14.70, 0.50]
Susmallian 2017	75	17.4	42	66.7	13.5	258	14.1%	8.30 [2.79, 13.81]
Total (95% CI)			**335**			**871**	**100.0%**	**1.41 [-5.05, 7.87]**

Heterogeneity: Tau² = 68.97; Chi² = 51.87, df = 7 (P < 0.00001); I² = 87%
Test for overall effect: Z = 0.43 (P = 0.67)

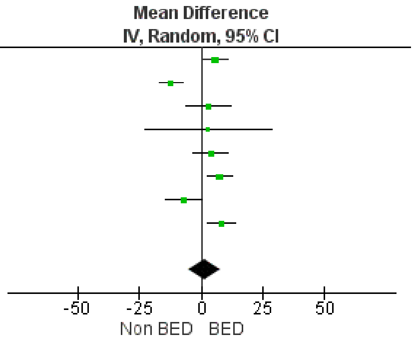


Table S1. Details of electronic bibliographic database search strategies

Date of Search: 17th August 2019

Medline (via Pubmed)

((“Binge-Eating Disorder” [Mesh]) OR (Binge Eating Disorder) OR (Binge-Eating Disorder) OR (Binge-Eating Disorders) OR (Disorder, Binge-Eating) OR (Disorders, Binge-Eating) OR “Feeding and Eating Disorders” [Mesh] OR (Eating Disorders Eating) and (Feeding Disorders) OR (Feeding Disorders Appetite Disorder) OR (Disorder, Eating Disorder, Feeding) OR (Disorders, Eating Disorders, Feeding) OR (Eating Disorder Feeding Disorder Appetite Disorders) OR “Feeding Behavior” [Mesh] OR (behavior, Feeding) OR (Behaviors, Feeding) OR (Feeding Behaviors) OR (Eating Behavior) OR (Behavior, Eating) OR (Behaviors, Eating) OR (Eating Behaviors) OR (Feeding Patterns) OR (Feeding Pattern) OR (Pattern, Feeding) OR (Patterns, Feeding) OR (Food Habits) OR (Food Habit) OR (Habit, Food) OR (Habits, Food) OR (Eating Habits) OR (Eating Habit) OR (Habit, Eating) OR (Habits, Eating) OR (Dietary Habits) OR (Dietary Habit) OR (Habit, Dietary) OR (Habits, Dietary) OR (Diet Habits) OR (Diet Habit) OR (Habit, Diet) OR (Habits, Diet) OR “Food addiction” [Mesh] OR (Compulsive Eating) OR (Eating, Compulsive) OR (Food Addictions))

AND

(“Bariatric Surgery” [Mesh]) OR (Surgeries, Bariatric) OR (Surgery, Bariatric) OR (Metabolic Surgery) OR (Metabolic Surgeries) OR (Surgeries, Metabolic) OR (Surgery, Metabolic) OR (Bariatric Surgical Procedures) OR (Bariatric Surgical Procedure) OR (Procedure, Bariatric Surgical) OR (Procedures, Bariatric Surgical) OR (Surgical Procedure, Bariatric) OR (Surgical Procedures, Bariatric) OR (Bariatric Surgeries) OR (Stomach Stapling) OR (Stapling, Stomach) OR “Gastric Bypass” [Mesh] OR (Bypass, Gastric) OR (Roux-en-Y Gastric Bypass) OR (Bypass, Roux-en-Y Gastric OR (Gastric Bypass, Roux-en-Y) OR (Roux en Y Gastric Bypass) OR (Greenville Gastric Bypass) OR (Gastric Bypass, Greenville) OR (Gastroileal Bypass) OR (Bypass, Gastroileal) OR (Gastrojejunostomy) OR (Gastrojejunostomies) OR “Gastroplasty” [Mesh] OR (Gastroplasties) OR (Collis Gastroplasty) OR (Gastroplasty, Collis) OR (Vertical-

Banded Gastroplasty) OR (Gastroplasties, Vertical-Banded) OR (Gastroplasty, Vertical-Banded) OR (Vertical Banded Gastroplasty) OR (Vertical-Banded Gastroplasties) R "Jejunoileal Bypass" [Mesh] OR (Bypass, Jejunoileal) OR (Bypasses, Jejunoileal) OR (Jejunoileal Bypasses) OR (Jejuno-Ileal Bypass) OR (Bypass, Jejuno-Ileal) OR (Bypasses, Jejuno-Ileal) OR (Jejuno Ileal Bypass) OR (Jejuno-Ileal Bypasses) OR (Ileojejunal Bypass) OR (Bypass, Ileojejunal) OR (Bypasses, Ileojejunal) OR (Ileojejunal Bypasses) OR (Intestinal Bypass) OR (Bypass, Intestinal) OR (Bypasses, Intestinal) OR (Intestinal Bypasses) OR "Obesity, Morbid" [Mesh] OR (Obesity, Severe) OR (Morbid Obesities) OR (Obesities, Morbid) OR (Obesities, Severe) OR (Severe Obesities) OR (Severe Obesity) OR (Morbid Obesity))

AND

("Body Weight Changes" [Mesh]) OR (Body Weight Change) OR (Change, Body Weight) OR (Changes, Body Weight) OR (Weight Change, Body) OR (Weight Changes, Body) OR "Weight Gain" [Mesh] OR (Gain, Weight) OR (Gains, Weight) OR (Weight Gains) OR "Weight Loss" [Mesh] OR (Loss, Weight) OR (Losses, Weight) OR (Weight Losses) OR (Weight Reduction) OR (Reduction, Weight) OR (Reductions, Weight) OR (Weight Reductions) OR "Body Weight" [Mesh] OR (Body Weights) OR (Weight, Body) OR (Weights, Body)

Table S2. Assessment of studies quality

First author	Research question	Study population	Participa-tion rate	Selection	Sampl e size	Time of exposure	Time-frame	Levels of the exposu re	Measur es	Exposu re	Definiti on of measure s	Blinde d	Follo w-up	Confoun -ding variables	Quality rating
Alger-Mayer	YES	YES	NR	YES	NO	YES	YES	NO	YES	YES	YES	NA	YES	YES	Good
Billodre	YES	NO	YES	YES	NO	YES	NO	YES	YES	NO	YES	NA	YES	NO	Fair
Bocchieri-Ricciardi	YES	YES	NR	YES	NO	YES	NO	NO	NO	NO	YES	NA	NR	YES	Poor
Bonnefond	YES	YES	NR	YES	NO	YES	YES	NO	YES	NO	YES	NA	YES	YES	Good
Chao	YES	YES	YES	YES	NO	YES	YES	YES	YES	NO	YES	NA	YES	YES	Good
Colles	YES	YES	YES	YES	NO	YES	NO	YES	YES	NO	YES	NA	YES	YES	Good
Díaz	YES	YES	YES	YES	NO	YES	YES	NO	NO	YES	YES	NA	YES	NO	Fair
Friedman	YES	YES	NR	YES	NO	YES	YES	NO	YES	YES	YES	NA	YES	YES	Fair
Fujioka	YES	YES	YES	YES	NO	YES	YES	NO	YES	YES	YES	NA	YES	YES	Good
Goldschmidt	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NA	YES	YES	Good
Gorin	YES	YES	NR	YES	NO	YES	NO	NO	YES	NO	YES	NA	NR	YES	Poor
Green	YES	YES	NR	YES	NO	YES	NO	NO	YES	NO	YES	NA	YES	NO	Poor
Hayden	YES	YES	YES	YES	NO	YES	YES	NO	YES	NO	YES	NA	YES	YES	Good
Lavender	YES	YES	NR	YES	NO	YES	NO	NO	YES	NO	YES	NA	YES	YES	Fair
Miller-Matero L.R.	YES	YES	NR	YES	NO	YES	NO	NO	NO	NO	YES	NA	YES	NO	Poor
Puglisi	YES	YES	YES	YES	NO	YES	NO	NO	NO	NO	YES	NA	YES	NO	Poor
Sallet	YES	YES	YES	YES	NO	YES	YES	NO	YES	YES	YES	NA	YES	NO	Fair
Susmallian	YES	YES	NR	YES	NO	YES	NO	YES	YES	YES	YES	NA	NR	YES	Good
Wadden	YES	YES	YES	YES	NO	YES	NO	YES	YES	NO	YES	NA	YES	YES	Good

NA, not applicable; NR, not reported.

PARTE III

5. CONSIDERAÇÕES FINAIS

Os fatores que contribuem para os resultados da cirurgia bariátrica são inúmeros, complexos e mediados por interações biológicas, comportamentais e ambientais. Encontramos uma associação significativa entre o genótipo *LEP223* e maior excesso de perda de peso pós cirurgia. Em relação aos fatores psicológicos, pacientes com uma maior pontuação na escala de compulsão alimentar parecem ter maior perda de peso logo após a cirurgia (6 meses), mas não a longo prazo. Outros fatores clínicos não predisseram a perda de peso.

A literatura indica que sexo feminino, maior perda de peso pré cirurgia e maior atividade física são alguns do fatores pré-operatórios associados a maior mudança de peso. É possível que tais achados não tenham sido encontrados nos artigos desta tese devido ao tamanho amostral do estudo ou às características da população estudada (maioria mulheres, brancas, com idade média de 43 anos). O efeito destes fatores pode ser modulado pelo tempo decorrido após a cirurgia, o qual sempre deveria ser considerado. A maioria dos estudos a levantar fatores preditivos é de tamanho amostral e/ou com acompanhamento pós operatório de curto prazo. Outras variáveis, como idade, presença de comorbidades e uso de medicamentos não parecem influenciar a variação de peso.

Em geral, os estudos avaliando fatores preditivos da perda de peso pós cirurgia são altamente informativos, mas possuem limitações. Muitos possuem limitações metodológicas, incluindo amostras pequenas ou falta de um grupo de comparação apropriado. Por outro lado, grandes estudos podem ter dificuldade em avaliar adequadamente os pacientes em termos psicológicos. Estabelecer diagnósticos psiquiátricos antes da cirurgia bariátrica é um desafio. As diretrizes recomendam que os pacientes sejam submetidos a uma avaliação clínica com um profissional de saúde mental antes da cirurgia. Acredita-se que alguns pacientes se engajem no "manejo da impressão" durante essas avaliações, minimizando os sintomas da psicopatologia para se apresentarem sob a luz mais favorável a fim de obter uma recomendação para cirurgia do profissional de saúde mental.

A associação entre os transtornos psicológicos, fatore sociais, tempo e perda de peso segue sendo complexa e ainda incompletamente entendida. De qualquer forma, sabe-se que a cirurgia por si só não melhorará os comportamentos compulsivos e comportamentais; por isso os pacientes devem entender a necessidade de tratar esses transtornos comportamentais. A relação entre estes fatores, ligados ao estado psicossocial pré-cirurgia, e os resultados pós-operatórios é uma das questões mais investigadas na área da cirurgia bariátrica, mas ainda é das menos compreendidas. A avaliação de fatores presentes no pós-operatório também é fundamental, mas não foi alvo deste estudo.

Mesmo que o número de cirurgias tenha aumentado drasticamente, esta nunca será uma opção de tratamento para a obesidade a nível populacional. O enfrentamento da obesidade depende de políticas públicas efetivas, como rotulagem nutricional, oferta e acesso aos alimentos saudáveis, taxação de bebidas açucaradas, proibição do marketing de alimentos junto às crianças e promoção de ambientes que favoreçam a atividade física. Uma vez que a cirurgia não é a cura para a obesidade, mas sim um tratamento que ajuda no seu controle, o acompanhamento multidisciplinar é para o resto da vida. Como a avaliação genética para polimorfismos associados à perda de peso ainda não é utilizada na prática clínica, a implementação de mudanças de estilo de vida, que incluem aumento da atividade física e uma dieta equilibrada serão essenciais para o sucesso do tratamento em longo prazo. O bom preparo dos pacientes candidatos à cirurgia é fundamental para o sucesso do procedimento. A avaliação deve ser minuciosa para identificar adequadamente qualquer fator que possa interferir no sucesso cirúrgico. E, idealmente, transtornos alimentares e comportamentais devem ser avaliados e manejados ainda antes da cirurgia.

É importante destacar que, apesar de ocorrer uma certa recuperação de peso, a longo prazo, dos pacientes cirúrgicos, após atingido um nadir de peso, o reganho de peso em geral não implica retorno ao peso período pré-operatório, onde as comorbidades estavam mais presentes. Mais estudos nesta área são importantes para melhorar a seleção de pacientes, aperfeiçoar as técnicas de reeducação alimentar e tratamentos, e desenvolver estratégias de intervenção para auxiliar os pacientes que não têm um resultado ideal após o procedimento.