NIPH
Norwegian Institute of Public Health

REPORT

2020

RAPID REVIEW FOR A PATIENT DECISION AID:
Treatment options for morbid obesity

Publisher Norwegian Institute of Public Health
Title Treatment options for morbid obesity: rapid review for a patient decision aid
Title in Norwegian Behandlingsalternativer for sykelig fedme: en hurtigoversikt for samvalgsverktøy
Director Camilla Stoltenberg
Authors Severin Zinöcker, Senior Adviser
Liv Merete Reinar, Senior Adviser
Finn Runar Eggen, Senior Adviser
Tonje Lehne Refsdal, Adviser/Research Librarian
Hege Kornør, Department Director
ISBN 978-82-8406-135-1
Publication type Systematic review
Pages 29
Commissioner University Hospital of North Norway
MeSH (Emneord) Obesity, Morbid; Bariatric Surgery; Life Style; Drug Therapy
(Sykelig fedme; Bariatrisk kirurgi; Livsstil; Farmakoterapi)
Citation Zinöcker S, Reinar LM, Eggen FR, Refsdal TL, Kornør H. Treatment options for morbid obesity: rapid review for a patient decision aid [Behandlingsalternativer for sykelig fedme: en hurtigoversikt for samvalgsverktøy]. Rapport 2020. Oslo: Folkehelseinstituttet, 2020.

Content

Key messages

Chronic obesity due to excess body weight can result in negative health effects. The World Health Organization defines morbid obesity as a body mass index ≥ 40 kg/m^2 or ≥ 35 kg/m^2 in patients with overweight-related comorbidity.

Treatment options for morbid obesity include lifestyle interventions alone or in combination with motivational stays, surgical treatments and pharmacological treatments.

We limited our searches to updated guidelines and systematic reviews. We did not search for primary studies. We included two systematic reviews as our evidence base for treatment options for morbid obesity. These reviews included seven comparisons with effect measures for several, but not all, outcomes we were interested in.

We found low to moderate quality evidence indicating that, compared to lifestyle interventions alone:

- Lifestyle interventions with Roux-en-Y gastric bypass probably improve weight loss at 1, 2, 3, 4, and 5 years and probably slightly improve triglycerides, blood pressure, plasma HbA1c, and blood glucose change at 1 year
- Lifestyle interventions with naltrexone-bupropion probably improve weight loss at 13 months
- Lifestyle interventions with liraglutide probably improve weight loss at 13 months
- Lifestyle interventions with orlistat may improve weight loss at 1, 2, and 4 years
- Lifestyle interventions with sleeve gastrectomy may improve weight loss at 1, 2, 3, 4, and 5 years

Title
Treatment options for morbid obesity

Publication type
Rapid review

We did not answer everything:
No recommendations
No economic evaluation

Publisher
The Norwegian Institute of Public Health was commissioned by the University Hospital of North Norway

---

Updated
Search for literature was conducted in January and February 2020

Hovedbudskap

Kronisk overvekt kan forårsake dårlig helse. Verdens helseorganisasjon definerer sykelig fedme som en kroppsmasseindeks ≥ 40 kg/m^2 eller ≥ 35 kg/m^2 hos pasienter med fedmerelatert sykdom.

Behandlingsalternativer for sykelig fedme omfatter livsstilsintervensjoner alene eller i kombinasjon med motivasjonsopphold, kirurgiske inngrep og medikamentell behandling.

Vi søkte etter oppdaterte oppslagsverk og systematiske oversikter. Vi søkte ikke etter primærstudier. Vi har inkludert to systematiske oversikter som vårt kunnskapsgrunnlag for behandling av sykelig fedme. Oversiktene inkluderte sju sammenlikninger med effektmål for flere, men ikke alle, utfall vi var interessert i.

Vi fant at sammenliknet med livsstilsintervensjoner alene:

- Gir trolig livsstilsintervensjoner kombinert med Roux-en-Y gastrisk bypassoperasjon større vektreduksjon etter 1, 2, 3, 4 og 5 år og trolig forebedrer endringer i triglyserider, blodtrykk, HBA1c i blodplasma og blodglukose etter 1 år
- Gir trolig livsstilsintervensjoner kombinert med legemiddelet naltrekson/bupropion større vektreduksjon etter 13 måneder
- Gir trolig livsstilsintervensjoner kombinert med legemiddelet liraglutid større vektreduksjon etter 13 måneder
- Gir muligens livsstilsintervensjoner kombinert med legemiddelet orlistat større vektreduksjon etter 1, 2 og 4 år
- Gir muligens livsstilsintervensjoner kombinert med sleeve gastrektomi større vektreduksjon etter 1, 2, 3, 4 og 5 år

Tittel
Behandlingsalternativer for sykelig fedme

Publikasjonstype
Hurtigoversikt

Svarer ikke på alt
Gir ingen anbefaling
Gir ingen økonomisk vurdering

Hvem står bak denne publikasjonen?
Folkehelseinstituttet har gjennomført oppdraget på oppdrag fra Universitetssykehuset Nord-Norge

---

Når ble litteratursøket utført?
Søk etter studier ble utført i januar og februar 2020

Preface

The Centre for Shared Decision Making at the University Hospital of North Norway (UNN) and the Division for Health Services, Norwegian Institute of Public Health (NIPH), have started a co-operation in 2017 to develop evidence-based shared decision making tools.

Patient decision aids are continuously published at www.helsenorge.no/samvalg/.

Our aim is to:
- be resource effective
- be trustworthy
- work in line with national quality criteria for patient decisison making tools
- present updated and evidence-based information in a format that is easily understood by laypeople, including patients and their caretakers

The authors report no conflict of interest.

For this rapid review, we aimed to summarise findings about the effectiveness of treatment options for morbid obesity.

We wish to thank Tove Skjelbakken (UNN) and Jøran Hjelmesæth (University of Oslo and Vestfold Hospital Trust) for peer review. Also, many thanks to our colleague Hilde Risstad at NIPH for invaluable contributions to the process of assessing the certainty of the evidence.

Hege Kornør
Department director

Severin Zinöcker, PhD
Senior adviser

Background

Morbid obesity is a chronic disease where a person's excess body weight results in negative health consequences. Over time, morbid obesity will increase the risk of other disease, disability and death.

Overweight is commonly expressed by the body mass index (BMI), a measure of a patient's weight relative to their size. The BMI is calculated as body weight in kilograms divided by the square of body height in meters (kg/m^2).

The World Health Organization defines obesity in adults as having a BMI of 30 or above (https://www.who.int/topics/obesity/). Morbid obesity is defined as having a BMI of 40 or higher, or a BMI of 35 or higher with one or more overweight-related comorbidities.

Treatment options for morbid obesity include lifestyle interventions (such as improved diet and physical activity) alone or in combination with motivational stays, pharmacological treatments with anti-obesity drugs (such as orlistat, liraglutide and naltrexone-bupropione), and surgical treatments (such as sleeve gastrectomy and gastric bypass).

The aim of this systematic review was to examine the relative effects of the above treatment options for morbid obesity.

Methods

Inclusion criteria

Population	Adults with morbid obesity (BMI ≥ 40 kg/m^2, or BMI ≥ 35 kg/m^2 and overweight-related comorbidity)
Interventions	Lifestyle interventions (improved diet and physical activity) Lifestyle interventions in combination with: • motivational stay • pharmacological treatments with anti-obesity drugs (orlistat, naltrexone-bupropion, liraglutide) • surgical treatments (gastric bypass, sleeve gastrectomy)
Comparisons	Interventions above compared with each other
Outcomes	- Weight reduction (total weight loss) percent - Diabetes status (risk of, remission/improvement → glycated hemoglobin) - Cardiovascular risk (mortality, morbidity, risk factors → lipids, blood pressure, blood glucose, glycated hemoglobin) - Quality of life (QoL) - Mortality - Surgical and medical complications short- and long-term (Abdominal pain, opioid use, intestinal obstruction, gallbladder disease, gastroduodenal ulcers, nausea and vomiting, postprandial hypoglycemia, anastomose leakage, dysphagia) - Re-operation/re-intervention - Gastroesophagal reflux disease (GERD) - Micronutrient status (iron deficiency, anemia, vitamin- and mineral deficiency) - Stroke - Mental problems, anxiety, depression, eating disorders - Sexual function - Obstructive sleep apnea - Colorectal cancer risk

Literature search

We searched for evidence in international guidelines (UpToDate, BMJ Best Practice, European Guidelines for Obesity Management) (1-3) and for systematic reviews in Epistemonikos (cf. Supplement 1). These literature searches were conducted in January and February 2020.

BMJ Best Practice (1) and UpToDate (2) were last updated in January and February 2020, when we searched for literature. None of the guidelines (1-3) identified new primary studies that met our inclusion criteria. Therefore, we decided to limit our searches to systematic reviews.

Selection of studies

Selected guideline literature and review articles were presented and discussed for eligibility within the project group. We selected systematic reviews that were recently published; relevant to the populations, interventions and comparisons of interest (cf. Inclusion criteria); reported one or more outcomes of interest (cf. Inclusion criteria); and were of high methodological quality.

Data extraction and analyses

We extracted data from the systematic reviews for each comparison specified in the Inclusion criteria above. We extracted data on the number of included studies, interventions, and comparisons. We also extracted results from relevant systematic reviews as specified below.

We used results from the meta-analyses, processed data using local Review Manager software and calculated absolute or relative effect estimates when appropriate.

Presenting the results and assessing our confidence in the evidence

We used GRADEpro (Guideline Development Tool) online (https://gdt.gradepro.org/app/) to rate overall certainty of the evidence. The GRADE (Grading of Recommendations Assessment, Development and Evaluation) tool allowed us to express our confidence in the results (Table 1) for each outcome with a summarized effect estimate.

Table 1. GRADE Working Group grades of evidence

High certainty ⊕⊕⊕⊕	*We are very confident that the true effect lies close to that of the estimate of the effect.*
Moderate certainty ⊕⊕⊕⊖	*We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.*

Low certainty ⊕⊕⊖⊖	*Our confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect.*
Very low certainty ⊕⊖⊖⊖	*We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of the effect.*

We present these results in Summary of Findings tables (cf. Supplement 2) and used standardized statements about effects as developed by Cochrane (Figure 1).

Table of standardised statements about effect

	Important benefit/harm	Less important benefit/harm	No important benefit/harm
High quality / certainty[1] evidence	[*Intervention*] improves/reduces [*outcome*] (high quality / certainty evidence)	[*Intervention*] slightly improves/reduces [*outcome*] (high quality / certainty evidence)	[*Intervention*] makes little or no difference to [*outcome*] (high quality / certainty evidence)
Moderate quality / certainty[1] evidence	[*Intervention*] probably improves/reduces [*outcome*] (moderate quality / certainty evidence)	[*Intervention*] probably slightly improves/reduces / probably leads to slightly better/worse [*outcome*] (moderate quality / certainty evidence)	[*Intervention*] probably makes little or no difference to [*outcome*] (moderate quality / certainty evidence)
Low quality / certainty[1] evidence	[*Intervention*] may improve/reduce [*outcome*] (low quality / certainty evidence)	[*Intervention*] may slightly improve/reduce [*outcome*] (low quality / certainty evidence)	[*Intervention*] may make little or no difference to [*outcome*] (low quality / certainty evidence
Very low quality / certainty[1] evidence	We / The review authors are uncertain whether [*intervention*] improves/reduces [*outcome*] as the quality / certainty of the evidence has been assessed as very low		
No studies	No studies were found that looked at [*outcome*]		

[1]Within GRADE, the phrase "quality of the evidence" is increasingly referred to as "certainty of" the evidence. Use the same term that has been used elsewhere in the review.

Figure 1. Standardised statements about effect

Source: https://www.cochrane.no/sites/cochrane.no/files/public/uploads/how_to_write_a_cochrane_pls_15th_june_2018.pdf

Results

Our searches identified three international guidelines and five systematic reviews, of which we selected two systematic reviews for analysis.

The selected guidelines on obesity (1-3) had been updated recently (British Medical Journal, Best Practice: January 2020, UpToDate: February 2020) or fairly recently (European Guidelines for Obesity Management: December 2015). Our peer reviewer suggested we consult the American Heart Association/American College of Cardiology/The Obesity Society's guidelines of 2013 (4). We decided not to use the latter guideline document as the former guidelines were more updated.

None of the guidelines above comprised comprehensive, systematic meta-analyses in line with the inclusion criteria (cf. Methods), but provided useful references to relevant research literature. We identified several systematic reviews referenced in the guideline documents and evaluated these for relevance to our evidence base (see Methods, Inclusion criteria).

Included evidence

Our own literature searches resulted in a list of publications that we evaluated further. We identified a health technology assessment by Avenell et al. (5) through literature search in the Epistemonikos database. We selected this publication, because it contained a thorough and up-to-date systematic review of randomized, controlled trials (RCTs) of bariatric surgery, different lifestyle interventional programs and orlistat in participants of mean or median BMIs of ≥ 35 kg/m^2 with follow-up durations of 12 months or more. Their meta-analysis included five comparisons of interventions that were consistent with our inclusion criteria (Table 2).

We also identified several systematic reviews when reading the above mentioned guidelines (1-3). We manually searched and evaluated several publications referenced in the guideline documents that seemed relevant, but only one systematic review by Khera et al. (6), referenced in the UpToDate guidelines of 2020 (2), matched our inclusion criteria. This review comprised the most recent meta-analysis of randomized studies conducted among overweight and obese adults receiving pharmacological obesity treatment, including naltrexone-bupropion and liraglutide, for at least 1 year (Table 2).

Table 2. Comparisons in included systematic reviews

Study first author, year (reference)	Number of included studies	Comparisons	
		Lifestyle intervention *with*:	Comparison; lifestyle intervention:
Avenell 2018 (5)	3	Motivational stay	Alone
Avenell 2018 (5)	12	Pharmacological treatment (orlistat)	With placebo
Khera 2016 (6)	2	Pharmacological treatment (naltrexone-bupropion)	With placebo
Khera 2016 (6)	3	Pharmacological treatment (liraglutide)	With placebo
Avenell 2018 (5)	5	Surgical treatment (Roux-en-Y gastric bypass)	Alone
Avenell 2018 (5)	2	Surgical treatment (sleeve gastrectomy)	Alone

Sources: **Avenell et al.** (2018) Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation. Health Technol Assess 22(68). **Khera et al.** (2016) Association of Pharmacological Treatments for Obesity With Weight Loss and Adverse Events: A Systematic Review and Meta-analysis. JAMA 315(22):2424–2434.

We did not find summarized evidence comparing the effects of lifestyle interventions and a motivational stay with lifestyle interventions and a surgical treatment, lifestyle interventions and a motivational stay with lifestyle interventions and a pharmacological treatment, or lifestyle interventions and a pharmacological treatment with lifestyle interventions and a surgical treatment.

Summary of Findings

Lifestyle interventions with motivational stay vs lifestyle interventions alone

What are the risks and benefits of lifestyle interventions alone compared to lifestyle interventions combined with a motivational stay in patients with morbid obesity?

See also Supplement 2. Summary of Findings, page 21.

In-patient, rehabilitational or hospital stay (21-23)

- We are uncertain whether lifestyle interventions with a motivational stay improve weight change at 1, 2, and 5 years

The evidence base included no other outcomes for this comparison.

Lifestyle interventions with pharmacological treatments vs lifestyle interventions alone

What are the risks and benefits of lifestyle interventions alone compared to lifestyle interventions combined with pharmacological treatment in patients with morbid obesity?

See also Supplement 2. Summary of Findings, page 22.

Orlistat (7-15,24-26)

- Lifestyle interventions with 120 mg orlistat three times daily may improve weight change at 1, 2, and 4 years.

- Lifestyle interventions with 120 mg orlistat three times daily may slightly improve total and low-density lipoprotein (LDL) cholesterol, systolic and diastolic blood pressure, and blood glucose change at 1 year.

- Lifestyle interventions with 120 mg orlistat three times daily may make no or little difference to high-density lipoprotein (HDL) cholesterol, triglycerides, and plasma hemoglobin (Hb)A1c change at 1 year.

One of the studies included in Avenell 2018, Swinburn et al. (7), specifically sought to determine whether orlistat treatment could reduce the risk of having a cardiovascular disease in overweight people with type 2 diabetes mellitus. The baseline median 10-year risk of a cardiovascular event was moderately low for the orlistat group and for the placebo group. Although there was no difference in the 10-year cardiovascular disease risk between groups, the orlistat group had significant improvements in individual cardiovascular risk factors compared with the placebo group at 1 year. We did not assess the certainty of this evidence.

One of the studies (7) included in Avenell 2018 reported on quality of life. Overweight patients with type 2 diabetes mellitus reported better quality of life on the Short Form questionnaire - 36 items vitality domain compared with placebo at 1 year. We did not assess the certainty of this evidence.

Overall, there were no differences between the intervention groups in the incidence of adverse events, with the exception of gastrointestinal events. The incidence of gastrointestinal adverse events were more frequent with orlistat than placebo in all studies (Table 3, below). We did not assess the certainty of this evidence.

The evidence base includes no other outcomes for this comparison.

Table 3. Incidence of gastrointestinal adverse events associated with 120 mg orlistat three times daily (5)

Study first author, year (reference)	% patients reporting an adverse event		
	Lifestyle interventions with placebo	Lifestyle interventions with orlistat	Group difference
Bakris 2002 (8)	43.6	72.5	28.9
Broom 2002 (9)	47	63	16
Davidson 1999 (10)	59	79[a]	20
Finer 2000 (11)	56.4	82.1	25.7
Hauptman 2000 (12)	59	79	20
Krempf 2003 (13)	36.3	63.3	27
Miles 2002 (14)	62	83	21
Sjöström 1998 (15)	10[b]	31[b]	20
Swinburn 2005 (7)	60.4	82.4	22

Source: **Avenell et al.** (2018) Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation. Health Technol Assess 22(68). **Khera et al.** (2016) Association of Pharmacological Treatments for Obesity With Weight Loss and Adverse Events: A Systematic Review and Meta-analysis. JAMA 315(22):2424–2434.

[a] Includes participants treated with 60 mg of orlistat
[b] Highest reported adverse event in year 1

- Lifestyle interventions with 60 mg orlistat three times daily may improve weight change at 1 and 2 years.

The evidence base includes no other outcomes for this comparison.

Naltrexone-bupropion (27,28)

- Lifestyle interventions with naltrexone-bupropion probably improve weight change at 13 months.

The evidence base includes no other outcomes for this comparison.

Liraglutide (29-31)

- Lifestyle interventions with liraglutide probably improve weight change at 13 months.

The evidence base includes no other outcomes for this comparison.

Lifestyle interventions with surgical treatments vs lifestyle interventions alone

What are the risks and benefits of lifestyle interventions alone compared to lifestyle interventions combined with surgical treatments in patients with morbid obesity?

See also Supplement 2. Summary of Findings, page 25.

Gastric bypass (16-19)

- Lifestyle interventions with Roux-en-Y gastric bypass probably improve weight change at 1, 2, 3, 4, and 5 years.

- Lifestyle interventions with Roux-en-Y gastric bypass probably slightly improve triglycerides, systolic and diastolic blood pressure, plasma HbA1c, and blood glucose change at 1 year.

- Lifestyle interventions with Roux-en-Y gastric bypass may make no or little difference to total and LDL cholesterol change at 1 year.

- Lifestyle interventions with Roux-en-Y gastric bypass may slightly elevate HDL cholesterol at 1 year.

In one of the studies included in Avenell 2018, Halperin et al. (16), patients randomised to lifestyle interventions combined with Roux-en-Y gastric bypass had lost more lean and fat body mass (−5.1 and −22.7 kg, respectively) at 1 year compared with patients randomised lifestyle interventions alone (−1.4 and −6.2 kg, respectively). Total changes in body mass were not reported. We did not assess the certainty of this evidence.

Two of the studies included in Avenell 2018, Halperin et al. and Schauer et al. (16,17), reported quality of life. Patients randomised to lifestyle interventions combined with Roux-en-Y gastric bypass had greater improvements in quality of life after 1 and 2 years than those randomised to lifestyle interventions alone. Quality of life was measured by Impact of Weight on Quality of Life-Lite survey (16) and the RAND 36-Item Health Survey (17). There were no between-group differences for other quality-of-life measures at 1 and 2 years (16). We did not assess the certainty of this evidence.

Overall, there were no differences between the intervention groups in the incidence of adverse events. In one of the studies included in Avenell 2018, Cummings et al. (18), there were 31 adverse events among patients randomised to lifestyle interventions with gastric bypass and 64 adverse events in lifestyle interventions alone group. In another study, Mingrone et al. (19), the frequency of metabolic adverse events were larger in surgical patients than in the comparison group. In a third study (17), four patients who had received surgery required subsequent surgical interventions and one patient in the comparison group died as a result of myocardial infarction. We did not assess the certainty of this evidence.

The evidence base includes no other outcomes for this comparison.

Sleeve gastrectomy (17-20)

- Lifestyle interventions with sleeve gastrectomy may improve weight change at 1, 2, 3, 4, and 5 years.

- Lifestyle interventions with sleeve gastrectomy may make little or no difference to total and LDL cholesterol change at 1 year.

- Lifestyle interventions with sleeve gastrectomy may slightly improve triglycerides, plasma HbA1c, and blood glucose change at 1 year.

- Lifestyle interventions with sleeve gastrectomy may slightly elevate HDL cholesterol at 1 year.

- We are uncertain whether lifestyle interventions with sleeve gastrectomy improve systolic and diastolic blood pressure at 1 year.

In one of the studies included in Avenell 2018, MacLaughlin et al. (20), patients randomised to lifestyle interventions with sleeve gastrectomy showed greater improvement in quality of life than patients randomised to lifestyle interventions alone. Quality of life was measured by Hospital Anxiety and Depression Scale scores and increased Short Form questionnaire-36 items physical domain scores at 1 year. We did not assess the certainty of this evidence.

In another study (17), four patients required subsequent surgical interventions and one had a stroke. One patient in the comparison group died as a result of myocardial infarction. We did not assess the certainty of this evidence.

The evidence base includes no other outcomes for this comparison.

Discussion

Main findings

We included two systematic reviews (5,6) in our evidence base for treatment options for morbid obesity. The reviews included six comparisons with effect measures for several, but not all, outcomes we were interested in.

Among overweight or obese adults, orlistat, lorcaserin, naltrexone-bupropion, and liraglutide, compared with placebo, were each associated with achieving at least 5% weight loss at 1 year (5,6). Bariatric surgery, especially Roux-en-Y gastric bypass, produced greater long-term weight change than any lifestyle interventions at 5 years (5). Initial inpatient programmes were not associated with greater weight loss (5).

We found low to moderate quality evidence indicating that:

- Lifestyle interventions with orlistat may improve weight change at 1, 2, and 4 years and slightly improve total and LDL cholesterol, systolic and diastolic blood pressure, and blood glucose change at 1 year.
- Lifestyle interventions with naltrexone-bupropion probably improve weight change at 13 months.
- Lifestyle interventions with liraglutide probably improve weight change at 13 months.
- Lifestyle interventions with Roux-en-Y gastric bypass probably improve weight change at 1, 2, 3, 4, and 5 years and slightly improve triglycerides, systolic and diastolic blood pressure, plasma HbA1c, and blood glucose change at 1 year.
- Lifestyle interventions with sleeve gastrectomy may improve weight change at 1 2, 3, 4, and 5 years and slightly improve triglycerides, plasma HbA1c, and blood glucose change at 1 year.

Many of the original studies had included patients that did not meet our criterion for morbid obesity (BMI < 35 kg/m^2 or < 40 kg/m^2 and no mention of overweight-related comorbidity). However, patients with lower body weight typically made up only a minority of the overall population. In our view, the evidence still reflects the target population of this review to a certain extent.

Randomization methods and allocation concealment were not always sufficiently performed or described in many of the studies included in the systematic reviews. All studies investigating pharmacological treatments and some on surgical treatments stated conflicts of interest, and most studies lacked pre-published study protocols. Blinding of

patients or staff in studies of motivational stays and surgical treatments was not possible. Attrition bias was high in pharmacotherapy studies.

Weight change was reported as the mean change in kilograms, not percent change relative to baseline body weight. With a measure of weight change relative to baseline weight lacking, we chose to report mean absolute body weight change, even though this effect measure may be misleading.

Limitations

BMJ Best Practice (1) and UpToDate (2) were recently updated. We reasoned that any new, relevant primary studies would have been identified in these guidelines, and therefore, decided to limit our searches to systematic reviews of randomized trials. We highlight that observational studies were not included in this review, and therefore, data and outcomes, e.g. longitudinal data and complications in patients that are often reported in such reports, are absent.

Obese children and youth were outside of the scope of this review, as were interventions for pre-obese adults that aim to prevent or counteract becoming obese and morbidly obese.

We did not find evidence comparing the effects of:

- lifestyle interventions with motivational stay vs lifestyle interventions with surgical treatments
- lifestyle interventions with motivational stay vs lifestyle interventions with pharmacological treatments
- lifestyle interventions with pharmacological treatments vs lifestyle interventions with surgical treatments

We did not find evidence for the following patient-relevant outcomes for any of the included comparisons:

- Mortality
- Re-operation/re-intervention
- Gastroesophagal reflux disease
- Micronutrient status (iron deficiency, anemia, vitamin- and mineral deficiency)
- Mental problems, anxiety, depression, eating disorders
- Sexual function
- Obstructive sleep apnea
- Colorectal cancer risk

References

1. Frantzides CT, Luu MB. Obesity in adults. In: BMJ Best Practice, BMJ Publishing Group Ltd, London, UK. Accessed January 2020 at: https://bestpractice.bmj.com/topics/en-gb/211

2. Perreault L. Obesity in adults: Drug therapy. In: UpToDate, Post TW (Ed), UpToDate, Waltham, MA, USA. Accessed January 2020 at: https://www.uptodate.com/contents/table-of-contents/endocrinology-and-diabetes/obesity

3. Yumuk V, Tsigos C, Fried M, Schindler K, Busetto L, Micic D, Toplak H. European Guidelines for Obesity Management in Adults. Obes Facts 2015;8:402–424. doi:10.1159/000442721

4. Jensen MD, Ryan DH, Apovian CM, Ard JD, Comuzzie AG, Donato KA, et al. 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults. Circulation 2014;129(25):S102–S138.

5. Avenell A, Robertson C, Skea Z, Jacobsen E, Boyers D, Cooper D, et al. Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation. Health Technol Assess 2018;22(68). doi:10.3310/hta22680

6. Khera R, Murad MH, Chandar AK, et al. Association of Pharmacological Treatments for Obesity With Weight Loss and Adverse Events: A Systematic Review and Meta-analysis. JAMA 2016;315(22):2424–2434. doi:10.1001/jama.2016.7602

7. Swinburn BA, Carey D, Hills AP, Hooper M, Marks S, Proietto J, et al. Effect of orlistat on cardiovascular disease risk in obese adults. Diabetes Obes Metab 2005;7:254-262. doi:10.1111/j.1463-1326.2004.00467.x

8. Bakris G, Calhoun D, Egan B, Hellmann C, Dolker M, Kingma I, Orlistat and Resistant Hypertension Investigators. Orlistat improves blood pressure control in obese subjects with treated but inadequately controlled hypertension. J Hypertens 2002;20:2257–2267. doi:10.1097/00004872-200211000-00026

9. Broom I, Wilding J, Stott P, Myers N, UK Multimorbidity Study Group. Randomised trial of the effect of orlistat on body weight and cardiovascular disease risk profile in obese patients: UK Multimorbidity Study. Int J Clin Pract 2002;56:494–499.

10. Davidson MH, Hauptman J, DiGirolamo M, Foreyt JP, Halsted CH, Heber D, et al. Weight control and risk factor reduction in obese subjects treated for 2 years with orlistat: a randomized controlled trial. JAMA 1999;281:235–242. doi:10.1001/jama.281.3.235

11. Finer N, James WP, Kopelman PG, Lean ME, Williams G. One-year treatment of obesity: a randomized, double-blind, placebo-controlled, multicentre study of orlistat, a gastrointestinal lipase inhibitor. Int J Obes Relat Metab Disord 2000;24:306–313. doi:10.1038/sj.ijo.0801128

12. Hauptman J, Lucas C, Boldrin MN, Collins H, Segal KR. Orlistat in the long-term treatment of obesity in primary care settings. Arch Fam Med 2000;9:160–167. doi:10.1001/archfami.9.2.160

13. Krempf M, Louvet JP, Allanic H, Miloradovich T, Joubert JM, Attali JR. Weight reduction and long-term maintenance after 18 months treatment with orlistat for obesity. Int J Obes Relat Metab Disord 2003;27:591–597. doi:10.1038/sj.ijo.0802281

14. Miles JM, Leiter L, Hollander P, Wadden T, Anderson JW, Doyle M, et al. Effect of orlistat in overweight and obese patients with type 2 diabetes treated with metformin. Diabetes Care 2002;25:1123–1128. doi:10.2337/diacare.25.7.1123

15. Sjöström L, Rissanen A, Andersen T, Boldrin M, Golay A, Koppeschaar HPF, et al. Randomised placebo-controlled trial of orlistat for weight loss and prevention of weight regain in obese patients. Lancet 1998;352:167–172. doi:10.1016/S0140-6736(97)11509-4

16. Halperin F, Ding SA, Simonson DC, Panosian J, Goebel-Fabbri A, Wewalka M, et al. Roux-en-Y gastric bypass surgery or lifestyle with intensive medical management in patients with type 2 diabetes: feasibility and 1-year results of a randomized clinical trial. JAMA Surg 2014;149:716–726. doi:10.1001/jamasurg.2014.514

17. Schauer PR, Kashyap SR, Wolski K, Brethauer SA, Kirwan JP, Pothier CE, et al. Bariatric surgery versus intensive medical therapy in obese patients with diabetes. N Engl J Med 2012;366:1567–1576. doi:10.1056/NEJMoa1200225

18. Cummings DE, Arterburn DE, Westbrook EO, Kuzma JN, Stewart SD, Chan CP, et al. Gastric bypass surgery vs intensive lifestyle and medical intervention for type 2 diabetes: the CROSSROADS randomised controlled trial. Diabetologia 2016;59:945–953. doi:10.1007/s00125-016-3903-x

19. Mingrone G, Panunzi S, De Gaetano A, Guidone C, Iaconelli A, Leccesi L, et al. Bariatric surgery versus conventional medical therapy for type 2 diabetes. N Engl J Med 2012;366:1577–1585. doi:10.1056/NEJMoa1200111

20. MacLaughlin HL, Hall WL, Patel AG, Blacklock RM, Swift PA, Phanish MK, et al. Weight loss, adipokines, and quality of life after sleeve gastrectomy in obese patients with stages 3-4 CKD: a randomized controlled pilot study. Am J Kidney Dis 2014;64:660–663. doi:10.1053/j.ajkd.2014.06.011

21. Hakala P, Karvetti RL, Rönnemaa T. Group vs. individual weight reduction programmes in the treatment of severe obesity – a five year follow-up study. Int J Obes Relat Metab Disord 1993;17:97–102.

22. Torgerson JS, Agren L, Sjöström L. Effects on body weight of strict or liberal adherence to an initial period of VLCD treatment. A randomised, one-year clinical trial of obese subjects. Int J Obes Relat Metab Disord 1999;23:190–197. doi:10.1038/sj.ijo.0800816

23. Hakala P. Weight reduction programmes at a rehabilitation centre and a health centre based on group counselling and individual support: short- and long-term follow-up study. Int J Obes Relat Metab Disord 1994;18:483–489.

24. Broom I, Hughes E, Dodson P, Reckless J. The role of orlistat in the treatment of obese patients with mild to moderate hypercholesterolaemia: consequences for coronary risk. Br J Cardiol 2002;9:460–468.

25. Kelley DE, Bray GA, Pi-Sunyer FX, Klein S, Hill J, Miles J, Hollander P. Clinical efficacy of orlistat therapy in overweight and obese patients with insulin-treated type 2 diabetes: a 1-year randomized controlled trial. Diabetes Care 2002;25:1033–1041. doi:10.2337/diacare.25.6.1033

26. Torgerson JS, Hauptman J, Boldrin MN, Sjöström L. XENical in the prevention of Diabetes in Obese Subjects (XENDOS) study: a randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients. Diabetes Care 2004;27:155–161. doi:10.2337/diacare.27.1.155

27. Apovian CM, Aronne L, Rubino D, Still C, Wyatt H, Burns C, et al. A randomized, phase 3 trial of naltrexone SR/bupropion SR on weight and obesity-related risk factors (COR-II). Obesity 2013;21(5):935–943.

28. Greenway FL, Fujioka K, Plodkowski RA, Mudaliar S, Guttadauria M, Erickson J, et al. Effect of naltrexone plus bupropion on weight loss in overweight and obese adults (COR-I): a multicentre, randomised, double-blind, placebo-controlled, phase 3 trial. Lancet 2010;376(9741):595–605.

29. Astrup A, Carraro R, Finer N, Harper A, Kunesova M, Lean MEJ, et al. Safety, tolerability and sustained weight loss over 2 years with the once-daily human GLP-1 analog, liraglutide. Int J Obes 2012;36(6):843–854.

30. Davies MJ, Bergenstal R, Bode B, Kushner RF, Lewin A, Skjøth TV, et al. Efficacy of liraglutide for weight loss among patients with type 2 diabetes: the SCALE diabetes randomized clinical trial. JAMA 2015;314(7):687–699.

31. Pi-Sunyer X, Astrup A, Fujioka K, Greenway F, Halpern A, Krempf M, et al. A randomized, controlled trial of 3.0 mg of liraglutide in weight management. N Engl J Med 2015;373(1):11–22.

32. Courcoulas AP, Goodpaster BH, Eagleton JK, Belle SH, Kalarchian MA, Lang W, et al. Surgical vs. medical treatments for type 2 diabetes mellitus: a randomized clinical trial. JAMA Surg 2014;149:707–715. doi:10.1001/jamasurg.2014.467

Supplement 1. Search strategy

Database: Epistemonikos (Advanced search – Title/Abstract)
Search date: 2020-02-17
Search performed by: Tonje Lehne Refsdal, Research librarian, Norwegian Institute of Public Health

(life* AND obes*)

Supplement 2. Summary of Findings

Lifestyle interventions with motivational stay vs lifestyle interventions alone

Table 1. Summary of findings for lifestyle interventions with motivational stay

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with lifestyle change only	**Risk with motivational stay**				
Weight change [kg] 12 months follow-up	N/A	MD **0.26 higher** (2.36 lower to 2.87 higher)	-	140 (2 RCTs) [21,22]	⨁⊖⊖⊖ VERY LOW [a-c]	We are uncertain whether lifestyle interventions with motivational stay improve weight change at 1 year
Weight change [kg] 24 months follow-up	N/A	MD **8.91 higher** (3.09 higher to 14.74 higher)	-	58 (1 RCT) [21]	⨁⊖⊖⊖ VERY LOW [a,d]	We are uncertain whether lifestyle interventions with motivational stay improve weight change at 2 years
Weight change [kg] 60 months follow-up	N/A	MD **0.14 higher** (4.51 lower to 4.80 higher)	-	110 (2 RCTs) [21,23]	⨁⊖⊖⊖ VERY LOW [a,c]	We are uncertain whether lifestyle interventions with motivational stay improve weight change at 5 years

CI: Confidence interval; **MD:** Mean difference; **N/A:** not available; **RCT:** randomized, controlled trial;

* Weight change is shown as the adjusted mean weight change. Higher MD means less weight reduction in the intervention group relative to the comparison group.
[a] Blinding of patients and personnel was not possible due to nature of the intervention. Interventions were not consistent with current treatment practise in Norway.
[b] High heterogeneity between studies
[c] Low precision (wide CI) of effect estimates.
[d] Single RCT including small number of patients

Source: **Avenell et al.** (2018) Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation. Health Technol Assess 22(68)

Lifestyle interventions with pharmacological treatments vs lifestyle interventions alone

Table 2. Summary of findings for lifestyle interventions with anti-obesity pharmacological treatment

120 mg orlistat

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with placebo	Risk with 120 mg orlistat				
Weight change [kg] 12 months follow-up	N/A	MD **3.43 lower** (3.60 lower to 3.01 lower)	-	8549 (12 RCTs) [7-15,24-26]	⨁⨁⨀⨀ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may improve weight change at 1 year
Weight change [kg] 24 months follow-up	N/A	MD **3.40 lower** (4.72 lower to 2.09 lower)	-	939 (2 RCTs) [12,15]	⨁⨁⨀⨀ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may improve weight change at 2 years
Weight change [kg] 48 months follow-up	N/A	MD **2.20 lower** (2.65 lower to 1.75 lower)	-	3277 (1 RCT) [26]	⨁⨁⨀⨀ LOW [a,c,d]	Lifestyle interventions with 120 mg orlistat may improve weight change at 4 years
Total cholesterol [mmol/L] 12 months follow-up	N/A	MD **0.31 lower** (0.38 lower to 0.25 lower)	-	3850 (9 RCTs) [7-9,11,12,14,15,24,25]	⨁⨁⨀⨀ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may slightly improve total cholesterol at 1 year
LDL cholesterol [mmol/L] 12 months follow-up	N/A	MD **0.26 lower** (0.31 lower to 0.21 lower)	-	3850 (9 RCTs) [7-9,11,12,14,15,24,25]	⨁⨁⨀⨀ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may slightly improve LDL cholesterol at 1 year
HDL cholesterol [mmol/L] 12 months follow-up	N/A	MD **0.03 lower** (0.04 lower to 0.01 lower)	-	2796 (7 RCTs) [7,11,12,14,15,24,25]	⨁⨁⨀⨀ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may make no or little difference to HDL cholesterol at 1 year
Triglycerides [mmol/L] 12 months follow-up	N/A	MD **0.01 lower** (0.08 lower to 0.06 higher)	-	2620 (6 RCTs) [7,12,14,15,24,25]	⨁⨁⨀⨀ LOW [a-c,f]	Lifestyle interventions with 120 mg orlistat may make no or little difference to triglycerides at 1 year
Systolic blood pressure [mmHg] 12 months follow-up	N/A	MD **2.14 lower** (2.77 lower to 1.52 lower)	-	6647 (9 RCTs) [7,8,11,12,14,15,24-26]	⨁⨁⨀⨀ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may slightly improve systolic blood pressure at 1 year

Diastolic blood pressure [mmHg] 12 months follow-up	N/A	MD **1.66 lower** (2.07 lower to 1.24 lower)	-	6143 (8 RCTs) [7,8,11,12,15,24-26]	⨁⨁◯◯ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may slightly improve diastolic blood pressure at 1 year
HbA1c [%] 12 months follow-up	N/A	MD **0.25 lower** (0.35 lower to 0.15 higher)	-	1378 (3 RCTs) [7,14,25]	⨁⨁◯◯ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may make no or little difference to plasma HbA1c at 1 year
Blood glucose [mmol/L] 12 months follow-up	N/A	MD **0.34 lower** (0.49 lower to 0.18 lower)	-	6532 (8 RCTs) [7,9,12,14,15,24-26]	⨁⨁◯◯ LOW [a-c]	Lifestyle interventions with 120 mg orlistat may slightly improve blood glucose at 1 year

60 mg orlistat

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with placebo	**Risk with 60 mg orlistat**				
Weight change [kg] 12 months follow-up	N/A	MD **2.94 lower** (1.84 lower to 4.04 lower)	-	425 (1 RCT) [12]	⨁⨁◯◯ LOW [a-e]	Lifestyle interventions with 60 mg orlistat may improve weight change at 1 year
Weight change [kg] 24 months follow-up	N/A	MD **2.81 lower** (2.17 lower to 3.45 lower)	-	425 (1 RCT) [12]	⨁⨁◯◯ LOW [a-e]	Lifestyle interventions with 60 mg orlistat may improve weight change at 2 years

Naltrexone-bupropion

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with placebo	**Risk with naltrexone-bupropion**				
Weight change [kg] 13 months follow-up	N/A	MD **4.95 lower** (5.54 lower to 4.36 lower)	-	2264 (2 RCTs) [27,28]	⨁⨁⨁◯ MODERATE [a,c,d]	Lifestyle interventions with naltrexone-bupropion probably improve weight change at 13 months

Liraglutide

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies) (references)	Certainty of the evidence (GRADE)	Comments
	Risk with placebo	**Risk with liraglutide**				
Weight change [kg] 13 months follow-up	N/A	MD **5.24 lower** (5.60 lower to 4.87 lower)	-	4424 (3 RCTs) [29-31]	⨁⨁⨁◯ MODERATE [a,c,d]	Lifestyle interventions with liraglutide probably improve weight change at 13 months

CI: Confidence interval; **LDL**: low-density lipoprotein; **HbA1c:** hemoglobin A1c (glycated haemoglobin); **HDL**: high-density lipoprotein; **MD:** Mean difference; **N/A**: not available; **RCT:** randomized, controlled trial;

***** Weight change is shown as the adjusted mean weight change. Lower MD means greater weight reduction in the intervention group relative to the comparison group.
[a] Possible attrition bias due to incomplete outcome data
[b] Unclear how allocation to treatment was randomized. Unclear whether allocation to treatment was concealed.
[c] Conflict of interest, affiliation with pharmaceutical industry and/or study authors received honoraria/financial support
[d] Included patients with body mass index below morbidly obese. Unclear whether patients suffered from overweight-related comorbidities.
[e] Unclear whether outcome data assessment was blinded
[f] High heterogeneity between studies

Sources: **Avenell et al.** (2018) Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation. Health Technol Assess 22(68); **Khera et al.** (2016) Association of Pharmacological Treatments for Obesity With Weight Loss and Adverse Events: A Systematic Review and Meta-analysis. JAMA 315(22):2424–2434.

Lifestyle interventions with surgical treatments vs lifestyle interventions alone

Table 3. Summary of findings for lifestyle interventions with gastric bypass surgery

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with lifestyle change only	**Risk with gastric bypass**				
Weight change [kg] 12 months follow-up	N/A	MD **23.28 lower** (25.82 lower to 20.74 lower)	-	213 (4 RCTs) [16-18,32]	⊕⊕⊕⊖ MODERATE [a,b]	Lifestyle interventions with gastric bypass probably improve weight change at 1 year
Weight change [kg] 24 months follow-up	N/A	MD **23.42 lower** (26.33 lower to 20.51 lower)	-	221 (4 RCTs) [16,17,19,32]	⊕⊕⊕⊖ MODERATE [a]	Lifestyle interventions with gastric bypass probably improve weight change at 2 years
Weight change [kg] 36 months follow-up	N/A	MD **21.14 lower** (24.49 lower to 17.79 lower)	-	87 (2 RCTs) [17,32]	⊕⊕⊕⊖ MODERATE [a]	Lifestyle interventions with gastric bypass probably improve weight change at 3 years
Weight change [kg] 48 months follow-up	N/A	MD **20.00 lower** (24.00 lower to 15.23 lower)	-	91 (1 RCT) [17]	⊕⊕⊕⊖ MODERATE [a,c]	Lifestyle interventions with gastric bypass probably improve weight change at 4 years
Weight change [kg] 60 months follow-up	N/A	MD **20.23 lower** (23.75 lower to 16.71 lower)	-	131 (2 RCTs) [17,19]	⊕⊕⊕⊖ MODERATE [a]	Lifestyle interventions with gastric bypass probably improve weight change at 5 years
Total cholesterol [mmol/L] 12 months follow-up	N/A	MD **0.18 lower** (0.50 lower to 0.15 higher)	-	181 (3 RCTs) [16,17,32]	⊕⊕⊖⊖ LOW [a]	Lifestyle interventions with gastric bypass may make no or little difference to cholesterol at 1 year
LDL cholesterol [mmol/L] 12 months follow-up	N/A	MD **0.10 lower** (0.38 lower to 0.17 higher)	-	181 (3 RCTs) [16,17,32]	⊕⊕⊖⊖ LOW [a]	Lifestyle interventions with gastric bypass may make no or little difference to LDL cholesterol at 1 year
HDL cholesterol [mmol/L] 12 months follow-up	N/A	MD **0.23 higher** (0.16 higher to 0.30 higher)	-	213 (4 RCTs) [16-18,32]	⊕⊕⊕⊖ MODERATE [a,b]	Lifestyle interventions with gastric bypass probably slightly elevate HDL cholesterol at 1 year
Triglycerides [mmol/L] 12 months follow-up	N/A	MD **0.44 lower** (0.64 lower to 0.23 lower)	-	213 (4 RCTs) [16-18,32]	⊕⊕⊕⊖ MODERATE [a,b]	Lifestyle interventions with gastric bypass probably slightly improve triglycerides at 1 year

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with lifestyle change only	**Risk with gastric bypass**				
Systolic blood pressure [mmHg] 12 months follow-up	N/A	MD **6.47 lower** (10.57 lower to 2.19 lower)	-	213 (4 RCTs) [16-18,32]	⊕⊕⊖⊖ LOW [a,b,d]	Lifestyle interventions with gastric bypass may slightly improve systolic blood pressure at 1 year
Diastolic blood pressure [mmHg] 12 months follow-up	N/A	MD **2.36 lower** (4.69 lower to 0.03 lower)	-	213 (4 RCTs) [16-18,32]	⊕⊕⊖⊖ LOW [a,b,d]	Lifestyle interventions with gastric bypass may slightly improve diastolic blood pressure at 1 year
HbA1c [%] 12 months follow-up	N/A	MD **1.69 lower** (2.13 lower to 1.25 lower)	-	213 (4 RCTs) [16-18,32]	⊕⊕⊕⊖ MODERATE [a,b]	Lifestyle interventions with gastric bypass probably slightly improve plasma HbA1c at 1 year
Blood glucose [mmol/L] 12 months follow-up	N/A	MD **2.77 lower** (3.66 lower to 1.89 lower)	-	213 (4 RCTs) [16-18,32]	⊕⊕⊕⊖ MODERATE [a,b]	Lifestyle interventions with gastric bypass probably slightly improve blood glucose at 1 year

CI: Confidence interval; **LDL**: low-density lipoprotein; **HbA1c:** hemoglobin A1c (glycated haemoglobin); **HDL**: high-density lipoprotein; **MD:** Mean difference; **N/A**: not available; **RCT:** randomized, controlled trial;

***** Weight change is shown as the adjusted mean weight change. Lower MD means greater weight reduction in the intervention group relative to the comparison group.
[a] Blinding of patients and personnel not possible due to nature of the intervention. Conflict of interest, affiliation with pharmaceutical industry and/or study authors received honoraria/financial support.
[b] Possible reporting bias due to selective outcome reporting
[c] Single RCT including small number of patients
[d] Low accuracy (non-overlapping CI) of effect estimates

Source: **Avenell et al.** (2018) Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation. Health Technol Assess 22(68)

Table 4. Summary of findings for lifestyle interventions with sleeve gastrectomy

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies) (references)	Certainty of the evidence (GRADE)	Comments
	Risk with lifestyle change only	**Risk with sleeve gastrec-tomy**				
Weight change [kg] 12 months follow-up	N/A	MD **22.24 lower** (25.13 lower to 19.34 lower)	-	101 (2 RCTs) [17,20]	⨁⨁⨀⨀ LOW [a,b]	Lifestyle interventions with sleeve gastrectomy may improve weight change at 1 year
Weight change [kg] 24 months follow-up	N/A	MD **18.48 lower** (22.42 lower to 14.54 lower)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may improve weight change at 2 years
Weight change [kg] 36 months follow-up	N/A	MD **17.43 lower** (21.00 lower to 13.86 lower)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may improve weight change at 3 years
Weight change [kg] 48 months follow-up	N/A	MD **17.2 lower** (21.01 lower to 13.39 lower)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may improve weight change at 4 years
Weight change [kg] 60 months follow-up	N/A	MD **13.46 higher** (17.03 lower to 9.88 lower)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may improve weight change 5 years
Total choles-terol [mmol/L] 12 months follow-up	N/A	MD **0.12 higher** (0.34 lower to 0.58 higher)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may make little or no difference to total cholesterol at 1 year
LDL choles-terol [mmol/L] 12 months follow-up	N/A	MD **0.17 higher** (0.25 lower to 0.59 higher)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may make little or no difference to LDL cholesterol at 1 year
HDL choles-terol [mmol/L] 12 months follow-up	N/A	MD **0.19 higher** (0.09 higher to 0.29 higher)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may slightly elevate HDL cholesterol at 1 year
Tri-glycerides [mmol/L] 12 months follow-up	N/A	MD **0.42 lower** (0.82 lower to 0.02 lower)	-	90 (1 RCT) [17]	⨁⨁⨀⨀ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may slightly improve triglycerides at 1 year

Outcomes*	Anticipated absolute effects (95% CI)		Relative effect (95% CI)	Number of participants (studies) (references)	Certainty of the evidence (GRADE)	Comments
	Risk with lifestyle change only	**Risk with sleeve gastrectomy**				
Systolic blood pressure [mmHg] 12 months follow-up	N/A	MD **1.20 lower** (7.75 lower to 5.35 higher)	-	90 (1 RCT) [17]	⊕⊖⊖⊖ VERY LOW [a,c,d]	We are uncertain whether lifestyle interventions with sleeve gastrectomy improve systolic blood pressure at 1 year
Diastolic blood pressure [mmHg] 12 months follow-up	N/A	MD **0.90 higher** (2.84 lower to 4.64 higher)	-	90 (1 RCT) [17]	⊕⊖⊖⊖ VERY LOW [a,c,d]	We are uncertain whether lifestyle interventions with sleeve gastrectomy improve diastolic blood pressure at 1 year
HbA1c [%] 12 months follow-up	N/A	MD **1.50 lower** (2.18 lower to 0.82 lower)	-	90 (1 RCT) [17]	⊕⊕⊖⊖ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may slightly improve plasma HbA1c at 1 year
Blood glucose [mmol/L] 12 months follow-up	N/A	MD **1.95 lower** (3.4 lower to 0.5 lower)	-	90 (1 RCT) [17]	⊕⊕⊖⊖ LOW [a,c]	Lifestyle interventions with sleeve gastrectomy may slightly improve blood glucose at 1 year

CI: Confidence interval; **LDL**: low-density lipoprotein; **HbA1c:** hemoglobin A1c (glycated haemoglobin); **HDL**: high-density lipoprotein; **MD:** Mean difference; **N/A**: not available; **RCT:** randomized, controlled trial;

***** Weight change is shown as the adjusted mean weight change. Lower MD means greater weight reduction in the intervention group relative to the comparison group.
[a] Blinding of patients and personnel not possible due to nature of the intervention. Conflict of interest, affiliation with pharmaceutical industry and/or study authors received honoraria/financial support.
[b] Low accuracy (non-overlapping CI) of effect estimates
[c] Single RCT including small number of patients
[d] Low precision (wide CI) of effect estimates

Source: **Avenell et al.** (2018) Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation. Health Technol Assess 22(68)

NIPH

Published by the Norwegian Institute of Public Health
November 2020
P.O.B 4404 Nydalen
NO-0403 Oslo
Phone: + 47-21 07 70 00
The report can be downloaded as pdf
at www.fhi.no/en/publ/