Exercise Training in Metabolic and Bariatric Surgery Adults: An Overview of Systematic Reviews

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SUPPLEMENTARY FILE

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Appendix A – Amendments to Preregistered Protocol

Table S1: Amendments to Preregistered Protocol with Reasoning

Preregistered Details	Amendment	Reasoning
Selection: Studies screened through RAYYAN	Covidence used	Preference of researchers conducting screening
Selection: "To avoid overlap between primary studies, only one systematic review per outcome will be selected. Several systematic reviews could be included for the same outcomes if they provide additional analysis (e.g., by exercise training type or timing, by bariatric surgery). If several systematic reviews are available for one outcome, the highest quality systematic review (AMSTAR 2) will be considered. The most recent systematic review will be chosen if several systematic reviews for the same outcome have the same quality score."	ALL reviews maintained for all outcomes. Overlap calculated but not avoided	Shifted study aim to synthesize the current FULL body of literature and assess concordance/ discordance between reviews
Risk of bias (quality) assessment	Item 7 was removed from critical item list	providing a list of excluded original articles with reasons for exclusion is not required by the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guidelines
Strategy for data synthesis: "A narrative synthesize will be performed per outcome with tables to ensure consistency of data presentation across studies."	Added in efforts to determine concordance / discordance followed by a categorization into "what we currently know", "what we think we know" and "what we still don't know"	Shifted study aim to synthesize the current FULL body of literature and assess concordance/ discordance between reviews

Note. All amendments were made after protocol preregistration on PROSPERO but before any data collection began on the study. Failing to update the protocol was an oversight.

Appendix B – PRIOR Checklist

(Gates M, Gates A, Pieper D, et al. Reporting guideline for overviews of reviews of healthcare interventions: development of the PRIOR statement. *BMJ* 2022;378:e070849. doi:10.1136/bmj-2022-070849.)

Page numbers will be updated based on final typeset manuscript

Section Topic	#	**Item**	**Location reported** ***(Page #)***
TITLE			
Title	1	Identify the report as an overview of reviews.	First page
ABSTRACT			
Abstract	2	Provide a comprehensive and accurate summary of the purpose, methods, and results of the overview of reviews.	First page
INTRODUCTION			
Rationale	3	Describe the rationale for conducting the overview of reviews in the context of existing knowledge.	Introduction *Page x*
Objectives	4	Provide an explicit statement of the objective(s) or question(s) addressed by the overview of reviews.	Introduction *Page x*
METHODS			
Eligibility criteria	5a	Specify the inclusion and exclusion criteria for the overview of reviews. If supplemental primary studies were included, this should be stated, with a rationale.	Eligibility Criteria *Page x & Table 1*
	5b	Specify the definition of 'systematic review' as used in the inclusion criteria for the overview of reviews.	*Table 1*
Information sources	6	Specify all databases, registers, websites, organizations, reference lists, and other sources searched or consulted to identify systematic reviews and supplemental primary studies (if included). Specify the date when each source was last searched or consulted.	Information Sources and Search Strategy *Page x*
Search strategy	7	Present the full search strategies for all databases, registers and websites, such that they could be reproduced. Describe any search filters and limits applied.	*Supplementary File* *Appendix C*
Selection process	8a	Describe the methods used to decide whether a systematic review or supplemental primary study (if included) met the inclusion criteria of the overview of reviews.	Study Selection *Page x*
	8b	Describe how overlap in the populations, interventions, comparators, and/or outcomes of systematic reviews was identified and managed during study selection.	Study Selection *Page x*
Data collection process	9a	Describe the methods used to collect data from reports.	Data Extraction *Page x*
	9b	If applicable, describe the methods used to identify and manage primary study overlap at the level of the comparison and outcome during data collection. For each outcome, specify the method used to illustrate and/or quantify the degree of primary study overlap across systematic reviews.	Data Synthesis *Page x*
	9c	If applicable, specify the methods used to manage discrepant data across systematic reviews during data collection.	Data Extraction Page x
Data items	10	List and define all variables and outcomes for which data were sought. Describe any assumptions made and/or measures taken	Data Extraction *Page x & Table 2*

		to identify and clarify missing or unclear information.	
Risk of bias assessment	11a	Describe the methods used to *assess* risk of bias or methodological quality of the included systematic reviews.	Risk of Bias of Included Systematic Reviews *Page X*
	11b	Describe the methods used to *collect* data on (from the systematic reviews) and/or *assess* the risk of bias of the primary studies included in the systematic reviews. Provide a justification for instances where flawed, incomplete, or missing assessments are identified but not re-assessed.	Data Extraction *Page x & Table 2*
	11c	Describe the methods used to *assess* the risk of bias of supplemental primary studies (if included).	N/A
Synthesis methods	12a	Describe the methods used to summarize or synthesize results and provide a rationale for the choice(s).	Data Synthesis *Page x*
	12b	Describe any methods used to explore possible causes of heterogeneity among results.	Data Synthesis *Page x*
	12c	Describe any sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting bias assessment	13	Describe the methods used to *collect* data on (from the systematic reviews) and/or *assess* the risk of bias due to missing results in a summary or synthesis (arising from reporting biases at the levels of the systematic reviews, primary studies, and supplemental primary studies, if included).	*Table 2*
Certainty assessment	14	Describe the methods used to *collect* data on (from the systematic reviews) and/or *assess* certainty (or confidence) in the body of evidence for an outcome.	Data Extraction *Page x & Table 2*
RESULTS			
Systematic review and supplemental primary study selection	15a	Describe the results of the search and selection process, including the number of records screened, assessed for eligibility, and included in the overview of reviews, ideally with a flow diagram.	Results *Page x* *Supplementary File* *Appendix D*
	15b	Provide a list of studies that might appear to meet the inclusion criteria, but were excluded, with the main reason for exclusion.	*Supplementary File* *Appendix E*
Characteristics of systematic reviews and supplemental primary studies	16	Cite each included systematic review and supplemental primary study (if included) and present its characteristics.	Preoperative Exercise Training *Page x* Postoperative Exercise Training *Page x* *Supplementary File* *Appendix F, I & K*
Primary study overlap	17	Describe the extent of primary study overlap across the included systematic reviews.	Preoperative Exercise Training *Page x* Postoperative Exercise Training *Page x* *Supplementary File* *Appendix H, J, & L*
Risk of bias in systematic reviews, primary	18a	Present assessments of risk of bias or methodological quality for each included systematic review.	Preoperative Exercise Training *Page x*

studies, and supplemental primary studies			Postoperative Exercise Training *Page x* *Supplementary File* *Appendix G*
	18b	Present assessments (*collected* from systematic reviews or *assessed* anew) of the risk of bias of the primary studies included in the systematic reviews.	*Supplementary File* *Appendix I & K*
	18c	Present assessments of the risk of bias of supplemental primary studies (if included).	N/A
Summary or synthesis of results	19a	For all outcomes, summarize the evidence from the systematic reviews and supplemental primary studies (if included). If meta-analyses were done, present for each the summary estimate and its precision and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Outcomes: Preoperative Exercise Training *Page x & Table 3* Postoperative Exercise Training *Page x & Table 4* Subanalyses: Subanalyses *Page x* *Supplementary File* *Appendix M* Feasibility and Acceptability: Feasibility and Acceptability *Page x & Table 5* *Supplementary File* *Appendix N* Overall: Overarching Results/Conclusions Page x
	19b	If meta-analyses were done, present results of all investigations of possible causes of heterogeneity.	N/A
	19c	If meta-analyses were done, present results of all sensitivity analyses conducted to assess the robustness of synthesized results.	N/A
Reporting biases	20	Present assessments (*collected* from systematic reviews and/or *assessed* anew) of the risk of bias due to missing primary studies, analyses, or results in a summary or synthesis (arising from reporting biases at the levels of the systematic reviews, primary studies, and supplemental primary studies, if included) for each summary or synthesis assessed.	*Supplementary File* *Appendix O*
Certainty of evidence	21	Present assessments (*collected* or *assessed* anew) of certainty (or confidence) in the body of evidence for each outcome.	Preoperative Exercise Training *Table 3* Postoperative Exercise Training *Table 4*
DISCUSSION			

Discussion	22a	Summarize the main findings, including any discrepancies in findings across the included systematic reviews and supplemental primary studies (if included).	Effects of Exercise Training *Page x* Beneficial Characteristics of Exercise Training Programs *Page x* Feasibility and Acceptability *Page x*
	22b	Provide a general interpretation of the results in the context of other evidence.	Effects of Exercise Training *Page x* Beneficial Characteristics of Exercise Training Programs *Page x* Feasibility and Acceptability *Page x*
	22c	Discuss any limitations of the evidence from systematic reviews, their primary studies, and supplemental primary studies (if included) included in the overview of reviews. Discuss any limitations of the overview of reviews methods used.	Strengths And Limitations *Page x*
	22d	Discuss implications for practice, policy, and future research (both systematic reviews and primary research). Consider the relevance of the findings to the end users of the overview of reviews, e.g., healthcare providers, policymakers, patients, among others.	Conclusion Page x
OTHER INFORMATION			
Registration and protocol	23a	Provide registration information for the overview of reviews, including register name and registration number, or state that the overview of reviews was not registered.	Materials And Methods *Page x*
	23b	Indicate where the overview of reviews protocol can be accessed, or state that a protocol was not prepared.	N/A
	23c	Describe and explain any amendments to information provided at registration or in the protocol. Indicate the stage of the overview of reviews at which amendments were made.	*Supplementary File* Appendix A
Support	24	Describe sources of financial or non-financial support for the overview of reviews, and the role of the funders or sponsors in the overview of reviews.	Funding Information *Page x*
Competing interests	25	Declare any competing interests of the overview of reviews' authors.	First page
Author information	26a	Provide contact information for the corresponding author.	First page
	26b	Describe the contributions of individual authors and identify the guarantor of the overview of reviews.	Author Contributions *Page x*
Availability of data and other materials	27	Report which of the following are available, where they can be found, and under which conditions they may be accessed: template data collection forms; data collected from included systematic reviews and supplemental primary studies; analytic code; any other materials used in the overview of reviews.	Reference to Supplementary File materials made where relevant throughout the manuscript

Appendix C – Search Methods and Strategy

1. SR / MA / HTA / ITC - MEDLINE, Embase, PsycInfo. In: CADTH Search Filters Database. Ottawa: CADTH; 2022: https://searchfilters.cadth.ca/link/33. Accessed 2022-11-21.
2. SR / MA / HTA / ITC - CINAHL. In: CADTH Search Filters Database. Ottawa: CADTH; 2022: https://searchfilters.cadth.ca/link/98. Accessed 2022-11-21.
3. SR / MA / HTA / ITC - Scopus. In: CADTH Search Filters Database. Ottawa: CADTH; 2022: https://searchfilters.cadth.ca/link/105. Accessed 2022-11-21.

Table S2: MEDLINE (Ovid) Search Strategy
Ovid MEDLINE(R) ALL: 1946 to November 18, 2022

#	Searches	Results
1	exp bariatric surgery/	32129
2	biliopancreatic diversion/	1092
3	((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) adj3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*)).ti,ab,kf.	55597
4	((metabolic or weight or obesity or antiobesity or restrictive) adj2 surger*).ti,ab,kf.	6829
5	(stomach* adj2 stapl*).ti,ab,kf.	41
6	(duoden* adj2 switch*).ti,ab,kf.	936
7	((gastric or gastrect* or silicon* or lap or stomach*) adj2 (band* or sleev*)).ti,ab,kf.	11781
8	(gastrojejunostom* or gastroplast* or roux-en-y).ti,ab,kf.	17478
9	or/1-8	74528
10	exp exercise/	238285
11	exp exercise therapy/	61315
12	exp physical fitness/	35572
13	exp exercise movement techniques/	9973
14	bicycling/	12610
15	(exercis* or aerobic* or sport* or walk* or jog* or swim* or danc* or yoga or cycling or biking or bicycl* or bike* or crossfit or tai chi or tai ji or pilate* or plyometric* or fitness or calisthenic* or kinesiotherap* or kinesitherap* or gym* or movement therap*).ti,ab,kf.	832917

16	((physical* or endurance or cardio* or muscl*) adj4 (fit* or train* or activit* or conditon*)).ti,ab,kf.	243264
17	((resistance or strength* or interval* or circuit*) adj4 (train* or program*)).ti,ab,kf.	37410
18	(weight* adj4 (lift* or train*)).ti,ab,kf.	7001
19	(work* adj2 out*).ti,ab,kf.	24311
20	or/10-19	1069291
21	(systematic review or meta-analysis).pt.	291952
22	meta-analysis/ or systematic review/ or systematic reviews as topic/ or meta-analysis as topic/ or "meta analysis (topic)"/ or "systematic review (topic)"/ or exp technology assessment, biomedical/ or network meta-analysis/	328880
23	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab,kf.	292532
24	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab,kf.	14615
25	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab,kf.	36462
26	(data synthes* or data extraction* or data abstraction*).ti,ab,kf.	37511
27	(handsearch* or hand search*).ti,ab,kf.	10798
28	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab,kf.	33728
29	(met analy* or metanaly* or technology assessment* or HTA or HTAs or technology overview* or technology appraisal*).ti,ab,kf.	11635
30	(meta regression* or metaregression*).ti,ab,kf.	13406
31	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	433902
32	(medline or cochrane or pubmed or medlars or embase or cinahl).ti,ab,hw.	315951
33	(cochrane or (health adj2 technology assessment) or evidence report).jw.	21064
34	(comparative adj3 (efficacy or effectiveness)).ti,ab,kf.	16694
35	(outcomes research or relative effectiveness).ti,ab,kf.	10880

36	((indirect or indirect treatment or mixed-treatment or bayesian) adj3 comparison*).ti,ab,kf.	4139
37	(multi* adj3 treatment adj3 comparison*).ti,ab,kf.	286
38	(mixed adj3 treatment adj3 (meta-analy* or metaanaly*)).ti,ab,kf.	176
39	umbrella review*.ti,ab,kf.	1189
40	(multi* adj2 paramet* adj2 evidence adj2 synthesis).ti,ab,kf.	13
41	(multiparamet* adj2 evidence adj2 synthesis).ti,ab,kf.	18
42	(multi-paramet* adj2 evidence adj2 synthesis).ti,ab,kf.	11
43	or/21-42	638533
44	9 and 20 and 43	213

Table S3: Embase (Ovid) Search Strategy
Embase Classic+Embase: 1947 to 2022 November 18

#	**Searches**	**Results**
1	exp bariatric surgery/	53897
2	((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) adj3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*)).ti,ab,kf.	89019
3	((metabolic or weight or obesity or antiobesity or restrictive) adj2 surger*).ti,ab,kf.	11752
4	(stomach* adj2 stapl*).ti,ab,kf.	99
5	(duoden* adj2 switch*).ti,ab,kf.	1885
6	((gastric or gastrect* or silicon* or lap or stomach*) adj2 (band* or sleev*)).ti,ab,kf.	23847
7	(gastrojejunostom* or gastroplast* or roux-en-y).ti,ab,kf.	29914
8	or/1-7	115379
9	exp exercise/	433457
10	exp physical activity/	528169
11	exp kinesiotherapy/	99059
12	fitness/	44353

13	(exercis* or aerobic* or sport* or walk* or jog* or swim* or danc* or yoga or cycling or biking or bicycl* or bike* or crossfit or tai chi or tai ji or pilate* or plyometric* or fitness or calisthenic* or kinesiotherap* or kinesitherap* or gym* or movement therap*).ti,ab,kf.	1092307
14	((physical* or endurance or cardio* or muscl*) adj4 (fit* or train* or activit* or conditon*)).ti,ab,kf.	327108
15	((resistance or strength* or interval* or circuit*) adj4 (train* or program*)).ti,ab,kf.	47367
16	(weight* adj4 (lift* or train*)).ti,ab,kf.	9509
17	(work* adj2 out*).ti,ab,kf.	35972
18	or/9-17	1668824
19	(systematic review or meta-analysis).pt.	0
20	meta-analysis/ or systematic review/ or systematic reviews as topic/ or meta-analysis as topic/ or "meta analysis (topic)"/ or "systematic review (topic)"/ or exp technology assessment, biomedical/ or network meta-analysis/	570330
21	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab,kf.	357776
22	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab,kf.	17125
23	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab,kf.	51553
24	(data synthes* or data extraction* or data abstraction*).ti,ab,kf.	45827
25	(handsearch* or hand search*).ti,ab,kf.	13130
26	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab,kf.	44640
27	(met analy* or metanaly* or technology assessment* or HTA or HTAs or technology overview* or technology appraisal*).ti,ab,kf.	18720
28	(meta regression* or metaregression*).ti,ab,kf.	16465
29	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	679977
30	(medline or cochrane or pubmed or medlars or embase or cinahl).ti,ab,hw.	411013
31	(cochrane or (health adj2 technology assessment) or evidence report).jw.	29476

32	(comparative adj3 (efficacy or effectiveness)).ti,ab,kf.	24750
33	(outcomes research or relative effectiveness).ti,ab,kf.	15951
34	((indirect or indirect treatment or mixed-treatment or bayesian) adj3 comparison*).ti,ab,kf.	7114
35	(multi* adj3 treatment adj3 comparison*).ti,ab,kf.	412
36	(mixed adj3 treatment adj3 (meta-analy* or metaanaly*)).ti,ab,kf.	256
37	umbrella review*.ti,ab,kf.	1251
38	(multi* adj2 paramet* adj2 evidence adj2 synthesis).ti,ab,kf.	27
39	(multiparamet* adj2 evidence adj2 synthesis).ti,ab,kf.	19
40	(multi-paramet* adj2 evidence adj2 synthesis).ti,ab,kf.	22
41	or/19-40	919343
42	8 and 18 and 41	653

Table S4: PsycInfo (Ovid) Search Strategy
APA PsycInfo: 1806 to November Week 2 2022

#	**Searches**	**Results**
1	bariatric surgery/	1301
2	((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) adj3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*)).ti,ab.	1786
3	((metabolic or weight or obesity or antiobesity or restrictive) adj2 surger*).ti,ab.	447
4	(stomach* adj2 stapl*).ti,ab.	0
5	(duoden* adj2 switch*).ti,ab.	8
6	((gastric or gastrect* or silicon* or lap or stomach*) adj2 (band* or sleev*)).ti,ab.	225
7	(gastrojejunostom* or gastroplast* or roux-en-y).ti,ab.	270
8	or/1-7	2075
9	exercise/	26560
10	physical activity/	24885

11	active living/	275
12	physical fitness/	4765
13	walking/	6725
14	running/	2343
15	(exercis* or aerobic* or sport* or walk* or jog* or swim* or danc* or yoga or cycling or biking or bicycl* or bike* or crossfit or tai chi or tai ji or pilate* or plyometric* or fitness or calisthenic* or kinesiotherap* or kinesitherap* or gym* or movement therap*).ti,ab.	179007
16	((physical* or endurance or cardio* or muscl*) adj4 (fit* or train* or activit* or conditon*)).ti,ab.	55242
17	((resistance or strength* or interval* or circuit*) adj4 (train* or program*)).ti,ab.	7163
18	(weight* adj4 (lift* or train*)).ti,ab.	1630
19	(work* adj2 out*).ti,ab.	14933
20	or/9-19	236602
21	(systematic review or meta-analysis).pt.	0
22	meta-analysis/ or systematic review/ or systematic reviews as topic/ or meta-analysis as topic/ or "meta analysis (topic)"/ or "systematic review (topic)"/ or exp technology assessment, biomedical/ or network meta-analysis/	5913
23	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab.	50317
24	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab.	10782
25	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab.	6089
26	(data synthes* or data extraction* or data abstraction*).ti,ab.	3534
27	(handsearch* or hand search*).ti,ab.	1513
28	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab.	5890
29	(met analy* or metanaly* or technology assessment* or HTA or HTAs or technology overview* or technology appraisal*).ti,ab.	993
30	(meta regression* or metaregression*).ti,ab.	2419

31	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	78189
32	(medline or cochrane or pubmed or medlars or embase or cinahl).ti,ab,hw.	33313
33	(cochrane or (health adj2 technology assessment) or evidence report).jx.	0
34	(comparative adj3 (efficacy or effectiveness)).ti,ab.	2301
35	(outcomes research or relative effectiveness).ti,ab.	3848
36	((indirect or indirect treatment or mixed-treatment or bayesian) adj3 comparison*).ti,ab.	494
37	(meta-analysis or systematic review).md.	59169
38	(multi* adj3 treatment adj3 comparison*).ti,ab.	51
39	(mixed adj3 treatment adj3 (meta-analy* or metaanaly*)).ti,ab.	19
40	umbrella review*.ti,ab.	208
41	(multi* adj2 paramet* adj2 evidence adj2 synthesis).ti,ab.	2
42	(multiparamet* adj2 evidence adj2 synthesis).ti,ab.	6
43	(multi-paramet* adj2 evidence adj2 synthesis).ti,ab.	2
44	or/21-43	125987
45	8 and 20 and 44	14

Table S5: Cochrane Database of Systematic Reviews (Ovid) Search Strategy
EBM Reviews - Cochrane Database of Systematic Reviews: 2005 to November 16, 2022

#	**Searches**	**Results**
1	((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) adj3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*)).ti,ab,kw.	34
2	((metabolic or weight or obesity or antiobesity or restrictive) adj2 surger*).ti,ab,kw.	3
3	(stomach* adj2 stapl*).ti,ab,kw.	0
4	(duoden* adj2 switch*).ti,ab,kw.	1
5	((gastric or gastrect* or silicon* or lap or stomach*) adj2 (band* or sleev*)).ti,ab,kw.	5

6	(gastrojejunostom* or gastroplast* or roux-en-y).ti,ab,kw.	6
7	or/1-6	37
8	(exercis* or aerobic* or sport* or walk* or jog* or swim* or danc* or yoga or cycling or biking or bicycling or crossfit or tai chi or tai ji or pilate* or plyometric* or fitness or calisthenic* or kinesiotherap* or kinesitherap* or gym* or movement therap*).ti,ab,kw.	835
9	((physical* or endurance or cardio* or muscl*) adj4 (fit* or train* or activit* or conditon*)).ti,ab,kw.	259
10	((resistance or strength* or interval* or circuit*) adj4 (train* or program*)).ti,ab,kw.	78
11	(weight* adj4 (lift* or train*)).ti,ab,kw.	8
12	(work* adj2 out*).ti,ab,kw.	24
13	or/8-12	929
14	7 and 13	3

Table S6: CINAHL (EBSCOhost) Search Strategy		
#	**Searches**	**Results**
S20	S8 AND S18 AND S19	63
S19	(MH "meta analysis" OR MH "systematic review" OR MH "Technology, Medical/EV" OR PT "systematic review" OR PT "meta analysis" OR (((TI systematic* OR AB systematic*) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*))) OR ((TI methodologic* OR AB methodologic*) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*)))) OR (((TI quantitative OR AB quantitative) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*) OR (TI synthes* OR AB synthes*))) OR ((TI research OR AB research) N3 ((TI integrati* OR AB integrati*) OR (TI overview* OR AB overview*)))) OR (((TI integrative OR AB integrative) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*))) OR ((TI collaborative OR AB collaborative) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*))) OR ((TI pool* OR AB pool*) N3 (TI analy* OR AB analy*))) OR ((TI "data synthes*" OR AB "data synthes*") OR (TI "data extraction*" OR AB "data extraction*") OR (TI "data abstraction*" OR AB "data abstraction*")) OR ((TI handsearch* OR AB handsearch*) OR (TI "hand search*" OR AB "hand search*")) OR ((TI "mantel haenszel" OR AB "mantel haenszel") OR (TI peto OR AB peto) OR (TI "der simonian" OR AB "der simonian") OR (TI dersimonian OR AB dersimonian) OR (TI "fixed effect*" OR AB "fixed effect*") OR (TI "latin square*" OR AB "latin square*")) OR ((TI "met analy*" OR AB "met analy*")	288,604

	OR (TI metanaly* OR AB metanaly*) OR (TI "technology assessment*" OR AB "technology assessment*") OR (TI HTA OR AB HTA) OR (TI HTAs OR AB HTAs) OR (TI "technology overview*" OR AB "technology overview*") OR (TI "technology appraisal*" OR AB "technology appraisal*")) OR ((TI "meta regression*" OR AB "meta regression*") OR (TI metaregression* OR AB metaregression*)) OR (MW meta-analy* OR MW metaanaly* OR MW "systematic review*" OR MW "biomedical technology assessment*" OR MW "bio-medical technology assessment*") OR ((TI medline OR AB medline OR MW medline) OR (TI cochrane OR AB cochrane OR MW cochrane) OR (TI pubmed OR AB pubmed OR MW pubmed) OR (TI medlars OR AB medlars OR MW medlars) OR (TI embase OR AB embase OR MW embase) OR (TI cinahl OR AB cinahl OR MW cinahl)) OR (SO Cochrane OR SO health technology assessment OR SO evidence report) OR ((TI comparative OR AB comparative) N3 ((TI efficacy OR AB efficacy) OR (TI effectiveness OR AB effectiveness))) OR ((TI "outcomes research" OR AB "outcomes research") OR (TI "relative effectiveness" OR AB "relative effectiveness")) OR (((TI indirect OR AB indirect) OR (TI "indirect treatment" OR AB "indirect treatment") OR (TI mixed-treatment OR AB mixed-treatment) OR (TI bayesian OR AB bayesian)) N3 (TI comparison* OR AB comparison*)) OR ((TI multi* OR AB multi*) N3 (TI treatment OR AB treatment) N3 (TI comparison* OR AB comparison*)) OR ((TI mixed OR AB mixed) N3 (TI treatment OR AB treatment) N3 ((TI meta-analy* OR AB meta-analy*) OR (TI metaanaly* OR AB metaanaly*))) OR (TI "umbrella review*" OR AB "umbrella review*") OR ((TI multi* OR AB multi*) N2 (TI paramet* OR AB paramet*) N2 (TI evidence OR AB evidence) N2 (TI synthesis OR AB synthesis)) OR ((TI multiparamet* OR AB multiparamet*) N2 (TI evidence OR AB evidence) N2 (TI synthesis OR AB synthesis)) OR ((TI multi-paramet* OR AB multi-paramet*) N2 (TI evidence OR AB evidence) N2 (TI synthesis OR AB synthesis))	
S18	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17	427,744
S17	TI (work* N2 out*) OR AB (work* N2 out*)	13,311
S16	TI (weight* N4 (lift* or train*)) OR AB (weight* N4 (lift* or train*))	3,305
S15	TI ((resistance or strength* or interval* or circuit*) N4 (train* or program*)) OR AB ((resistance or strength* or interval* or circuit*) N4 (train* or program*))	19,704
S14	TI ((physical* or endurance or cardio* or muscl*) N4 (fit* or train* or activit* or conditon*)) OR AB ((physical* or endurance or cardio* or muscl*) N4 (fit* or train* or activit* or conditon*))	107,433
S13	TI ((exercis* or aerobic* or sport* or walk* or jog* or swim* or danc* or yoga or cycling or biking or bicycling or crossfit or tai chi or tai ji or pilate* or plyometric* or fitness or calisthenic* or kinesiotherap* or kinesitherap* or gym* or movement therap*)) OR AB ((exercis* or aerobic* or sport* or walk* or jog* or swim* or danc* or yoga or cycling or biking or bicycling or crossfit or tai chi or tai ji or pilate* or plyometric* or fitness or calisthenic* or kinesiotherap* or kinesitherap* or gym* or movement therap*))	281,360

S12	(MH "Physical Activity")	49,322
S11	(MH "Therapeutic Exercise+")	62,339
S10	(MH "Physical Fitness+")	20,623
S9	(MH "Exercise+")	128,907
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	17,459
S7	TI ((gastrojejunostom* or gastroplast* or roux-en-y)) OR AB ((gastrojejunostom* or gastroplast* or roux-en-y))	3,225
S6	TI ((gastric or gastrect* or silicon* or lap or stomach*) N2 (band* or sleev*)) OR AB ((gastric or gastrect* or silicon* or lap or stomach*) N2 (band* or sleev*))	2,613
S5	TI (duoden* N2 switch*) OR AB (duoden* N2 switch*)	144
S4	TI (stomach* N2 stapl*) OR AB (stomach* N2 stapl*)	19
S3	TI ((metabolic or weight or obesity or antiobesity or restrictive) N2 surger*)) OR AB ((metabolic or weight or obesity or antiobesity or restrictive) N2 surger*))	2,736
S2	TI ((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) N3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*)) OR AB ((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) N3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*))	12,124
S1	(MH "Bariatric Surgery+")	9,611

Table S7: SPORTDiscus (EBSCOhost) Search Strategy		
#	**Searches**	**Results**
S9	S7 AND S8	43
S8	PT "systematic review" OR PT "meta analysis" OR (((TI systematic* OR AB systematic*) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*))) OR ((TI methodologic* OR AB methodologic*) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*)))) OR (((TI quantitative OR AB quantitative) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*) OR (TI synthes* OR AB synthes*))) OR ((TI research OR AB research) N3 ((TI integrati* OR AB integrati*) OR (TI overview* OR AB overview*)))) OR (((TI integrative OR AB integrative) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*))) OR ((TI collaborative OR AB collaborative) N3 ((TI review* OR AB review*) OR (TI overview* OR AB overview*))) OR ((TI pool* OR AB pool*) N3 (TI analy* OR AB analy*))) OR ((TI "data synthes*" OR AB "data synthes*") OR (TI "data extraction*" OR AB	23,657

	"data extraction*") OR (TI "data abstraction*" OR AB "data abstraction*")) OR ((TI handsearch* OR AB handsearch*) OR (TI "hand search*" OR AB "hand search*")) OR ((TI "mantel haenszel" OR AB "mantel haenszel") OR (TI peto OR AB peto) OR (TI "der simonian" OR AB "der simonian") OR (TI dersimonian OR AB dersimonian) OR (TI "fixed effect*" OR AB "fixed effect*") OR (TI "latin square*" OR AB "latin square*")) OR ((TI "met analy*" OR AB "met analy*") OR (TI metanaly* OR AB metanaly*) OR (TI "technology assessment*" OR AB "technology assessment*") OR (TI HTA OR AB HTA) OR (TI HTAs OR AB HTAs) OR (TI "technology overview*" OR AB "technology overview*") OR (TI "technology appraisal*" OR AB "technology appraisal*")) OR ((TI "meta regression*" OR AB "meta regression*") OR (TI metaregression* OR AB metaregression*)) OR (MW meta-analy* OR MW metaanaly* OR MW "systematic review*" OR MW "biomedical technology assessment*" OR MW "bio-medical technology assessment*") OR ((TI medline OR AB medline OR MW medline) OR (TI cochrane OR AB cochrane OR MW cochrane) OR (TI pubmed OR AB pubmed OR MW pubmed) OR (TI medlars OR AB medlars OR MW medlars) OR (TI embase OR AB embase OR MW embase) OR (TI cinahl OR AB cinahl OR MW cinahl)) OR (SO Cochrane OR SO health technology assessment OR SO evidence report) OR ((TI comparative OR AB comparative) N3 ((TI efficacy OR AB efficacy) OR (TI effectiveness OR AB effectiveness))) OR ((TI "outcomes research" OR AB "outcomes research") OR (TI "relative effectiveness" OR AB "relative effectiveness")) OR (((TI indirect OR AB indirect) OR (TI "indirect treatment" OR AB "indirect treatment") OR (TI mixed-treatment OR AB mixed-treatment) OR (TI bayesian OR AB bayesian)) N3 (TI comparison* OR AB comparison*)) OR ((TI multi* OR AB multi*) N3 (TI treatment OR AB treatment) N3 (TI comparison* OR AB comparison*)) OR ((TI mixed OR AB mixed) N3 (TI treatment OR AB treatment) N3 ((TI meta-analy* OR AB meta-analy*) OR (TI metaanaly* OR AB metaanaly*))) OR (TI "umbrella review*" OR AB "umbrella review*") OR ((TI multi* OR AB multi*) N2 (TI paramet* OR AB paramet*) N2 (TI evidence OR AB evidence) N2 (TI synthesis OR AB synthesis)) OR ((TI multiparamet* OR AB multiparamet*) N2 (TI evidence OR AB evidence) N2 (TI synthesis OR AB synthesis)) OR ((TI multi-paramet* OR AB multi-paramet*) N2 (TI evidence OR AB evidence) N2 (TI synthesis OR AB synthesis))	
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6	992
S6	TI ((gastrojejunostom* or gastroplast* or roux-en-y)) OR AB ((gastrojejunostom* or gastroplast* or roux-en-y))	172
S5	TI ((gastric or gastrect* or silicon* or lap or stomach*) N2 (band* or sleev*)) OR AB ((gastric or gastrect* or silicon* or lap or stomach*) N2 (band* or sleev*))	135
S4	TI (duoden* N2 switch*) OR AB (duoden* N2 switch*)	7
S3	TI (stomach* N2 stapl*) OR AB (stomach* N2 stapl*)	3
S2	TI ((metabolic or weight or obesity or antiobesity or restrictive) N2 surger*) OR AB ((metabolic or weight or obesity or antiobesity or restrictive) N2 surger*)	326

S1	TI ((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) N3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*)) OR AB ((bariatric* or stomach* or gastric* or gastroileal* or jejuno* or ileo* or intestin* or bilio* or pancreatobiliar*) N3 (surger* or surgical* or bypass* or diversion* or operat* or procedure*))	778

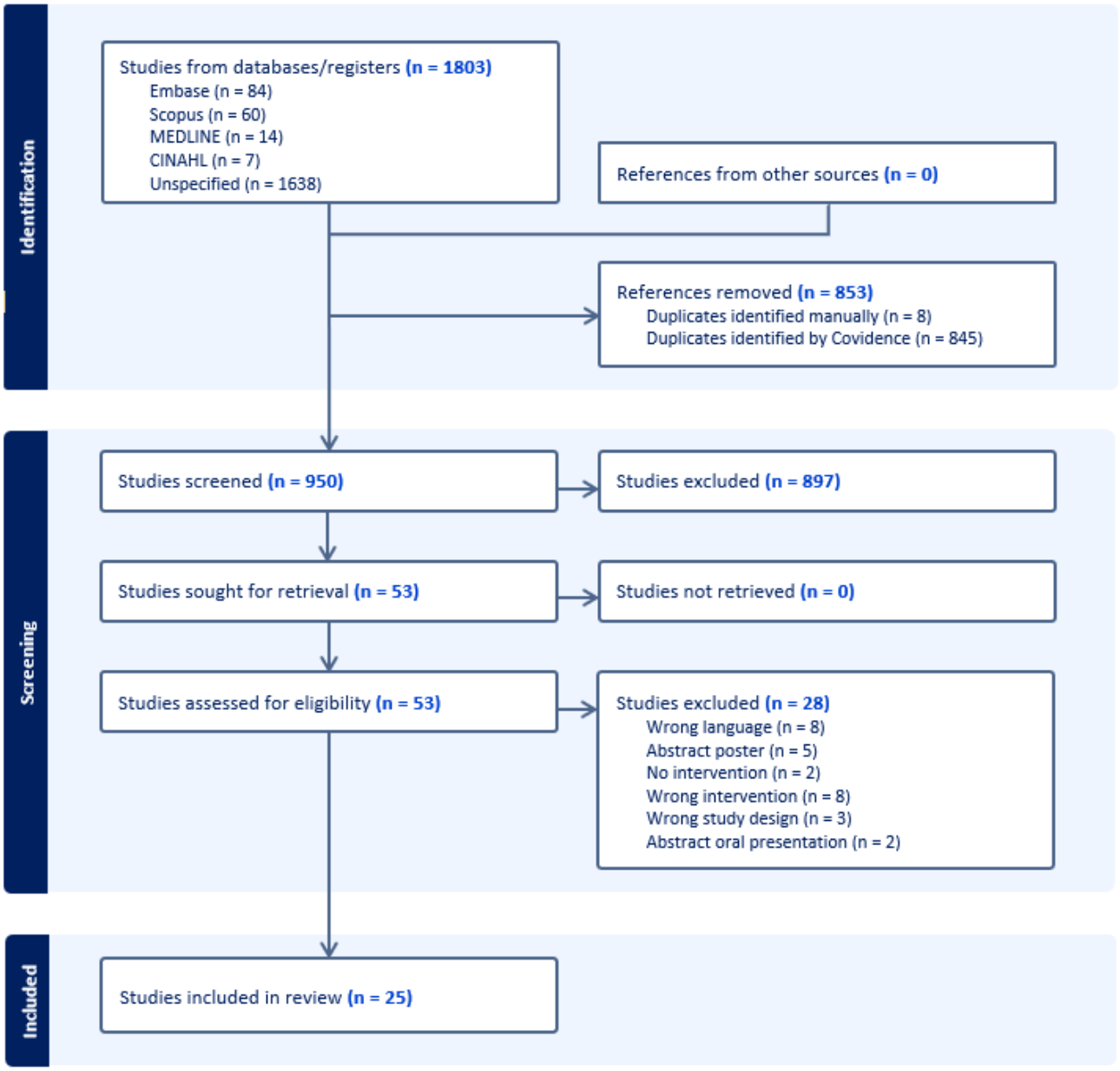
Table S8: Scopus Search Strategy

#	**Searches**	**Results**
1	((TITLE-ABS-KEY ((bariatric* OR stomach* OR gastric* OR gastroileal* OR jejuno* OR ileo* OR intestin* OR bilio* OR pancreatobiliar*) W/3 (surger* OR surgical* OR bypass* OR diversion* OR operat* OR procedure*))) OR (TITLE-ABS-KEY ((metabolic OR weight OR obesity OR antiobesity OR restrictive) W/2 surger*)) OR (TITLE-ABS-KEY (stomach* W/2 stapl*)) OR (TITLE-ABS-KEY (duoden* W/2 switch*)) OR (TITLE-ABS-KEY ((gastric OR gastrect* OR silicon* OR lap OR stomach*) W/2 (band* OR sleev*))) OR (TITLE-ABS-KEY (gastrojejunostom* OR gastroplast* OR roux-en-y))) AND ((TITLE-ABS-KEY (exercis* OR aerobic* OR sport* OR walk* OR jog* OR swim* OR danc* OR yoga OR cycling OR biking OR bicycl* OR bike* OR crossfit OR "tai chi" OR "tai ji" OR pilate* OR plyometric* OR fitness OR calisthenic* OR kinesiotherap* OR kinesitherap* OR gym* OR "movement therap*")) OR (TITLE-ABS-KEY ((physical* OR endurance OR cardio* OR muscl*) W/4 (fit* OR train* OR activit* OR conditon*))) OR (TITLE-ABS-KEY ((resistance OR strength* OR interval* OR circuit*) W/4 (train* OR program*))) OR (TITLE-ABS-KEY (weight* W/4 (lift* OR train*))) OR (TITLE-ABS-KEY (work* W/2 out*))) AND (TITLE-ABS-KEY ((systematic* W/3 (review* OR overview*)) OR (methodologic* W/3 (review* OR overview*))) OR TITLE-ABS-KEY ((quantitative W/3 (review* OR overview* OR synthes*)) OR (research W/3 (integrati* OR overview*))) OR TITLE-ABS-KEY ((integrative W/3 (review* OR overview*)) OR (collaborative W/3 (review* OR overview*)) OR (pool* W/3 analy*)) OR TITLE-ABS-KEY ("data synthes*" OR "data extraction*" OR "data abstraction*") OR TITLE-ABS-KEY (handsearch* OR "hand search*") OR TITLE-ABS-KEY ("mantel haenszel" OR peto OR "der simonian" OR dersimonian OR "fixed effect*" OR "latin square*") OR TITLE-ABS-KEY ("met analy*" OR metanaly* OR "technology assessment*" OR hta OR htas OR "technology overview*" OR "technology appraisal*") OR TITLE-ABS-KEY ("meta regression*" OR metaregression*) OR TITLE-ABS-KEY (meta-analy* OR metaanaly* OR "systematic review*" OR "biomedical technology assessment*" OR "bio-medical technology assessment*") OR TITLE-ABS-KEY (medline OR cochrane OR pubmed OR medlars OR embase OR cinahl) OR SRCTITLE (cochrane OR (health W/2 "technology assessment") OR "evidence report") OR TITLE-ABS-KEY (comparative W/3 (efficacy OR	635

	effectiveness)) OR TITLE-ABS-KEY ("outcomes research" OR "relative effectiveness") OR TITLE-ABS-KEY ((indirect OR "indirect treatment" OR mixed-treatment OR bayesian) W/3 comparison*) OR TITLE-ABS-KEY (multi* W/3 treatment W/3 comparison*) OR TITLE-ABS-KEY (mixed W/3 treatment W/3 (meta-analy* OR metaanaly*)) OR TITLE-ABS-KEY ("umbrella review*") OR TITLE-ABS-KEY (multi* W/2 paramet* W/2 evidence W/2 synthesis) OR TITLE-ABS-KEY (multiparamet* W/2 evidence W/2 synthesis) OR TITLE-ABS-KEY (multi-paramet* W/2 evidence W/2 synthesis))	

Appendix D – PRISMA Flow Diagram

Figure S1: PRISMA Flow Diagram



Appendix E – Excluded Publications

Table S9: Publications Excluded from the Overview of Reviews

Author(s), Year	Title	Reason for Exclusion
de Aquino Chamis et al., 2022	Abordagem fisioterapêutica no pós-operatório de cirurgia bariátrica: revisão sistemática	Wrong language (i.e., not available in English or French)
Cobos-Fernández et al., 2021	Effects of exercise in bariatric surgery	
Chaves-Alves et al, 2020	Efeito do treinamento de força sobre a aptidão física em pós - bariátricos: revisão sistemática	
DosSantos & Palmeira, 2022	Long-term association between physical activity, weight gain, metabolic risk factors and quality of life in patients undergoing bariatric surgery - systematic literature review	
Zhao et al., 2023	Dietary and physical activity behavior promotion strategies after bariatric surgery from a cognitive perspective: an integrative review	
Amarodos Santos et al., 2022	Associação no longo-termo entre a prática de atividade física, o reganho de peso, fatores de risco metabólico e qualidade de vida, em pacientes submetidos a cirurgia bariátrica - revisão sistemática da literatura	
Barrientos-Sanchez et al., 2022	Physical exercise and loss of weight and body mass index in bariatric surgery: a systematic review	
Cobos-Fernández et al., 2021	Efectos del ejercicio en cirugía bariátrica	
Pouwels et al., 2016	Aspects of exercise before or after bariatric surgery: a systematic review	Abstract poster
Barreto et al., 2015	Physical activity and bariatric surgery - a review	
Pouwels et al., 2017	Comparative analysis of respiratory muscle strength before and after bariatric surgery using five predictive equations exercise and bariatric surgery	
Marshall et al, 2019	Do intensive preoperative and postoperative behavioural interventions impact on health-related bariatric surgery outcomes? A systematic review	
Pattyn et al., 2018	The effects of exercise training on body composition and exercise capacity following bariatric surgery: a systematic review and meta-analysis	
Pouwels et al., 2015	Aspects of exercise before or after bariatric surgery: a systematic review	Abstract oral presentation
Marshall et al, 2019	Do intensive preoperative and postoperative multidisciplinary interventions impact health-related bariatric surgery outcomes? a systematic review	

Egberts et al., 2012	Does exercise improve weight loss after bariatric surgery? A systematic review	No intervention
Livhits et al., 2010	Exercise following bariatric surgery: systematic review	
Smith et al., 2022	Preoperative assessment and prehabilitation in patients with obesity undergoing non-bariatric surgery: a systematic review	Wrong intervention (i.e., not exercise training)
Stewart & Avenell, 2016	Behavioural interventions for severe obesity before and/or after bariatric surgery: a systematic review and meta-analysis	
James et al., 2022	A systematic review of interventions to increase physical activity and reduce sedentary behaviour following bariatric surgery	
Swierz et al., 2020	Systematic review and meta-analysis of perioperative behavioral lifestyle and nutritional interventions in bariatric surgery: a call for better research and reporting	
Jiménez-Loaisa et al., 2015	Psychosocial effects of surgery and physical activity in bariatric patients: a systematic review	
Robinson et al., 2021	Digital technology to support lifestyle and health behaviour changes in surgical patients: systematic review	
Roman et al., 2019	Meta-analysis of the influence of lifestyle changes for preoperative weight loss on surgical outcomes	
Tabesh et al., 2023	Nutrition, physical activity, and prescription of supplements in pre- and post-bariatric surgery patients: an updated comprehensive practical guideline	
Cornejo-Pareja et al., 2021	Factors related to weight loss maintenance in the medium-long term after bariatric surgery: a review	Wrong study design (i.e., not a systematic review or meta-analysis)
Petering & Webb, 2009	Exercise, fluid, and nutrition recommendations for the postgastric bypass exerciser	
Mao et al., 2023	Prehabilitation in metabolic and bariatric surgery: a narrative review	

Appendix F – Methodological Details of Included Reviews

Table S10: Methodological Details of Pre- and Post-MBS Systematic Reviews/Meta-Analyses (Alphabetical Order)

Author (Year) **Design i.e., SR and/or MA**	Aim/Objective	Selection Criteria				Search Information 1. Date (+ Date Restrictions If Applicable) 2. Databases Searched + Other Search Methods
		Patient and/or Problem	Intervention and Comparator	Outcome(s)	Study Design	
Baillot (2014) **SR**	To appraise current knowledge on the impact of physical activity and physical fitness on the health of class II and III obese subjects and bariatric surgery patients	Adult population of subjects with class II and III obesity or subjects awaiting or having undergone bariatric surgery When more than one publication used the same cohort, we included only the results from the publication with the largest sample size, unless specific findings (e.g. on selected outcomes) were present only in the other papers.	Intervention or recommendations on physical activity or with an evaluation of physical fitness or physical activity level Comparator requirements not reported	At least one of these outcomes: anthropometric parameters, body composition, cardiometabolic risk factors, physical fitness, quality of life or psychological parameters. Studies evaluating only weight loss after bariatric surgery were excluded since this was previously reviewed.	Peer reviewed original studies	November 16th, 2012 Medline Scopus CINAHL Sportdiscus + reference lists of included articles + consultation with physical activity and obesity experts
Baillot (2022) **MA**	To assess the evidence, and identifying factors, of the feasibility and acceptability of exercise intervention in	Adults awaiting or having undergone bariatric surgery.	Articles were excluded if they only presented a study focused	Number of participants who discontinued the intervention and reasons; participants'	Primary research involving a controlled trial, either randomized	April 2021 Searched articles in a

	adults awaiting or having undergone bariatric surgery		on behavioral interventions to promote exercise engagement Comparing an exercise group to a control group without exercise.	satisfaction ratings/scores; reported attendance rate related to session frequency; reported compliance rate related to session duration and intensity; number and type of adverse events related to exercise intervention only and other quantitative or qualitative data showing feasibility and acceptability of the intervention.	or non-randomized published in a peer-reviewed journal in English	systematic review and meta-analysis published in June 2021 on exercise training and bariatric surgery. +Search for articles published from January 1, 2019, onwards on PubMed, Web of Science, and EMBASE. +hand-search reference lists from eligible articles and relevant reviews.
Bellicha (2021) **MA**	To examine the impact of physical activity interventions performed before or after bariatric surgery in subjects with obesity	Adults undergoing bariatric surgery with at least one obesity comorbidity	Exercise training based on aerobic and/or resistance and/or high-intensity interval training Comparison group of patients undergoing bariatric surgery receiving usual care without	Preintervention to postintervention changes reported for at least one of the following outcome category: anthropometry or body composition, objectively measured physical activity or physical	Originals, RCT, NRCT	October 2019 PubMed, Web of Science, and EMBASE + Reference lists from the resulting reviews and articles were also screened to

			following an exercise training program	fitness, health-related quality of life, and other relevant health outcomes.		identify additional articles
Bond (2023) **MA**	To determine the effect of exercise interventions on weight change 12 months following bariatric surgery	Adults who had undergone metabolic and bariatric surgery	Exercise intervention Control group that included at least usual post-surgery care	Measured weight change beyond 12 months post surgery	RCT	Feburary 2022 PubMed, Cochrane, Scopus, SPORTDiscus, and CINAHL + Cross referenced lists of included studies, relevant reviews, and meta-analyses manually
Boppre (2021) **MA**	To determine if exercise favors weight loss and promotes additional benefits on body composition compared to those elicited solely by bariatric surgery? To determine the characteristics of exercise interventions (mode, duration, and onset after BS) that were more likely to favor WL and body composition benefits	Adults with severe obesity that underwent bariatric surgery	Supervised and semi-supervised training protocols, with a minimum of 1-month duration in addition to the usual medical follow-up, were included and no restrictions were applied on exercise mode, intensity, and the timing onset after surgery Control group that received usual follow-up care	Body weight, anthropometric measures, and body composition (BMI, waist circumference, fat mass and lean body mass) Only studies in which body composition was assessed by dual-energy X-ray absorptiometry were included in fat mass and lean body mass analysis	RCTs published in English	Between 2000 and November 2020. PubMed/MEDLINE®, EBSCO®, Web of Science® and Scopus® + Manual inspection of select articles references

Boppre (2022) **MA**	To determine the effects of different exercise types, duration, and onset after bariatric surgery on cardiometabolic risk factors	Adults with severe obesity who underwent bariatric surgery	Exercise intervention program with a minimum of 1-month duration. No restrictions were applied regarding exercise type, intensity, and onset timing after surgery Post-bariatric surgery patients receiving usual medical care only as control group	Cardiometabolic risk factors: primary (lipid profile and glucose metabolism) and secondary outcomes (resting heart rate, systolic and diastolic blood pressure)	RCTs published in English	July 2021 PubMed, Web of Science, Scopus, and EBSCO + A reference inspection from selected articles
Carretero-Ruiz (2019) **MA**	To analyze the effects of exercise training, and type of training, after bariatric surgery in relation to weight loss	Adults having undergone bariatric surgery	Exercise interventions performed after bariatric surgery Excluded articles combining physical activity with other types of intervention, such as medications, nutrition, other surgeries and lifestyle interventions Comparator requirements not reported	Weight loss	RCT, NRCT	May 23, 2019 MEDLINE, EMBASE, Scopus, Cochrane, and Web of Science
Carretero-Ruiz (2021) **MA**	To review the evidence on the effectiveness of exercise training to improve cardiometabolic risk in	Adults having undergone bariatric surgery	Intervention based on physical activity Excluded articles combining physical	At least one outcome related to metabolic risk (VO2max or peak, heart rate, blood pressure, lipid profile,	RCT, NRCT	December 6, 2020 MEDLINE,

	patients with obesity who are undergoing bariatric surgery.		activity with other types of intervention, such as medications, nutrition, other surgeries and lifestyle interventions Comparator requirements not reported	glucose, insulin or inflammation markers)		EMBASE, Scopus, Cochrane, and Web of Science
Da Silva (2019) **MA**	To perform a meta-analysis in order to determine the effect size of exercise training on VO2max in adults following bariatric surgery weight loss	Adults who have undergone bariatric surgery	Intervention including aerobic exercise, resistance exercise, or both Comparator requirements not reported	Association between cardiometabolic risk factors and measured cardiorespiratory variables following bariatric surgery by cardiopulmonary exercise testing (VO2max)	Original studies including all eligible prospective cohort models that (1) is written in English language, (2) investigates the association between cardiometabolic risk factors and measured cardio-respiratory variables following BS and (3) included a description of the exercise training protocol	August 21, 2018 MEDLINE (through PubMed)
Diniz-Sousa (2022) **MA**	To compare the effect of exercise and usual medical care in the prevention of bone mineral density loss following bariatric surgery	Adults with severe obesity submitted to bariatric surgery	Supervised or unsupervised structured exercise training program with a minimum of 3-month	Areal bone mineral density from relevant clinical skeletal sites (total hip, femoral neck, lumbar spine,	RCTs and NRCTs	January 2021 PubMed/MEDLINE, Web of

	To identify which skeletal sites might be more responsive to exercise following bariatric surgery		duration with any training characteristics (except swimming); including those combined with other interventions (e.g., nutrition) Patients receiving usual medical post-BS care as control	and one-third distal radius) assessed by dual-energy X-ray absorptiometry		Science, Scopus, and EBSCO
Durey (2022) **MA**	To summarise the evidence comparing the effects of preoperative whole-body exercise based interventions on fitness and clinical outcomes for bariatric surgery patients	Adult BS patients	Preoperative exercise intervention Excluded any studies without a control group (didn't define control group)	The primary outcomes assessed were (1) all-cause mortality in the short-term (30 days) and/or longer-term (maximal follow-up), (2) post-operative short-term morbidity, (3) overall quality of life and (4) serious adverse events (short term and longer term). The secondary outcomes were treatment-associated costs, length of hospital stay, number of days of lost work (maximal follow-up), changes in fitness (preoperative and maximal follow-up), re-operation/re-intervention and its	RCT	First search on May 1 2020 and updated on March 2 2021 MEDLINE, Embase, Cochrane Central Register of Controlled Clinical Trials, SPORTDiscus, Web of Science and Scopus

				classification of severity, change in weight, diabetes status, technical complications of the specific operation and micronutrient status		
Fonseca-Junior (2013) **SR**	To investigate the effects of exercise training programs in clinical and surgical treatment of morbid obese patients	Morbidly obese adults awaiting or having undergone bariatric surgery	Intervention program of physical exercise in the treatment for weight loss or any other aspect of health Could use control group or not	Weight loss or any other aspect of health in general	Pre-and post-intervention test design published in English, Spanish or Portuguese	From January 2000 until July 2012 Virtual Health Library in the database of the "Health Sciences in General" (Medline, Lilacs and IBECS) and PubMed
Gasmi (2022) **MA**	To evaluate the influence of physical activity on different biological markers of patients' post-bariatric surgery	Adult patients who had undergone bariatric surgery	Physical activity intervention Control was bariatric surgery	Weight loss and specified biomarkers (body mass index, fat mass, fat-free mass, hip to waist ratio, and waist circumference).	RCT published in English	From January 2000 to December 2020 PubMed, Embase, OVID, CINAHL, and Cochrane Library + search of reference list of included articles
Herrera-Santelices (2022) **MA**	To determine the effect of rehabilitation on the body composition, functional	Adults awaiting their first bariatric surgery who were included in	Supervised physical exercise programs described as aerobic	One or more of the following outcomes: (1) Body composition,	RCT	Between July 1-31 2021

	capacity, quality of life and surgical outcomes in patients who are candidates for BS	a rehabilitation program	exercise training, resistance exercise training or included both, with a duration of at least one week and performed before bariatric surgery. The control received only the standard care	(2) Functional capacity (e.g., six-minute walk test, VO2 max, sit to stand etc.), (3) Quality of life, (4) Surgical outcomes (e.g., number of hospital stay days)		PubMed, Web of Science, SciELO, Scopus, MEDLINE and CINAHL
Jabbour (2022) **SR**	To review the available evidence for the beneficial health impact of adding exercise to standard care preoperatively and to address metabolic health and surgical outcomes compared to standard care alone in bariatric patients	Bariatric surgery candidates	Preoperative physical activity and/or exercise intervention Standard care control	Fitness level, body weight and composition, physical activity level, physical functioning and muscular performance, aerobic fitness, metabolic parameters, hospital stay	Randomized control trial, intervention trial, and prospective studies	Search date not specified (published before article publication in July 2022) PubMed, Institute for Scientific Information Web of Knowledge, Web of Science, and SPORTDiscus + manual search of references
Karaaslan (2020) **SR**	To determine the optimal exercise program to prevent weight gain and maintain weight loss in patients after undergoing bariatric surgery.	Adult bariatric surgery patients	Exercise therapy program included after bariatric surgery with a study length of at least 4 weeks	Changes in body composition, muscular strengths, aerobic capacity, functional	RCT	Articles published from January 2008 through September 2018.

			Comparator requirements not reported	capacity, walking distance, or relevant health outcomes		PubMed (NLM), Pedro, and the Web of Science
Lodewijks (2022) **SR**	To systematically review the current literature on the overall effects of a preoperative programme concerning exercise, behaviour and/or diet in patients eligible for bariatric surgery with a primary focus on weight loss	Preoperative adults who were eligible for bariatric surgery and who participated in a preconditioning programme	Preconditioning programme concerning exercise, behaviour and/or diet Comparator requirements not reported	The primary outcome of interest was weight loss. Secondary outcomes were all other available outcomes of the included studies	RCT, NRCT, and pilot studies published in English	Studies published between January 2010 and September 2021 Embase, Cinahl, PubMed and Cochrane Library
Marshall (2020) **SR and MA**	To evaluate the effect of preoperative and/or post-operative support for adults who elect bariatric surgery delivered by an multidisciplinary team on postoperative body composition, mental health, co-morbidities, quality of life, and side effects	Adults who elect bariatric surgery delivered by a multidisciplinary team	Intervention had to be implemented by a multidisciplinary team (≥3 health disciplines including the surgeon and nurse). Intervention duration needed to be ≥2 weeks if delivered preoperatively and ≥ 3 months if delivered post-operatively. Post-operative interventions that commenced >12 months post-operatively were excluded.	Postoperative body composition, mental health, co-morbidities, quality of life and side effects	RCTs, pseudo-RCTs, or non-RCTs.	July 19 2018 Medline (PubMed), CENTRAL, EMBASE, CINAHL, PsycINFO, and Web of Science + snowball search of Google Scholar and key papers

			Prospectively compared a preoperative and/or post-operative intervention delivered by an multidisciplinary team against a comparator group that had less engagement with the multidisciplinary team or had no follow-up			
Morales-Marroquin (2020) **SR**	To evaluate the effect of resistance training on body composition and strength post-metabolic and bariatric surgery	Adults who've undergone bariatric surgery	Exercise interventions conducted post-metabolic and bariatric surgery that include resistance exercise as part of the exercise intervention (either alone or in combination with cardiovascular exercise) Comparator requirements not reported	Body composition (changes in fat-free mass, fat mass, visceral adipose tissue, bone mineral density) and strength	RCT, NRCT written in English	December 2019 PUBMED, Web of Science, and Science Direct
Pouwels (2015) **SR**	To determine the kind/type/mode of exercise an obese patient should be advised to undertake What is the most beneficial timing of exercise delivery -	Patients who have undergone or are awaiting bariatric surgery	Intervention that includes strength training and/or endurance training or a combination of both. Also, multimodal programs with	Improvement of anthropometric and physical fitness variables (VO2 max and/or heart rate reserve / heart rate kinetics), complications, effect	Randomized controlled trial or prospective trial.	July 2014 Pubmed, Embase, and CINAHL

	pre- or postoperatively or a combination of both?		exercise components were included Intervention of interest was exercise training compared to regular care	on weight, and quality of life.		+ cross-references were screened
Ren (2018) **MA**	To determine whether engaging in exercise after surgery can provide additional weight loss and improvement in physical function.	adults with obesity who had undergone bariatric surgery	Intervention includes aerobic exercise, resistance training or a combination of both. Control group received only standard care	Primary outcomes: weight loss and physical function (6 min walk test). Secondary outcomes: body mass index, total body fat percentage, fat and fat-free mass, waist and hip circumference, systolic and diastolic blood pressure, and heart rate	RCT	May 2018 PubMed, Embase, the Cochrane Library, OVID and the CINAHL + searched the reference lists of the retrieved articles and relevant review articles
Roth (2022) **MA**	To investigate the effect of exercise training, protein, calcium, and vitamin D supplementation on the preservation of fat free mass during non-surgical and surgical weight loss and of the combination of all interventions together in adults with obesity	Overweight or obese adults undergoing diet- or surgery-induced weight loss	Exercise training, or being physically active, alone or combined with dietary supplementation Compared to placebo intervention, controlled comparison intervention or standard care	Fat free mass, bone mineral density and muscle mass	RCT	August 27 2020 Ovid Medline, Ovid Embase, Cochrane Central Register of Controlled Trials, ISI Web of Science
Schurmans (2022) **SR**	To summarize the effects of different physical exercise programs on various health	Adult	Physical exercise intervention	At least one of the following parameters as an outcome: BMI,	RCTs and quasi-experimental	Search date not specified but

	variables in obese patients in peri-operative bariatric surgery	subjects with a body mass index >30 and scheduled to undergo or already have undergone bariatric surgery	Compared to usual care	weight loss, muscle strength, lean body or fat free mass, cardiorespiratory endurance, quality of life, or functional capacity	Studies published in English, Dutch, French or German	article sent on Feburary 2021 PubMed and the Cochrane Library
Vieira (2022) **MA**	To assess the effect of exercise on muscle strength in individuals following bariatric surgery To conduct separate meta-analyses for studies that used different muscle strength tests	Adults who underwent bariatric surgery	Physical exercise intervention Utilized a control group	Muscle strength (using any method)	RCT and NRCT	October 27, 2021 Embase, Medline, Scopus, SPORTDiscus, and Web of Science + searched 2 grey literature databases (ProQuest and Google Scholar) + reference lists of the included studies were also searched

Appendix G – AMSTAR 2 Ratings

Figure S2: Breakdown of AMSTAR2 Ratings for the Included Reviews

Reviews	AMSTAR 2 Items																Overall
	1 PICO search	2 a priori review methods	3 Justified design inclusion	4 Comprehensive search strategy	5 Duplicate study selection	6 Duplicate data extraction	7 Justified exclusions	8 Described included studies	9 Risk of bias assessed	10 Funding sources reported	11 Meta-analysis statistics	12 Meta-analysis risk of bias	13 Risk of bias impact	14 Result heterogeneity	15 Publication bias assessed	16 Conflicts of interest declared	
Preoperative Intervention Reviews																	
Durey et al 2022	⊕	⊕	⊖	⊖	⊕	⊕	⊖	⊖	⊕	⊖	⊖	⊖	⊖	⊖	⊖	⊕	C-LOW
Herrera-Santelices et al 2022	⊕	⊕	⊖	⊖	⊕	⊕	⊖	?	⊕	⊖	⊖	⊖	⊕	⊕	⊖	⊕	C-LOW
Jabbour et al 2022	⊕	⊖	⊖	?	⊖	⊖	⊖	?	⊖	⊖	N/A	N/A	⊖	⊕	N/A	⊕	C-LOW
Lodewijks et al 2022	⊖	⊖	⊖	?	⊖	⊖	⊖	?	⊕	⊖	N/A	N/A	⊕	⊕	N/A	⊕	LOW
Postoperative Intervention Reviews																	
Bond et al 2023	⊖	⊕	⊖	?	⊕	⊕	⊖	⊕	⊕	⊖	⊖	⊖	⊕	⊕	⊕	⊕	LOW
Roth et al 2022	⊕	⊕	⊖	?	⊖	⊖	⊖	?	⊕	⊖	⊕	⊖	⊕	⊕	⊕	⊕	MODERATE
Vieira et al 2022	⊖	?	⊖	?	⊕	⊕	⊖	?	⊕	⊖	⊖	⊖	⊕	⊕	⊕	⊕	LOW
Gasmi et al 2022	⊕	⊖	⊖	?	⊖	⊕	⊖	?	⊕	⊖	⊖	⊖	⊖	⊖	⊕	⊕	C-LOW
Diniz-Sousa et al 2022	⊕	⊕	⊖	?	⊕	⊖	⊖	?	⊕	⊖	⊕	⊖	⊕	⊕	⊕	⊕	MODERATE
Boppre et al 2022	⊕	?	⊖	⊖	⊖	⊖	⊖	⊖	⊕	⊖	⊖	⊖	⊖	⊕	⊕	⊕	C-LOW
Boppre et al 2021	⊕	?	⊖	⊖	⊖	⊖	⊖	⊖	⊕	⊖	⊖	⊖	⊕	⊕	⊕	⊕	C-LOW
Carretero-Ruiz et al 2021	⊖	⊖	⊖	?	⊕	⊕	⊖	?	⊕	⊖	⊕	⊖	⊖	⊕	⊕	⊕	C-LOW

Carretero-Ruiz et al 2019	⊖	⊕	⊖	?	⊕	⊕	⊖	?	⊕	⊖	⊕	⊖	⊖	⊕	⊕	⊕	LOW
da Silva et al 2019	⊖	⊖	⊖	⊖	⊕	⊖	⊖	?	⊕	⊖	⊖	⊖	⊖	⊕	⊕	⊕	C-LOW
Ren et al 2018	⊕	⊖	⊖	?	⊕	⊕	⊖	⊖	⊕	⊖	⊕	⊖	⊕	⊕	⊕	⊕	LOW
Morales-Marroquin et al 2020	⊖	⊖	⊖	?	⊖	⊖	⊖	⊕	⊕	⊖	N/A	N/A	⊕	⊕	N/A	⊕	LOW
Civi Karaaslan et al 2020	⊖	⊖	⊖	?	⊖	⊖	⊖	⊖	⊕	⊖	N/A	N/A	⊖	⊖	N/A	⊕	C-LOW
Pre- and Postoperative Intervention Reviews																	
Baillot et al 2022	⊕	⊕	⊖	?	⊕	⊖	⊖	⊕	⊕	⊖	⊖	⊕	⊕	⊕	⊕	⊕	LOW
Marshall et al 2020	⊕	⊕	⊖	?	⊕	⊖	⊖	?	⊕	⊖	⊕	⊕	⊕	⊕	⊖	⊕	LOW
Schurmans et al 2022	⊕	?	⊖	?	⊕	⊖	⊖	⊕	⊕	⊖	N/A	N/A	⊖	⊕	N/A	⊕	LOW
Bellicha et al 2021	⊕	?	⊖	?	⊖	⊖	⊖	⊕	⊕	⊖	⊖	⊕	⊖	⊕	⊕	⊕	C-LOW
Pouwels et al 2015	⊕	⊖	⊖	?	⊕	⊖	⊖	⊖	⊕	⊖	N/A	N/A	⊖	⊖	N/A	⊕	C-LOW
Baillot et al 2014	⊖	⊖	⊖	?	⊕	⊖	⊖	⊖	⊕	⊖	N/A	N/A	⊕	⊕	N/A	⊕	LOW
Fonseca-Junior et al 2013	⊖	⊖	⊖	?	⊖	⊖	⊖	⊖	⊖	⊖	N/A	N/A	⊖	⊖	N/A	⊕	C-LOW

Note. Critical categories highlighted in grey. Green positive symbol=full completion of criteria, yellow question mark=partial completion of criteria, and red negative symbol=lack of completion of criteria. C-LOW= critically low. 1=PICO criteria used for search, 2=explicit a priori established review methods, 3=justification of study design inclusion, 4=comprehensive literature search strategy, 5=study selection completed in duplicate, 6=data extraction completed in duplicate, 7=list and justification for excluded individual studies, 8=adequate description of included studies, 9=satisfactory technique for risk of bias (RoB) assessment, 10=sources of funding of included studies listed, 11=appropriate statistics to combine results for meta-analysis, 12=impact of RoB on meta-analysis evidence synthesis, 13=RoB considered for result interpretation/discussion, 14=explanation and discussion of result heterogeneity, 15=publication bias assessed and interpreted for quantitative synthesis and 16=declared author conflicts of interest.

Appendix H – Corrected Covered Area Calculations Summary

Table S11: Summary of the Corrected Covered Area (CCA) Calculations

	Number of Times Studies Appeared in Reviews	Number of Studies	Number of Reviews	CCA
Pre-MBS				
Overall	65	23	11	0.18
Body weight, Body mass index, Weight Loss	30	15	6	0.20
Fat Mass	8	4	4	0.33
Fat Free and Lean Body Mass	6	3	4	0.33
VO_2max	10	8	3	0.13
6-Min Walk Test Distance	10	6	4	0.22
Muscle strength	6	4	2	0.50
Resting Heart Rate	4	3	2	0.33
Blood Pressure	11	6	4	0.28
Quality of Life	11	7	4	0.19
Glucose/Lipid Metabolism	3	3	2	0.00
Physical Activity	6	5	2	0.20
Adverse Events	1	1	1	NA
Hospital Stay Length	2	2	2	0.00
Post-MBS				
Overall	196	42	20	0.19
Body weight, Body mass index, Weight Loss	78	29	8	0.24
Waist Circumference*	6	5	2	0.20
Fat Mass*	19	11	4	0.24
Fat Free and Lean Body Mass*	35	16	6	0.24
Bone Mineral Density	11	4	4	0.58
VO_2max	32	12	5	0.42
6-Min Walk Test Distance	10	6	3	0.33
Muscle Strength	29	16	4	0.27
Resting Heart Rate*	17	9	4	0.30
Blood Pressure*	30	13	5	0.33
Quality of Life	4	3	2	0.33
Glucose Metabolism	19	10	4	0.30
Lipid Metabolism	25	12	5	0.27

Note. *This outcome was included in Ren et al., 2018; however, Ren et al., 2018 was not included in the CCA calculation since the studies been reviewed were not disclosed. MBS=metabolic and bariatric surgery.

Appendix I – Pre-MBS Study Characteristics

Table S12: Summary of Meta-Analyses and Systematic Reviews for Pre-Metabolic and Bariatric Surgery Exercise Interventions

Author Year (Country[a]) Number of primary studies included	Study designs	Sample description (N, age range, BMI range, % women)[b]	Intervention description	Control group	Outcomes assessed[c]	Main results[d] Level of evidence	Quality scores of the studies included (*quality assessment tool*)	AMSTAR rating
Meta-analyses								
Baillot 2022 (Canada+1) *k*=7	RCT (*k*=4) NRCT (*k*=3)	NO SYNTHESIS ONLY FOR PRE-MBS	Exercise training (*k*=7) Duration: 4-26 weeks Type: E, E/R, HIIT, aquatic Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 25-70 min Supervision: supervised (*k*=6), partial (*k*=1)	Usual care (*k*=7)	1. Adverse events during exercise 2. Attendance 3. Dropout 4. Compliance 5. Satisfaction	1. None (*k*=2), occasional pain, fatigue, or dyspnea (*k*=1), hypoglycemia or hypotension (*k*=1) 2. Pooled percentage: 79.4% [67.7; 89.4], I^2=0%; *n*=NR, *k*=4 3. Pooled percentage: 3.6% [0.0; 14.6], I^2=44%; *n*=NR, *k*=7 4. No-metanalysis due to small number of studies (*k*=3) and various operationalization of compliance 5. all participants very satisfied/satisfied, except 1 participant = moderately satisfied by location and schedule (*k*=1) Sub-analysis: NS differences in attendance, dropout rates based on studies quality, exercise intervention timing, and exercise intervention duration	Good (*k*=1) Fair (*k*=3) Poor (*k*=3) *(National Heart, Lung and Blood Institute quality assessment tool)*	Low
Durey 2022 (UK+1) *k*=5	RCT (*k*=5) included 2 conference abstracts	*N* = 199 38-47 years 45 to 47 kg.m^2 68-86% women	Exercise training (*k*=3) PA counseling (*k*=2) Duration: 2-12 wk. Type: E, R, E/R, HIIT, BC Frequency: 3-7x/week Intensity: Moderate to vigorous	Usual care (*k*=5)	1. Adverse events 2. Pre-MBS VO_2 max change 3. VO_2 max change at	1. RR: 6.00 adverse events [0.27; 131.34], I^2=N/A; *n*=22; *k*=1 2. MD: 0.73 mL/kg/min [0.61; 0.86], I^2=62%; *n*=79, *k*=3 3. MD: 0.98 mL/kg/min [0.05; 1.90], I^2=0%; *n*=131, *k*=3 4. MD: 0.94% [-1.61; 3.48], I^2=70%; *n*=142; *k*=3	Some concerns (*k*=2) High risk (*k*=3) *(Cochrane risk of bias tool 2)*	Critically low

			Session duration: 120-240 min/week Supervision: unsupervised (*k*=2), partial (*k*=2), full-supervised (*k*=1)		maximal follow-up 4. %WL 5. Length of hospital stay	5. NS ≠ bw intervention and control; *n*=22; *k*=1		
Herrera-Santelices 2022 (Chili+1) *k*=5 including 2 publications with the same intervention and overlapping data in the results	RCT (*k*=5)	*N* = 139* 28-54 years BMI = NR 76-95% women **N*=114 (*k*=4), however Baillot 2016/2018 included in same analyses	Exercise training (*k*=5) Duration: 8-16 wk. Type: E, R, E/R, Water aerobics Frequency: 2-3x/wk. Intensity: Moderate to vigorous Session duration: 25-80 min Supervision: supervised (*k*=5)	Usual care (*k*=4) No intervention (*k*=1)	1. BMI 2. %FM 3. FFM 4. 6MWTD 5. QoL	1. SMD: -0.71 [-1.55; 0.12], I^2=76%; *n*=115; *k*=4, very low 2. SMD: 0.38 [-0.08; 0.84], I^2=0%; *n*=75; *k*=3, moderate 3. SMD: - 0.41[-1.00; 0.18], I^2=0%; *n*=46; *k*=2, moderate 4. SMD: 2.59 [1.89; 3.30], I^2=0%; *n*=61; *k*=2, high 5. SMD: 0.88 [-0.23; 1.99], I^2=67%; *n*=53; *k*=3, moderate	High risk (*k*=1) Uncertain risk (*k*=4) (*Cochrane risk of bias tool*)	Critically low
Marshall (2020) (Australia) *k*= 3 (data resulting in 8 publications)	RCT (*k*=3)	*N*=208 43-47 years 45.8-47.4 kg.m² 80-90% women	Exercise training (*k*=1) PA counselling (*k*=2) Duration: 6 weeks Type: E/R, aqua fitness Frequency:3 x/wk. Intensity: NR Session duration: 30-80 min Supervision: Supervised (*k*=1), NR (*k* = 2)	Usual care (*k*=3)	Pre- and post-MBS 1. RHR 2. DBP 3. SBP	Pre- and post-MBS intervention results merged 1. MD: -3.06 bpm [-5.65; -0.47], I^2=0%; *n*=111, *k*=4 (8 arms; very low level of evidence) 2. MD: -1.31 mmHg [-2.33; -0.29], I^2=23%; *n*=251, *k*=6 (13 arms; very low level of evidence) 3. MD: -1.59 mmHg [-3.74; 0.56], I^2=27%; *n*=239, *k*=6 (5 with 1 outlier removed; 13 arms) (very low level of evidence)	Overall risk of bias not reported) *(Cochrane risk of bias tool)*	Low
Systematic literature reviews								
Schurmans 2022 (Belgium) *k*=4 including 2 publications with the same intervention	RCT (*k*=4)	*N* = 104 (*k*=2) 41.1-48.1 years 44.4 to 47.8 kg.m² 75-100% women	Exercise training (*k*=2) PA counseling (*k*=2) Duration: 6-12wk. Type: E/R, E Frequency: 3-7/wk. Intensity: Moderate to vigorous Session duration: 30-80 min	Usual care (*k*=4)	1. WL 2. BMI 3. FFM 4. BP 5. 6MWTD 6. QoL 7. RHR	1. NS (*k*=1) 4. NS (*k*=2) 5. + (*k*=1) 6. + (*k*=1 except role-emotional domain) 7. NS (*k*=2) **1yr after MBS** 2. NS (*k*=1) 3. + (*k*=1) 5. NS (*k*=1) 6. NS (*k*=1)	3/10 (*k*=1) Good (6/10 *k*=2; 7/10 *k*=1) *(PEDro scale)*	Low

			Supervision: supervised (*k*=2), unsupervised (*k*=2)				
Jabbour 2022 (Qatar+2) *k*=13 including 2 and 3 publications with the same intervention	RCT (*k*=10) Intervention trial (*k*=3)	*N* = 261 (*k*=10) 37.3-50.1 years 43.9 to 51.4 kg.m^2 67-100% women	Exercise training (*k*=11) PA counseling (*k*=3) Duration: 30d.-24 wk. Type: E, R, E/R, Water exerc, respiratory. Frequency: 1-7x/wk. Intensity: Low to vigorous Session duration: 25-219 min Supervision: supervised (*k*=11), unsupervised (*k*=2)	Usual care (*k*=8) A 3-day outpatient control Period (*k*=1) NR (*k*=5)	1. BW 2. BMI 3. FM% 4. 6MWTD 5. Sit-to-stand 6. Arm curl 7. Leg strength/ muscle quality 8. Maximum aerobic capacity 9. SI 10. Adipokines 11. SBP 12. DBP 13. Length of hospital stay	Difficult interpretation of text and table results 1. NS (*k*=3), + (*k*=2) * 2. NS (*k*=1), + (*k*=3) 3. NS (*k*=1) 4. NS (*k*=1), + (*k*=2) 5. NS (*k*=1), + (*k*=1) 6. + (*k*=2) 7. + (*k*=3)* 8. NS (*k*=1, METS), + (*k*=1, VO_2 peak) 9. NS (*k*=1) 10. NS (*k*=1) 11. NS (*k*=2), + (*k*=1) 12. NS (*k*=2), + (*k*=1) 13. + (*k*=1) *Daniels 2018 removed from results as it is a postMBS intervention	No evaluation	Critically low
Lodewijks 2022 (Netherlands) *k*=11 including 2 publications each from 2 interventions	RCT (*k*=8) NRCT (*k*=3)	*N* = 305 (*k*=9) NO SYNTHESIS ONLY FOR EXERCISE	Exercise training (*k*=7) PA counseling (*k*=4) Duration: 2 wk.-52wk. NO OTHER INFORMATION COLLECTED AND REPORTED	Usual care (*k*=7) No intervention (*k*=4)	1. Pre-MBS WL 2. Post-MBS WL 3. BMI 4. FM 5. Physical activity 6. QoL 7. FFM	1. NS (*k*=9), + (*k*=1)* 2. NS (*k*=1)* 3. + (*k*=1) 4. + (*k*=1) 5. + (*k*=4) 6. + (*k*=2, 1 for physical functioning, general health perceptions, mental health and social functioning, and 1 for all except role-emotional) 1-year postMBS 2. + (*k*=1)* 3. + (*k*=1) 5. + (*k*=1) 7. + (*k*=1) *Unclear if comparison is pre- vs post-MBS in intervention group or ex vs c	3/ NR (*k*=4) 2/5 (*k*=4) *(Jadad)* Serious bias (*k*=1) Moderate bias (*k*=2) *(ROBINS-1 tool)*	Low
Bellicha 2021 (France+6) *k*= 4 including 2 publications	RCT (*k*=3) NRCT (*k*=1)	*N* = 104 (*k*=3) 37.5 to 50.1 years 41.5 to 50.8 kg.m^2	Exercise training (*k*=4) Duration: 12-16 wk. Type: E, E/R, HIIT/R Frequency: 2-4x/wk. Intensity: Moderate to vigorous	Usual care (*k*=4)	1. BW/BMI 2. FM 3. LBM 4. Muscle Strength 5. Walking distance	1. NS (*k*=1), + (*k*=2) 2. NS (*k*=1), + (*k*=1), 3. NS (*k*=1) 4. NS (*k*=1), + (*k*=1) 5. + (*k*=2) 6. NS (*k*=2), + (*k*=1) 7. NS (*k*=1), + (*k*=1)	Good (*k*=1) Fair (*k*=1) Poor (*k*=1) *(National Heart, Lung and Blood*	Critically low

with the same intervention		76-90% women	Session duration: 25-50 min Supervision: Full-supervised (*k*=4)	6. VO_2max 7. QoL 8. BP 9.Glucose metabolism 10. Lipid profile 11. Habitual physical activity	8. NS (*k*=2), + (*k*=1) 9. NS (*k*=1), + (*k*=1) 10. NS (*k*=1), + (*k*=1) 1 yr post-MBS effects in one publication 1. + (*k*=1) 2. NS (*k*=1) 3. - (*k*=1) 4. NS (*k*=1) 5. + (*k*=1) 6. NS (*k*=1) 7. NS (*k*=1) 8. NS (*k*=1) 11. + (*k*=1)	*Institute quality assessment tool)*	
Pouwels 2015 (Netherlands) *k*=4	RCT (*k*=1) NRCT (*k*=3)	NO SYNTHESIS ONLY FOR PRE-MBS	Exercise training (*k*=4) Duration: 1-24 wk. Type: E, E/R, Water exercise. Frequency: 1-7/wk. Intensity: Low to vigorous Session duration: 60-219 min Supervision: Full-supervised (*k*=3), partial (*k*=1)	NR	1. BW/BMI 2. FM 3. BP 4. Glucose metabolism 5. Lipid profile 6. Walking distance 7. VO_2 max 8. QoL	Unclear: only one RCT with no systematic clear comparison between ex vs. c in the original article due to small sample size lack of control groups	Good 6/10 (*k*=1) Fair (5/10 *k*=2; 4/10 *k*=1) (PEDro *scale*)	Critically low
Baillot 2014 (Canada) *k*=3	RCT (*k*=1) UCT (*k*=2)	*N* = 46 29.6 to 49.3 years 48.5 to 48.7 kg.m^2 0-86% women	Exercise training (*k*=3) Duration: 1-24 wk. Type: E, Water exercise. Frequency: 1-7/wk. Intensity: Low to vigorous Session duration: 30-60 min Supervision: Full-supervised (*k*=3)	NR	1. BW/BMI 2. Walking distance 3. Insulin action 4. BP 5. QoL/Depression scores 6. Bodily pain 7. Cardiovascular risk	Unclear as only one RCT with no systematic clear comparison between ex vs. c in the original article due to small sample size and other articles lack of control group	Moderate (*k*=2) Weak (*k*=1) *(Effective Public Health Practice Project)*	Low
Fonseca-Junior 2013 (Brazil) *k*=1	NR	*N* = 61 NR	Exercise training (*k*=1) Duration: 24 wk. Type: E Frequency: 1/wk. Intensity: Low Session duration: 30 min	NR	1. BMI 2. BP 3. Glucose metabolism 4. Lipid profile 5. Functional capacity	Explicit comparison between ex vs control groups not made clear in text and no table to reinforce data	No evaluation	Critically low

	Supervision: Full-supervised

Note. All data were reported as they were presented in the manuscript. Details presented in blue were obtained directly or calculated from tables/figures in the manuscripts rather than from the text. *N*=Total sample size, *n*=subsample size, *k*=number of studies, RCT=randomized control trial, NCRT=non-randomized control trial, E=endurance, R=resistance, E/R=combination endurance and resistance, HIIT=high intensity interval training, BC=behavioral component, MBS=metabolic and bariatric surgery, BW=body weight, WL=weight loss, BMI=body mass index, WL=weight loss, FM=fat mass, FFM=fat-free mass, LBM=lean body mass, 6MWTD=6 minute walking test difference, QoL=quality of life, BP=blood pressure, SBP=systolic blood pressure, DBP=diastolic blood pressure, RHR=resting heart rate, RR=risk ratio, MD=mean difference, SMD=standardized mean difference, NR=not reported, N/A=not applicable, NS=non-significant.

[a] First country listed in first author's affiliations plus number of additional countries in all authors' reported affiliations;
[b] Values reported from details provided in tables include minimum and maximum or mean/median age and BMI, and % women;
[c] only outcomes with a synthesis within the meta-analysis or in the systematic review text are reported;
[d] For meta-analyses, summary includes effect size estimate, 95% confidence interval, I^2 = values of heterogeneity, sample size (*n*) and number of studies (*k*) included in the analysis. For systematic reviews, NS indicates no significant difference, while + and - indicate a significant improvement and deterioration respectively, following intervention compared to control.

Appendix J – Pre-MBS Primary Articles

Table S13: Pre-MBS Primary Articles

ALL ARTICLES	Baillot et al 2022	Durey et al 2022	Herrera-Santelices et al 2022	Marshall et al 2020	Schurmans et al 2022	Jabbour et al 2022	Lodewijks et al 2022	Bellicha et al 2021	Pouwels et al 2015	Baillot et al 2014	Fonseca-Junior et al 2013	Total Count
Arman et al 2021	X		X				X					3
Baillot et al 2014				X		X			X			3
Baillot et al 2016	X		X		X	X	X	X				6
Baillot et al 2017						X	X					2
Baillot et al 2018		X	X	X	X	X	X	X				7
Bond et al 2015a				X		X	X					3
Bond et al 2015b				X	X	X	X					4
Bond et al 2016				X								1
Bond et al 2017a		X		X	X	X						4
Bond et al 2017b				X								1
Creel et al 2016		X		X			X					3
Daniels et al 2018						X						1
Funderburk et al 2010	X		X			X	X		X	X		6
Garcia Delegado et al 2021						X						1
Gilbertson et al 2020	X					X	X					3
Hickey et al 1999									X	X		2
Kwok et al 2016		X										1
Li et al 2013		X										1
Marc-Hernandez et al 2019	X						X	X				3
Marcon et al 2011						X			X	X	X	4
Marcon et al 2017	X		X			X		X				4
Parikh et al 2012							X					1

Pico-Sirvent et al 2019	X									1

***Note*.** Black = primary studies published after systematic review/meta-analysis and therefore not possible for inclusion.
Grey = primary articles published the same year as the systematic review/meta-analysis and therefore not likely for inclusion.

1. Arman N, Tokgoz G, Seyit H, Karabulut M. The effects of core stabilization exercise program in obese people awaiting bariatric surgery: A randomized controlled study. Complement Ther Clin Pract. 2021;43:101342. doi:10.1016/j.ctcp.2021.101342
2. Baillot A, Mampuya WM, Comeau E, Méziat-Burdin A, Langlois MF. Feasibility and impacts of supervised exercise training in subjects with obesity awaiting bariatric surgery: a pilot study. Obesity surgery. 2014;23:882-91.
3. Baillot A, Mampuya WM, Dionne IJ, Comeau E, Méziat-Burdin A, Langlois MF. Impacts of Supervised Exercise Training in Addition to Interdisciplinary Lifestyle Management in Subjects Awaiting Bariatric Surgery: a Randomized Controlled Study. Obes Surg. 2016;26(11):2602-2610. doi:10.1007/s11695-016-2153-9
4. Baillot A, Boissy P, Tousignant M, Langlois MF. Feasibility and effect of in-home physical exercise training delivered via telehealth before bariatric surgery. J Telemed Telecare. 2017;23(5):529-535. doi:10.1177/1357633X16653511
5. Baillot A, Vallée CA, Mampuya WM, et al. Effects of a Pre-surgery Supervised Exercise Training 1 Year After Bariatric Surgery: a Randomized Controlled Study. Obes Surg. 2018;28(4):955-962. doi:10.1007/s11695-017-2943-8
6. Bond DS, Thomas JG, King WC, et al. Exercise improves quality of life in bariatric surgery candidates: Results from the Bari-Active trial. Obesity. 2015;23(3):536-542. doi:10.1002/oby.20988
7. Bond DS, Thomas JG, Vithiananthan S, et al. Intervention-related increases in preoperative physical activity are maintained 6-months after Bariatric surgery: results from the bari-active trial. Int J Obes. 2017;41(3):467-470. doi:10.1038/ijo.2016.237
8. Bond DS, Vithiananthan S, Thomas JG, et al. Bari-Active: a randomized controlled trial of a preoperative intervention to increase physical activity in bariatric surgery patients. Surg Obes Relat Dis. 2015;11(1):169-177. doi:10.1016/j.soard.2014.07.010
9. Bond DS, Raynor HA, Thomas JG, et al. Greater Adherence to Recommended Morning Physical Activity is Associated With Greater Total Intervention-Related Physical Activity Changes in Bariatric Surgery Patients. J Phys Act Health. 2017;14(6):492-498. doi:10.1123/jpah.2016-0529
10. Bond DS, Graham Thomas J, Vithiananthan S, et al. Changes in enjoyment, self-efficacy, and motivation during a randomized trial to promote habitual physical activity adoption in bariatric surgery patients. Surg Obes Relat Dis. 2016;12(5):1072-1079. doi:10.1016/j.soard.2016.02.009
11. Creel DB, Schuh LM, Reed CA, et al. A randomized trial comparing two interventions to increase physical activity among patients undergoing bariatric surgery. Obesity. 2016;24(8):1660-1668. doi:10.1002/oby.21548
12. Daniels P, Burns RD, Brusseau TA, et al. Effect of a randomised 12-week resistance training programme on muscular strength, cross-sectional area and muscle quality in women having undergone Roux-en-Y gastric bypass. J Sports Sci. 2018;36(5):529-535. doi:10.1080/02640414.2017.1322217

13. Funderburk JA, Callis S. Aquatic intervention effect on quality of life prior to obesity surgery: a pilot study. [Conference Abstract]. Annu Ther Recreat. 2010;18:66-78.
14. García-Delgado Y, López-Madrazo-Hernández MJ, Alvarado-Martel D, et al. Prehabilitation for Bariatric Surgery: A Randomized, Controlled Trial Protocol and Pilot Study. Nutrients. 2021;13(9):2903. doi:10.3390/nu13092903
15. Gilbertson NM, Gaitán JM, Osinski V, et al. Pre-operative aerobic exercise on metabolic health and surgical outcomes in patients receiving bariatric surgery: A pilot trial. PLOS ONE. 2020;15(10):e0239130. doi:10.1371/journal.pone.0239130
16. Hickey M, Gavigan KE, McCammon MR, et al. Effects of 7 days of exercise training on insulin action in morbidly obese men. Clin Exerc Physiol. 1:24-28.
17. Kwok K, Hardy K, Bouchard D, Vergis A. The Impact of a Pre-operative Exercise Program on Patients Awaiting Bariatric Surgery. [Conference Abstract]. Surg Obes Relat Dis. 2016;12(7):S201-S202. doi:10.1016/j.soard.2016.08.350
18. Li C, Zavorsky GS, Kim DJ, Christou NV, Feldman LS, Carli F. Effects of a bariatric preoperative exercise program: a pilot randomized study. [Conference Abstract]. Surg Endosc Interv Tech. 2013;27:S431.
19. Marc-Hernández A, Ruiz-Tovar J, Aracil A, Guillén S, Moya-Ramón M. Impact of Exercise on Body Composition and Cardiometabolic Risk Factors in Patients Awaiting Bariatric Surgery. Obes Surg. 2019;29(12):3891-3900. doi:10.1007/s11695-019-04088-9
20. Marcon ER, Baglioni S, Bittencourt L, Lopes CLN, Neumann CR, Trindade MRM. What Is the Best Treatment before Bariatric Surgery? Exercise, Exercise and Group Therapy, or Conventional Waiting: a Randomized Controlled Trial. Obes Surg. 2017;27(3):763-773. doi:10.1007/s11695-016-2365-z
21. Marcon ER, Gus I, Neumann CR. Impact of a minimum program of supervised exercises in the cardiometabolic risk in patients with morbid obesity. Arq Bras Endocrinol Metab. 2011;55(5):331-338. doi:10.1590/S0004-27302011000500006
22. Parikh M, Dasari M, McMacken M, Ren C, Fielding G, Ogedegbe G. Does a preoperative medically supervised weight loss program improve bariatric surgery outcomes? A pilot randomized study. Surg Endosc. 2012;26(3):853-861. doi:10.1007/s00464-011-1966-9
23. Picó-Sirvent I, Aracil-Marco A, Pastor D, Moya-Ramón M. Effects of a Combined High-Intensity Interval Training and Resistance Training Program in Patients Awaiting Bariatric Surgery: A Pilot Study. Sports. 2019;7(3):72. doi:10.3390/sports7030072

Appendix K – Post-MBS Study Characteristics

Table S14: Summary of Meta-Analyses and Systematic Reviews for Post-Metabolic and Bariatric Surgery Exercise Interventions

Author Year (Country[a]) Number of primary studies included	Study designs	Sample description (*N*, age range, BMI range, % women)[b]	Intervention description	Control group	Outcomes assessed[c]	Main results[d] *Level of evidence*	Quality scores of the studies included (*quality assessment tool*)[e]	*AMSTAR rating*
Meta-analyses								
Bond 2023 (USA+1) *k*=5	RCT (*k*=5)	*N* = 189 47.8 ± 4.2 years 36.1 ± 6 3.8 kg/m^2 83.2 ± 9.5% women	Exercise training (*k*=5) Duration: 19.2 ± 7.0 (12 - 26) weeks Type: E/R, E, HIIT Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 40-80 min Supervision: supervised *k*=4, semi supervised *k*=1 Start: for post-MBS intervention = 18.9 ± 11.5 (12 - 37) months	Usual care (*k*=4) Standard diet and PA recommendations (*k*=1)	1. WL (≥12 months postMBS)	1. SMD: - 2.26 [-2.07; 1.55], I^2=0%; *n*=189, *k*=5	High risk (*k*=3) Some concerns (*k*=1) Low risk (*k*=1) *(Cochrane risk of bias tool 2)*	Low
Baillot 2022 (Canada+1) *k*=21	RCT (*k*=15) NRCT (*k*=6)	NO SYNTHESIS ONLY FOR POST-MBS	Exercise training (*k*=21) Duration: 4-104 weeks Type: R, E, E/R, HIIT balance Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 25-90 min Supervision: supervised *k*=14, semi supervised *k*=4, unsupervised *k*=1, not reported *k*=2 Start: for post-MBS intervention = 0-7 years	Usual care (*k*=13) Diet education (*k*=1) Instruction to continue normal activities (*k*=1) Protein supplementation (*k*=1)* Placebo (*k*=1)* Not reported (*k*=5) *1 study with two control groups	1. Adverse events during exercise 2. Attendance 3. Dropout 4. Compliance	1. None (*k*=7), occasional pain, fatigue, or dyspnea (*k*=3), hypoglycemia or hypotension (*k*=1), back bruise after a fall (*k*= 1) 2. Pooled percentage: 87.4% [76.7; 95.6], I^2=0%; *n*=NR, *k*=6 3. Pooled percentage: 5.6% [0.6; 13.8], I^2=69%; *n*=NR, *k*=12 4. No metanalysis due to small number of studies (*k*=3) and various operationalization of term "compliance" Sub-analysis: NS differences in attendance, dropout rates based on studies quality, exercise intervention timing, and exercise intervention duration	Poor (*k*=7) Fair (*k*=7) Good (*k*=7) *(National Heart, Lung and Blood Institute quality assessment tool)*	Low

Roth 2022 (Switzerland) *k*=6	RCT (*k*=6)	*N* = 433 35.4-42.5 years 41.7to 49.8kg.m^2 55-100% women	**Exercise training** (*k*=6) Duration: 12-104 wk. Type: R, E, E/R Frequency: 2-3x/wk. Intensity: Moderate to vigorous Session duration: 20-85 min Supervision: NR Start: Combined synthesis NR individual results	Control (*k*=4) High protein (*k*=2)	**1.** FFM **2.** BMD	**1.** Ex. vs. C SMD: 0.39 [-0.01; 0.78], I^2=0%; *n*=132, *k*=3 (Very Low level of evidence) **1.** Ex+Protein vs. Protein, SMD: 0.25 [-1.15; 1.65], I^2=0%; *n*=91, *k*=2 (Low level of evidence) **1.** Ex+Protein+vit. D+Ca2$^+$ vs. Control, SMD: 5.16 [4.60; 5.71], I^2=N/A; *n*=220, *k*=1 (Moderate level of evidence) **2.** Ex vs. C, SMD:0.51 [0.01; 1.01], I^2=N/A; *n*=63, *k*=1 (Moderate level of evidence) **2**. Ex+Protein+vit. D+Ca2+ vs. Control, SMD: 3.88 [3.43; 4.34], I^2=N/A; *n*=220, *k*=1 (Moderate level of evidence)	High risk (*k*=2) Some concerns (*k*=1) Low risk (*k*=3) *(Cochrane risk of bias tool 2)*	Moderate
Vieira 2022 (Brazil) *k*=15	RCT (*k*=10) NRCT (*k*=5)	*N* = 638 18-65 years majority>30 kg.m^2 up to 100% women	**Exercise training** (*k*=15) Duration: 12-54 wk. Type: R, E/R, respiratory Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 5-110min Supervision: Full-supervised (*k*=11), partial (*k*=2), unsupervised (*k*=1), NR (*k*=1) Start:1-84 months after MBS	Usual care (*k*=11) Usual care + PA encouragement (*k*=4)	**1.** Upper muscle strength (1RM) **2.** Lower muscle strength (1RM) **3.** Muscle strength (sit-to stand) **4.** Muscle strength (dynamometer) **5.** Muscle strength (handgrip test)	**1.** ES: 0.71 [0.41; 1.01], I^2=0%; *n*=NR, *k*=4 (Very low level of evidence) **2.** ES: 1.37 [0.84; 1.91], I^2=46%; *n*=NR, *k*=5 (Very low level of evidence) **3.** ES: 0.60 [0.20; 1.01], I^2=69%; *n*=NR, *k*=8 (Very low level of evidence) **4**. ES: 0.46 [0.06; 0.87], I^2=31%; *n*=NR, *k*=4 (Very low level of evidence) **5**. ES: 0.11 [-0.42; 0.63], I^2=73%; *n*=NR, *k*=6 (Very low level of evidence)	None of the studies had a low risk of bias *(Joanna Briggs Institute critical appraisal tools)*	Low
Gasmi 2022 (France+7) *k*=11 including 3 publications with the same intervention	RCT (*k*=11)	*N* = 495 (*k*= 9) 31.0-50.6 years NR kg.m^2 NR women	**Exercise training** (*k*=10) **Physical activity** (*k*=1) **WBS + dynamic exercise** (*k*=1) Duration: NR Type: E, R, E/R Frequency: NR Intensity: NR clearly Session duration: NR Supervision: NR Start: early–3 years after MBS	Usual care (*k*=1) Control group (*k*=10)	**1.** BMI **2.** FFM **3.** FM **4**. Hip to waist **5**. WC	**1**. SMD: -0.93 [-1.65; -0.20], I^2=85%; *n*=341, *k*=5 **2.** SMD: 0.23 [-0.31; 0.77], I^2=0%; *n*=54, *k*=2 **3.** SMD: -0.08 [-0.54; 0.38], I^2=0%; *n*=74, *k*=3 **4.** SMD: -0.25 [-0.76; 0.26], I^2=0%; *n*=60, *k*=2 **5.** SMD: -0.18 [-0.79; 0.43], I^2=0%; *n*=42, *k*=2 2,3,4,5 based on final data intervention vs. control groups	No results reported *(Cochrane risk of bias tool)*	Critically low
Diniz-Sousa 2022 (Portugal+1) *k*=4	RCT (*k*=3) NRCT (*k*=1)	*N* = 340 37-47 years Pre-MBS 41.8-49.8 kg.m^2 72% women	**Exercise training** (*k*=4) Duration: 6-11.5 months Type: R, E/R, high impact/balance Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 30-90 min Supervision: Full-supervised (*k*=3), semi-supervised (*k*=1)	Usual care (*k*=4)	**1.** BMD total hip **2.** BMD femoral neck **3.** BMD lumbar spine **4.** BMD 1/3 radius	**1.** SMD: 0.37 [0.02; 0.71], I^2=50%; *n*=340, *k*=4 (very low certainty evidence) **2.** SMD: 0.63 [0.19; 1.06], I^2=19%; *n*=112, *k*=2 (low certainty evidence) **3.** SMD: 0.41 [0.19; 0.62], I^2=0%; *n*=341, *k*=4 (low certainty evidence) **4.** SMD: 0.58 [0.19; 0.97], I^2=0%; *n*=112, *k*=2 (low certainty evidence)	Some concerns (*k*=3) *(Cochrane risk of bias tool 2)* Moderate risk of bias (*k*=1)	Moderate

			Start:2 wk.-3 months after MBS			*(ROBINS-I)*	
Boppre 2022 (Portugal) *k*=11 including 3, 2 and 2 publications with the same intervention	RCT (*k*=11)	*N* = 386 (*k* = 7) 36.0-53.9 years NR kg.m^2 84% women	**Exercise training** (*k*=11) Duration: 12-26 wk. Type: E, E/R Frequency: 2-5x/wk. Intensity: Moderate Session duration: 40-60 min Supervision: NR Start:1-24 months after MBS	Usual care (*k*=11)	**1.** VO_2max **2**. SBP **3.** DBP **4.** RHR **5.** Insulin **6.** Glucose **7**. HOMA-IR **8**. HbA1C **9.** TC **10**. HDL-C **11**. LDL-C **12**. TG	**1.** MD: 0.26 L/min [-0.11; 0.63], I^2=0%; *n*=, *k*=3 **2.** MD: − 5.33 mmHg [-8.99; -1.66], I^2=0%; *n*=314, *k*=6 (moderate certainty evidence) **3.** MD: -2.66 mmHg [-6.72; 1.40], I^2=59%; *n*=NR, *k*=6 **4.** MD: -2.05 bpm [-6.64; 2.54], I^2=0%; *n*= NR, *k*=3 **5.** MD: -1.58 µIU/mL [-5.14; 1.98], I^2=71%; *n*= NR, *k*=4 **6.** MD: 0.94 mg/dL [-3.31; 5.19], I^2=0%; *n*= NR, *k*=4 **7.** MD: 1.39 [-1.30; 4.08], I^2=89%; *n*= NR, *k*=2 **8.** MD: -0.65 mmol/mol [-2.22; 0.93], I^2=0%; *n*= NR, *k*=2 **9.** MD: -3.08 mg/dL [-12.04; 5.87], I^2=0%; *n*= NR, *k*=5 **10.** MD: 0.61 mg/dL [-3.05; 4.28], I^2=26%; *n*= NR, *k*=5 **11.** MD: -8.17 mg/dL [-20.35; 4.00], I^2=57%; *n*= NR, *k*=5 **12.** MD: -8.38 mg/dL [-19.81; 3.04], I^2=0%; *n*= NR, *k*=5 Sub-analysis: Endurance exercise vs MBS: NS change for VO_2max (*k*=2), SBP (*k*=3), DBP (*k*=3), insulin (*k*=2), glucose (*k*=2), TC (*k*=2), HDL-C (*k*=2), LDL-C (*k*=2), and TG (*k*=2) Combined exercise vs. MBS: **2**. MD: -7.18 mmHg [-12.42; -1.94], I^2=0%; *n*=137, *k*=3 (moderate certainty evidence) **12.** MD: -17.56 mg/dL [-34.15; -0.96], I^2=0%; *n*=171, *k*=3 (low certainty evidence) NS change for DBP (*k*=3), insulin (*k*=2), glucose (*k*=2), HbA1C (*k*=2), TC (*k*=3), HDL-C (*k*=3), and LDL-C (*k*=3) Studies starting < 6 months after MBS = NS change for SBP (*k*=4), DBP (*k*=4), insulin (*k*=3), glucose (*k*=3), TC (*k*=4), HDL-C (*k*=4), LDL-C (*k*=4), and TG (*k*=4) Studies starting > 6 months after MBS:	High risk (*k*=3) Some concerns (*k*=1) Low risk (*k*=7) *(Cochrane risk of bias tool)*	Critically low

					2. SBP, MD: -7.71 mmHg [-13.12; -2.31], I^2=0%; *n*=84, *k*=2 (high certainty evidence) NS change for DBP (*k*=2) and RHR (*k*=4) Intervention duration < 12 week = NS change for SBP (*k*=3), DBP (*k*=3), TC (*k*=2), HDL-C (*k*=2), LDL-C (*k*=2), and TG (*k*=2) Intervention duration > 12 week: **2**. SBP, MD: -5.78 mmHg [-9.91; -1.66], I^2=0%; *n*=212, *k*=3 (high certainty evidence) NS change for VO_2max (*k*=2), DBP (*k*=3), RHR (*k*=2), insulin (*k*=3), glucose (*k*=3), HOMA-IR (*k*=2), HbA1C (*k*=2), TC (*k*=3), HDL-C (*k*=3), LDL-C (*k*=3), and TG (*k*=3)		
Boppre 2021 (Portugal) *k*=10	RCT (*k*=10)	*N* = 487 35.4-53.9 years NR kg.m^2 85% women	**Exercise training** (*k*=10) Duration: 12-26 wk. Type: E, E/R, R Frequency: 3-5x/wk. Intensity: Moderate-Vigorous Session duration: 40-80 min Supervision: Full-supervised (*k*=6), partial-supervised (*k*=1), semi-supervised (*k*=3) Start:1-24 months after MBS	Usual care (*k*=10)	**1.** BW **2**. BMI **3.** FM **4.** LBM **5**. WC	**1.** MD: -2.51 kg [-4.74; -0.27], I^2=0%; *n*=496, *k*=10 (11 arms) **2**. MD: -0.84 kg/m^2 [-1.60; -0.08], I^2=0%; *n*=401, *k*=7 (8 arms) **3.** MD: 0.49 kg [-1.71; 2.69], I^2=0%; *n*=173, *k*=2 **4.** MD: 0.87 kg [-0.65; 2.40], I^2=0%; *n*=201, *k*=3 **5.** MD: -4.14 cm [-8.16; -0.12], I^2=9%; *n*=201, *k*=4 Sub-analysis: Endurance exercise vs. MBS: NS change for BW (*k*=4), BMI (*k*=3), LBM (*k*=2), and WC (*k*=3) Resistance exercise vs. MBS: NS change for BW (*k*=2) Combined exercise vs. MBS: **1.** BW, MD: -5.02 kg [-8.13; -1.90], I^2=0%; *n*=221, *k*=5 **2.** BMI, MD: -1.62 kg/m^2 [-2.72; -0.59], I^2=0%; *n*=170, *k*=4 Studies starting < 6 months after MBS: NS change for BW (*k*=7), BMI (*k*=5), FM (*k*=2), LBM (*k*=3), and WC (*k*=3) Studies starting > 6 months after MBS: **1.** BW, MD: -5.25 kg [-8.52; -1.97], I^2=0%; *n*=135, *k*=3 **2.** BMI, MD: -1.84 kg/m^2 [-3.04; -0.64], I^2=0%; *n*=84, *k*=2 Intervention duration ≤ 12 week NS change for BW (*k*=5), FM (*k*=3), and WC (*k*=1)	Fair 5/10 (*k*=6) Good 6/10 (*k*=4) (PEDro *scale*)	Critically low

					Intervention duration >12 week: NS change for BW (*k*=4), BMI (*k*=4), FM (*k*=3), LBM (*k*=2), and WC (*k*=2)		
Bellicha 2021 (France+6) *k*=14 included in meta-analysis[f]	RCT (*k*=9) NRCT (*k*=5)	*N* = 587 33.3-53.9 years 29.6-47.9 kg.m^2 57-100% women	**Exercise training** (*k*=14) Duration: 3-10 months Type: E, R, E/R Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 20-60 min Supervision: Totally supervised (*k*=10), partially supervised (*k*=2), not supervised (*k*=1), NR (*k*=1) Start:1-42 months after MBS	Usual care (*k*=14)	**1.** BW **2.** FM **3.** LBM **4.** Muscle Strength **5.** Walking distance **6.** VO_2max **7.** QoL physical **8.** QoL mental **9.** HOMA-IR **10.**HDL-C **11.**LDL-C **12.** TG **13.** BMD **14.** SBP **15.** DBP **16.** MVPA	**1**. MD: -1.8 kg [-3.2; -0.4], I^2=35%; *n*=NR, *k*=13 (14 arms) **2**. MD: -2.1 kg [-3.7; -0.5], I^2=50%; *n*=NR, *k*=8 (9 arms) **3**. MD: 0.7 kg [-0.2; 1.6], I^2=45%; *n*=NR, *k*=10 (11 arms) **4**. SMD: 0.82 [0.48; 1.16], I^2=42%; *n*=NR, *k*=8 (9 arms) **5**. SMD: 1.46 [0.27; 2.66], I^2=89%; *n*=NR, *k*=5 (6 arms) **6**. SMD: 0.70 [0.35; 1.06], I^2=42%; *n*=NR, *k*=8 **7**. MD: -2.5 [-5.1; 0.2], I^2=0%; *n*=NR, *k*=2 **8**. MD: 3.9 [-0.5; 8.3], I^2=0%; *n*=NR, *k*=2 **9**. SMD: 0.14 [-0.10; 0.38], I^2=0%; *n*=NR, *k*=2 **10**. SMD: 0.10 [-0.16; 0.37], I^2=0%; *n*=NR, *k*=4 **11**. SMD: -0.18 [-0.46; 0.09], I^2=0%; *n*=NR, *k*=3 **12**. SMD: 0.01 [-0.26; 0.27], I^2=0%; *n*=NR, *k*=4 **13**. SMD: 0.44 [0.21; 0.67], I^2=0%; *n*=NR, *k*=3 **14**. MD: -4.2 mmHg [-9.3; 1.0], I^2=47%; *n*=NR, *k*=4 **15**. MD: -2.3 mmHg [-8.5; 3.9], I^2=77%; *n*=NR, *k*=4 **16.** MD: -0.20 min/d [-13.19; 12.79], I^2=77%; *n*=NR, *k*=3 Sub analyses to have MD **6.** VO_2max relative to BW, MD: 2.73 mL/kg/min [0.81; 4.64], I^2=79%; *n*=NR, *k*=6	Poor (*k*=5) Fair (*k*=3) Good (*k*=6) *(National Heart, Lung and Blood Institute quality assessment tool)*	Critically low
Carretero-Ruiz 2021 (Spain+2) *k*=14 in meta-analysis[g] including 6 publications from 3	RCT (*k*=10) NRCT (*k*=4)	*N* = 469 (*k* = 11) 36.0-53.9 years NR kg.m^2 66.6-100% women	**Exercise training** (*k*=14) Duration: 12-40 weeks Type: E, R, E/R Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 25-75 min Supervision: Supervised (*k*=10), supervised/programmed (*k*=4)	Usual care (*k*=14)	**1.** VO_2max/peak relative to BW **2.** VO_2max/peak **3.** RHR **4.** HDL-C **5.**SBP **6.** DBP	**1.** ES: 0.67 [0.29; 1.06] (MD: 1.25 ml/kg/min [0.48; 2.02]), I^2=23%; *n*=NR, *k*=6 **2.** ES: 0.32 [0.07; 0.57], I^2=0%; *n*=NR, *k*=5 **3.** ES: -0.44 [-0.75; -0.02] (MD: -3.93 bpm [-6.54; 1.31]), I^2=0%; *n*=NR, *k*=5 **4.** ES: 0.22 [0.01; 0.43], I^2=0%; *n*=NR, *k*=6 **5.** ES: -0.16 [-0.40; 0.08] (MD = -2.65 mmHg [-7.32; -1.11]), I^2=0%; *n*=NR, *k*=5 **6.** ES: -0.12 [-0.45, 0.21] (MD: -1.41 mmHg [-5.56, 2.75]), I^2=34%; *n*=NR, *k*=5	Poor (3/10 *k*=2) Fair (4/10 *k*=1; 5/10 *k*=3) Good (7/10 *k*=4; 8/10 *k*=3; 9/10 *k*=1) (PEDro *scale*)	Critically low

interventions (2 each)			Start: 1-102 months after MBS					
Marshall (2020) (Australia) *k*=7 (resulting in 13 publications)	RCT (*k*=4) Pseudo RCT (*k*=1) NRCT (*k*=2)	*N* = 282 36-54 years 32.7-45.6 kg.m^2 70-100% women	Exercise training (*k*=7) Duration: 12-26 weeks Type: E, R, E/R Frequency: 2-5x/wk. Intensity: NR Session duration: 40-80 min Supervision: Supervised (*k*=6), Semi-supervised (*k*=1) Start: 1-6 months after MBS	Usual care (*k*=4) Health education (*k*=3)	Pre- and post-MBS **1.** RHR **2.** DBP **3.** SBP PostMBS **4.** TG **5.** HDL-C **6.** LDL-C **7.**TC **8.**Fasting insulin **9.**Fasting glucose	Pre- and post-MBS **1.** MD: -3.06 bpm [-5.65; -0.47], I^2=0%; *n*=111, *k*=4* (very low level of evidence) **2**. MD: -1.31 mmHg [-2.33; -0.29], I^2=23%; *n*=251, *k*=6 (very low level of evidence) **3.** MD: -1.59 mmHg [-3.74; 0.56], I^2=27%; *n*=239, *k*=6 (5 with 1 outlier removed) (very low level of evidence) Post-MBS **4.** MD: 0.01 mmol/L [-0.15; 0.16], I^2=0%; *n*=180, *k*=2*** (low level of evidence) **5.** MD: -0.00 mmol/L [-0.01; 0.01], I^2=0%; *n*=180, *k*=2*** (low level of evidence) **6.** MD: -0.06 mmol/L [-0.21; 0.09], I^2=0%; *n*=180, *k*=2*** (low level of evidence) **7.** MD: -0.08 mmol/L [-0.26; 0.11], I^2=0%; *n*=180, *k*=2*** (low level of evidence) **8**. MD: 4.88 pmol/L [-2.09; 11.84], I^2=0%; *n*=180, *k*=2*** (low level of evidence) **9.** MD: 0.05 mmol/L [-0.14; 0.24], I^2=0%; *n*=180, *k*=2*** (low level of evidence) * *k*=1 with 2 pre-MBS intervention publications and *k*=1 with 4 post-MBS intervention publications ** *k*=1 with 2 pre-MBS intervention publications and *k*=2 with 4 post-MBS intervention publications each *** *k*=2 with 4 publications each	Overall risk of bias not reported *(Cochrane risk of bias tool)*	Low
Carretero-Ruiz 2019 (Spain+2) *k*=16 included in meta-analysis[h]	RCT (*k*=10) NRCT (*k*=6)	*N* = 604 33.3 -53.9 years 29.6 - 47.8 kg.m^2 66.6 -100% women	**Exercise training** (*k*=14) **Physiotherapy** (*k*=1) **Respiratory training** (*k*=1) Duration: 1-40 wk. Type: E, R, E/R, Respiratory training, balance training Frequency: 2-5x/wk. Intensity: Low to vigorous	Usual care (*k*=16)	**1.** WL	**1.** SMD: 0.15 [-0.02; 0.32], I^2=0%; *n*=NR, *k*=16 (17 arms) Sub-analysis: Endurance exercise vs MBS: NS change (*k*=5) Resistance exercise vs MBS: NS change (*k*=2) Combined E/R exercise vs MBS: NS change (*k*=7) Alternative training: NS change (*k*=3)	High risk (*k*=7) Moderate risk (*k*=6) Low risk (*k*=3) *(Cochrane risk of bias tool)*	Low

			Session duration: 30 - 80 min Supervision: Supervised/programmed (*k*= 4), supervised (*k*=7), programmed (*k*=4), NR (*k*=1) Start: 1 day – 3 years after MBS			Programmed PA: NS change (*k*=3) Supervised PA: NS change (*k*=9) Programmed/Supervised PA: NS change (*k*=4) ≤3 months postMBS: NS change (*k*=11) >3 months posMBS: NS change (*k*=5) ≤16 weeks: NS change (*k*=12) >16 weeks: NS change (*k*=5) ≤150 min/week exercise: NS change (*k*=4) >150 min/week exercise: NS change (*k*=13) Meta-regression analyses Mean age: SMD: -0.00 [-0.04; 0.04], I^2=0%; *n*=NR, *k*=NR Length of intervention: SMD: 0.01 [-0.01; 0.00], I^2=0%; *n*=NR, *k*=NR Time per session: SMD: -0.00 [-0.01; 0.01], I^2=0%; *n*=NR, *k*=NR.		
da Silva 2019 (Brazil/USA) *k*=7 including 2 publications with the same intervention	RCT (*k*=7) *error in reporting as *k*=4 are NRCTs*	*N* = 193 (*k* = 6) 38.5-53.9 years 98.2-130.8 kg (baseline weight) 87% women	**Exercise training** (*k*=7) Duration: 3-10 months Type: E, R, E/R Frequency: 2-5x/wk. Intensity: Moderate-vigorous Session duration: 44-75 min Supervision: NR Start: 1-102 months after MBS	NR	**1.** VO_2max	**1.** SMD: 0.43 [0.16; 0.70], I^2=0%; *n*=215, *k*=7	4/10 (*k*=3) 6/10 (*k*=1) 7/10 (*k*=3) (PEDro *scale*)	Critically low
Ren 2018 (China) *k*=8	RCT (*k*=8)	*N* = 347 36.0-53.9 years NR kg.m^2 NR women	**Exercise training** (*k*=8) Duration: 12-26 wk. Type: E, R, E/R Frequency: 2-5/wk. Intensity: Moderate to vigorous Session duration: 1.3-4h/wk. Supervision: NR Start: immediately-19.3 months after MBS	Usual care/No exercise training (*k*=8)	**1.** BW **2.** 6MWTD **3.** BMI **4.** BF% **5.** FM **6**. FFM **7.** WC **8.** SBP **9.** DBP **10**. RHR **11.** HC	**1.** WMD: -1.94 kg [-3.18; -0.69], I^2=51%; *n*=347, *k*=8 (Moderate level of evidence) Sub-analysis: Endurance exercise vs MBS: NS change (*k*=3) Resistance exercise vs MBS: NS change (*k*=1) Combined E/R exercise: WMD: -3.12 kg [-4.56; -1.68], I^2=32%; *n*=NR, *k*=4 Studies starting < 6 months after MBS: WMD: -1.71 kg [-3.06; -0.36], I^2=32%; *n*=NR, *k*=5 Studies starting ≥ 12 months after MBS: WMD: -3.63 kg [-5.35; -1.91], I^2=0%; *n*=NR, *k*=2 Varying starting times: NS change (*k*=1)	No overall risk reported *(Cochrane's collaboration tool)*	Low

					2. WMD: 29.67 m [25.97; 33.37], I^2=0%; *n*=65, *k*=2 (Low level of evidence) **3.** WMD: -0.40 kg/m^2 [-0.81; 0.00], I^2=44%; *n*=259, *k*=5 (Moderate level of evidence) **4**. WMD: -1.93% [-4.06; 0.20], I^2=93%; *n*=107, *k*=4 (Low level of evidence) **5.** WMD: -3.35 kg [-7.99; 1.29], I^2=95%; *n*=186, *k*=3 (Low level of evidence) **6.** WMD**:** 0.53 kg [-1.88; 2.94], I^2=71%; *n*=58, *k*=2 (Very low level of evidence) **7.** WMD: -5.25 cm [-10.48; -0.03], I^2=94%; *n*=198, *k*=4 (Low level of evidence) **8.** WMD: -4.12 mmHg [−6.68; -1.55], I^2=6%; *n*=229, *k*=4 (Low level of evidence) **9.** WMD: -3.56 mmHg [-8.61; 1.48], I^2=83%; *n*=229, *k*=4 (Very low level of evidence) **10**. WMD: -4.39 bpm [-8.11; -0.68], I^2=0%; *n*=94, *k*=3 (Low level of evidence) **11**. WMD: -3.91 cm [-11.09; 3.26], I^2=88%; *n*=70, *k*=3 (Very low level of evidence)		
Systematic literature reviews							
Schurmans 2022 (Belgium) *k*=16 including 5, 3 and 2 publications with the same intervention	RCT (*k*=15) NRCT (*k*=1)	*N*=403 (*k* = 9) 31.0-53.9 years 32.7-48.1 kg.m^2 66-100% women	**Exercise training** (*k*=16) Duration: 8 weeks-12 months Type: E, R, E/R Frequency: 2-5x/wk. Intensity: Moderate-vigorous Session duration: 30-80 min Supervision: Supervised (*k*=4), semi supervised (*k*=10), NR (*k*=2) Start: 8 weeks-12 months after MBS	Usual care (*k*=16)	**1.** BMI **2.** WL **3.** LBM **4.** FFM **5.** Muscle strength **6.** 6MWTD **7.** VO_2max **8.** QoL **9.** SBP **10.** DBP **11.** Mean/RHR **12.** Dyspnea perception **13.** Leg exertion symptoms **14.** Blood lipids **15.** Insulin sensitivity **16.** AIRg/Di **17.** SPISE **18.** HOMA-IR	**1.** NS (*k*=7), + (*k*=3; 1 only at 24 months) **2.** NS (*k*=10), + (*k*=4; 1 only at 24 months) **3.** NS (*k*=5) **4.** NS (*k*=3), + (*k*=2, 1 only for combined E/R vs control) **5.** + (*k*=1) **6.** NS (*k*=3) **7.** NS (k=2), + (k=4) **8.** NS (*k*=2) except for general health domain **9.** NS (*k*=4), + (*k*=1) **10.** NS (*k*=2), + (*k*=2, 1 only at 24 months post-op) **11.** NS (*k*=3) **12.** NS (*k*=1), + (*k*=1) **13.** NS (*k*=1) **14.** NS (*k*=1), + (*k*=1 for HDL-C) **15.** NS (*k*=1), + (*k*=3) **16.** NS (*k*=1), + (*k*=1) **17.** NS (*k*=1) **18.** NS (*k*=2) **19.** + (*k*=1) **20.** NS (*k*=1)	3/10 (*k*=1) Fair (4/10 *k*=2; 5/10 *k*=8) Good (6/10 *k*=3; 7/10 *k*=1) NR (*k*=1) (PEDro *scale*)	Low

					19. Glucose effectiveness **20.** Forced vital capacity			
Morales-Marroquin 2020 (USA) *k*=9	RCT (*k*=6) NRCT (*k*=3)	*N* = 344 33.3-53.6 years NR kg.m^2 100% W (*k*=2)	**Exercise training** (*k*=9) Duration: 12-36 wk. Type: R, E/R Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 40-90 min Supervision: Supervised (*k*=7), not supervised (*k*=1), NR (*k*=1) Start: 1-12 months after MBS	NR	**1.** BW **2.** FM **3.** FFM **4.** Muscle Strength **5.** BMD	**1.** NS (*k*=4), + (*k*=2) **2.** NS (*k*=4), + (*k*=2) **3.** NS (*k*=5), + (*k*=1 only for combined E/R v control) **4.** + (*k*=5, 1 only for combined E/R v control and 1 for exercise+protein supplementation) **5.** + (*k*=2)	Fair (*k*=6) Good (*k*=3) *(National Institutes of Health rating system)*	Low
Civi Karaaslan 2020 (Turkey) *k*=7 including 2 publications with the same intervention	RCT (*k*=7)	*N* = 234 (*k* = 6) 33.9±13.1 years NR kg.m^2 100% W (*k*=3) remaining studies ≥80% female (*k*=4)	**Exercise training** (*k*=6) Physiotherapy (*k*=1) Duration: 4-26 wk. Type: E, R, E/R Frequency: 2-5x/wk. Intensity: Moderate to vigorous Session duration: 30-80 min Supervision: NR Start: 1month-3.5 y. after MBS	NR	**NO NARRATIVE SYNTHESIS not the aim**	**NO NARRATIVE SYNTHESIS**	Fair (4/10 *k*=2; 5/10 *k*=2) Good (6/10 *k*=3) (PEDro *scale*)	Critically low
Pouwels 2015 (Netherlands) k=3 (Berggren et al. not included because no control group)	RCT (*k*=2) Prospective trial (*k*=1)	**No synthesis only for post-MBS and no details in tables**	**Exercise training** (*k*=3) Duration: 12-16 weeks Type: E, E/R Frequency: 3-5x/week Intensity: Moderate-Vigorous Session duration: 30-60 min Supervision: Full-supervised (*k*=2), partial (*k*=1) Start: NR (*k*=4)	NR	**1.** BW **2.** BMI **3.** WC **4.** HC **5.** Cardiovascular risk **6.** Aerobic capacity **7.** Muscle strength **8.** QoL	**1.** NS (*k*=2) **2.** NS (*k*=1) **3.** NS (*k*=1) **4.** NS (*k*=1) **5.** NS (*k*=1) **6.** NS (*k*=1), **7.** + (*k*=1) **8.** + (*k*=1, emotional well-being, energy levels and mental QoL)	4/10 (*k*=1) 5/10 (*k*=1) 7/10 (*k*=2) (PEDro *scale*)	Critically low
Baillot 2014 (Canada) *k*=3	RCT (*k*=2) NRCT (*k*=1)	*N* = 64 36.0 to 53.9 years 40.4 to 45.6 kg.m^2	**Exercise training** (*k*=3) Duration: 12wk. Type: E, E/R Frequency: 3-5/wk. Intensity: Moderate - Vigorous	NR	**1.** FM **2.** FFM **3.** 6MWTD **4.** Muscle strength **5.** QoL	**1.** NS (*k*=3, 1 is %FM) **2.** NS (*k*=3) **3.** NS (*k*=1), + (*k*=1) **4.** + (*k*=1) **5.** + (*k*=1)	Moderate (*k*=3) *(Quality assessment tool Effective Public*	Low

		57-100% women	Session duration: 20-60 min Supervision: Full-supervised (*k*=2), partial (*k*=1) Start: NR				*Health Practice Project)*	
Fonseca-Junior 2013 (Brazil) *k*=3	NR	*N* = 64 NR	**Exercise training** (*k*=3) Duration: 12weeks to 3 months Type: E, E/R Frequency: 3-5/wk. Intensity: Moderate - Vigorous Session duration: ~60 min Supervision: NR Start:NR	NR	**1.** DBP **2**. Aerobic capacity **3**. Functional capacity **4.** Autonomous cardiac functional capacity **5**. Post-pandrial glucose **6.** Muscle strength **7**. Weight loss	Explicit comparison between ex vs control groups not made clear in text and no table to reinforce data	No evaluation	Critically low

Note. All data were reported as they were presented in the manuscript. Details presented in blue were obtained directly or calculated from tables/figures in the manuscripts rather than from the text. N=Total sample size, *n*=subsample size, *k*=number of studies, RCT=randomized control trial, NCRT=non-randomized control trial, E=endurance, R=resistance, E/R=combination endurance and resistance, HIIT=high intensity interval training, BC=behavioral component, MBS=metabolic and bariatric surgery, BMI=body mass index, WL=weight loss, FM=fat mass, FFM=fat-free mass, LBM=lean body mass, BF=body fat, BW=body weight, 1RM=1 rep maximum, Ex=exercise group. C=control group, 6MWTD=6 minute walking test difference, MVPA=moderate to vigorous physical activity, WC=waist circumference, HC=hip circumference, QoL=quality of life, SBP=systolic blood pressure, DBP=diastolic blood pressure, RHR=resting heart rate, HDL-C=high density lipoprotein cholesterol, LDL=low density lipoprotein cholesterol, TC=total cholesterol, TG=triglycerides, HOMA-IR=homeostatic model assessment for insulin resistance, SPISE=single-point insulin sensitivity estimator, AIRg=acute insulin response, Di=disposition index, HbA1C=hemoglobin A1C, ES=Hedge's g effect size, MD=mean difference, WMD=weighted mean difference, SMD=standardized mean difference, NR=not reported, N/A=not applicable.

[a] First country listed in first author's affiliations plus number of additional countries in all authors' reported affiliations;
[b] Values reported from details provided in tables include minimum and maximum or mean/median age and BMI, and % women;
[c] only outcomes with a synthesis within the meta-analysis or in the systematic review text are reported;
[d] For meta-analyses, summary includes effect size estimate, 95% confidence interval, I^2 = values of heterogeneity, sample size (*n*) and number of studies (*k*) included in the analysis. For systematic reviews, NS indicates no significant difference and + indicate a significant improvement following intervention compared to control;
[e] RoB = Cochrane risk of bias tool, RoB2 = Cochrane risk of bias tool 2, PEDro = Physiotherapy evidence database, ROBINS-I = Risk of bias n non-randomized studies of interventions;
[f] *k*=17 in systematic review;
[g] *k*=20 in systematic review including 4, 3, 2, 2 and 2 publications with the same interventions;
[h] *k*=26 in systematic review.

Appendix L – Post-MBS Primary Articles

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Table S15: Post-MBS Primary Articles

ALL ARTICLES	Bond et al 2023	Baillot et al 2022	Roth et al 2022	Vieira et al 2022	Gasmi et al 2022	Diniz-Sousa et al 2022	Boppre et al 2022	Boppre et al 2021	Bellicha et al 2021	Carretero-Ruiz et al 2021	Marshall et al 2020
Auclair et al 2021							X			X	
Campanha-Versiani et al 2017		X	X	X		X			X		
Carnero et al 2017											
Casali et al 2011											
Castello et al 2011		X	X				X	X	X	X	X
Castello et al 2013					X						
Coen et al 2015a							X			X	X
Coen et al 2015b		X					X	X	X	X	X
Coleman et al 2017	X	X		X				X	X		
Daniels et al 2018		X		X				X	X		X
Dantas et al 2020							X			X	
de Oliveira et al 2021				X							
Diniz-sousa et al 2021		X		X		X					
Freitas et al 2017					X						
Galle et al 2020				X							
Gil et al 2021				X							
Hassannejad et al 2017		X	X	X	X			X	X		
Herring et al 2017	X	X		X	X		X	X	X	X	
Huck 2015		X		X					X	X	X
Kelley 2019				X							
Lamarca et al 2021		X		X							
Marc-Hernandez et al 2020	X	X			X						

Marchesi et al 2015		X							X	X	
Mundberg et al 2018a		X			X		X	X	X	X	X
Mundberg et al 2018b	X			X	X		X			X	X
Murai et al 2019		X	X			X					
Muschitz et al 2016		X	X			X					
Noack-Segovia et al 2019				X							
Nunez Lopez et al 2017							X				X
Oliveira et al 2016											
Onofre et al 2017		X							X	X	X
Oppert et al 2018		X	X		X			X	X		
Ricci et al 2020					X						
Rojhani-Shirazi et al 2016		X									
Sellberg et al 2019					X						
Shah et al 2011	X	X					X	X	X	X	
Stegen et al 2011		X		X					X	X	X
Stolberg et al 2018a											X
Stolberg et al 2018b											
Stolberg et al 2018c					X						X
Tardif et al 2020		X					X	X		X	
Woodlief et al 2015											X

***Note*.** Black=primary studies published after systematic review/meta-analysis and therefore not possible for inclusion.
Grey=primary articles published the same year as the systematic review/meta-analysis and therefore not likely for inclusion.

ALL ARTICLES	Carretero-Ruiz et al 2019	da Silva et al 2019	Ren et al 2018	Schurmans et al 2022	Morales-Marroquin et al 2020	Civi Karaaslan et al 2020	Pouwels et al 2015	Baillot et al 2014	Fonseca-Junior et al 2013	Total Count
Auclair et al 2021										2
Campanha-Versiani et al 2017	X				X					7
Carnero et al 2017				X						1

Casali et al 2011	X									1
Castello et al 2011	X		X	X		X		X	X	13
Castello et al 2013				X		X	X			4
Coen et al 2015a	X	X		X						6
Coen et al 2015b			X	X						8
Coleman et al 2017	X		X	X		X				9
Daniels et al 2018	X		X	X	X	X				10
Dantas et al 2020										2
de Oliveira et al 2021										1
Diniz-sousa et al 2021										3
Freitas et al 2017										1
Galle et al 2020										1
Gil et al 2021										1
Hassannejad et al 2017	X		X	X	X					10
Herring et al 2017	X		X	X	X					12
Huck 2015	X	X		X	X					9
Kelley 2019										1
Lamarca et al 2021										2
Marc-Hernandez et al 2020										3
Marchesi et al 2015	X	X								5
Mundberg et al 2018a	X		X	X	X					11
Mundberg et al 2018b						X				7
Murai et al 2019					X					4
Muschitz et al 2016										3
Noack-Segovia et al 2019										1
Nunez Lopez et al 2017		X		X						4
Oliveira et al 2016	X					X				2
Onofre et al 2017	X	X								6
Oppert et al 2018					X					6
Ricci et al 2020										1

Rojhani-Shirazi et al 2016	X									2
Sellberg et al 2019										1
Shah et al 2011	X	X	X	X		X	X	X	X	14
Stegen et al 2011	X	X			X		X	X	X	11
Stolberg et al 2018a				X						2
Stolberg et al 2018b				X						1
Stolberg et al 2018c										2
Tardif et al 2020										4
Woodlief et al 2015				X						2

Note. Black=primary studies published after systematic review/meta-analysis and therefore not possible for inclusion.
Grey=primary articles published the same year as the systematic review/meta-analysis and therefore not likely for inclusion.

1. Auclair A, Harvey J, Leclerc J, et al. Determinants of Cardiorespiratory Fitness After Bariatric Surgery: Insights From a Randomised Controlled Trial of a Supervised Training Program. Can J Cardiol. 2021;37(2):251-259. doi:10.1016/j.cjca.2020.03.032
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Appendix M – Post-MBS Subanalyses

Table S16: Post-MBS Exercise Interventions: Systematic Reviews/Meta-Analyses Sub Analysis Results, Considerations and Conclusions

Author (Year) Number of primary studies included	**Outcomes assessed**[a]	**Main results**[b] *Level of evidence*	**Special considerations**	**AMSTAR2**	**Conclusions**
Intervention Type					
Boppre 2022 *k*=11	**1**. VO_2max **2.** SBP **3.** DBP **4.** Insulin **5.** Glucose **6.** HbA1C **7.** TC **8.** HDL-C **9.** LDL-C **10**. TG	**Endurance** **1**. MD: 0.75 L/min [-1.06; 2.56], I^2=49%; *n*=NR, *k*=2 **2.** MD: -3.55 mmHg [-8.68; 1.58], I^2=0%; *n*=NR, *k*=3 **3.** MD: -0.89 mmHg [-5.61; 3.82], I^2=0%; *n*=NR, *k*=3 **4.** MD: 0.69 µIU/mL [-0.62; 2.01], I^2=0%; *n*=NR, *k*=2 **5.** MD: 1.13 mg/dL [-3.66; 5.93], I^2=0%; *n*=NR, *k*=2 **7.** MD: -2.14 mg/dL [-15.37; 11.09], I^2=0%; *n*=NR, *k*=2 **8**. MD: 0.22 mg/dL [-4.48; 4.92], I^2=0%; *n*=NR, *k*=2 **9**. MD: -1.79 mg/dL [-12.49; 8.90], I^2=0%; *n*=NR, *k*=2 **10**. MD: -0.13 mg/dL [-15.87; 15.61], I^2=0%; *n*=NR, *k*=2 **Combined Endurance/Resistance** 2. MD: -7.18 mmHg [-12.42; -1.94], I^2=0%; *n*=137, *k*=3 (moderate certainty evidence) **3.** MD: -4.01 mmHg [-9.49; 1.46], I^2=53%; *n*=NR, *k*=3 **4.** MD: -3.36 µIU/mL [-7.03; 0.31], I^2=45%; *n*=NR, *k*=2 **5.** MD: 0.23 mg/dL [-8.95; 9.42], I^2=0%; *n*=NR, *k*=2 **6**. MD: -0.65 mmol/mol [-2.22; 0.93], I^2=0%; *n*=NR, *k*=2 **7.** MD: -3.88 mg/dL [-16.04; 8.27], I^2=0%; *n*=NR, *k*=3 **8**. MD: -11.77 mg/dL [-30.17; 6.64], I^2=67%; *n*=NR, *k*=3 **9**. MD: 1.36 mg/dL [-5.18; 7.91], I^2=59%; *n*=NR, *k*=3 10. MD: -17.56 mg/dL [-34.15; -0.96], I^2=0%; *n*=171, *k*=3 (low certainty evidence)	Only RCT	Critically Low	**Combined E/R = + SBP and TG**
Boppre 2021 *k*=10	**1.** BW **2.** BMI **3.** FM **4.** LBM **5.** WC	**Endurance** 1. MD: -0.80 kg [-7.19; 5.58], I^2=0%; *n*=214, *k*=4 2. MD: -0.21 kg/m² [-2.42; 2.00], I^2=0%; *n*=186, *k*=3 4. MD: -0.10 kg [-3.61; 3.41], I^2=0%; *n*=156, *k*=2 5. MD: -4.30 cm [-11.30; 2.70], I^2=39%; *n*=177, *k*=3 **Resistance** 1. MD: 0.46 kg [-3.24; 4.16], I^2=0%; *n*=61, *k*=2 **Combined E/R** **1.** MD: -5.02 kg [-8.13; -1.90], I^2=0%; *n*=221, *k*=5 **2.** MD: -1.62 kg/m² [-2.72; -0.59], I^2=0%; *n*=170, *k*=4	Only RCT	Critically Low	**Combined E/R = + BW and BMI**

Carretero-Ruiz 2019 *k*=16	WL	**Endurance** Pooled SMD: 0.21 [-0.07; 0.49], I^2=0%; *n*=NR, *k*=5 **Resistance** Pooled SMD: 0.15 [-0.56; 0.85], I^2=0%; *n*=NR, *k*=2 **Combined E/R** Pooled SMD: 0.19 [-0.09; 0.46], I^2=0%; *n*=NR, *k*=7 **Alternative** Pooled SMD: -0.08 [-0.48; 0.33], I^2=0%; *n*=NR, *k*=3 **Programmed** Pooled SMD: 0.15 [-0.23; 0.54], I^2=0%; *n*=NR, *k*=3 **Supervised** Pooled SMD: 0. 10 [-0.16; 0.36], I^2=0%; *n*=NR, *k*=9 **Combined Programmed/Supervised** Pooled SMD: 0.20 [-0.09; 0.50], I^2=0%; *n*=NR, *k*=4	RCT, NRCT Respiratory (*k*=1), and physiotherapy (*k*=1) interventions	Low	**NS differences**
Ren 2018 *k*=8	BW	**Endurance** WMD: -0.24 kg [-1.56; 1.09], I^2=0%, *n*=NR, *k*=3 **Resistance** WMD: -2.20 kg [-5.35; 0.95], I^2=N/A, *n*=NR, *k*=1 **Combined E/R** WMD: -3.12 kg [-4.56; -1.68], I^2=32%; *n*=NR, *k*=4	Only RCT	Low	**Combined E/R = + BW**
Intervention Start Time					
Boppre 2022 *k*=11	**1**. SBP **2**. DBP **3**. RHR **4**. Insulin **5**. Glucose **6**. TC **7**. HDL-C **8**. LDL-C **9**. TG	**<6 months** **1.** MD: -3.30 mmHg [-8.29; 1.69), I^2=0%; *n*=NR, *k*=4 **2.** MD: -0.08 [-3.25; 3.09], I^2=0%; *n*=NR, *k*=4 **4.** MD: -1.84 µIU/mL [-6.89; 3.20], I^2=80%; *n*=NR, *k*=3 **5.** MD: 0.77 mg/dL [-3.87; 5.42], I^2=0%; *n*=NR, *k*=3 **6.** MD: -1.40 mg/dL [-11.85; 9.05], I^2=0%; *n*=NR, *k*=4 **7**. MD: 2.10 mg/dL [-1.58; 5.78], I^2=0%; *n*=NR, *k*=4 **8**. MD: -1.84 mg/dL [-10.48; 6.80;], I^2=0%; *n*=NR, *k*=4 **9.** MD: -4.51 mg/dL [-17.09; 8.07], I^2=%; *n*=NR, *k*=4 **>6 months** **1.** MD: -7.71 mmHg [-13.12; -2.31], I^2=0%; *n*=84, *k*=2 (high certainty evidence) **2.** MD: -5.20 mmHg [-11.72; 1.33], I^2=%; *n*=NR, *k*=2 **3.** MD: -0.08 bpm [-3.25; 3.09], I^2=%; *n*=NR, *k*=4	Only RCT	Critically Low	**>6 months = + SBP**

Boppre 2021 *k*=10	**1.** BW **2.** BMI **3.** FM **4.** LBM **5.** WC	**<6 months** **1.** MD: -0.12 kg [-3.17; 2.93], I^2=0%; *n*=361, *k*=7 (8 arms) **2.** MD: -0.16 kg/m^2 [-1.15; 0.82], I^2=0%; *n*=317, *k*=5 (6 arms) **3.** MD: 0.49 kg [-1.71; 2.69], I^2=0%; *n*=173, *k*=2 **4.** MD: 0.87 kg [-0.65; 2.40], I^2=0%; *n*=201, *k*=3 **5.** MD: -4.30 cm [-11.30; 2.70], I^2=39%; *n*=177, *k*=3 **>6 months** **1.** MD: -5.25 kg [-8.52; -1.97], I^2=0%; *n*=135, *k*=3 **2.** MD: -1.84 kg/m^2 [-3.04; -0.64], I^2=0%; *n*=84, *k*=2	Only RCT	Critically Low	**>6 months = + BW and BMI**
Carretero-Ruiz 2019 *k*=16	WL	**≤3 months postMBS** Pooled SMD: 0.12 [-0.08; 0.33], I^2=0%; *n*=NR, *k*=11 **>3 months posMBS** Pooled SMD: 0.20 [-0.13; 0.53], I^2=0%; *n*=NR, *k*=5	RCT, NRCT Respiratory (*k*=1), and physiotherapy (*k*=1) interventions	Low	**NS differences**
Ren 2018 *k*=8	BW	**<6 months** WMD: -1.71 kg [-3.06; -0.36], I^2=32%; *n*=NR, *k*=5 **>12 months** WMD: -3.63 kg [-5.35; -1.91], I^2=0%; *n*=NR, *k*=2 **Varying starting times** WMD: 0.50 kg [-1.79; 2.79], I^2=N/A; *n*=NR, *k*=1	Only RCT	Low	**<6 months and >12 months = + BW** *significantly greater effects for >12 months compared to <6 months
Intervention Duration					
Boppre 2022 *k*=11	**1.** VO_2max **2.** SBP **3.** DBP **4.** RHR **5.** Insulin **6.** Glucose **7.** HOMA-IR **8.** HbA1C **9.** TC **10.** HDL-C **11.** LDL-C **12.** TG	**<12 weeks** **2.** MD: -3.61 mmHg [-11.61; 4.39;], I^2=0%; *n*=NR, *k*=3 **3.** MD: -2.97 mmHg [-8.01; 2.08], I^2=0%; *n*=NR, *k*=3 **9.** MD: 1.96 mg/dL [-19.93; 23.85], I^2=0%; *n*=NR, *k*=2 **10.** MD: 4.39 mg/dL [-2.58; 11.36], I^2=0%; *n*=NR, *k*=2 **11.** MD: -1.10 mg/dL [-20.00; 17.80;], I^2=0%; *n*=NR, *k*=2 **12.** MD: -7.30 mg/dL [-34.65; 20.04], I^2=0%; *n*=NR, *k*=2 **>12 weeks** **1.** MD: 0.23 L/min [-0.15; 0.60;], I^2=0%; *n*=NR, *k*=2 **2.** MD: -5.78 mmHg [-9.91; -1.66], I^2=0%; *n*=212, *k*=3 (high certainty evidence) **3.** MD: --2.51 mmHg [-9.22; 4.19], I^2=82%; *n*=NR, *k*=3 **4.** MD: -2.16 bpm [-6.98; 2.66], I^2=0%; *n*=NR, *k*=2 **5.** MD: -1.61 µIU/mL [-5.41; 2.19], I^2=81%; *n*=NR, *k*=3 **6.** MD: 0.91 mg/dL [-3.35; 5.18], I^2=0%; *n*=NR, *k*=3 **7.** MD: 1.39 [-1.30; 4.08], I^2=89%; *n*=NR, *k*=2 **8.** MD: -0.65 mmol/mol [-2.22; 0.93], I^2=0%; *n*=NR, *k*=2 **9.** MD: -4.10 mg/dL [-13.91; 5.71], I^2=0%; *n*=NR, *k*=3 **10.** MD: -0.41 mg/dL [-5.08; 4.26], I^2=45%; *n*=NR, *k*=3 **11.** MD: -10.66 mg/dL [-27.69; 6.36], I^2=76%; *n*=NR, *k*=3 **12.** MD: -10.23 mg/dL [-26.02; 5.56], I^2=31%; *n*=NR, *k*=3	Only RCT	Critically Low	**>12 weeks = + SBP**

only outcomes with a synthesis within the meta-analysis or in the systematic review text are reported;

Boppre 2021 *k*=10	**1.** BW **2**. BMI **3.** FM **4.** LBM **5**. WC	**<12 weeks** **1.** MD: - 1.68 kg [-7.68; 4.32], I^2=0%; *n*=188, *k*=5 (6 arms) **2.** MD: -0.40 kg/m^2 [-2.54; 1.74], I^2=0%; *n*=144, *k*=3 (4 arms) **5.** MD: -6.51 cm [-14.30; 1.29], I^2=N/A; *n*=74, *k*=1 (2 arms) **>12 weeks** **1.** MD: - 2.28 kg [-6.31; 1.75], I^2=48%; *n*=257, *k*=4 **2.** MD: - 0.85 kg/m^2 [-2.05; 0.35], I^2=40%; *n*=257, *k*=4 **3.** MD: -1.40 kg [-4.84; 2.03], I^2=68%; *n*=197, *k*=3 **4.** MD: 0.92 kg [-0.65; 2.50], I^2=0%; *n*=173, *k*=2 **5.** MD: -3.38cm [-7.66; 0.90], I^2=0%; *n*=152, *k*=2	Only RCT	Critically Low	**NS differences**
Carretero-Ruiz 2019 *k*=16	WL	**≤16 weeks** Pooled SMD: 0.06 [-0.17; 0.29], I^2=0%; *n*=NR, *k*=12 **>16 weeks** Pooled SMD: 0.25 [-0.01; 0.50], I^2=0%; *n*=NR, *k*=5	RCT, NRCT Respiratory (*k*=1), and physiotherapy (*k*=1) interventions	Low	**NS differences**
Intervention Exercise Time/Week					
Carretero-Ruiz 2019 *k*=16	WL	**≤150 min/week** Pooled SMD: 0.17 [-0.11; 0.44], I^2=0%; *n*=NR, *k*=4 **>150 min/week** Pooled SMD: 0.13 [-0.08; 0.35], I^2=0%; *n*=NR, *k*=13	RCT, NRCT Respiratory (*k*=1), and physiotherapy (*k*=1) interventions	Low	**NS differences**

Note. All data were reported as they were presented in the manuscript. Red text represents significant findings. MBS=metabolic and bariatric surgery, RCT=randomized control trial, NCRT=non-randomized control trial, E=endurance, R=resistance, E/R=combination endurance and resistance, BMI=body mass index, WL=weight loss, FM=fat mass, LBM=lean body mass, BW=body weight, WC=waist circumference, SBP=systolic blood pressure, DBP=diastolic blood pressure, HDL-C=high density lipoprotein cholesterol, LDL=low density lipoprotein cholesterol, TC=total cholesterol, TG=triglycerides, HOMA-IR=homeostatic model assessment for insulin resistance, HbA1C=hemoglobin A1C, MD=mean difference, WMD=weighted mean difference, SMD=standardized mean difference, NR=not reported.

[a] only outcomes with a synthesis within the meta-analysis or in the systematic review text are reported;
[b] For meta-analyses, summary includes effect size estimate, 95% confidence interval, I^2 = values of heterogeneity, sample size (*n*) and number of studies (*k*) included in the analysis.

Appendix N – Feasibility and Acceptability Outcomes

Table S17: Summary of Baillot et al., 2022 Feasibility and Acceptability Outcomes

Effects	n	k	arms	I^2	Studies included	Study Design
Total Attendance Rate (%; Exercise Training)						
Pre MBS pooled percentage: 79.4% [67.7; 89.4]	NR	3	4	0%	Baillot 2016, Marcon 2017, Picó-Servant 2019	RCT only
Post MBS pooled percentage: 87.4% [76.7; 95.6]	NR	5	6	0%	Castello 2011, Herring 2017, Huck 2015, Lamarca 2021, Murai 2019	RCT/NRCT
Total Refusal Rate (%; Exercise Training and Control Group)						
Pre MBS pooled percentage: 30.7% [0.0%; 81.0%]	NR	4	4	92%	Arman 2021, Baillot 2016, Gilbertson 2020, Marcon 2017	RCT/NRCT
Post MBS pooled percentage: 20.3% [6.5%; 38.7%]	NR	12	12	95%	Campanha-Versiani 2017, Castello 2011, Diniz Souza 2020, Hassanejad 2017, Herring 2017, Lamarca 2021, Marc-Hernandez 2020, Mundberg 2018a, Murai 2019, Onofre 2017, Oppert 2018, Tardif 2020	RCT/NRCT
Total Recruitment Rate (*n*/month; Exercise Training and Control Group)						
Pre MBS pooled percentage: 8.1% [0.7; 20.2]	NR	3	3	0%	Arman 2021, Baillot 2016, Gilbertson 2020	RCT/NRCT
Post MBS pooled percentage: 7.0% [2.9; 12.4]	NR	9	9	70%	Castello 2011, Coen 2015b, Diniz Souza 2020, Hassanejad 2017, Herring 2017, Lamarca 2021, Mundberg 2018a, Oppert 2018, Tardif 2020	RCT/NRCT
Total Enrollment Speed (*n*/month; Exercise Training and Control Group)						
Pre MBS pooled percentage: 1.1% [0.0; 6.2]	NR	3	3	0%	Arman 2021, Baillot 2016, Gilbertson 2020	RCT/NRCT
Post MBS pooled percentage: 2.9% [1.6; 4.4]	NR	10	10	0%	Castello 2011, Coen 2015b, Diniz Souza 2020, Hassanejad 2017, Herring 2017, Lamarca 2021, Marc-Hernandez 2020, Mundberg 2018a, Oppert 2018, Tardif 2020	RCT/NRCT
Total Enrollment Rate (%; Exercise Training and Control Group)						
Pre MBS pooled percentage: 17.4% [0.4; 46.5]	NR	4	4	75%	Arman 2021, Baillot 2016, Gilbertson 2020, Marcon 2017	RCT/NRCT
Post MBS pooled percentage: 50.8% [36.4; 65.2]	NR	14	14	93%	Campanha-Versiani 2017, Castello 2011, Coen 2015b, Coleman 2017, Diniz Souza 2020, Hassanejad 2017, Herring 2017, Lamarca 2021, Marc-Hernandez 2020, Mundberg 2018a, Murai 2019 , Onofre 2017, Oppert 2018, Tardif 2020	RCT/NRCT

Total Dropout Rate (%; Pre MBS)						
Exercise pooled percentage: 3.6% [0.0; 14.6]	NR	6	7	44%	Arman 2021, Baillot 2016, Gilbertson 2020, Marc-Hernandez 2019, Marcon 2017, Picó-Servant 2019	RCT/NRCT
Control pooled percentage: 0.0% [0.0; 0.3]	NR	4	4	0%	Baillot 2016, Gilbertson 2020, Marcon 2017, Picó-Servant 2019	RCT/NRCT
Total Dropout Rate (%; Post MBS)						
Exercise pooled percentage: 5.6% [0.6; 13.8]	NR	12	12	69%	Castello 2011, Coen 2015b, Coleman 2017, Daniels 2017, Herring 2017, Marc-Hernandez 2020, Marchesi 2015, Murai 2019, Onofre 2017, Oppert 2018, Shah 2011, Tardif 2020	RCT/NRCT
Control pooled percentage: 2.8% [0.0; 8.2]	NR	13	14	62%	Castello 2011, Coen 2015b, Coleman 2017, Daniels 2017, Herring 2017, Marc-Hernandez 2020, Marchesi 2015, Murai 2019, Muschitz 2016, Onofre 2017, Oppert 2018, Shah 2011, Tardif 2020	RCT/NRCT
Total Retention Rate (%; Pre MBS)						
Exercise pooled percentage: 96.4% [84.6; 100]	NR	6	8	50%	Arman 2021, Baillot 2016, Gilbertson 2020, Marc-Hernandez 2019, Marcon 2017, Picó-Servant 2019	RCT/NRCT
Control pooled percentage: 89.5% [77.8; 97.8]	NR	6	6	0%	Arman 2021, Baillot 2016, Gilbertson 2020, Marc-Hernandez 2019, Marcon 2017, Picó-Servant 2019	RCT/NRCT
Total Retention Rate (%; Post MBS)						
Exercise pooled percentage: 83.6% [74.1; 91.5]	NR	17	18	83%	Campanha-Versiani 2017, Castello 2011, Coen 2015b, Coleman 2017, Daniels 2017, Herring 2017, Lamarca 2021, Marc-Hernandez 2020, Marchesi 2015, Mundberg 2018a, Murai 2019, Muschitz 2016, Onofre 2017, Oppert 2018, Shah 2011, Stegen 2011, Tardif 2020	RCT/NRCT
Control pooled percentage: 85.6% [78.1; 92.1]	NR	18	20	73%	Campanha-Versiani 2017, Castello 2011, Coen 2015b, Coleman 2017, Daniels 2017, Diniz Souza 2020, Herring 2017, Lamarca 2021, Marc-Hernandez 2020, Marchesi 2015, Mundberg 2018a, Murai 2019, Muschitz 2016, Onofre 2017, Oppert 2018, Shah 2011, Stegen 2011, Tardif 2020	RCT/NRCT

Note. All data were reported as they were presented in the manuscript. MBS=metabolic and bariatric surgery, *n*=sample size, *k*=number of studies, I^2=measure of heterogeneity, NR=not reported, RCT=randomized control trial, NRCT=nonrandomized control trial.

Appendix O – Authors Conclusions for Publication Bias by Outcome

Table S18: Pre-MBS Outcomes

Systematic Review/ Meta-analysis	Author Comments on Publication Bias
Body weight (BW), Body mass index (BMI) and Weight loss (WL)	
Jabbour 2022	None
Lodewijks 2022	None
Durey 2022	None
Herrera-Santelices 2022	Very low level of evidence with serious risk of bias but no reported concerns about publication bias
Schurmans 2022	None
Bellicha 2021	None
Fat Mass (FM)	
Jabbour 2022	None
Lodewijks 2022	None
Herrera-Santelices 2022	Moderate level of evidence with serious risk of bias but no reported concerns about publication bias
Bellicha 2021	None
Fat-free mass (FFM) and Lean body mass (LBM)	
Lodewijks 2022	None
Herrera-Santelices 2022	Moderate level of evidence with serious risk of bias but no reported concerns about publication bias
Schurmans 2022	None
Bellicha 2021	None
VO2max/Maximum aerobic capacity	
Durey 2022	None
Jabbour 2022	None
Bellicha 2021	None
6-minute walking test distance (6MWTD)	
Jabbour 2022	None
Herrera-Santelices 2022	High level of evidence with not serious risk of bias and no reported concerns about publication bias
Schurmans 2022	None
Bellicha 2021	None
Muscle strength and functional capacity	
Jabbour 2022	None
Bellicha 2021	None
Resting heart rate (RHR)	
Schurmans 2022	None
Marshall 2020	Pooled pre and postoperative results: Very low level of evidence with serious risk of bias but no reported concerns about publication bias
Blood pressure (BP)	
Schurmans 2022	None
Jabbour 2022	None
Bellicha 2021	None
Marshall 2020	For systolic and diastolic blood pressure, pooled pre and postoperative results: Very low level of evidence with serious risk of bias but no reported concerns about publication bias

Quality of Life (QoL)	
Herrera-Santelices 2022	Moderate level of evidence with serious risk of bias but no reported concerns about publication bias
Lodewijks 2022	None
Schurmans 2022	None
Bellicha 2021	None
Glucose and lipid metabolism	
Jabbour 2022	None
Bellicha 2021	None
Physical activity	
Lodewijks 2022	None
Bellicha 2021	None
Adverse events	
Durey 2022	None
Length of hospital stay	
Durey 2022	None
Jabbour 2022	None

Table S19: Post-MBS Outcomes

Systematic Review/ Meta-analysis	Author Comments on Publication Bias
Weight loss (WL) ≥ 12 months post MBS	
Bond 2023	Based on the tests introduced by Begg and Mazumdar (P = .81) and Egger et al. (P = .52), we did not observe any publication or small sample bias, whereas the funnel plots suggested publication or other reporting bias
Body weight (BW) and Body mass index (BMI)	
Gasmi 2022	For the analysis on BMI and pooled BMI, the funnel plots showed a few outliers, but in both directions, suggesting true heterogeneity rather than publication bias
Schurmans 2022	None
Boppre 2021	There was no significant publication bias as demonstrated by the funnel plot symmetry and the Egger's test result adjusted to body weight. Bias coefficient is −3.00 (intercept) and p-value is higher (p = 0.708)
Bellicha 2021	Visual inspection of the funnel plot suggested little evidence of publication bias, which was suggested by Egger's test (P = 0.22)
Morales-Marroquin 2020	None
Carretero-Ruiz 2019	As seen in the funnel plot and once the Egger test was performed, there was no evidence of significant publication bias risk (p = 0.208)
Ren 2018	The funnel plot did not suggest publication bias for physical exercise with respect to body weight and the p value for publication bias was 0.44. For both body weight and BMI: Moderate level of evidence and not a high risk of publication bias
Waist circumference (WC)	
Gasmi 2022	Funnel plots displayed a symmetrical appearance with no major outliers despite the small number of included studies

Boppre 2021	There was no significant publication bias as demonstrated by the funnel plot symmetry and the Egger's test result adjusted to body weight. Bias coefficient is −3.00 (intercept) and p-value is higher (p = 0.708)
Ren 2018	Low level of evidence and not a high risk of publication bias
Fat mass (FM)	
Gasmi 2022	Funnel plots displayed a symmetrical appearance with no major outliers despite the small number of included studies
Boppre 2021	There was no significant publication bias as demonstrated by the funnel plot symmetry and the Egger's test result adjusted to body weight. Bias coefficient is −3.00 (intercept) and p-value is higher (p = 0.708)
Bellicha 2021	Visual inspection of the funnel plot suggested little evidence of publication bias
Morales-Marroquin 2020	None
Ren 2018	Low level of evidence and not a high risk of publication bias
Fat-free mass (FFM) and Lean body mass (LBM)	
Roth 2022	For fat-free mass: Very low level of evidence * Potential publication bias could not be assessed using funnel plots or statistical tests, such as Egger's test, because these methods do not possess enough power to distinguish chance from real asymmetry when fewer than 10 studies are involved in a pairwise metaanalysis
Gasmi 2022	For fat-free mass: Funnel plots displayed a symmetrical appearance with no major outliers despite the small number of included studies
Schurmans 2022	None
Boppre 2021	unclear
Bellicha 2021	Visual inspection of the funnel plot suggested little evidence of publication bias, which was suggested by Egger's test (P = 0.40 for lean mass loss outcomes)
Morales-Marroquin 2020	None
Ren 2018	For fat-free mass: Very low level of evidence and not a high risk of publication bias
Bone mineral density (BMD)	
Roth 2022	Moderate level of evidence * Potential publication bias could not be assessed using funnel plots or statistical tests, such as Egger's test, because these methods do not possess enough power to distinguish chance from real asymmetry when fewer than 10 studies are involved in a pairwise metaanalysis
Diniz-Souza 2022	* Publication bias assessment was not performed because such analysis is not recommended in meta-analysis with less than 10 studies
Bellicha 2021	None
Morales-Marroquin 2020	None
Vo2max/peak	
Boppre 2022	* Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
Schurmans 2022	None
Bellicha 2021	Visual inspection of the funnel plot suggested little evidence of publication bias

Carretero-Ruiz 2021	No evidence of publication bias. In all the funnel plots performed, a symmetrical study distribution was observed, leaving all the studies within the limits of the funnel plot. In all cases, the Egger's statistics were not significant.
da Silva 2019	The p value for Egger's test was 0.25, suggesting no risk of publication bias
6-minute walking test distance (6MWTD)	
Schurmans 2022	None
Bellicha 2021	Visual inspection of the funnel plot suggested little evidence of publication bias
Ren 2018	Low level of evidence and not a high risk of publication bias
Muscle strength	
Vieira 2022	For 1 rep maximum upper and lower muscle, sit to stand, dynamometer, and handgrip tests of muscle strength: Very low level of evidence * As none of the meta-analyses included more than 10 studies, Egger's test could not be used to assess publication bias. Therefore, we assessed publication bias by evaluating the search strategy and use of industry funding; the results indicated that none of the meta-analyses were affected by publication bias
Schurmans 2022	None
Bellicha 2021	Visual inspection of the funnel plot suggested little evidence of publication bias
Morales-Marroquin 2020	None
Resting heart rate (RHR)	
Boppre 2022	* Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
Schurmans 2022	None
Carretero-Ruiz 2021	No evidence of publication bias. In all the funnel plots performed, a symmetrical study distribution was observed, leaving all the studies within the limits of the funnel plot. In all cases, the Egger's statistics were not significant.
Marshall 2020	Pooled pre and postoperative results: Very low level of evidence with serious risk of bias but no reported concerns about publication bias
Ren 2018	Low level of evidence and high risk of publication bias
Blood pressure (BP)	
Boppre 2022	* Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
Schurmans 2022	None
Carretero-Ruiz 2021	No evidence of publication bias. In all the funnel plots performed, a symmetrical study distribution was observed, leaving all the studies within the limits of the funnel plot. In all cases, the Egger's statistics were not significant.
Bellicha 2021	None
Marshall 2020	For systolic and diastolic blood pressure, pooled pre and postoperative results: Very low level of evidence with serious risk of bias but no reported concerns about publication bias
Ren 2018	For systolic blood pressure: Low level of evidence and not a high risk of publication bias For diastolic blood pressure: Very low level of evidence and high risk of publication bias
Quality of life (QoL)	
Schurmans 2022	None

Bellicha 2021	None
Glucose metabolism	
Boppre 2022	* Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
Schurmans 2022	None
Bellicha 2021	None
Marshall 2020	For fasting blood glucose and insulin: Low level of evidence with not serious risk of bias and no reported concerns about publication bias
Lipid metabolism	
Boppre 2022	* Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
Schurmans 2022	None
Carretero-Ruiz 2021	No evidence of publication bias. In all the funnel plots performed, a symmetrical study distribution was observed, leaving all the studies within the limits of the funnel plot. In all cases, the Egger's statistics were not significant.
Bellicha 2021	None
Marshall 2020	For triglycerides, high-density lipoprotein, low-density lipoprotein, and total cholesterol: Low level of evidence with not serious risk of bias and no reported concerns about publication bias

Table S20: Post-MBS Subanalysis Outcomes

Systematic Review/ Meta-analysis	Sub analysis and outcome	Author Comments on Publication Bias
Intervention type		
Boppre 2022	Combined endurance/ resistance on systolic blood pressure	Moderate certainty of evidence * Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
	Combined endurance/ resistance on triglycerides	Low certainty of evidence * Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
Boppre 2021	Combined endurance/ resistance on body weight	None
	Combined endurance/ resistance on BMI	None
Ren 2018	Combined endurance/ resistance on body weight	None
Intervention start time		
Boppre 2022	> 6 months post MBS on systolic blood pressure	High certainty of evidence * Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included
Boppre 2021	> 6 months post MBS on body weight	None
	> 6 months post MBS on BMI	None
Ren 2018	< 6 months post MBS on body weight	None
	> 12 months post MBS on body weight	None
Intervention duration		

Boppre 2022	> 12 weeks on systolic blood pressure	High certainty of evidence * Publication bias assessment was not performed, because outcomes analyses had less than 10 studies included

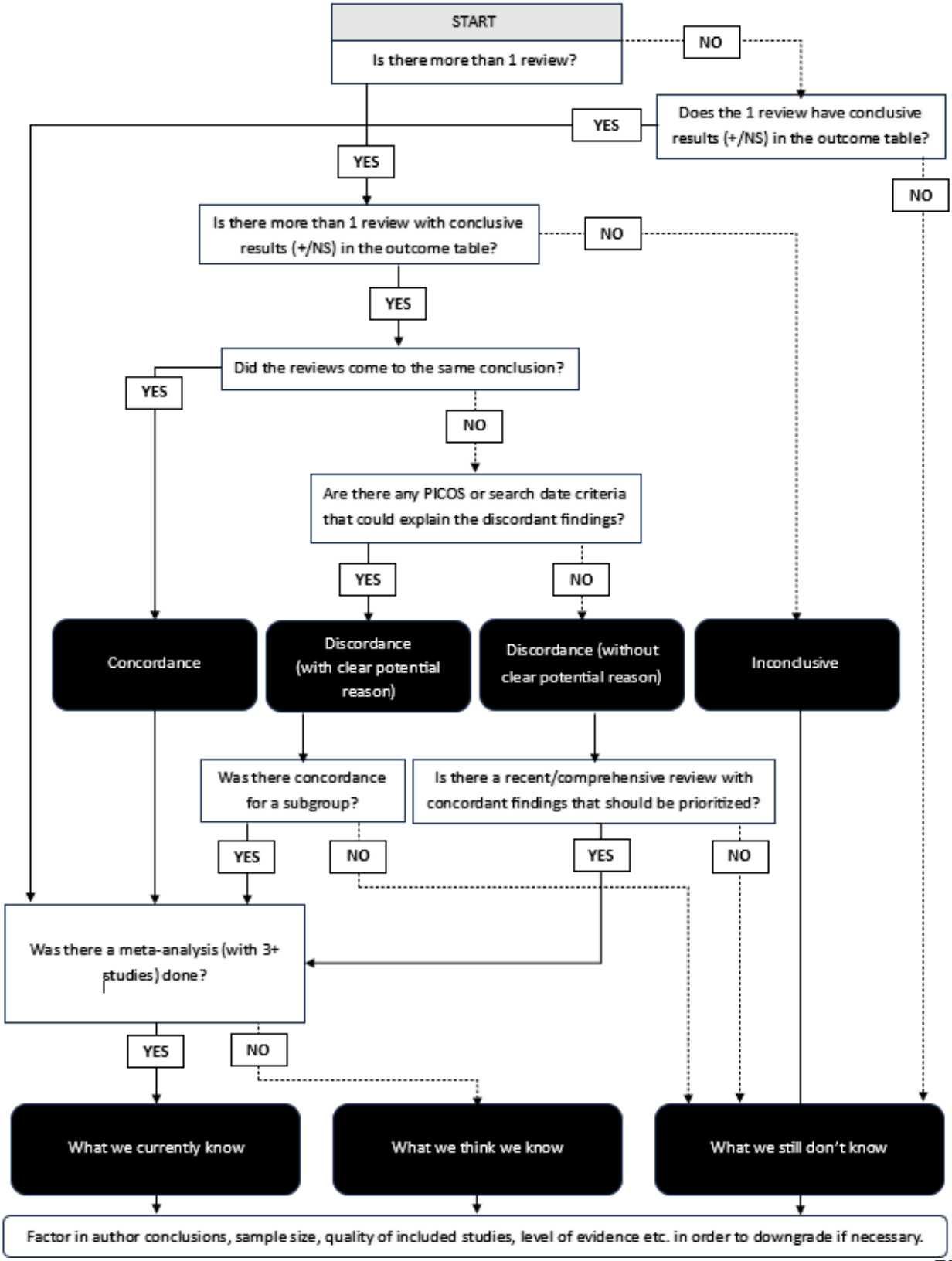
Table S21: Baillot et al., 2022: Feasibility and Acceptability Outcomes. Egger's Test of Funnel Plot Asymmetry

Outcome	Author Comments on Publication Bias
Attendance rate (exercise arm)	t = 0.8555, df = 8, p = 0.4172
Dropout rate (exercise arm)	t = 0.3489, df = 17, p = 0.7315
Enrollment rate (exercise and control arms)	t = -0.6026, df = 16, p = 0.5552
Refusal rate (exercise and control arms)	t = -0.4638, df = 14, p = 0.6499
Retention rate (exercise arm)	t = 0.9979, df = 24, p = 0.3283

Note. The risk of publication bias was examined with funnel plots and tested using the Egger's test (p < 0.10 indicating a publication bias). A trim and fill analysis was also carried out to examine the impact of missing studies by adjusting the meta-analysis to take into account the theoretically missing studies. After the trim and fill, no risk of publication bias was found for any of the included outcomes.

Appendix P – Outcome Conclusions Flow Diagram

Figure S3: Outcome Conclusions Flow Diagram



Appendix Q – Expanded Discussion

Within the last decade, 25 systematic reviews and meta-analyses have explored the benefits of exercise training delivered pre- and post-metabolic and bariatric surgery (MBS) and have come to varied conclusions. Thus, the current overview aimed to summarize this evidence-based knowledge into a single cohesive resource to aid clinicians and researchers. Specifically, the data were synthesized to examine: (1) the effect of exercise training pre- and postoperatively, (2) whether there are exercise training characteristics that led to better health outcomes and (3) the feasibility and acceptability of exercise training with adults awaiting or who have undergone MBS.

Effects of Exercise Training

Exploring reviews focused on postoperative exercise training revealed a greater number of reviews (11 vs 20), total number of primary articles (21 vs 42), range of original studies per review (1 to 13 vs 3 to 21), and concordance between reviews (2 variables vs 10), compared to those focused on preoperative exercise training.

What We Currently Know

Preoperative Exercise Training. No outcome was classified into this category due to the absence of at least one meta-analysis with 3+ studies. Thus, more original studies, and subsequently more comprehensive meta-analyses, are needed to explore the impact of exercise training during the preoperative period.

Postoperative Exercise Training. There was concordance between reviews on exercise training revealing (1) a positive effect on waist circumference and muscle strength and (2) a nonsignificant effect on lean-body mass, diastolic blood pressure, fasting insulin/glucose, total cholesterol, triglycerides, and low-density lipoprotein cholesterol.

Discordance between reviews, with potential explanations, was found for body weight/BMI, fat-free mass, and 6-minute walking test distance. For body weight/BMI, the explanation for discordance appears to lie in the intervention type as upon removing one systematic review that includes much overlapping data (nine primary articles from three original studies),[22] one systematic review that specified a requirement for a resistance training component,[38] and one meta-analysis that included respiratory, physiotherapy and physical activity counselling interventions,[37] the remaining reviews on exercise training [11–14] had a concordance for a significant positive effect of exercise training. For fat-free mass, one systematic review [22] reported both positive (k = 2) and nonsignificant (k = 3) impacts of exercise training; upon further review, the positive effects were only for a combined endurance/resistance group, not a purely endurance group, and only at 24 weeks post-MBS, not 12 weeks. The remaining reviews had concordance for a non-significant effect of exercise training, and although the only meta-analysis with 3+ studies[20] reported a very low level of evidence, it was supported by additional meta-analyses[11,14] and a systematic review[38] with different, and more recent, primary articles included. Similarly, removing the one systematic review[22] from the 6-minute walking test distance results, due to difficult interpretation of the results within the review and the original studies referenced, led to concordance for a significant positive effect of exercise training.

Two recent overviews of reviews revealed similar findings for the effect of exercise training on adults with overweight or obesity.[54,55] Specifically, exercise training was found to have a (1) significant positive effect on weight loss and muscle strength, and (2) a non-significant effect on lean-body mass. Importantly, within the overview of reviews[54] for lean-body mass, two meta-analyses comparing exercise to control groups revealed significantly more weight loss in the exercise group but no significant differences in lean-body mass change between groups; with this

in mind, for the current overview, it is possible that the significant positive effect of post-MBS exercise training on body weight and the non-significant effect on lean-body mass actually reflects a preservation of lean-body mass that would otherwise be lost to factors such as protein deficiency post-MBS. Further studies are required to determine the impact of protein supplementation on lean-body mass preservation post-MBS.[56] For diastolic blood pressure, glucose and lipid metabolism, it is possible than any changes due to exercise are overshadowed by the drastic improvement as a result of MBS.

What We Think We Know

Preoperative Exercise Training. Concordance between reviews revealed a significant positive effect of exercise training on 6-minute walking test distance. Discordance between reviews was found for body weight/BMI, however a potential reason for the discordance was revealed as reviews that included only exercise training[13,23] showed some concordance for a positive effect on BMI, whereas those that included physical activity counselling interventions[16,24] showed greater concordance for a non-significant effect on pre-MBS weight loss and % weight loss. Removal of reviews including physical activity counselling resulted in concordance for a significant positive effect of exercise training on body weight/BMI. Notably, in physical activity counselling, compared to prescribed exercise training, the amount of exercise performed is likely lower, may not include as much vigorous exercise, and is often unsupervised, which may explain why the inclusion of physical activity counselling interventions above does not lead to a significant effect on weight variables. It is important that authors explicitly define the type of exercise intervention (i.e., exercise training, physical activity counselling, etc.) because although much data is currently available, a comprehensive meta-analysis on the impact of preoperative exercise

intervention on weight related variables should be conducted utilizing intervention type (e.g., exercise training, physical activity counselling etc.) as a moderating variable.

Discordance between reviews was also found for quality of life and VO_2max. No clear reason for discordance was identified between reviews, however, the RCT only meta-analyses[16,19] were prioritized over the systematic reviews[13,22–24] revealing a non-significant effect of exercise training on quality of life and a significant positive effect of exercise intervention (included a physical activity counselling intervention) on VO_2max. Importantly, both these findings were downgraded from what we currently know as a result of (1) a low sample size and variability in measurement domains for quality of life, and (2) the inclusion of conference abstracts for VO_2max. In a recent meta-analysis, it was found that exercise training improves quality of life in adults with overweight or obesity; thus, it is possible that exercise training could positively impact quality of life in adults awaiting MBS but that the prioritized meta-analysis[19] was not adequately powered to detect the effect (k=3, n=53). Consequently, future studies should explore the impact of pre-MBS exercise training on quality of life as a primary study aim. Next, a single meta-analysis[19] revealed a non-significant effect of exercise training on fat-free mass and a single systematic review[24] (including two physical activity counselling interventions) revealed 100% concordance for a significant positive effect of exercise intervention on physical activity.

Postoperative Exercise Training. Concordance between reviews revealed a significant positive effect of exercise training on bone mineral density but this finding was downgraded from what we currently know because the more recent and comprehensive meta-analysis[18] reported a very low/low certainty of evidence. For fat mass, VO_2max, systolic blood pressure, and high-density lipoprotein, a deeper interpretation of the findings conjures a necessity to rank, or at least consider, the value of different study designs. For all these variables, the discordance could be

partially or fully explained by looking at reviews that solely considered RCTs, versus those that also included NRCTs in addition to RCTs (herein called mixed reviews). Exploring fat mass, RCT-only meta-analyses,[11,12,14] (including one[12] that only considered fat mass measured by the highly accurate dual-energy X-ray absorptiometry) and one mixed systematic review that required a resistance training component,[38] shared a concordance for a non-significant effect; conflictingly, the one mixed meta-analysis[13] revealed a significant positive effect. Similarly for VO_2max, after removing one systematic review[22], because 4/6 primary articles derived from the same original study, the remaining RCT-only meta-analysis[21] revealed a non significant effect, while the remaining mixed meta-analyses[10,13] shared concordance for a significant positive effect. The same trend was also seen for high-density lipoprotein; granted, the two mixed meta-analyses[10,13] showed opposite results but prioritizing the more recent and comprehensive one[10] again revealed a significant positive effect for the mixed review and a non-significant effect for the RCT-only reviews[10,13]. Uniquely, the results for systolic blood pressure showed the opposite trend when observing the meta-analyses (note the primary articles from the one systematic review[22] are all captured within the other meta-analyses): the RCT-only meta-analyses[14,21] were concordant for a significant positive effect while the mixed meta-analyses[10,13] revealed concordance for a non-significant effect. Of note, the study design explanation did not initially present as a reason for discordance in resting heart rate findings, however, upon prioritizing the more recent meta-analyses[10,21], the now common trend of RCT-only reviews leading to concordance for a nonsignificant effect and mixed reviews leading to concordance for a significant positive effect, was again demonstrated. Although RCTs provide the most reliable evidence, conducting them can be impractical and their findings may be unrepresentative of real-world settings[57]; resultingly, NRCTs are commonly used to fill the gap, but their findings need to be interpreted with caution

since they are more prone to bias and overestimation of effects.[57] Within the reviews incorporated into the outcome tables, about 41% of the meta-analyses and 50% of the systematic reviews included both RCTs and NRCTs. In a framework presented by Sarri and colleagues[57], explicit steps were shared to synthesize data from both NRCTs and RCTs together including (1) analyzing study quality and excluding NRCTs that are deemed as high risk, (2) evaluating study findings prior to data synthesis to determine whether RCTs and NRCTs show similar effect patterns, (3) identifying core confounders in NRCTs that need to be adjusted for, (4) employing statistical approaches to incorporate NRCT data, and (4) conducting sensitivity analyses to examine the extent to which results are impacted by the inclusion of NRCTs. For fat mass, VO_2max, systolic blood pressure, high-density lipoprotein and resting heart rate neither of the mixed meta-analyses[10,13] statistically or narratively explored any differences between the impact of RCTs and NRCTs on the reported effects. Thus, the findings originating from RCT-only reviews were prioritized. Considering the contrasting mixed review findings, however, led to the downgrading of the conclusions from what we currently know.

Finally, a single meta-analysis[36] found a non-significant effect of exercise training on weight loss ≥ 12 months post-MBS. This finding was downgraded from what we currently know as an investigation into the authors' conclusions determined that the included studies were not conducted with the objective to reduce post-MBS weight recurrence, and so, definitive conclusions could not be made. Knowing that weight recurrence is a common occurrence post MBS,[8] and following exercise training in adults with overweight and obesity,[54] future research should employ strategies to encourage the maintenance of weight loss postoperatively.

At first glance, some of these findings may appear to be counter intuitive. For example, it appears odd that exercise training postoperatively would have positive effects on BMI and body

weight, while having non-significant effects on fat-mass and fat-free mass. As well, the absence of a significant effect on VO_2max is surprising since exercise training of all types (i.e., E, R, combined E/R, HIIT) is well know to improved VO_2max in adults with obesity.[55] In the interpretation of the results, it is important to consider that the assessment of body composition and certain fitness measures (e.g., VO_2max) are not as reliable, have not been validated, and/or have barriers to it's use (e.g., weight limit of equipment, high cost for gold-standard methods, and difficulty reaching peak exertion) in populations with obesity.[58,59] Thus, these results should be interpreted with caution and additional high quality studies, utilizing gold standard methods, could aid in reaching conclusive results.

What We Still Don't Know

Preoperative Exercise Training. Concordance between reviews for a non-significant effect of exercise training on blood pressure was found. Notably, the only meta-analysis[42] exploring blood pressure was removed as it included both preoperative and postoperative exercise training results, as well, there was not 100% concordance within any of the systematic reviews exploring more than one original study[13,23]; consequently, despite concordance between the reviews, this finding was downgraded from what we think we know. Moreover, discordance, with no clear reason, was found for muscle strength. future research should aim to collect a variety of previously used outcome measures that are consistent with the exercise performed in the training, e.g., sit to stand test, arm curl, one rep maximum for upper and lower muscles, dynamometer and handgrip testing etc.; increasing the available data would allow for a meta-analysis to be performed, using measurement type as a moderating variable, in order to tailor the application of the research findings in clinical settings.

For fat mass and length of hospital stay, multiple reviews included the variables but results were inconclusive due to the inclusion of only one study[16,23,45,54], the inclusion of a meta-analysis that incorporated data from multiple primary articles from the same original study[19], or a lack of concordance between the included primary articles in a single review[13]. While two reviews explored the impact of exercise training on glucose and lipid metabolism, they utilized different outcomes and so conclusions could not be made. Further, a single review revealed inconclusive findings, due to the inclusion of only one study or only multiple publications from the same study, for lean-body mass, resting heart rate, and surgery-related adverse events.

Postoperative exercise training. Although there was concordance between reviews for a nonsignificant effect of exercise training on quality of life and HOMA-IR (a glucose metabolism measure), neither outcome had a meta-analysis with 3+ studies, sample sizes were not reported and, for quality of life, the domains evaluated were unclear; consequently, both findings were downgraded from what we think we know; although it was only explored by a single meta-analysis[21], the reasoning behind downgrading HbA1c - another glucose metabolism outcome measure - was identical. For the remaining glucose metabolism measures, a single systematic review[22] explored insulin sensitivity, AIRg and Di, SPISE and glucose effectiveness; the results were all inconclusive due to the inclusion of only 1 study or only multiple primary articles from the same original study (e.g., Coen 2015b and Woodlief 2015).

As a final point, no conclusions could be made on the long-term impacts of exercise training (pre- or post-MBS) on any variable as only one primary article included an extended follow-up (1 year)[35]. Distinctly, “extended” is referring to the time since exercise training, rather than since MBS, as some exercise training interventions did not even begin until 7 years post-

MBS. Thus, there is still a need to determine whether any positive impacts of exercise training are sustained in the long-term.

Beneficial Characteristics of Exercise Training Programs

The second aim for the current overview was to determine whether better health outcomes could be attributed to any characteristic(s) of the exercise training. To determine this, the significant positive effects revealed through the subgroup analyses were explored. Notably, subgroup analyses were only performed on data originating from postoperative exercise training studies and while 14 meta-analyses were conducted on this subject, only four[12,14,21,37] conducted subgroup analyses, and only two[12,21] explored variables outside of body weight/BMI/weight loss.

What We Currently Know

Discordance without a clear reason was found for the impact of exercise training starting less than six months post-MBS on body weight/BMI; prioritizing the more recent and comprehensive meta-analysis[12] revealed nonsignificant effects on body weight. Moreover, a single review revealed significant positive effects of (1) combined endurance/resistance training[21], and training lasting greater than 12 weeks[21], on systolic blood pressure, and (2) exercise training starting greater than six months post-MBS on body weight[12].

What We Think We Know

Discordance between studies examining the effect of combined endurance/resistance exercise training on body weight/BMI revealed different findings for RCT-only and mixed reviews. Following the standard set above, the RCT-only meta-analyses'[12,14] finding of a significant positive effect was prioritized but the finding was downgraded from what we currently know. Additionally, a single review revealed a significant positive effect of (1) combined endurance/ resistance exercise training on triglycerides (downgraded from what we currently know

due to low reported certainty of evidence),[21] (2) exercise training starting > 6 months post-MBS on systolic blood pressure,[21] and (3) exercise training starting > 12 months post-MBS on body weight (an even greater positive effect on body weight than those beginning within 6 months).[14]

What We Still Don't Know

As the subanalyses were only performed on post-MBS exercise training interventions, currently we still don't know of any training characteristics of pre-MBS exercise training interventions that lead to improved health outcomes. To determine the most effective exercise training interventions to support adults awaiting, or who have undergone MBS, there is a need to further explore the training characteristics that most benefit health outcomes through comprehensive meta-analyses. Thus, future researchers should make explicit efforts to collect, report, and analyse subgroup data. A recent overview of reviews exploring the effect of exercise training on adults with overweight and obesity gives insight into the potential impacts of exercise training modality; specifically, certain modalities had a greater positive impact than others on lean body mass loss (i.e., R > other types), VO_2max (i.e. HIIT > E = combined E/R >R) and muscle strength (i.e., R = combined E/R > E).[55] As a result, future research should explore the exercise training modality relative to the goal of the training (e.g., improving cardiorespiratory fitness versus increasing muscular strength).

Future research should also specifically explore intervention timing, intervention duration, and sustained effects on various outcomes; for example, how soon should an exercise training intervention be delivered post-MBS to result in long-term weight loss. Of note, aligning with the subanalyses results, and the substantial weight loss that occurs in the first year following MBS, exercise training may actually be more beneficial 12 months post-MBS or when weight begins to stabilize if done with the goal of preventing weight recurrence. This may also hold true for other

outcomes as the changes in the year following MBS may "wash out" any less substantial changes resulting from exercise training.

Feasibility and Acceptability

Although findings by Baillot and colleagues[9] favor concluding that exercise training seems feasible and acceptable in adults awaiting, or who have undergone, MBS, they must be interpreted with caution due to the lack of reporting of these outcome variables in primary articles; specifically, adherence data is rarely reported (~11%) and attendance to sessions and drop out rates were often not reported (39% and 64% respectively). Adherence is important because while an individual may attend a session, their completion of the prescribed exercise will provide crucial information when interpreting the success of the training; our knowledge of participants' adherence to their prescribed exercise training is currently classified as "what we still don't know". Further, studies with lower attendance and higher dropout rates may represent those that did not report this data, so their omission could bias the results; with this in mind, the current evidence that exercise training shows high attendance rates, low drop out rates, high retention rates, and low rates and severity of exercise-related adverse events, are classified under "what we think we know". Finally, although we found reported no significant differences in any of the feasibility or acceptability measures based on exercise training timing (pre- or post-MBS) or duration ($\leq$ 12 weeks, or > 12 weeks), these subanalyses were underpowered leading to classification of this finding as "what we still don't know". Researchers should make explicit efforts to collect and report on feasibility and acceptability data to aid in transparency and potential explanations for the impacts, or lack thereof, of exercise training.

Strengths and Limitations

The key strengths of this overview lay in the rigor of the methodology employed. First, the established PRIOR guidelines were followed to ensure complete and accurate reporting. Second, a flow diagram was created and utilized to encourage a consistency in the categorization of the findings as concordant, discordant, or inconclusive. Third, methodological details of the included reviews (and characteristics of their primary articles) were collected in order to encourage deeper comparisons. Fourth, the primary articles were investigated in order to exclude reviews that may bias the findings – e.g., those that include multiple primary articles deriving from the same cohort. Fifth, in instances of discordant findings between reviews, both study design (RCT vs NRCT) and intervention type (exercise training vs additional exercise interventions) were explored, and more recent and comprehensive reviews were prioritized. Sixth, the systematic categorization, and display, of what we currently know, what we think we know and what we still don't know was completed in order to inform both clinicians and researchers on the current state of the evidence-based knowledge. The final strength rests in the collaboration between the authors (consisting of researchers and practitioners) in the interpretation of the results in order to formulate the findings in a way that is widely informative.

However, there are also limitations of the current overview, related primarily to either the methodology or limitations of the included research, that impact the generalizability of the findings. Throughout this overview, emphasis has been placed on the conducted meta-analyses and several suggestions for future meta-analyses have been made. One limitation of the current overview is that while the magnitude of the effect sizes reported by the meta-analyses were shared within the tables, they were not considered in the interpretation of results as it goes beyond the scope of our current efforts; instead, the emphasis was placed on simply whether or not significant effects were found. Although also beyond scope of this manuscript, it is important to consider the

quality of conducted meta-analyses. Specifically, many of the meta-analyses (a) included less than three studies, (2) had a small total sample size from underpowered studies, (3) included primary articles of poor quality or high risk, and (4) were not fully transparent in the reporting of their included studies, sample sizes, heterogeneity, and level of evidence – issues common to many meta-analyses.[60] Consequently, the category has been titled "what we currently know" to demonstrate the lack of "absolute" conclusions. Moreover, within previous reviews, and the current overview, the intervention timing is divided into pre-and post-MBS, however, this fails to capture an important distinction in the time frame post-MBS; for example, defining the impact of exercise training 6-12 months postoperatively versus 12+ months postoperatively may be just as important considering the potential for weight regain and the resulting changes to adults cardiometabolic risk factors. Despite this knowledge, observing the wide range of intervention start times post-MBS (see Supplementary File Appendix K) makes conducting this comparison impractical at this time. Future research and reviews should aim to explore the impact of post-MBS exercise training on various outcomes at pre-defined time points corresponding to changes typically observed in adults postoperatively.

Further, specific to the methodology, the current overview did not (a) include a search of grey literature, (b) include articles that were not available in French of English, and (c) explore original/primary articles that were published recently and thus, not captured within the identified reviews. Specific to the reviews, first, a high degree of overlap between primary articles was identified and 3/21 and 7/42 primary articles exploring pre- and postoperative exercise intervention respectively, contributed to over 50% of the reviews; thus, certain primary articles may have influenced the outcome conclusions more heavily than others. Secondly, a large limitation exists in the quality of both the primary articles and the included reviews. Reviewing supplementary

Tables S12 and S14 (see Appendix I and K), many of the primary articles included were scored as high risk of bias, or low quality, and reviewing Tables 3 and 4 in the current manuscript, many of the included reviews were scored as critically low or low quality. Notably, many of the factors impacting the quality of studies pertain to the transparency of reporting, rather than the methodology, and may result from the often compact, but necessary, page limits set for manuscript submission; authors should embrace the open sharing of additional details and data through supplementary files that would allow for deeper comparisons and interpretations of findings to be made. Finally, for many of the outcomes, the review authors could not statistically assess risk of publication bias due to the inclusion of less than 10 studies in the analysis (see Appendix O), and so the risk of publication bias and the "file drawer effect" affecting the current findings cannot be ruled out entirely.[57]

Conclusion

The current overview assumed the challenge of collecting, condensing, interpreting, and reporting on a large body of literature pertaining to the impacts of pre- and post-MBS exercise training on various health outcomes. A systematic approach to organizing the findings resulted in clear categories of "what we currently know", "what we think we know" and "what we still don't know". "We currently know" that postoperative exercise training has a positive effect on weight, waist circumference, 6-minute walking test distance and muscle strength, but does not have significant effects on lean body/fat-free mass, diastolic blood pressure, fasting insulin/glucose, total cholesterol, low density lipoprotein and triglycerides. However, the specific training characteristics that contribute to enhanced outcomes is still unknown because the exercise training interventions were highly variable in their duration, prescribed exercise quantity, and timing. Finally, although exercise training appears to feasible and acceptable for our population of adults

awaiting, or who have undergone, MBS, very little is known about participants' adherence to prescribed exercise – a factor that may explain the (in)effectiveness of exercise training in specific interventions. Despite the published research available, what we don't know still far outweighs what we do know thus demonstrating the need for more high-quality experimental studies with larger sample sizes to increase the quality of evidence. While exercise training has the potential to support patients in MBS programs, it is also important to note that maintaining the benefits of MBS requires sustained lifestyle changes and a single short duration exercise training intervention alone is unlikely to create lasting effects. Therefore, longer duration exercise training, or a combination of exercise training and physical activity counselling, may be most beneficial.

Appendix R – Summary of Outcome Conclusions

LEGEND	
	Concordant
	Discordant with potential reason
	Discordant without clear reason
	Inconclusive
	N/A
	Downgraded outcome

Table S17: Summary of Outcome Conclusions and Categorizations

Outcome	Removed Reviews and Reason	# MAs # SRs	1st Conclusion					Meta with *k* = 3+? Yes/ No	2nd Conclusion		
			Concordance	Discordance	Potential Explanations for Discordance	Inconclusive	Reason for Inconclusive Categorization		What We Currently Know	What We Think We Know	What We Still Don't Know
Pre-MBS Intervention											
Pre1: 6MWTD	None	**1 MA** *(Herrera Santelices 2022)* **3 SR** *(Jabbour 2022, Schurmans 2022, Bellicha 2021)*	☒ + effect	☐		☐		No		ET likely has a + effect on 6MWTD	
Pre2: BP	Marshall 2020 (Combined pre and post MBS results)	**3 SR** *(Schurmans 2022, Jabbour 2022, Bellicha o2021)*	☒ NS effect	☐		☐		No		ET likely has NS effect on BP***	*** downgraded because not 100% concordance within any review and low number of studies

Pre3: BW/BMI/WL	Herrera-Santelices 2022 (meta which includes 2 publications from 1 study)	**1 MA** *(Durey 2022)* **4 SR** *(Jabbour 2022, Lodewijks 2022, Schurmans 2022, Bellicha 2021)*	☐	☒	Potential explanation related to the inclusion of PAC. Removing Lodejwikes and Durey (include PAC) → potential to have (+) effect	☐		No		ET (not PAC) likely has a + effect on BMI	
Pre4: Vo2max	None	**1 MA** *(Durey 2022)* **2 SR** *(Jabbour 2022, Bellicha 2021)*	☐	☒	Discordance without clear reason Prioritize MA with + effect (RCT only but includes PAC)	☐		Yes	Exercise intervention has a + effect on VO2max	*** downgraded because conference abstracts may not include final data and creel may be pre and post intervention effects	
Pre5: QoL	None	**1 MA** *(Herrera Santelices 2022)* **3 SR** *(Lodewijks 2022, Schurmans 2022, Bellicha 2021)*	☐	☒	Discordance without clear reason Prioritize Herrera-Santelices MA with NS effect (RCT)	☐		Yes	ET has a NS effect on QoL	*** Downgraded due to low sample size and variability in QOL measurement/ domains	
Pre6: Strength	None	**2 SR** *(Jabbour 2022, Bellicha 2021)*	☐	☒	Discordance without clear reason	☐		N/A			Impact of ET on muscle strength. More studies need to be done with different measures of strength to form conclusions
Pre7: FM	Herrera-Santelices 2022 (meta which includes 2 publications from 1 study)	**3 SR** *(Jabbour 2022, Lodewijks 2022, Bellicha 2021)*	☐	☐		☒	No review with conclusive results	N/A			Impact of ET on FM

Pre8: Hospital Stay	None	**1 MA** *(Durey 2022)* **1 SR** *(Jabbour 2022)*	☐	☐		☒	Both the meta and SR only had 1 study	N/A			Impact of ET on length of hospital stay
Pre9: FFM/LBM	None	**1 MA** FFM *(Herrera Santelices 2022)* **1 SR** LBM *(Bellicha 2021)*	N/A only 1 review each (inconclusive findings for LBM)					No FFM N/A LBM		ET seems to have a NS effect on FFM	Impact of ET on LBM
Pre10: RHR	Marshall 2020 (Combined pre and post MBS results)	**1 SR** *(Schurmans 2022)*	N/A only 1 review (inconclusive findings)					N/A			Impact of ET on RHR
Pre11: Glucose/ Lipid	None	**2 SR** *(Jabbour 2021, Bellicha 2021)*	N/A (Different outcome measures)					N/A			Impact of ET on glucose and lipid metabolism
Pre12: PA	None	**1 SR** *(Lodewijks 2022)*	N/A only 1 review which includes PAC (conclusive findings)					No		Exercise intervention likely has a + effect on PA	
Pre13: Adverse (Surgical) Events	None	**1 MA** *(Durey 2022)*	N/A only 1 review (inconclusive findings due to inclusion of only 1 article)					N/A			Impact of ET on surgical adverse events

Outcome	Removed Reviews and Reason	# MAs # SRs	1st Conclusion					Meta with *k* = 3+? Y/N	2nd Conclusion		
			Concordance	Discordance	Potential Explanations for Discordance	Inconclusive	Reason for Inconclusive Categorization		What We Currently Know	What We Think We Know	What We Still Don't Know
Post-MBS Intervention											
Post1: BMD	None	**3 MA** *(Roth 2022, Diniz Sousa 2022, Bellicha 2021)* **1 SR** *(Morales Marroquin 2020)*	☒ + effect	☐		☐		Yes	ET has a + effect on BMD***	*** downgraded to here because meta reports very low or low certainty of evidence	
Post2: Strength	None	**2 MA** *(Vieira 2022, Bellicha 2021)* **2 SR** *(Schurmans 2022, Morales Marroquin 2020)*	☒ + effect	☐		☐		Yes	ET has a + effect on muscle strength		
Post3: WC	Gasmi 2022 not the same measure	**2 MA** *(Boppre 2021, Ren 2018)*	☒ + effect	☐		☐		Yes	ET has a + effect on WC		
Post4: LBM	None	**2 MA** *(Boppre 2021, Bellicha 2021)* **1 SR** *(Schurmans 2022)*	☒ NS effect	☐		☐		Yes	ET has NS effect on LBM		

Post5: DBP	Marshall 2020 (Combined pre and post MBS results)	**4 MA** *(Boppre 2022, Carretero Ruiz 2021, Bellicha 2021, Ren 2018)* **1 SR** *(Schurmans 2022)*	☒ NS effect	☐		☐		Yes	ET has NS effect on DBP		
Post6: QoL	None	**1 MA** *(Bellicha 2021)* **1 SR** *(Schurmans 2022)*	☒ NS effect	☐		☐		No		ET likely has a NS effect on QoL***	*** downgraded because unclear domains evaluated and sample size not reported
Post7: Glucose: Fasting insulin, fasting glucose and HOMA-IR	None	**3 MA** *(Boppre 2022, Bellicha 2021, Marshall 2020)* **1 SR** *(Schurmans 2022)*	☒ NS effect	☐		☐		Yes Insulin and glucose No Homa-IR and HBA1c	ET has a NS effect on fasting glucose and insulin	ET likely has a NS effect on Homa-IR ***	*** HOMA-IR downgraded because not enough studies and sample size not reported

Post8: Glucose: HbA1c	None	**1 MA** *(Boppre 2022)*	N/A only 1 review					No		ET likely has a NS effect on HbA1c***	*** downgraded because not enough studies and sample size not reported
Post9: Lipid: TG, LDL, and TC	None	**4 MA** *(Boppre 2022, Carretero Ruiz 2021, Bellicha 2021, Marshall 2020)* **1 SR** *(Schurmans 2022)*	☒ NS effect			☐		Yes	ET has a NS effect on TG, LDL or TC		
Post10: BW/BMI/WL	None	**5 MA** *(Gasmi 2022, Boppre 2021, Bellicha 2021, Carretero Ruiz 2019, Ren 2018)* **2 SR** *(Schurmans 2022, Morales Marroquin 2020)*	☐	☒	Removing Schurmans (multiple same studies), Morales Marroquin (only resistance) and Carretero Ruiz (respiratory, physio and PAC) → concordance for a + effect	☐		Yes	ET has a + effect on BW and BMI.		
Post11: FFM	None	**3 MA** *(Roth 2022, Gasmi 2022, Ren 2018)* **2 SR** *(Schurmans 2022, Morales Marroquin 2020)*	☐	☒ FFM	Schurmans has + (*k*=2) however one was only for combined E/R group and other was only at 24 weeks. Excluding Schurmans → concordance for a NS effect	☐			ET has NS effect on FFM (discuss modalities and newer non included studies results)		

Post12: 6MWTD	None	**2 MA** *(Bellicha 2021, Ren 2018)* **1 SR** *(Schurmans 2022)*	☐	☒	Removal of Schurmans (difficult interpretation of text, including text in original articles) → concordance for a + effect	☐		Yes	ET has a + effect on 6MWTD		
Post13: FM	None	**4 MA** *(Gasmi 2022, Boppre 2021, Bellicha 2021, Ren 2018)* **1 SR** *(Morales Marroquin 2020)*	☐	☒	Potential reason associated with study design. Bellicha (RCT/NRCT)→ + effect Morales (RCT/NRCT) which requires a resistance component → NS and gold standard FM assessment (DXA and RCT only by Boppre) → NS	☐		Yes	ET has a NS effect on FM	*** downgraded because missing studies and inclusion of NRCTs leads to different effect	
Post14: Vo2max	Da Silva meta with 2 pubs from 1 study	**3 MA** *(Boppre 2022, Bellicha 2021, Carretero Ruiz 2021)* **1 SR** *(Schurmans 2022)*	☐	☒	Remove Schurman (4 articles from 1 study) Potential reason related to design inclusion. Boppre (only RCT) → NS effect Inclusion of NRCTs → + effect	☐		Yes	ET has a NS effect on Vo2max.	*** downgraded because inclusion of NRCTs leads to different results than just RCT	
Post15: SBP	Marshall 2020 (Combined pre and post MBS results)	**4 MA** *(Boppre 2022, Carretero Ruiz 2021, Bellicha 2021, Ren 2018)* **1 SR** *(Schurmans 2022)*	☐	☒	Potential reason related to study inclusion. MA that include only RCT (Boppre and Ren) → + effect, MA that include (RCT/NRCT) → NS effect	☐		Yes	ET has a + effect on SBP	*** downgraded because different results when NRCTs are included	

Post16: Lipid: HDL	None	**4 MA** *(Boppre 2022, Carretero Ruiz 2021, Bellicha 2021, Marshall 2020)* **1 SR** *(Schurmans 2022)*	☐	☒	Only RCT (Boppre and Marshall) → NS effect. Carretero and Bellicha both include NRCTs but Carretero is more comprehensive thus inclusion of NRCTs → + effect	☐		Yes	ET has a NS effect on HDL	*** downgraded because different results when NRCTs are included	
Post17: RHR	Marshall 2020 (Combined pre and post MBS results)	**3 MA** *(Boppre 2022, Carretero Ruiz 2021, Ren 2018)* **1 SR** *(Schurmans 2022)*	☐	☒	Discordance without clear reason Prioritize Boppre (only RCT)→ NS effect and Carretero (RCT/NRCT) → + effect	☐		Yes	ET has a NS effect on RHR	*** downgraded because different results when NRCTs included	
Post18: Glucose	None	**1 SR** *(Schurmans 2022)*	N/A only 1 review (inconclusive findings)					No			Impact on insulin sensitivity, AIRg, Di, SPISE and glucose effectiveness
Post19: WL > 12 months	None	**1 MA** *(Bond 2023)*	N/A only 1 review					Yes	ET has NS effect on WL > 12 months postMBS	*** downgraded due to author conclusions (based on this type of intervention) need more studies that specifically aim for weight loss maintenance	

Outcome	Removed Reviews and Reason	# MAs # SRs	1st Conclusion						2nd Conclusion		
			Concordance	Discordance	Potential Explanations for Discordance	Inconclusive	Reason for Inconclusive Categorization	Meta with *k* = 3+? Y/N	What We Currently Know	What We Think We Know	What We Still Don't Know
Post-MBS Subanalyses											
Sub1: Combined E/R on BW/BMI/ WL	None	**3 MA** *(Boppre 2021, Carretero Ruiz 2019, Ren 2018)*	☐	☒	Only RCT → + effect Inclusion of NRCTs and alternative interventions (physiotherapy and respiratory) → NS effect	☐		Yes	Combined E/R has a + effect on BE/BMI/WL	*** downgraded because different results when NRCTs are included	
Sub2: Combined E/R on SBP and TG	None	**1 MA** *(Boppre 2022)*	N/A only 1 review					Yes	Combined E/R has a + effect on SBP and TG	*** TG downgraded due to small low reported certainty of evidence	
Sub3: Exercise start time < 6 months post-MBS on BW/BMI	None	**2 MA** *(Boppre 2021, Ren 2018)*	☐	☒	Boppre 2021 more comprehensive and new than Ren 2018	☐		Yes	Exercise start time < 6 months has NS effect on BW/BMI		
Sub4: Exercise start time > 6 months post-MBS on SBP	None	**1 MA** *(Boppre 2022)*	N/A only 1 review					No		Exercise start time > 6 months likely has a + effect on SBP	

Sub5: Exercise start time > 6 months post-MBS on BW/BMI	None	**1 MA** *(Boppre 2021)*	N/A only 1 review	Yes	Exercise start time > 6 months likely has a + effect on BW/BMI		
Sub6: Exercise start time > 12 months post-MBS on BW	None	**1 MA** *(Ren 2018)*	N/A only 1 review	No		Exercise start time > 12 months likely has a + effect on BW	
Sub7: Intervention duration > 12 weeks on SBP	None	**1 MA** *(Boppre 2022)*	N/A only 1 review	Yes	Intervention duration > 12 weeks has a + effect on SBP		