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REVIEW

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Exercise interventions following bariatric surgery are poorly reported: A systematic review and a call for action

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Summary

Objectives: This study assessed the transparency and replicability of exercise-based interventions following bariatric surgery by evaluating the content reporting of exercise-based clinical trials.

Design: The study design of the present article is a systematic review.

Data sources: PubMed, Scopus, Web of Sciences, PsycINFO, and Cochrane were searched from their inception to May 2023.

Eligibility criteria: Eligible studies were clinical trials including exercise interventions in participants following bariatric surgery. There were 28 unique exercise interventions. Two independent reviewers applied the exercise prescription components of Frequency, Intensity, Time, and Type (FITT; four items) and the Consensus on Exercise Reporting Template (CERT; 19 items). Exercise interventions were organized into four major exercise components: aerobic training, resistance training, concurrent training, and "others."

Results: The FITT assessment revealed that 53% of the trials did not report the training intensity, whereas 25% did not indicate the duration of the major exercise component within the training session. The mean CERT score was 5 out of a possible score of 19. No studies reached CERT score >10, while 13 out of the total 19 CERT items were not adequately reported by ≥75% of the studies.

Conclusion: This study highlights that the exercise interventions following bariatric surgery are poorly reported, non-transparent, and generally not replicable. This precludes understanding the dose–response association of exercise and health-related effects and requires action to improve this scientific field.

KEYWORDS
bariatric surgery, exercise, obesity, systematic review

1 | INTRODUCTION

Obesity is a global public health concern affecting over 650 million individuals worldwide that is associated with premature morbidity and mortality.[1,2] In recent decades, the prevalence of adults with severe obesity (defined as body mass index; BMI ≥ 35 kg/m^2) has drastically increased,[1,3,4] reaching up to 9% of the adult population in developed countries.[5] Bariatric surgery (BS) is considered the most effective treatment for people with severe obesity,[6,7] resulting in significant weight loss,[8] enhanced cardiovascular risk factors,[9] and improved quality of life.[10] However, approximately 50% of patients experience recurrent weight gain, and comorbidities relapse within 5 years,[11] and the long-term optimal clinical response of BS is largely dependent of the post-surgery lifestyle strategies.

Exercise is recommended for the long-term optimal clinical response of BS.[12] Previous meta-analyses have demonstrated the beneficial effects of exercise following BS on body weight,[13] cariometabolic risk factors,[14,15] or bone health,[16] although no additional effect on lean body mass was found compared to usual care.[13,17] While resistance training improved body composition and muscle strength,[18,19] aerobic training has widely been suggested to enhance aerobic capacity and cardiometabolic risk factors following BS.[15,20,21] In contrast, some studies found no further effect of exercise over the benefits of BS alone for several health parameters such as inflammation or endothelial function.[22,23] The next step is understanding the dose–response relationship of different exercise configurations with clinical outcomes, which would contribute to optimize exercise prescription following BS.[24]

Because clinicians and exercise professionals need to be aware of the optimal exercise type and dose that maximizes health-related benefits,[25] all exercise-based clinical trials should provide a full and accurate description of the exercise interventions to ensure transparency, replicability, and comparability across studies.[26,27] For this purpose, several relevant tools, such as the checklist of exercise prescription components of Frequency, Intensity, Time, and Type (FITT) and the Consensus on Exercise Reporting Template (CERT), have been developed.[26,27] It is worrisome to note, however, that poor content reporting of exercise interventions has been observed in several systematic reviews of rotator cuff disease, cancer, or mental health trials, among others,[28–32] even after the release of the FITT and CERT checklists. Some reports have also suggested potential misreporting in BS clinical trials. For instance, Soriano-Maldonado et al.[24] highlighted poor reporting of an exercise intervention, which severely affected the interpretation of the trial results. In this line, the meta-analysis by Baillot et al.[33] concluding that exercise was feasible and acceptable for individuals undergoing BS, suggested that an improved reporting could help identify methodological challenges and assess bias more effectively. However, a comprehensive characterization of the content reporting of exercise-based clinical trials following BS is currently lacking and would provide a clear standpoint for improving the quality of ongoing and future clinical trials in this population.

Therefore, this systematic review aimed to assess the transparency and replicability of exercise-based interventions following BS by evaluating the content reporting of exercise-based clinical trials.

2 | METHODS

This systematic review was registered in PROSPERO (Registration no. CRD42023426877) and was conducted following the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) statement[34] (Table S1).

2.1 | Search strategy and selection criteria

A systematic search without language restrictions was conducted for clinical trials, including exercise interventions in adult BS patients. Two reviewers (ABR and EMR) independently searched PubMed, Scopus, Web of Sciences, PsycINFO, and Cochrane databases from their inception to May 2023. The complete search strategy is presented in Table 1. Two reviewers (ABR and EMR) independently determined eligibility using an online software system (Rayyan Software). Article titles and abstracts were screened after the duplicates were removed. Thereafter, full-text articles were reviewed. Discrepancies were discussed and resolved by consensus and the input of a third reviewer (ASM) when necessary. The papers excluded were recorded in a separate sheet with the reasons for their exclusion. Clinical trials and Randomized Controlled Trials of exercise interventions in adult BS patients were included. Studies were excluded if (a) the population was not BS patients (e.g., people with obesity awaiting BS) or had other clinical conditions; (b) including unspecified lifestyle modifications (i.e., the exercise information was not reported); (c) the intervention was respiratory physiotherapy; and (d) articles were case studies, literature reviews, brief reviews, meta-analyses, letters to the editor, guidelines, interviews, comments, and conference abstracts.

2.2 | Data extraction and evaluation of content reporting

The data extraction and quality assessment were independently conducted by two reviewers (ABR and EMR) using a standardized Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, Washington, United States); any discrepancies were resolved by a third reviewer (ASM). Studies were organized into (a) aerobic training, (b) resistance training, (c) concurrent training (aerobic training + resistance training), and (d) other types of exercise interventions: balance, core, circuit, electrostimulation training, among others. We categorized electrostimulation as exercise training because it met two criteria: (i) integration into dynamic movements requiring voluntary muscle contraction such as squats, upper limbs lifts, trunk flexion, or isometric abdomen contraction and (ii) adherence to important exercise prescription components such as frequency, time, and type of exercise. Exercise prescription components were extracted from the methods section of each publication following the "FITT" format (frequency of sessions per week, relative or absolute intensity of exercise, time/duration of the major exercise component of the training session [i.e., aerobic training, resistance training, concurrent training, and others], and type of exercise). Data extraction also included the sample size, % of female participants, primary outcomes, and results of the outcomes as reported by the authors.

The CERT template comprises 16 categories and 19 items listed under seven domains: what (materials), who (provider), how (delivery), where (location), when and how much (dosage), tailoring (what and how), and how well (compliance/planned and actual). A comprehensive description of the CERT items is available in the Explanation and Elaboration Statement.[27] This document was used to rate and interpret each item. Each CERT item was rated as "1" (criterion met, indicating item clearly reported), "0" (indicating item not reported), or "?" (indicating unclear item reporting). We summed the number of items rated as "1" to compute a total score ranging from 0 to 19. We retrieved and extracted information whenever the authors referred to supplementary data. Before starting the assessment, all reviewers conducted individual pilot tests of the data extraction form using one study from each category (aerobic training, resistance training, concurrent training, or other). They subsequently discussed their CERT and FITT ratings. After both reviewers finished assessing all studies, we repeated the same procedure.

The included studies were assessed for their methodological quality using Version 2 of the Cochrane risk-of-bias tool for randomized trials, classifying trials for each domain as presenting a low risk of bias, some concerns, or high risk of bias.[35] This tool comprises the assessment of five dimensions of bias: randomization, variations from intended interventions, missing outcome data, outcome assessment, and selection of reported results.

3 | RESULTS

The flow chart of search results and the study selection process is shown in Figure 1. The initial screening provided 983 studies, of which 195 were duplicates. After screening the title and abstract of the remaining results, the full text of 45 reports was screened further. Then, three studies were excluded because they did not specify the exercise protocol implemented within the lifestyle intervention (Table S2). Finally, 42 articles belonging to a total of 28 studies (i.e., clinical trials) met the inclusion criteria and were included (Figure 1). The 28 main articles reporting the results of the primary trial outcome and describing the complete exercise interventions were included in our main analyses. The remaining 14 records were secondary articles referring to any of the 28 main articles for further information (e.g., "the exercise protocol is thoroughly described elsewhere"). Since these 14 secondary articles generally contained less detailed information than the main article, they were not included in our main analysis, although their content reporting is presented in Tables S7–S11. The sample size of the 28 studies included a total of 1,563 participants, with 1,256 (80%) women. These 28 studies were pooled by exercise intervention type in (1) aerobic training (5 studies)[21,36–39]; resistance training (3 studies)[40–42]; concurrent training (13 studies)[43–55]; and other types of exercise interventions (7 studies) such as balance ($n = 1$),[56] core ($n = 1$),[57] electrostimulation training ($n = 2$),[58,59] and multicomponent intervention (e.g., aerobic training, resistance training based on a circuit design, balance, and mobility) ($n = 3$)[60–62] (Table 2). The intervention duration and onset time after BS are presented in Figure S1. Trials specifically referring to published original exercise intervention protocols were aerobic training,[20,64] resistance training,[19,65,66] concurrent training,[23,67–71] and other.[16,59] In 57% of the studies (16 out of 28 trials),[21,36,38–41,43,45,50–53,57,59,61,62] the overall risk of bias was low, with 14% raising some concerns,[44,46,48,58] and 29% deemed to have a high risk of bias[37,42,47,49,54,55,60] (Figure S2). The primary concerns

TABLE 1 Summarized search strategy to assess completeness of content reporting of exercise interventions in bariatric surgery trials.

Population		Intervention		Study design
"Obesity surgery" OR "weight reduction surgery" OR "bariatric surgery[a]" OR "Biliopancreatic Diversion" OR "Duodenal switch" OR "Gastric bypass[a]" OR "Gastroplasty[a]" OR "gastric sleeve" OR "sleeve gastrectomy" OR "Roux-en-Y Gastric bypass" OR "gastric banding" OR "duodenal switch" OR "one anastomosis gastric bypass" OR "OAGB"	AND	"Physical activity" OR "physical therapy" OR "Exercise[a]" OR "sports[a]" OR "Physical Fitness[a]" OR "Exercise therapy" OR "Exercise training[a]" OR "Exercise program" OR "Exercise regime" OR "Aerobic exercise" OR "aerobic" OR "Aerobic Training" OR "Aerobic capacity OR Training[a]" OR "resistance[a]" OR "Resistance training[a]" OR "Resistance program" OR "Resistance regime" OR "Resistance exercise" OR "Weight Reduction Programs[a]" OR "Interval training OR High-Intensity Interval Training[a]" OR "HIIT"	AND	"Clinical trial" OR "Randomized control trial" OR "Random" OR "RCT"

[a]Mesh terms.

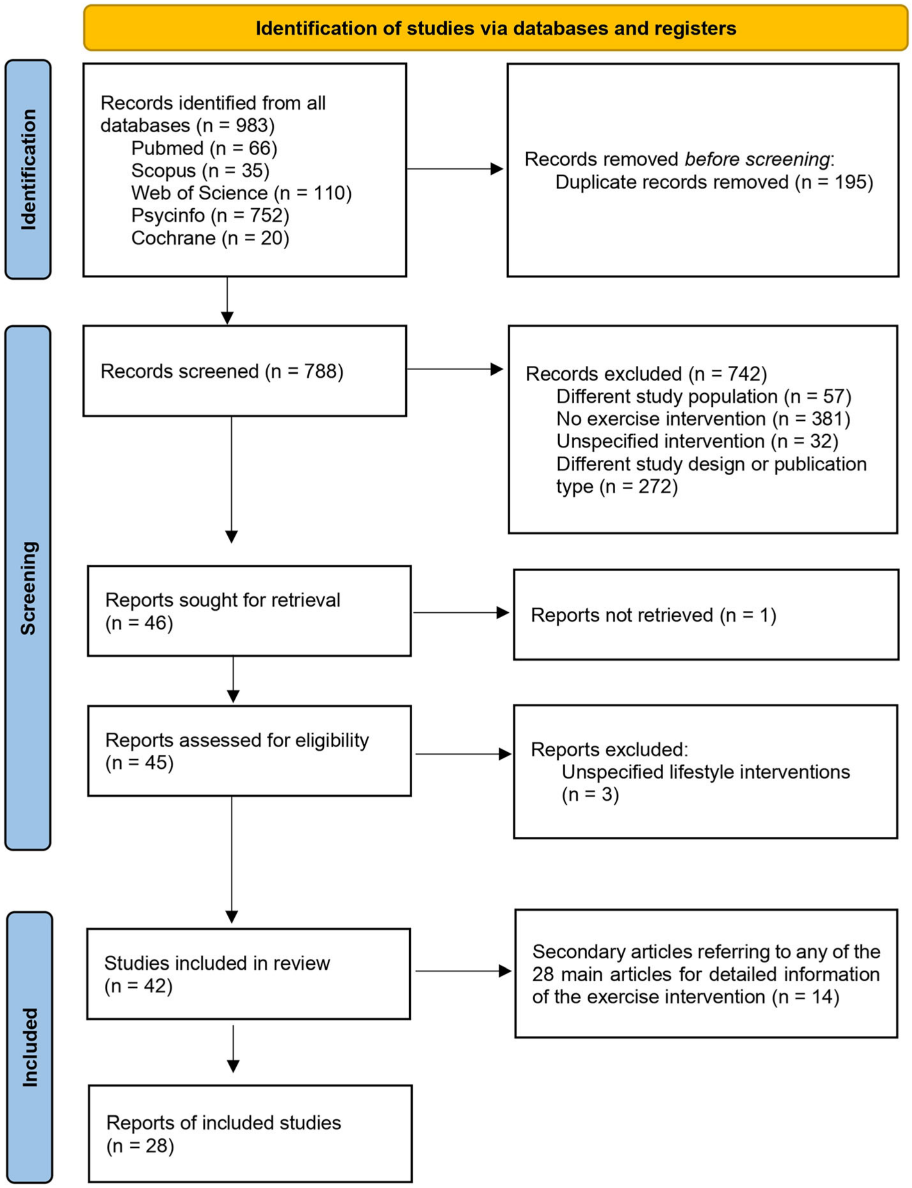

FIGURE 1 Flow diagram for the selection of the studies.

mainly involved deviations from planned interventions and the randomization process. Regarding randomization, 61% presented low risk of bias,[21,36–41,43,50–53,55,57,59,61,62] 21% had some concerns,[44–46,48,58,60] and 18% presented high risk of bias.[42,47,49,54,56] For deviations from intended interventions, 36% had a low risk,[21,36,39,41–43,45,50–52] while 50% raised some concerns.[38,40,44,46,48,49,53,56,57,59–62] However, bias in measuring outcomes (79%) and selecting reported results (89%) was generally low in most studies (Figure S3).

Only two out of five aerobic exercise interventions (40%)[36,38] reported the time (duration) of the aerobic component within the training session, whereas five out of five (100%) reported the frequency of sessions per week and the type of exercise (Figure 2A). Aerobic training included three to five sessions per week, and the intensity was mainly prescribed based on the maximum heart rate (Table 2). The RT interventions reported all the FITT exercise components, including three sessions per week of 60–80 min. The intensity was mainly defined according to the one-repetition maximum. A total of 11 out of 13 concurrent exercise interventions (85%)[45–55] reported the intensity for the aerobic condition (Figure 2D), whereas only 5 out of 13 (38%)[45,49,50,52,54] and 10 out of 13 (77%)[43,45–50,53–55] reported the intensity and time of the RT condition, respectively. These training programs included ≥2–5 sessions per week, with more extended periods of time for the aerobic component. Finally, only three out of seven studies (43%)[59–61] reported the intensity of the intervention within the other types of exercise category (Figure 2C).

Regarding the CERT evaluation, the mean score was 5 (range 0–10) out of a possible score of 19. No studies reached more than 10 CERT score (Tables S3–S6). Likewise, only 2 out 28 studies (7%) adequately reported the following CERT items: whether exercises are generic or tailored (Item 14a),[50,60] how exercises are tailored to the individual (Item 14b),[21,52] and how adherence or fidelity was assessed (item 16a)[50,61] (Figure 3). Any aerobic training provided detailed description of the exercise equipment, progression, whether exercise

TABLE 2 Compliance with the exercise prescription components of Frequency, Intensity, Time, and Type (FITT) and results of included studies.

First author, year	Sample size [*n* women (%)]	Frequency	Intensity	Time	Type	Results of the primary outcomes (as reported by the authors)
Aerobic training						
Castello et al.[36]	21 [21 (100%)]	3	% HRpeak	60 min	AE or CON	↑ HRV; ↑ 6MWT
Shah et al.[37]	33 [30 (90%)]	≥5	% $VO2_{max}$	-	AE or CON	↑ $VO2_{max}$
Coen et al.[21]	128 [113 (88.3%)]	3–5	% HRmax	-	AE or CON	↑ S_I
Woodlief et al.[39]	98 [83 (84%)]	3–5	% HRmax	-	AE or CON	↑ S_I; ↓ abdominal deep adipose tissue; ↔ rest of body composition variables; ↑ $VO2_{max}$
Cummings et al.[38]	32 [22 (69%)]	≥5	-	≥45 min	AE or CON	↓ HbA1c
Resistance training						
Daniels et al.[40]	17 [17 (100%)]	3	%1RM	60–80 min	RT or CON	↑ MS; ↔ cross-sectional area; ↑ muscle quality
Oppert et al.[63]	76 [76 (100%)]	3	%1RM	60 min	RT + PRO or PRO or CON	↔ Lean body mass; ↑ MS
Lamarca et al.[42]	63 [58 (88.9%)]	3	OMNI Resistance Exercise Scale	80 min	RT or RT + PRO	↑ FFM & SMM; ↔ REE

Concurrent training		Frequency		Intensity		Time		Type	
		AE	RT	AE	RT	AE	RT		
Muschitz et al.[43]	220 [127 (58%)]	≥3	≥2	-	-	≥45 min	30 min	CT or CON	↑ Serum markers of bone turnover
Hassannejad et al.[48]	60 [45 (75%)]	3–5	3	Borg Scale	-	150–200 min/week	25–30 min	CT or AE or CON	↓ % body fat
Kaviani et al.[44]	80 [80 (100%)]	5	2	-	-	30–60 min	-	CT or CON	↓ Lipid profile
Onofre et al.[49]	12 [12 (100%)]	3		%HRR	%1RM	30 min	20 min	CT or CON	↑ VO_{2pea}; ↔ pulmonary function
Mundbjerg et al.[50]	60 [42 (70%)]	2		Borg Scale	%1RM	30 min	10 min	CT or CON	↓ Body weight; ↓ CRM
Murai et al.[51]	70 [70 (100%)]	3		50% Δ (VAT -RCP)	nRM	30–60 min	-	CT or CON	↑ Areal bone mineral density
Noack-Segovia et al.[52]	45 [32 (74.4%)]	3		%HRR	%1RM	45 min	-	CT or CON	↔ MS
Auclair et al.[53]	58 [53 (78%)]	3		%HRR	-	35 min	25 min	CT or CON	↑ VO_{2peak}
Marc-Hernández et al.[54]	18 [14 (78%)]	2		% VO_{2peak}	Brzycki formula	20–50 min	8–24 min	CT or CON	↓ Body weight; ↓ fat mass; ↑ FFM
Tardif et al.[55]	49 [37 (75%)]	3		%HRR	-	35 min	25 min	CT or CON	↓ HDL and triglyceride; ↔ rest of lipid variables
Aguilar-Cordero et al.[45]	43 [32 (74%)]	3		% 6MWT	%1RM	45 min	45 min	CT or CON	↑ 6MWT
Asselin et al.[46]	20 [20 (100%)]	3		% VO_{2peak}	-	42 min	30 min	CT or CON	↑ Cortisol; ↑ testosterone
Belzile et al.[47]	59 [45 (76%)]	3		%HRR	-	35 min	25 min	CT or CON	↔ HRV

(Continues)

TABLE 2 (Continued)

Others		Frequency	Intensity	Time	Type	
Jassil et al.[60]	8 [8 (100%)]	1	Borg Scale	60 min	MUL or CON	↑ 6MWT
Coleman et al.[62]	51 [43 (84%)]	2	-	60 min	MUL or CON	↑ 6MWT; ↑ 30s chair rise; ↑ chair sit-and reach; ↑ arm curl
Rojhani-Shirazi et al.[56]	32 [– (–%)]	4	-	45 min	Balance or CON	↑ Balance
Ruiz-Tovar and Llavero[58]	75 [75 (100%)]	2	-	30 min	EMS or specific training or CON	↓ Breast ptosis; ↓ mammary projection
Ricci et al.[59]	20 [16 (80%)]	3	Borg Scale	30 min	EMS or CON	↑ 6MWT; ↑ HRV
Diniz-Sousa et al.[61]	61 [50 (82%)]	3	GRF and nRM	75 min	MUL or CON	↑ Bone mineral density
Ali et al.[57]	54 [35 (65%)]	3	-	-	Core or CON	↑ Core endurance

Abbreviations: AE, aerobic training; CON, control; CRM, cardiovascular risk markers; CT, concurrent training; EMS, electrostimulation; FFM, fat free mass; GRF, ground reaction forces; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein cholesterol; HRmax, maximum heart rate; HRpeak, peak heart rate; HRR, heart rate reserve; HRV, heart rate variability; MS, muscle strength; MUL, multicomponent intervention; nRM, maximum number of repetitions performed with a given load; PRO, protein supplementation; RCP, respiratory compensation point; REE, resting energy expenditure; RT, resistance training; S_I, insulin sensitivity; SMM, skeletal muscle mass; TG, triglyceride; VAT, ventilatory anaerobic threshold; VO_{2max}, maximum oxygen consumption; VO_{2peak}, peak oxygen consumption; 1RM, one-repetition maximum; 6MWT, six-minute walk test.

was generic or individually tailored, or how adherence was assessed. Moreover, only one out of the five aerobic training (20%)[36] analyzed included sufficient details of the exercise intervention to be replicable (Items 8 and 13) (Figure 3A). For the RT interventions, all of the studies detailed the exercise progression. In contrast, 9 out of 19 items were not reported by any of the studies (Figure 3B). For the concurrent training, 14 out of 19 items were only reported by 23.1% of the studies (Figure 3D). Within concurrent training, 5 out of 19 items had a lower rating for RT condition than the aerobic condition. For the other types of exercise interventions, 4 out of 19 items were not reported by any of the studies, whereas 8 out of 19 items were reported by at least 43% of the other interventions (Figure 3C).

4 | DISCUSSION

The findings of this systematic review indicate that exercise interventions following BS are poorly reported, which compromises the transparency and replicability of exercise interventions, and the comparability of results across studies. This poor reporting may bias the interpretation of the study results and limit the capacity of clinicians and exercise professionals to replicate or prescribe effective exercise interventions in both research settings and clinical practice.

Poor content reporting of the FITT components prevents an appropriate interpretation of the dose–response relationship of exercise interventions.[30] All the resistance training interventions fully described all the FITT components. While 4 out of the 5 aerobic interventions (80%) reported exercise intensity, only 5 out of the 13 concurrent training interventions (38%), and 3 out of the 7 other types of exercise interventions (43%) reported how the intensity of exercise was prescribed. Importantly, there was also poor reporting on instructor qualifications. Most interventions were supervised by physical therapists, but the studies did not report whether they had a certification as strength and conditioning specialists or not. This is noteworthy, as research suggests that physical therapists without a certification as strength and conditioning specialists might have limited knowledge of resistance training.[72] This wide lack of available information on the instructors' background could contribute to the misreporting of exercise intensity in such interventions. The lack of available technology to evaluate exercise intensity in clinical settings may also contribute to the misreporting of resistance training intensity. While clinicians typically prescribing aerobic exercise use heart rate monitors to control the intensity, specific tools for monitoring resistance training intensity, such as linear encoders, are rarely seen in clinical settings. However, the absence of these devices should not justify inadequate reporting, as compelling evidence supports the reliability and validity of perceived effort scales (i.e., repetitions in reserve or rate of perceived exertion) to monitor resistance training intensity.[73,74]

A total of 21 out of 28 studies (75%) specified the duration of the major exercise component of the training session (i.e., aerobic-, resistance-, concurrent-training, and others). These findings concur

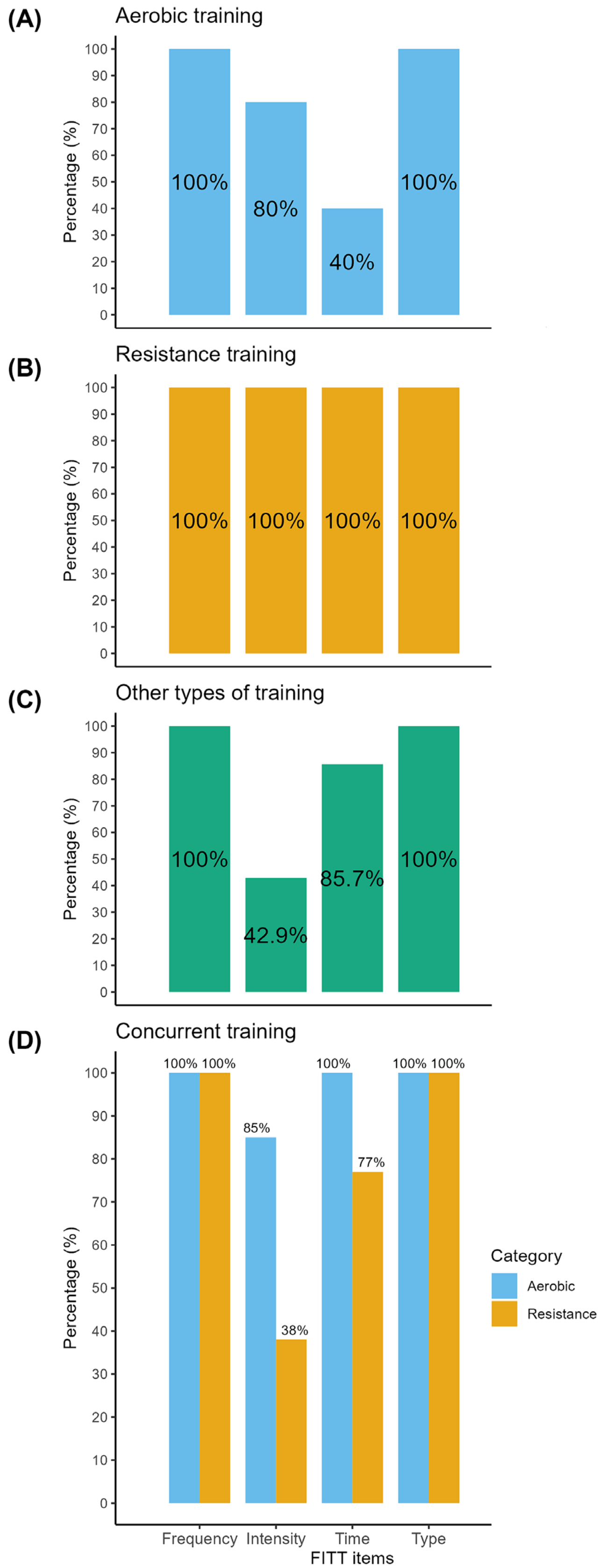

FIGURE 2 Percentage of interventions reporting components of Frequency, Intensity, Time and Type (FITT) for exercise prescription categorized by: (A) Aerobic training; (B) Resistance training; (C) Other types of training; (D) Concurrent training.

with previous investigations on exercise prescription in all types of cancers or youth mental health.[29,30,32] Compelling evidence demonstrates that manipulating exercise intensity and volume affects the resulting training adaptations (i.e., muscular strength, muscle size, metabolic and cardiovascular health, or motor unit recruitment) in healthy participants and individuals with chronic conditions.[75–77] Therefore, due to inadequate reporting, our findings suggest that certain results should be interpreted cautiously, as the prescribed exercise dose and the actual dose received remains unclear.[25] Thus, although different intensities and volumes may produce different effects on physical fitness, glycemia, or blood cholesterol,[37,54] poor reporting hinders identifying the specific components driving the health-related effects of exercise following BS.

We found that only 1 out of 28 trials had a CERT score of ≥10, while 13 out of 19 CERT items were only reported by ≤25% of the studies. Previous studies in other populations (e.g., rotator cuff disease or youth mental health) also indicated insufficient descriptions of the CERT items,[28,32] which restricts health practitioner's capacity to deliver effective exercise protocols in clinical practice.[24,26,27] Only 6 out of 28 (21%) described how adherence to exercise was measured, and only 2 out of 28 (7%) studies reported adherence rates. Weight-restricted mobility, lack of cardiorespiratory fitness, body dissatisfaction, or lack of self-efficacy to regularly engage in physical activity have been suggested as key barriers to physical activity adherence in BS participants.[78,79] Given that adherence rates to the training program may influence the study results,[24,33] confidently assessing the efficacy of these exercise interventions appears challenging. In addition, less than 23% of the aerobic training, concurrent training, and other exercise interventions reported how the exercise intervention progressed. A lack of progression within the training program could lead to null findings since, as participants' fitness levels improve in the early weeks of the exercise intervention, the intended intensity and effort for each session may become relatively lower.[75,76,80] Consequently, participants may complete the training sessions with a significantly different intensity than initially prescribed. This is especially relevant in bariatric participants since they experience a considerable reduction in weight, lean mass, and bone mass after the intervention,[13] and these changes in body composition may impair their short-term physical function, as well as the metabolic and physiological training response.[13,76,77]

Several relevant aspects need to be better reported. First, only 5 out of the 28 (18%) studies reported the exercise equipment or provided a detailed description of each exercise, which precludes replicability. Second, the person delivering the intervention was reported by 13 out of 28 studies (46%), including exercise physiologists, physiotherapists, researchers, or clinicians, while only 5 out of 28 studies (18%) described whether exercises are performed individually or in groups. These may influence intervention fidelity and its potential to be delivered in practical settings.[32] Finally, the number of studies reporting whether the intervention was delivered as planned (Item 16b) was higher compared to previously reported for patients with rotator cuff disease[28] (7 out of 28 studies vs. 2 out of 34 studies). However, this low rating still hinders the reader from knowing if

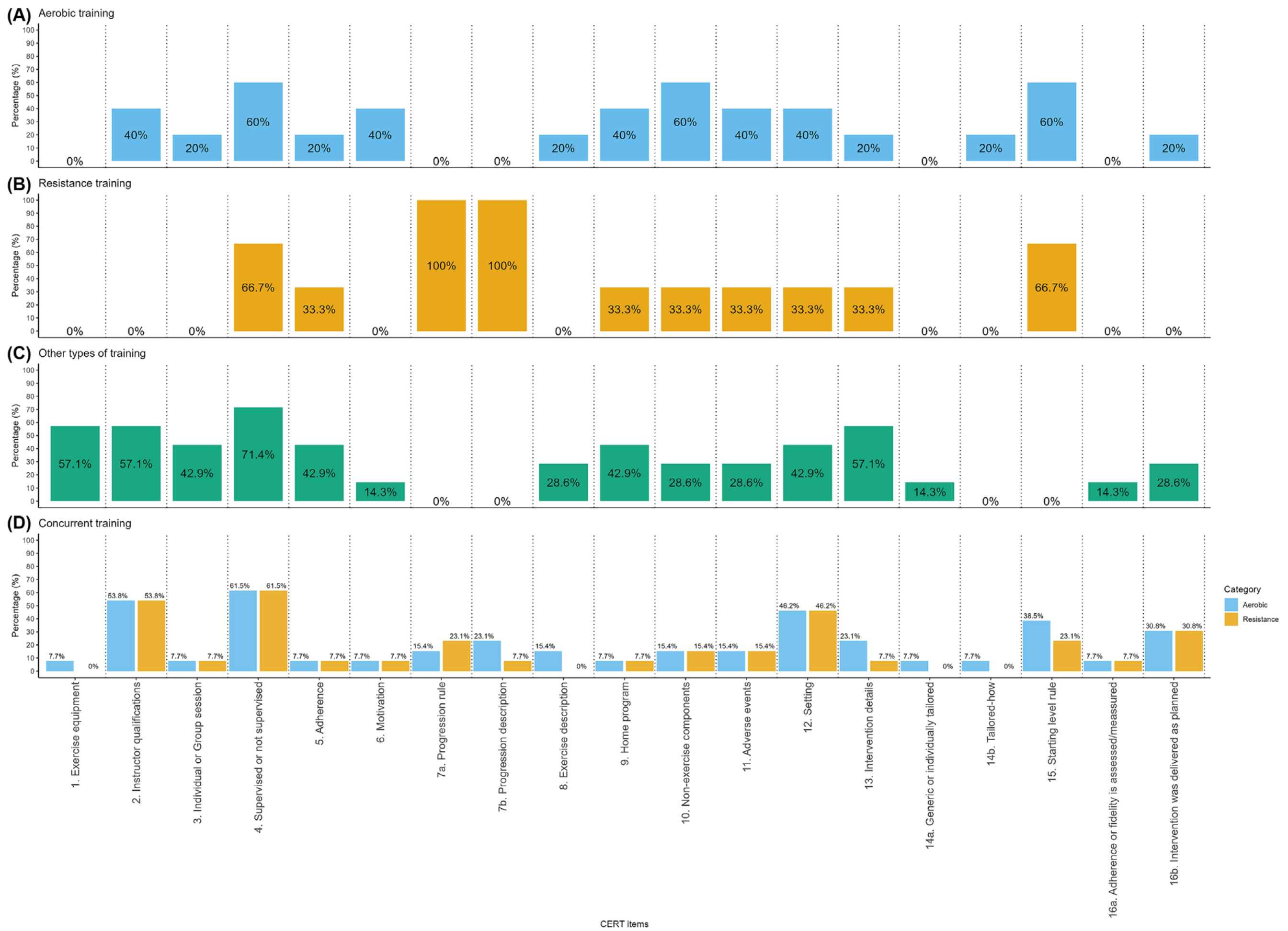

FIGURE 3 Percentage of interventions (out of 28 studies) with complete reporting for each item in the Consensus on Exercise Reporting Template checklist categorized by: (A) Aerobic training; (B) Resistance training; (C) Other types of training; (D) Concurrent training.

participants actually followed the prescribed exercise intervention.[28] While a strict journal space restriction might, to some extent, explain part of the missing information in some clinical trials, the supplementary materials should always provide a comprehensive description of the exercise intervention. In the present study, the overall risk of bias was low in 16 out of 28 studies (57%), contrasting with the poor reporting of the exercise intervention, which precludes successful study replicability. In this regard, previous authors of RCTs have identified potential barriers to the adoption of intervention reporting guidelines, which could account for this misreporting, such as low awareness of the guidelines, unclear perceived benefits, and concerns about increased researcher burden.[81] Of note, 20 out of 28 studies (71.4%) were published after the release of the CERT. Hence, the relative recent introduction of this template should not excuse inadequate content reporting in individuals undergoing BS. However, the criteria to properly report adherence in the CERT template may lack clarity, potentially leading to misreporting. In that sense, Baillot et al.[33] emphasized the importance of considering both attendance (frequency) and compliance with the prescribed exercise dosage (duration and intensity) for transparency and accurately assess the efficacy of the exercise intervention.

This study has limitations that must be addressed. First, although we highlight potential factors that could contribute to the poor reporting of exercise interventions in BS participants, such as strict journal page limits or the limited involvement of strength and conditioning specialists in supervising interventions, we cannot provide a definitive explanation for this misreporting. Second, while we acknowledge the existence of numerous reporting guidelines in the literature such as PRIRES,[82] we opted to use the two most frequently cited ones.

4.1 | Recommendations for exercise intervention reporting

These results represent a call for action. The scientific journals in this field should require a comprehensive reporting of exercise interventions in clinical trials following BS. This will allow the implementation of exercise interventions derived from clinical trials into clinical practice, improving the replicability of exercise programs and enhancing the quality of the scientific knowledge in this field. Likewise, to raise awareness of the importance of adhering to the reporting guidelines, it is crucial to recommend their implementation at all levels, from co-authors to supervisors.[81] For instance, research groups may consider implementing courses or specific training sessions to facilitate their adoption. Specifically, detailed reporting of intensity and its progression throughout the intervention is crucial to understand the specific training components driving the health-related effects in individuals undergoing BS and to conduct dose–response meta-analyses. Hence, strength and conditioning specialists should help clinicians to conduct exercise interventions and supervise training sessions to ensure that individuals complete the training program with the prescribed intensity and meeting all the exercise principles. Moreover, authors are urged to fully report adherence rates, including both attendance and compliance data,[33] to enhance transparency. All these recommendations will undoubtedly improve the quality of ongoing and future clinical trials where exercise is part or the main intervention.

5 | CONCLUSIONS

The main findings of this systematic review indicate that exercise interventions following BS are poorly reported, which compromises the transparency and replicability of exercise interventions, and the comparability of results across studies. This poor reporting may bias the interpretation of the study results and limit the capacity of clinicians and exercise professionals to replicate or prescribe effective exercise interventions in both research settings and clinical practice. These results should be considered a call for action to urgently improve the quality of exercise prescription and optimize the reporting of exercise-based clinical trials following BS.

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CONFLICT OF INTEREST STATEMENT

All co-authors have seen and agree with the contents of the manuscript, and there is no financial interest to report.

DATA AVAILABILITY STATEMENT

Data will be shared on reasonable request to the corresponding author.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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