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Physical Exercise as an Adjunctive Treatment in Eating Disorders: A Systematic Review

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Abstract

This systematic review aimed to identify the interventions carried out to date to assess the effectiveness of physical exercise (PE) as an adjunctive treatment for eating disorders (EDs). The main objectives of this systematic review were: (a) to identify which aspects—both symptomatological and physical—improve with the inclusion of PE in the treatment of EDs, and (b) to determine the characteristics that PE should have to improve the identified symptomatology. A literature search was conducted following PRISMA guidelines using the PubMed, Web of Science, PsycINFO, and Scopus databases. Keywords were divided into three groups (Eating disorders; Exercise and treatment; Characteristics of physical activity), and articles published between 2012 and 2022 were reviewed. Of the initial 1,247 results, 20 studies were included in the analysis, 10 of which were randomized controlled trials (RCTs). Improvements were observed in muscle strength, aerobic capacity, BMI, bone density, as well as in ED symptomatology and quality of life. However, due to methodological differences among the exercise programs, it was not possible to determine the specific characteristics responsible for symptom improvement. Further research is needed to determine the frequency, intensity, duration, type, and volume of PE programs.

Keywords: anorexia, bulimia, exercise treatment, intervention, physical activity

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Short track athlete in
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Introduction

It has been demonstrated that engaging in physical activity (PA) promotes the physical, psychological, and social well-being of participants (González-Peris et al., 2022). In recent years, scientific literature has increasingly focused on the therapeutic properties of physical exercise (PE) in addressing mental health issues. Eating disorders (ED), such as anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), or other specified feeding or eating disorders (OSFED), are considered psychiatric conditions characterized by altered eating behaviors that impair health and psychosocial functioning (González-Peris et al., 2022). In several manifestations of these ED, patients use PA as a common strategy to lose weight, improve their figure (Quiles et al., 2021), compensate for or eliminate food intake, or to relieve negative states (anxiety, depression, and stress) and ED symptoms (concern about weight, drive for thinness, body dissatisfaction, and restrictive profiles). However, it has been shown that PE as an adjunctive treatment can have positive effects on the main symptoms of AN, on both physical and mental health, and can promote better engagement with healthcare teams (Quiles et al., 2021). In fact, the first studies on this topic, conducted by Blinder et al. (1970) and Beaumont et al. (1994), observed improvements in symptomatology after implementing a supervised PE program in groups of patients with EDs. Later research indicated that PE reduced compensatory behaviors and facilitated weight gain in anorexia, decreased drive for thinness, bulimic symptoms, and body dissatisfaction, increased strength levels, reversed cardiac abnormalities in severe anorexia, and improved quality of life (Calogero & Pedrotty, 2004; Cook et al., 2017; Fernández-del-Valle et al., 2014).

Interestingly, PE is still rarely used in mental health units as part of ED treatment due to concerns that it might reinforce excessive exercise aimed at achieving the "ideal body" (Quesnel et al., 2018). This is likely due to the absence of clear guidelines on how to manage PE in this context, the lack of standardized protocols guiding professionals on how to use exercise effectively as part of ED treatment, and differing attitudes toward these approaches in clinical settings (Fernández-del-Valle et al., 2014; Toutain et al., 2022).

Based on the above, the objectives of this systematic review were: (i) to identify which aspects, both symptom-related and physical fitness-related, improve with the inclusion of PE in the treatment of EDs, and (ii) to determine the characteristics that PE should have in treatment to improve the identified symptomatology.

Method

A systematic review of relevant literature was conducted following the PRISMA 2020 statement (Page et al., 2021). Due to the methodological and statistical heterogeneity of the included studies, a descriptive approach was adopted in the synthesis of the study (Rethlefsen et al., 2021).

Search Strategy

A search of the relevant literature was conducted in four databases: PubMed, Web of Science, PsycINFO, and Scopus. The search strategy included both controlled vocabulary terms and free-text terms (see Table 1).

Inclusion and Exclusion Criteria

For inclusion, the retrieved articles had to have been published between 2012 and 2022, in English and/or Spanish. The search was conducted on November 28, 2022. Systematic reviews, descriptive guides or intervention protocols, and studies that included samples of professional athletes were excluded.

Potential articles were selected based on a set of keywords defined through the PICOS strategy (Participants, Intervention, Comparison, Outcomes, Study design; Liberati et al., 2009) (see Table 2). The search initially focused on the title and abstract.

One reviewer (C.T.B.) carried out the data analysis and the search process in the main databases. All records identified electronically were evaluated by title and abstract. Duplicate articles were removed and considered only once. Full texts were obtained for all articles considered potentially eligible. Subsequently, the preselected records were independently examined by two reviewers (C.T.B. and C.V.), who selected the final studies to be included in the review. In case of disagreement, the opinion of a third reviewer (E.P.) was considered.

Results

Search Results:

After excluding duplicate records, a total of 1,247 potentially relevant publications were considered eligible. Following title and abstract screening, 48 publications were selected for full-text review. Finally, 20 articles were included in this systematic review (Figure 1), 10 of which were randomized controlled trials (RCTs).

Table 1

Terms used for the search

Group 1: Eating disorders	("eating disorder*" OR "disordered eating" OR "eating patholog") OR ("anorexia nervosa" OR "anorexia" OR "bulimia nervosa" OR "bulimia" OR "avoidant restrictive food intake disorder" OR "other specified feeding or eating disorder" OR "binge eating disorder") OR ("feeding disorder*" OR "appetite disorder*" OR "eating and feeding disorder*" OR "relative energy deficiency in sport" OR "female athlete triad syndrome")
Group 2: PE and treatment	("exercis*" OR "physical activi*" OR "physical fitness" OR "sport") AND ("intervent*" OR "treatment*" OR "treatment outcome" OR "inpatient treatment" OR "clinical experience" OR "exercise treatment" OR "therap*" OR "prescription" OR "body-oriented therap*" OR "rehabilitation" OR "prescription")
Group 3: Characteristics of the PE	("endurance training" OR "resistance training" OR "flexibility exercise*" OR "strength" OR "intensity" OR "frequency" OR "duration" OR "type" OR "aerobic exercise*" OR "high-intensity interval training" OR "circuit-based exercise" OR "weightlifting" OR "functional fitness" OR "endurance exercise*" OR "resistance exercise*" OR "HIIT")

Note. HIIT = High Intensity Interval Training.

Table 2

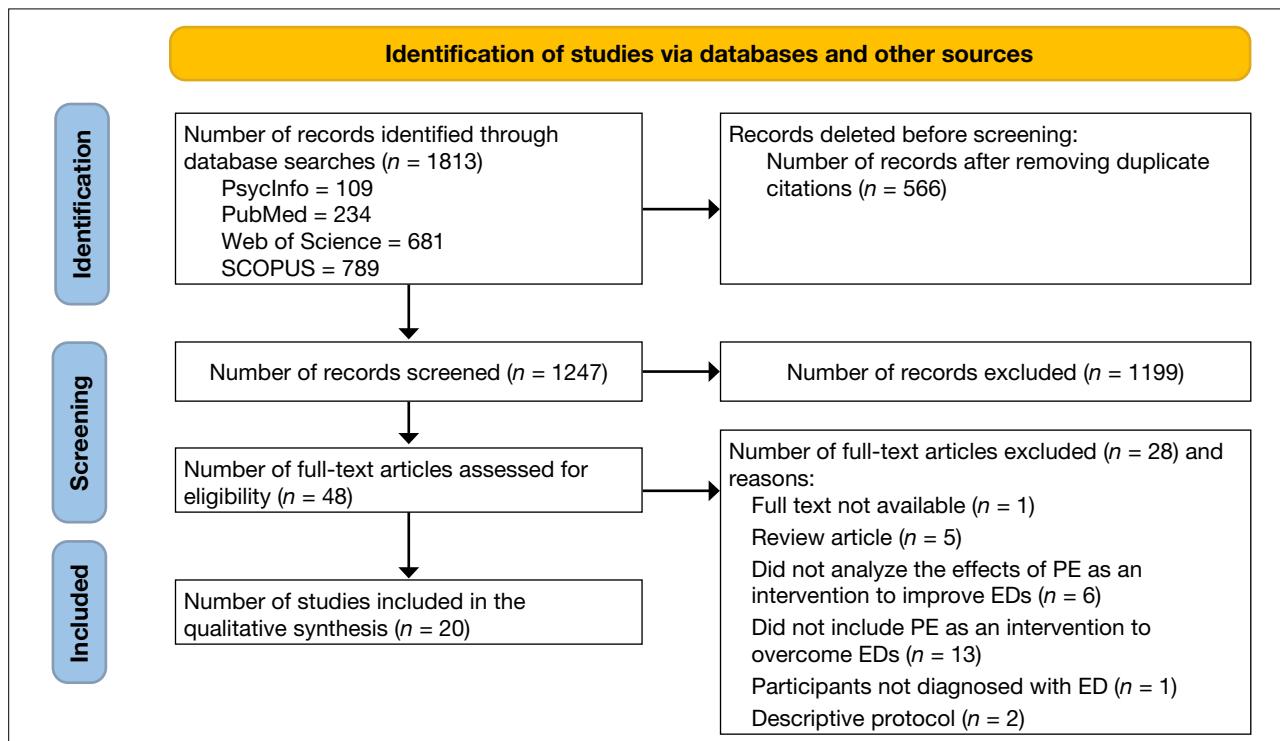
Key terms defined through the PICOS strategy

PARTICIPANTS	Women and men with a confirmed diagnosis of an eating disorder (AN, BN, BED, OSFED) who have practiced some form of physical activity as part of the ED treatment.
INTERVENTION	Physical activity as the main component or as part of the ED treatment.
COMPARISON	All comparisons and control conditions, as well as studies including a comparison group.
OUTCOMES	Improvement of eating disorder symptomatology and description of the defining aspects of physical activity.
STUDY DESIGN	Non-randomized controlled studies (NRS), randomized controlled trials (RCT), observational studies (OS), case studies (CS), quasi-experimental studies (QES).

Note. AN: Anorexia Nervosa, BN: Bulimia Nervosa, BED: Binge Eating Disorder, OSFED: Other Specified Feeding or Eating Disorder.

Figure 1

Flowchart (Page et al., 2021)



Note. PE = Physical Exercise, ED = Eating Disorder.

Participant Characteristics

The total number of participants across the different studies was 895. Table 3 details their characteristics.

Table 3
Characteristics of the participants

Sample size (range of participants)	1–164
Age range	12.6–60
Sex (n; %)	
Females	711 (79.4%)
Males	6 (0.7%)
Not specified	178 (19.9%)
Pathologies (n)	
Anorexia nervosa	10
Bulimia nervosa	10
Binge eating disorder	7
Other Specified Feeding or Eating Disorder	2
Number of patients for each pathology (n)	
Anorexia nervosa	285
Bulimia nervosa	298
Binge eating disorder	187
Other Specified Feeding or Eating Disorder	23
Not specified	67
Lost	35

Characteristics of the Interventions

Among the twenty studies reviewed, the duration of the interventions ranged from one to twenty-six weeks. Tables 4 and 5 present, in alphabetical order, the main characteristics of all the reviewed studies.

Effects of Physical Exercise on ED Symptomatology

Effects of physical exercise on physical condition

Thirteen articles analyzed the effects of PE on the physical condition of patients. Regarding physical condition and

abilities, improvements were found in muscle strength of the upper and lower limbs ($n = 6$; Bratland-Sanda et al., 2012; Bratland-Sanda et al., 2018; Dauty et al., 2022; Fernández-del-Valle et al., 2014; Fernández-del-Valle et al., 2015b; Mathisen et al., 2018a); cardiorespiratory improvements ($n = 3$; Dauty et al., 2022; Galasso et al., 2018; Galasso et al., 2020); better balance test results ($n = 1$; Dauty et al., 2022); and improved agility ($n = 2$; Fernández-del-Valle et al., 2014; Fisher & Schenkman, 2012). With regard to anthropometric measures, significant improvements were observed in BMI ($n = 7$; Agne et al., 2022; Bratland-Sanda & Vrabel, 2018; Bratland-Sanda et al., 2018; Dauty et al., 2022; Galasso et al., 2018; Fernández-del-Valle et al., 2015a; Fernández-del-Valle et al., 2015b) and in skinfold thickness ($n = 2$; Agne et al., 2022; Fernández-del-Valle et al., 2015b).

Efficacy of physical exercise on ED symptomatology

Ten articles analyzed the effects of PE on ED symptomatology. One study included aerobic exercise ($n = 1$; Galasso et al., 2018), reporting a decrease in pathological behaviors related to compulsive exercise (CE) and food intake. Another study examined the effects of strength-endurance training on the psychopathological symptoms of BN and BED and on CE-related pathological behaviors after the intervention (Mathisen et al., 2018b).

As for interventions combining strength training and aerobic activities ($n = 3$; Bakland et al., 2019; Bratland-Sanda et al., 2012; Galasso et al., 2020), a significant reduction was observed in the total score of the Eating Disorders Examination (EDE), as well as significant improvements in emotional and cognitive symptoms related to binge eating and a reduction in compensatory behaviors.

Regarding mind-body activities such as yoga ($n = 2$; Brennan et al., 2020; Diers et al., 2020) or Pilates ($n = 1$; Martínez-Sánchez et al., 2020), yoga reduced binge-eating frequency in individuals with BN, decreased emotional dysregulation and self-criticism, improved self-compassion and mindfulness skills, and significantly reduced body-image concerns. Pilates, on the other hand, improved sleep quality.

Other studies allowed participants to choose the type of PE they wished to practice ($n = 2$; Bratland-Sanda & Vrabel, 2018; Lampe et al., 2022). Both reported improvements in ED symptomatology, and one of them also found a reduction in overall psychological distress and a decrease in compulsive PE practice.

Table 4
Main characteristics of the studies included

Author (year)	Type of study	Sample (age, sex, ED manifestation, comorbidity)	Time of data collection; Description of intervention (type and intensity); Duration and frequency (individual, group, or unspecified training)
Agne et al. (2022)	RCT	$N = 41$ (Age: 12.78 ± 0.88 years, sex n/s, AN) / CG $n = 22$; EG PREx $n = 19$	Pre, post (2 months) CG: CBT + NP EG PREx: CBT + strength training (8 exercises, 3 sets, 10 reps, 70% 6RM or OMNI-Resistance Exercise Scale [OMNI-RES] < 6, 1-2 min rest) + NP with caloric supplement (+150 kcal post-session) 24 sessions over 8 weeks (3 sessions/wk; 50 min/session); (group)
Bakland et al. (2019)	Qualitative study (RCT context)	$N = 15$ (Age: 19–42 years old, females, BN $n = 6$, BED $n = 9$.)	16 months after PED-t. PED-t: CBT + strength + endurance training (1 supervised session/wk [n/s] + 1 unsupervised session/wk of pyramidal interval running) + dietary therapy 20 sessions in 4 months (3 sessions/wk; 40–60 min/session); (group)
Bratland-Sanda and Vrabel (2018)	OS	$N = 84$ (Age: 28.1 ± 7.7 years, sex n/s, AN $n = 21$, BN $n = 43$, OSFED $n = 20$) / CE $n = 19$ (Age: 27.7 ± 8.0 years, sex n/s, AN $n = 9$, BN $n = 5$, OSFED $n = 5$)	Pre, during and post. Individual and group CBT + PE intervention (n/s) CE: 1 additional individual counseling session to reduce excessive exercise 12 weeks (2 sessions/wk; 45 min/session); (individual)
Bratland-Sanda et al. (2012)	OS	$N = 29$, females. BMI < 18.5 $n = 7$ (Age: 31.9 ± 9.4 years, AN $n = 3$, BN $n = 1$, OSFED $n = 3$); BMI ≥ 18.5 $n = 22$ (Age: 30.6 ± 9 years, AN $n = 3$, BN $n = 11$, OSFED $n = 11$)	n/s. CBT + psychoeducation + moderate-intensity PE; ball games, walking and Nordic walking, strength exercises (n/s) and horse riding + NP + Art Therapy 12–24 weeks (2 sessions/wk; 60 min/session); (group)
Bratland-Sanda et al. (2018)	CS	$N = 1$ Age: 25 years old, female, restrictive AN, BMI: 17.6, Osteopenia in lumbar spine, menstrual disturbances, CE	Pre, post and follow-up at 6 months. Psychotherapy (psychoeducation, interpersonal, therapeutic, and social support) + strength training (Maximal Strength Training intervention [4 exercises, 3 sets, 5RM, 3 min rest]) 48 sessions in 16 weeks (3 sessions/wk; 60 min/session); (individual)
Brennan et al. (2020)	RCT	$N = 53$ (Age n/s, females, BN or BED) / EG $n = 26$; CG $n = 27$	Pre, post CG: (n/s) EG: Yoga 8 sessions in 8 weeks (1 session/wk; 90 min/session); (group)

Note. AN = Anorexia Nervosa, BED = Binge Eating Disorder, BN = Bulimia Nervosa, CBT = Cognitive Behavioral Therapy, CE = Compulsive Exercise, CG = Control Group, CS = Case Study, DERS = Difficulties in Emotion Regulation Scale, EG = Experimental Group, FSCRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale, NRS = Non-Randomized Controlled Studies, NP = Nutritional Plan, n/s = Not Specified, OS = Observational Study, OSFED = Other Specified Feeding or Eating Disorder, PED-t = Physical Exercise and Dietary Therapy, QES = Quasi-Experimental Study, RCT = Randomized Controlled Trial, ROM = Range of Motion, SCS-SF = Self-Compassion Scale – Short Form, TMS = Toronto Mindfulness Scale.

Table 4 (continued)

Main characteristics of the studies included

Author (year)	Type of study	Sample (age, sex, ED manifestation, comorbidity)	Time of data collection; Description of intervention (type and intensity); Duration and frequency (individual, group, or unspecified training)
Dauty et al. (2022)	OS	<i>N</i> = 37 (Age: 32 ± 11 years, females <i>n</i> = 34, restrictive AN <i>n</i> = 13, purging AN <i>n</i> = 9, AN with history of bulimic episodes <i>n</i> = 11, AN with hyperactivity <i>n</i> = 4, Hyperactivity <i>n</i> = 17).	Pre, post and follow-up at 12 months Psychotherapy + psychiatric treatment + dietary treatment + stretching + neuromuscular training + relaxation + strength training (3–5 sets, 6–10 reps, 1 min rest) + functional exercises + varied physical activities (3 sessions/week; badminton, billiards, table tennis, archery, volleyball, swimming, walking, cycling) 4 weeks, 5 days/week (2 sessions/day, 60 min/session); (n/s)
Diers et al. (2020)	Mixed methods	<i>N</i> = 67 (Age n/s, females <i>n</i> = 66, ED manifestation n/s)	Pre, during and post Yoga (therapeutic yoga + group discussion) 8 sessions 8 weeks (1 session/wk; 90 min/session); (group)
Fernández-del-Valle et al. (2015a)	RCT	<i>N</i> = 44, females / CG <i>n</i> = 22 (Age: 13.0 ± 0.6 years, females, restrictive AN); EG <i>n</i> = 22 (Age: 12.7 ± 0.6 years, females, restrictive AN)	Pre, post. CG: Psychotherapy + NP EG: Psychotherapy + NP with caloric adjustment + Strength Work (8 exercises, 3 sets, 8–10 reps, 70% of 6 RM, 1–2' rest, according to National Strength and Conditioning Association guidelines 24 sessions in 8 weeks (3 sessions/wk; 50–60 min/session); (group)
Fernández-del-Valle et al. (2015b)	RCT	<i>N</i> = 44, females / CG <i>n</i> = 22 (Age: 12.6 ± 0.6 years, restrictive AN, days from hospitalization to inclusion: 50.8 ± 36.4 days); EG <i>n</i> = 22 (Age: 13.0 ± 0.6 years, restrictive AN, days from hospitalisation to inclusion: 61.5 ± 37.3 days) Final sample <i>N</i> = 36 (EG <i>n</i> = 18 and CG <i>n</i> = 18)	Pre, post and follow-up at 4 weeks CG: Psychotherapy + NP EG: Psychotherapy + NP with calorie adjustment + Strength work (8 exercises, 3 sets, 8–10 reps, 70% of 6 RM, 1–2' rest) 24 sessions over 8 weeks (3 sessions/wk; 50–60 min/session); (n/s)
Fernández-del-Valle et al. (2014)	RCT	<i>N</i> = 36, females / CG <i>n</i> = 18 (Age: 13.0 ± 0.60 years; females; restrictive AN); EG <i>n</i> = 18 (Age: 12.6 ± 0.59 years; restrictive AN)	Pre, post (8 weeks) and follow-up at 4 weeks CG: Psychotherapy + NP EG: Psychotherapy + NP with calorie adjustment + Strength work (8 exercises, 3 sets, 8–10 reps, 70% of 6 RM, 1–2' rest) 24 sessions in 8 weeks (3 sessions/wk; 50–60 min/session); (group)
Fisher and Schenkman (2012)	CS	<i>N</i> = 1 (Age: 48 years; female; AN; hypothermia, hyponatremia, hypoglycemia, starvation-induced hepatitis, vitamin D deficiency, coagulopathy, vitamin K deficiency, amenorrhea, refeeding syndrome, exertional tachycardia, and stage-1 pressure ulcer.	Pre, post Strength training (following the guidelines of the American College of Sports Medicine for frail older adults) + ROM/flexibility + postural stability + strength and functional strength training 9 weeks (4–6 sessions/wk, 1 session/day; 30 min/session); (individual)

Note. AN = Anorexia Nervosa, BED = Binge Eating Disorder, BN = Bulimia Nervosa, CBT = Cognitive Behavioral Therapy, CE = Compulsive Exercise, CG = Control Group, CS = Case Study, DERS = Difficulties in Emotion Regulation Scale, EG = Experimental Group, FSCRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale, NRS = Non-Randomized Controlled Studies, NP = Nutritional Plan, n/s = Not Specified, OS = Observational Study, OSFED = Other Specified Feeding or Eating Disorder, PED-t = Physical Exercise and Dietary Therapy, QES = Quasi-Experimental Study, RCT = Randomized Controlled Trial, ROM = Range of Motion, SCS-SF = Self-Compassion Scale – Short Form, TMS = Toronto Mindfulness Scale.

Table 4 (continued)*Main characteristics of the studies included*

Author (year)	Type of study	Sample (age, sex, ED manifestation, comorbidity)	Time of data collection; Description of intervention (type and intensity); Duration and frequency (individual, group, or unspecified training)
Galasso et al. (2018)	RCT	<i>N</i> = 14 (Age n/s, females <i>n</i> = 11, BED <i>n</i> = 14) / CG <i>n</i> = 8 (Age: 58 ± 13 years); EG <i>n</i> = 6 (Age: 45 ± 16 years)	Pre- and follow-up 6 months after completion of intervention CG: CBT + NP EG: CBT + NP + Endurance work (brisk walking) 6 months (4 sessions/wk; 90 min/session of aerobic activity); (group)
Galasso et al. (2020)	RCT	<i>N</i> = 19 females / CG <i>n</i> = 9 (Age: 53 ± 13 years, BED); CE CAAET <i>n</i> = 10 (Age: 54 ± 11 years, BED)	Pre- and follow-up 6 months after completion of intervention CG: CBT + NP EG CAAET: CBT + NP + Endurance work (brisk walking) + Strength work 24 sessions in 6 weeks (4 sessions/wk; 90 min/session); (group)
Lampe et al. (2022)	Series of proof-of-concept cases	<i>N</i> = 3 females (Age: 18–60 years, BN or subthreshold BN)	Pre, during (week 4, treatment) and post (week 12) CBT + PE (weekly goals of moderate-to-vigorous intensity PA) 12 sessions in 12 weeks (1 session/wk); (n/s)
Martin et al. (2017)	RCT	<i>N</i> = 41 (Age: n/s, females <i>N</i> = 39 AN) / CG <i>n</i> = 21 (Age: 16.8 ± 2.3 years, Sex n/s); EG <i>n</i> = 20 (Age: 16.8 ± 2.4 years, Sex n/s).	Days 0–3 (T1), days 4–6 (T2) and days 7–9 (T3). Blood analysis with a 3-day interval between blood draws during hospitalization: days 1–3 (T1), days 4–6 (T2), and days 7–9 (T3). CG: NP + Standard care EG: NP + Standard care + 24-hour bed rest monitoring + High impact, low frequency exercise: 20 vertical jumps of 5 inches off the ground 9 days (2 sessions/day; 5 min/session); (n/s)
Martínez-Sánchez et al. (2020)	QES	<i>N</i> = 12 (Age: 14.6 ± 1.7 years; females; restrictive AN <i>n</i> = 11, atypical AN <i>n</i> = 1).	Pre, post Pilates (range of motion, strength, balance and coordination); 10 reps/exercise 10 weeks (3 sessions/wk; 60 min/session); (group)
Mathisen et al. (2018a) ¹	RCT	<i>N</i> = 164 females / CG <i>n</i> = 73 (Age: 27.8 ± 5.3 years, BN <i>n</i> = 51, BED <i>n</i> = 27); EG <i>n</i> = 76 (Age: 28.3 ± 6.2 years, BN <i>n</i> = 51, BED <i>n</i> = 27)	Pre, post and follow-up (at 6 and 12 months) CG: CBT EG (PED-t): CBT + maximal muscle strength training (progressive resistance; 10 RM – 2 RM) + strength-endurance training (HIIT, pyramidal intensity structure according to general cardiorespiratory fitness recommendations) + nutritional psychoeducation 16 weeks, 20 sessions (2 sessions/wk; 90 min/session); (group)

Note. AN = Anorexia Nervosa, BED = Binge Eating Disorder, BN = Bulimia Nervosa, CBT = Cognitive Behavioral Therapy, CE = Compulsive Exercise, CG = Control Group, CS = Case Study, DERS = Difficulties in Emotion Regulation Scale, EG = Experimental Group, FSCRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale, NRS = Non-Randomized Controlled Studies, NP = Nutritional Plan, n/s = Not Specified, OS = Observational Study, OSFED = Other Specified Feeding or Eating Disorder, PED-t = Physical Exercise and Dietary Therapy, QES = Quasi-Experimental Study, RCT = Randomized Controlled Trial, ROM = Range of Motion, SCS-SF = Self-Compassion Scale – Short Form, TMS = Toronto Mindfulness Scale.

Table 4 (continued)*Main characteristics of the studies included*

Author (year)	Type of study	Sample (age, sex, ED manifestation, comorbidity)	Time of data collection; Description of intervention (type and intensity); Duration and frequency (individual, group, or unspecified training)
Mathisen et al. (2018b) ²	RCT	<i>N</i> = 156 females (BN <i>n</i> = 103, BED <i>n</i> = 53) / CG <i>n</i> = 23 (Age: 26.5 ± 5.6 years, BN <i>n</i> = 20, BED <i>n</i> = 3); G CBT <i>n</i> = 73 (Age: 27.7 ± 5.3 years, BN <i>n</i> = 48, BED <i>n</i> = 25); EG PED-t <i>n</i> = 76 (Age: 28.2 ± 6.2 years, BN <i>n</i> = 49, BED <i>n</i> = 27)	Pre, post and follow-up (at 6 and 12 months) CG: no intervention G CBT: CBT; 1–2 sessions/wk for 16 weeks; total of 20 sessions EG PED-t: Dietary treatment + theoretical sessions on exercise physiology and exercise principles + strength and strength-endurance training (1–2 supervised strength sessions/week combined with dietary therapy + 2 unsupervised sessions/week [1 strength session + 1 HIIT session]) 20 sessions over 16 weeks (1–2 supervised sessions/week + 2 unsupervised sessions/week); (n/s)
Vancampfort et al. (2014a)	Exploratory one-group repeated measures	<i>N</i> = 34 females (<i>n</i> = 31) (Age: 38.5 ± 10.7 years, BED completed the 6-month program)	Pre and follow-up (at 3 and 6 months) CBT, 1 session/wk; 105 min/session + PE intervention; (n/s). 6 months (1 session/wk; 60 min/session); (group)

Note. AN = Anorexia Nervosa, BED = Binge Eating Disorder, BN = Bulimia Nervosa, CBT = Cognitive Behavioral Therapy, CE = Compulsive Exercise, CG = Control Group, CS = Case Study, DERS = Difficulties in Emotion Regulation Scale, EG = Experimental Group, FSCRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale, NRS = Non-Randomized Controlled Studies, NP = Nutritional Plan, n/s = Not Specified, OS = Observational Study, OSFED = Other Specified Feeding or Eating Disorder, PED-t = Physical Exercise and Dietary Therapy, QES = Quasi-Experimental Study, RCT = Randomized Controlled Trial, ROM = Range of Motion, SCS-SF = Self-Compassion Scale – Short Form, TMS = Toronto Mindfulness Scale.

Table 5
Characteristics of the included studies: instruments and main results

Author (year)	Instruments and measures	Results
Agne et al. (2022)	Accelerometer; graded exercise test on ergometer; 6RM strength test; SF-36; BMI; Anthropometry.	Improvements in quality of life in CG and SG, with larger effects in SG. The EG improved anthropometric differences without affecting skinfolds, body weight, or BMI.
Bakland et al. (2019)	Semi-structured interview.	Improvement in knowledge and in the application of PE and nutrition; positive evaluation of the support received during the intervention.
Bratland-Sanda and Vrabel (2018)	EDE-Q; SCL-5; BMI.	Significant reduction in EDE-Q and SCL-5 scores, and in exercise, along with an increase in BMI.
Bratland-Sanda et al. (2012)	EDE v12; EDI v2; accelerometer; Bruce treadmill protocol; 1RM test; body composition; BMI; DXA.	Patients with $\text{BMI} < 18.5$: increase in lower-body muscle strength, mean total body mass, fat mass, lean body mass, and BMI. Patients with $\text{BMI} \geq 18.5$: increase in upper-body muscle strength, fat mass, and BMI. Positive correlation between BMI and the EDI subscales of body dissatisfaction and bulimia, and negative correlation with the EDE restraint subscale.
Bratland-Sanda et al. (2018)	EDE v16; CET; 1RM test (half squats and bench press); BMD; DXA; energy intake (kcal/day) and daily PA (min/week); questionnaire on the intervention.	Improvement in the 1RM test and in BMD, with self-perceived psychological benefits. No changes were observed in menstrual dysfunction, weight, EDE, or CET.
Brennan et al. (2020)	EDE-Q 6.0; DERS; FSCRS; SCS-SF; TMS; ATSPPH-SF.	Only the EG showed improvements in binge-eating episode frequency, emotion regulation difficulties, self-criticism, self-compassion, and the ability to achieve mindfulness.
Dauty et al. (2022)	BMI; muscle strength (knee, biceps and triceps brachii, and handgrip); Shirado-Ito test; Biering-Sorensen test; balance; 6MWT; spirometry; hip DXA.	Weight gain, BMI, fat mass (trunk, upper and lower limbs) and BMD parameters remain stable. Significant improvement in walking distance, balance, respiratory function, upper- and lower-limb strength, and trunk strength endurance.
Diers et al. (2020)	BSQ; 5 self-developed open-ended questions.	Improved BSQ scores, mixed responses on post-intervention self-perception of body image.
Fernández-del-Valle et al. (2015a)	6RM test (bench press, leg press, and lateral row). ISAK anthropometry: BMI, TSF (mm), MTSF (mm), MUAC (cm) and MTC (cm); AMA (cm ²) and MTMA (cm ²) calculated using Heymsfield equations.	In the post-training phase, the EG was in higher percentile categories for MUAC and MTC compared with the CG, and AMA either increased or remained within the same range.

Note. AG = android-to-gynoid fat mass ratio; ALPHA Fitness Battery = Assessing Levels of Physical Activity and Fitness; AMA = Arm Muscle Area; Anthropometry ISAK = Anthropometry following International Standards for the Advancement of Kinanthropometry; AROM = Active Range of Motion; ATSPPH-SF = Attitudes Toward Seeking Professional Psychological Help – Short Form; Bd = Body Density; BES = Binge Eating Scale; BIA = Bioelectrical Impedance Analysis; BITE = Bulimic Investigatory Test, Edinburgh; BMD = Bone Mineral Density; BMI = Body Mass Index; BP = Blood Pressure; BPA = Baecke Physical Activity Questionnaire; BSAP = Bone-Specific Alkaline Phosphatase; BSQ = Body Shape Questionnaire; CBT = Cognitive Behavioral Therapy; CE = Compulsive Exercise; CET = Compulsive Exercise Test; CRF = Cardiorespiratory Fitness; DERS = Difficulties in Emotion Regulation Scale; DXA = Dual-Energy X-ray Absorptiometry; EDE v12 = Eating Disorder Examination v12; EDE v16 = Eating Disorder Examination v16; EDE-Q v6 = Eating Disorder Examination Questionnaire v6.0; EDI = Eating Disorder Inventory v2; EMA = Ecological Momentary Assessment; FIM = Functional Independence Measure; FM = Fat Mass; FSCRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale; HR = Heart Rate; MTMA = Mid-Thigh Muscle Area; MTC = Mid-Thigh Circumference; MTSF = Mid-Thigh Skinfold Thickness; MUAC = Mid-Upper Arm Circumference; NTX = Serum N-Telopeptide; PANAS = Positive and Negative Affect Schedule; PED-t = Physical Exercise and Dietary Therapy; POMA = Performance-Oriented Mobility Assessment; PSPP = Physical Self-Perception Profile; SCL-5 = Symptom Checklist-5; SCS-SF = Self-Compassion Scale – Short Form; SF-36 = 36-Item Short Form Health Survey; SMM = Skeletal Muscle Mass; ST = Strength Test; TMS = Toronto Mindfulness Scale; TSF = Triceps Skinfold Thickness; TUDS = Timed Up and Down Stairs Test; TUG = Timed Up and Go Test; VAT = Visceral Adipose Tissue; VSS = Vital Signs Stable; 3MWT = 3 Minutes Walking Test; 6MWT = 6 Minutes Walking Test; %BF = relative body fat.

Table 5 (continued)

Characteristics of the included studies: instruments and main results

Author (year)	Instruments and measures	Results
Fernández-del-Valle et al. (2015b)	6RM test (bench press, leg press, and lateral row); body weight (kg); height (m); skinfolds: biceps, triceps, subscapular, and suprailiac (mm); thigh, arm, and calf circumferences (cm); BMI; Durnin equation (Bd); Heyward equation (%BF); Poortmans equation (SMM).	Increase in BMI, skeletal muscle mass and relative strength in EG. Increases in fat mass in the CG. The group effect was not significant for SMM, FM, or %BF.
Fernández-del-Valle et al. (2014)	Accelerometer; graded treadmill test; BMI; muscle strength (seated bench press, seated lateral row, seated leg press); 3-m and 10-m TUG; TUDS.	Significantly greater improvement in the EG compared with the CG after the intervention in leg press, bench press, and lateral row, as well as beneficial effects on agility.
Fisher and Schenkman (2012)	Musculoskeletal system: Upper/lower quartile screening, weight, height, BMI, numerical rating scale. Neuromuscular system: light sensitivity, AROM, observation. Cardiopulmonary system: Cardiopulmonary system: BP, resting HR, activity HR, oxygen saturation. Integumentary system: ulcer identification. Cognitive system: orientation $\times 3$. Others: blood glucose level, dual-energy X-ray absorptiometry test; FIM, TUG(s), POMA, 3MWT.	Mean gain of 1.32 kg/week; recovery of independence in daily activities (improvements in FIM); improvements in POMA (postural stability Pre = 17; Post = 24), in TUG score (Pre = 19.27; Post = 11.00 s), and in walking speed (Pre = 0.35; Post = 0.81 m/s).
Galasso et al. (2018)	BMI; 6MWT	Non-significant greater reduction in BMI and 6MWT in the EG compared with the CG.
Galasso et al. (2020)	BMI; BES; BITE; 6MWT; ST.	Improvement in both CG and EG in anthropometric measures, ED symptoms, and exercise capacity. Significantly greater improvement in the EG compared with the CG
Lampe et al. (2022)	EDE-Q; EDE subscales: Shape Concern and Weight Concern; EMA; PANAS; accelerometer; item on weekly duration of moderate-to-vigorous PA.	Reduction in weight and shape concern, negative affect, and binge and compensatory/purging episodes. Weekly PE goals were not achieved, and perceived control over weight did not decrease.
Martin et al. (2017)	Sociodemographic questionnaire; physical examination; blood analysis (sex steroids and vitamin D); BMI. Measurement of vital signs every 4 hours; pulse and blood pressure at rest after 5 minutes of rest and after standing for 2 minutes.	Significantly greater reduction in VSS in the EG compared with the CG, but no differences in BSAP, NTX, osteocalcin, weight, or length of stay.

Note. AG = android-to-gynoid fat mass ratio; ALPHA Fitness Battery = Assessing Levels of Physical Activity and Fitness; AMA = Arm Muscle Area; Anthropometry ISAK = Anthropometry following International Standards for the Advancement of Kinanthropometry; AROM = Active Range of Motion; ATSPPH-SF = Attitudes Toward Seeking Professional Psychological Help – Short Form; Bd = Body Density; BES = Binge Eating Scale; BIA = Bioelectrical Impedance Analysis; BITE = Bulimic Investigatory Test, Edinburgh; BMD = Bone Mineral Density; BMI = Body Mass Index; BP = Blood Pressure; BPA = Baecke Physical Activity Questionnaire; BSAP = Bone-Specific Alkaline Phosphatase; BSQ = Body Shape Questionnaire; CBT = Cognitive Behavioral Therapy; CE = Compulsive Exercise; CET = Compulsive Exercise Test; CRF = Cardiorespiratory Fitness; DERS = Difficulties in Emotion Regulation Scale; DXA = Dual-Energy X-ray Absorptiometry; EDE v12 = Eating Disorder Examination v12; EDE v16 = Eating Disorder Examination v16; EDE-Q v6 = Eating Disorder Examination Questionnaire v6.0; EDI = Eating Disorder Inventory v2; EMA = Ecological Momentary Assessment; FIM = Functional Independence Measure; FM = Fat Mass; FSCRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale; HR = Heart Rate; MTMA = Mid-Thigh Muscle Area; MTC = Mid-Thigh Circumference; MTSF = Mid-Thigh Skinfold Thickness; MUAC = Mid-Upper Arm Circumference; NTX = Serum N-Telopeptide; PANAS = Positive and Negative Affect Schedule; PED-t = Physical Exercise and Dietary Therapy; POMA = Performance-Oriented Mobility Assessment; PSPP = Physical Self-Perception Profile; SCL-5 = Symptom Checklist-5; SCS-SF = Self-Compassion Scale – Short Form; SF-36 = 36-Item Short Form Health Survey; SMM = Skeletal Muscle Mass; ST = Strength Test; TMS = Toronto Mindfulness Scale; TSF = Triceps Skinfold Thickness; TUDS = Timed Up and Down Stairs Test; TUG = Timed Up and Go Test; VAT = Visceral Adipose Tissue; VSS = Vital Signs Stable; 3MWT = 3 Minutes Walking Test; 6MWT = 6 Minutes Walking Test; %BF = relative body fat.

Table 5 (continued)*Characteristics of the included studies: instruments and main results*

Author (year)	Instruments and measures	Results
Martínez-Sánchez et al. (2020)	BIA; blood biochemical composition; accelerometer; ALPHA-Fitness Battery: handgrip strength, upper-body strength, standing long jump test, 4×10 m shuttle run test, 20 m shuttle run test.	After the program, height, plasma calcium, and sleep efficiency increased significantly, while plasma follicle-stimulating hormone, sleep duration, and nighttime disturbances decreased. Overall, no differences were detected in body composition.
Mathisen et al. (2018a) ¹	Seca scale, dual-energy X-ray absorptiometry, fat mass, %fat mass, lean body mass, VAT, WHR, BMD; CRF; 1RM test: Smith machine squats, bench press, and seated cable row; categorization into high-risk groups for non-communicable disease if at least two of the three high-risk assessment categories are met: (1) elevated BMI, high body fat percentage, or masked obesity; (2) elevated VAT levels; and/or (3) low VO ₂ peak.	Improvement in the EG compared with the CG (with moderate to large effect sizes) in mean absolute VO ₂ peak, 1RM test for squat, bench press, and seated row, proximal femur BMD, and proximal femur BMD-Z. Body composition deteriorated in both groups during follow-up. Neither PED-t nor CBT reduced the risk of non-communicable diseases.
Mathisen et al. (2018b) ²	EDE-Q; CET; ActiGraph Accelerometer	Reduction in EG of CE from baseline, but no difference with CG. The proportion of participants meeting the official PA recommendation did not change or differ between groups after the intervention.
Vancampfort et al. (2014a)	EDE-Q; 6MWT; SF-36; BPA; PSPP	Significant improvement in all parameters (except occupational PA, physical strength, and self-esteem) after 6 months. Increased participation in sports activities (large effect size) and a reduction (small effect size) in the number of binge episodes, which was associated with significant improvements in quality of life. Significant increases in leisure-time PA (BPA) were associated with significant improvements in quality of life (SF-36) and increased perceived sport competence, physical condition, and body attractiveness.

Note. AG = android-to-gynoid fat mass ratio; ALPHA Fitness Battery = Assessing Levels of Physical Activity and Fitness; AMA = Arm Muscle Area; Anthropometry ISAK = Anthropometry following International Standards for the Advancement of Kinanthropometry; AROM = Active Range of Motion; ATSPPH-SF = Attitudes Toward Seeking Professional Psychological Help – Short Form; Bd = Body Density; BES = Binge Eating Scale; BIA = Bioelectrical Impedance Analysis; BITE = Bulimic Investigatory Test, Edinburgh; BMD = Bone Mineral Density; BMI = Body Mass Index; BP = Blood Pressure; BPA = Baecke Physical Activity Questionnaire; BSAP = Bone-Specific Alkaline Phosphatase; BSQ = Body Shape Questionnaire; CBT = Cognitive Behavioral Therapy; CE = Compulsive Exercise; CET = Compulsive Exercise Test; CRF = Cardiorespiratory Fitness; DERS = Difficulties in Emotion Regulation Scale; DXA = Dual-Energy X-ray Absorptiometry; EDE v12 = Eating Disorder Examination v12; EDE v16 = Eating Disorder Examination v16; EDE-Q v6 = Eating Disorder Examination Questionnaire v6.0; EDI = Eating Disorder Inventory v2; EMA = Ecological Momentary Assessment; FIM = Functional Independence Measure; FM = Fat Mass; FSCRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale; HR = Heart Rate; MTMA = Mid-Thigh Muscle Area; MTC = Mid-Thigh Circumference; MTSF = Mid-Thigh Skinfold Thickness; MUAC = Mid-Upper Arm Circumference; NTX = Serum N-Telopeptide; PANAS = Positive and Negative Affect Schedule; PED-t = Physical Exercise and Dietary Therapy; POMA = Performance-Oriented Mobility Assessment; PSPP = Physical Self-Perception Profile; SCL-5 = Symptom Checklist-5; SCS-SF = Self-Compassion Scale – Short Form; SF-36 = 36-Item Short Form Health Survey; SMM = Skeletal Muscle Mass; ST = Strength Test; TMS = Toronto Mindfulness Scale; TSF = Triceps Skinfold Thickness; TUDS = Timed Up and Down Stairs Test; TUG = Timed Up and Go Test; VAT = Visceral Adipose Tissue; VSS = Vital Signs Stable; 3MWT = 3 Minutes Walking Test; 6MWT = 6 Minutes Walking Test; %BF = relative body fat.

Discussion

This review provides evidence that physical exercise (PE) can serve as an effective therapeutic tool for patients diagnosed with an eating disorder (ED). It shows that the prescription of PE, when supervised by professionals and implemented by a multidisciplinary team, can be safe and offer multiple benefits for individuals with such disorders (Cook et al., 2016).

Improvements in ED Symptomatology Through the Inclusion of PE in Treatment

A total of 35% of the studies ($n = 7$) did not describe the intervention characteristics in sufficient detail (for example, the volume or intensity of PE), providing only general information about the type of PE (e.g., Bakland et al., 2019; Mathisen et al., 2018b). Furthermore, the instruments used to assess symptomatology were heterogeneous (e.g., EDE-Q [Eating Disorder Examination Questionnaire], BITE [Bulimic Investigatory Test Edinburgh], BSQ [Body Shape Questionnaire], and semi-structured interviews), as each focused on different dimensions.

In this regard, in the present systematic review, the effectiveness of the interventions could not be determined based on specific improvements in ED symptomatology; it could only be examined according to the degree of adherence and the changes in reported outcomes obtained after the PE program. Nevertheless, even though the efficacy

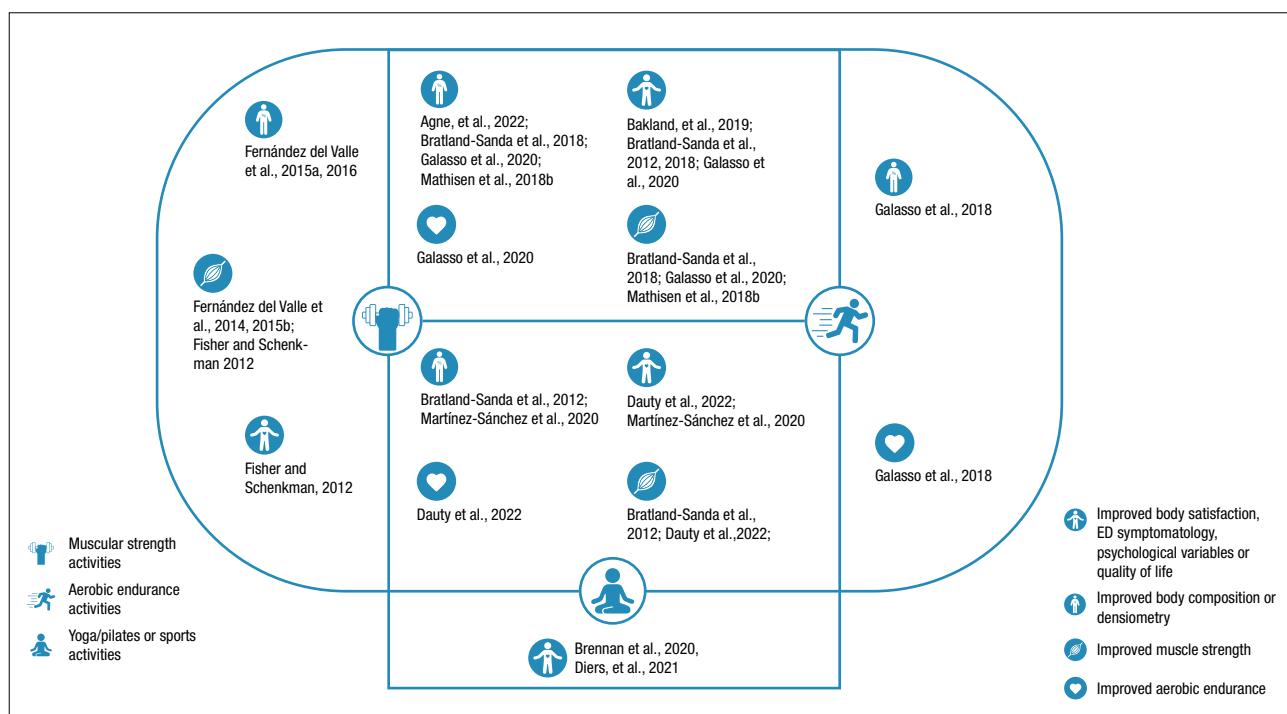
criteria were not standardized, only one study concluded that including PE in the treatment for EDs was not more or equally effective in experimental groups compared to CG (Mathisen et al., 2018b).

In this case, as the authors themselves point out, the lack of significant differences could be due to the low statistical power resulting from the small sample size and the high dropout rate in the control group. The remaining studies concluded that prescribed exercise provided greater efficacy.

As illustrated in Figure 2, the results indicated both psychological and physical benefits after performing PE as part of ED treatment. Consequently, the findings suggest that PE therapy for patients with EDs (AN, BN, BED, or OSFED) is safe and beneficial for both ED symptomatology and overall physical and mental health, although identifying a single specific type of PE remains challenging (Mathisen et al., 2023; Toutain et al., 2022). In this regard, strength training targeting major muscle groups showed significant increases in strength based on the 5RM test after 16 weeks of weight training and the 70% 6RM test after 8 weeks (Bratland-Sanda et al., 2018; Fernández-del-Valle et al., 2014). Previous reviews involving AN patients have also confirmed improvements in muscle strength through PE with resistance training, both with and without weights, after 12 weeks of training, and through bench press and leg press tests following 8 weeks of high-intensity strength training (Miñano-Garrido et al., 2022).

Figure 2

Synthesis of studies showing improvements in ED symptomatology, body composition, and physical fitness according to the type of PE applied in treatment



More specifically, Vancampfort et al. (2014b) concluded that a program combining aerobic and strength-endurance training for patients with AN and BN resulted in increased muscle strength, BMI, and body fat percentage. Similar findings were observed in non-clinical samples. Recent review studies, such as Mikkonen et al. (2024), indicate that regular strength and endurance training leads to gains in both strength and endurance capacity in healthy adult women.

However, in addition, a combined program including aerobic exercise, yoga, and basic body-awareness therapy in patients with AN and BN promoted reductions in eating disorder symptomatology and depressive symptoms. Notably, this review identified a larger number of studies analyzing the benefits of strength and aerobic-resistance training. It is particularly important to highlight the difficulty and complexity of performing aerobic exercise in patients with AN, since excessively intense activity—especially aerobic modalities such as running or swimming—may be inappropriate for individuals with severe malnutrition due to its high energy expenditure requirements, which could lead to further weight loss or other medical risks (Heinl, 2018). Moreover, aerobic PE is generally avoided in the care of patients with AN, as they often show a strong drive for physical activity and an inability to remain still—commonly referred to as a "drive for activity."

It should be noted that although, in individuals with an ED, the goal is usually to restore BMI by increasing it, Galasso et al. (2018) reported an improvement in aerobic capacity but also a reduction in BMI, possibly because the sample consisted of patients diagnosed with BED who presented obesity ($BMI \geq 30$). Similarly, Martínez-Sánchez et al. (2020) found no changes in body composition or physical condition after the Pilates program, although they did observe a slight increase in BMI percentile among women with higher weight. This was likely because the participants were adolescents and possibly in a period of restoration and stabilization of body composition, so Pilates helped maintain this stability. In fact, Kibar et al. (2016) found that an 8-week Pilates program in healthy women had beneficial effects on muscle strength (abdominal and lumbar), as well as on static balance and flexibility. It should also be noted that the present review did not identify physical changes after Pilates or yoga interventions, as the variables evaluated in these studies focused on behavioral aspects rather than physical condition (Brennan et al., 2020; Diers et al., 2020).

At the physiological level, as in healthy women (Hsu et al., 2024), PE was also found to improve bone health in women with EDs, who often show low bone mineral density (BMD), deteriorated bone structure, and reduced bone strength (Bratland-Sanda et al., 2018; Mathisen et

al., 2018b)—effects that may be further worsened by the negative influence of antidepressants (DiVasta et al., 2017). It will be important to take BMD values into account, as low levels increase the risk of osteoporosis and, consequently, the likelihood of experiencing pain and fractures in adulthood (Lopes et al., 2022).

Among the experimental studies in this review, a reduction was recorded in compulsive exercise, the drive for thinness, and bulimic symptoms in ED patients who engaged in PE. Improvements were also observed in body satisfaction (Bakland et al., 2019; Bratland-Sanda & Vrabel, 2018; Diers et al., 2020), as well as in mood, quality of life, and well-being (Agne et al., 2022; Bakland et al., 2019; Brennan et al., 2020; Vancampfort et al., 2014a). The mental benefits and improvements in pathological behaviors related to CE reported by Bakland et al. (2019) and Mathisen et al. (2018b) were likely due to the fact that therapeutic exercise treatment can help reduce patients' anxiety and "drive for thinness," decrease compulsive engagement in exercise, provide enjoyment, and contribute to better mood and body image (Cook et al., 2011; Vancampfort et al., 2014b).

Characteristics of PE for Improving ED Symptomatology in Treatment

This review revealed substantial variability and a lack of systematization in PE prescription—similar to the findings of the systematic review by Moola et al. (2013)—making it difficult to determine specific characteristics or guidelines for incorporating PE into ED treatment.

Focusing on training variables, and specifically on external load, these were heterogeneous. Regarding intensity and volume in strength training, most programs applied moderate loads (around 50% of 1RM or 70% of 6RM, with 6–15 repetitions and 1–5 sets; Agne et al., 2022; Fernández-del-Valle et al., 2015a). For strength-endurance training, loads were not specified (Mathisen et al., 2018b), while for range-of-motion exercises, work durations of 15–60 seconds and 2–4 sets were reported (Dauty et al., 2022; Fisher & Schenkman, 2012). On the other hand, similarities were found in the strength exercises included, as most involved multi-joint movements and large muscle groups (e.g., seated row, bench press, leg press, leg extension, lat pulldown, trunk curl, back extension, and push-ups; Bratland-Sanda et al., 2018; Fernández-del-Valle et al., 2015a). As for aerobic activity, the interventions were much more diverse, both in activity type (e.g., varied sports; Dauty et al., 2022) and in structure—pyramidal intervals (Bakland et al., 2019), high-intensity intervals (Mathisen et al., 2018b)—and in external load. Despite this heterogeneity, the programs produced beneficial effects.

Cook et al. (2016) concluded that tailoring the exercise mode to individual needs is one of the most therapeutically important principles. Therefore, applying the principle of individualization is key, including the type of exercise itself. In this sense, authors such as Bratland-Sanda and Vrabel (2018), Lampe et al. (2022), or Vancampfort et al. (2014a) allowed participants to choose their preferred activity type and found improvements in ED psychopathology and quality of life, likely due to increased motivation to engage in enjoyable activities. It is important to note that factors such as enjoyment, motivation, choice, social interaction, and sense of belonging (White et al., 2018) also influence the relationship between physical activity and mental health.

On the other hand, mind-body interventions (e.g., pilates or yoga) have also been used as treatment in EDs, as they appear to positively influence body image and reduce ED symptomatology (Hall et al., 2016; Vancampfort et al., 2014a). In fact, Sánchez and Munguía-Izquierdo (2017) stated that yoga has the potential to promote body self-awareness—that is, the ability to experience the body from within through meditation, physical movement, and breathing.

The heterogeneity of PE characteristics identified in this review may also be explained by the inclusion of various ED diagnoses (AN, BN, OSFED, and BED), unlike previous reviews that focused on a single manifestation (Toutain et al., 2022). The spectrum of eating-related behavior differs depending on diagnosis, suggesting that each ED type requires a specific exercise prescription adapted to its particularities.

Given all the above and the difficulty of determining common PE guidelines for ED patients, it is proposed that before initiating exercise in these individuals, it is necessary to reconsider what physical activity means to them, as the personal meaning of PE must change (Cook et al., 2016). The goal is not to eliminate exercise from daily life but to educate the person to understand movement as a complement to psychotherapy or nutrition. Thus, when individuals return to the gym or resume PE after recovery, they will perceive the activity as enjoyable and healthy. If this shift in perspective is not addressed, there is also a risk that the ED may become chronic (Rizk et al., 2020) or that maladaptive exercise patterns may increase the risk of injury. For these reasons, and as a final conclusion, PE should not be withdrawn from ED patients but rather adapted and ensured to be carried out under supervision and with the approval of both a therapist and a qualified exercise professional.

Limitations

Despite the contributions of the present work, some limitations should be mentioned. On the one hand, in some

cases the studies did not specify what type of stimuli were used or provided little detail regarding the training variables applied to the patient. On the other hand, the heterogeneity of the interventions in terms of analyzed variables, content, duration, and assessment timing made it difficult to compare the results among studies, highlighting the need for further research. Likewise, in order to obtain a substantial number of articles for the review, studies with different methodological designs were included, many of them with limited sample sizes and heterogeneous use of assessment measures and instruments.

Conclusions

This systematic review summarizes the evidence that participation in structured PE programs (aerobic endurance, muscle strength, strength-endurance, or yoga exercises) can be highly beneficial for this clinical population, as it reduces ED symptomatology, improves quality of life and psychological well-being, increases muscle strength and cardiorespiratory capacity, and enhances BMD and anthropometric measures. However, there is still insufficient research to develop a systematic and standardized methodology for prescribing PE as an adjunctive treatment for EDs. Moreover, the inclusion of various ED manifestations in this review made it difficult to identify specific and common guidelines, since each type presents unique nuances and characteristics. For this reason, in future work we aim to analyze and detail the reviewed studies individually, focusing on the similarities according to the type of ED, specifically AN, BN, and BED.

Along the same lines, this also makes it difficult to determine the specific characteristics that PE should have for this population. It has been shown that structured PE programs—including aerobic endurance, muscle strength, strength-endurance, or yoga exercises—significantly improve symptomatology. In general terms, the interventions that have improved the physical or mental symptomatology of individuals diagnosed with EDs are based on the use of light to moderate loads, both for strength and for aerobic endurance, progressively increased while respecting the principle of individualization.

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