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REVIEW

A systematic review of physical therapy interventions for patients with anorexia and bulimia nervosa

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Abstract

Purpose: The purpose of this systematic review was to summarise the evidence from randomised controlled trials examining the effectiveness of physical therapy compared with care as usual or a wait-list condition on eating pathology and on physiological and psychological parameters in patients with anorexia and bulimia nervosa. **Method:** EMBASE, PsycINFO, PubMed, Cumulative Index to Nursing and Allied Health Literature, Physiotherapy Evidence Database and The Cochrane Library were searched from their inception until February, 2013. Articles were eligible if they utilised a randomised controlled trial design, compared physical therapy with a placebo condition, control intervention, or standard care and included patients with anorexia and bulimia nervosa. The methodological quality was assessed with the Jadad scale. **Results:** Eight randomised controlled trials involving 213 patients (age range: 16–36 years) met all selection criteria. Three of the 8 included studies were of strong methodological quality (Jadad score ≥ 3). Major methodological weaknesses were attrition and selection bias. The main results demonstrate that aerobic and resistance training result in significantly increased muscle strength, body mass index and body fat percentage in anorexia patients. In addition, aerobic exercise, yoga, massage and basic body awareness therapy significantly lowered scores of eating pathology and depressive symptoms in both anorexia and bulimia nervosa patients. No adverse effects were reported. **Conclusions:** The paucity and heterogeneity of available studies limits overall conclusions and highlights the need for further research.

► Implications for Rehabilitation

- Supervised physical therapy might increase weight in anorexia nervosa patients.
- Aerobic exercise, massage, basic body awareness therapy and yoga might reduce eating pathology in patients with anorexia and bulimia nervosa.
- Aerobic exercise, yoga and basic body awareness therapy might improve mental and physical quality of life in patients with an eating disorder.

Introduction

Eating disorders are characterised by disturbances in eating behaviour often accompanied by feelings of distress and concerns about one's body weight or shape [1]. Anorexia and bulimia nervosa are the two major formal diagnostic categories of eating disorders [1]. Anorexia nervosa is characterised by severe food

restriction, maintenance of an abnormally low body weight, intense fear of weight gain, and body image disturbance. Excessive exercise affects up to 80% of anorexia nervosa patients and has been associated with negative emotionality [2]. Patients with anorexia nervosa who engage in excessive exercise report intense feelings of guilt accompanied by a severe fear of weight gain when exercise is postponed. They have an intense aversion of fat and report that their primary reason to exercise is to influence weight and shape [3]. The core feature of bulimia nervosa is loss of control over the eating behaviour resulting in binge eating and purging. Binge eating involves taking in an abnormally large quantity of food in a discrete time period and feeling a lack of

Keywords

Anorexia nervosa, bulimia nervosa, exercise, physical activity, physical therapy

History

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control during the episode. Compensatory behaviours occur after a binge and might include vomiting, laxative or other diet medication use, fasting, or excessive exercise. Often, patients with bulimia nervosa eat at irregular intervals, and long periods of fasting trigger food cravings and then binge/purge cycles.

Lifetime prevalence estimates of anorexia nervosa and bulimia nervosa in the US are between 0.9% and 1.5% among women and between 0.3% and 0.5% among men [4]. It is known that cultural, social, and interpersonal factors can trigger onset of the illnesses, while changes in neural networks can sustain anorexia and bulimia nervosa [4]. Both eating disorders are also associated with significant impairment of physical health and psychosocial functioning [5] and carry increased risk of death [6]. The physical abnormalities seen in anorexia nervosa seem to be largely secondary to these patients' disturbed eating habits and their compromised nutritional state. Hence, most impairments are reversed by restoration of healthy eating habits and sound nutrition, with the possible exception of reduced bone density [4,7]. The main physical features of anorexia nervosa include decreased bone integrity (osteopenia leading to osteoporosis), weak proximal muscles, bradycardia, gastrointestinal symptoms, dizziness and syncope and amenorrhea [4,7]. The physical abnormalities seen in bulimia nervosa are usually minor unless vomiting, or laxative or diuretic misuse are frequent, in which case there is risk of electrolyte disturbance [4,7]. Eating disorders also present with psychiatric co-morbidity in a number of important areas, including depression, bipolar disorder, anxiety disorders (obsessive-compulsive disorder, panic disorder, social anxiety disorder, other phobias, and post-traumatic stress disorder) and substance abuse [8,9]. Because of co-morbid physical and psychiatric conditions, eating disorders have been characterised as one of the most difficult psychiatric conditions to treat [10].

Several treatments have been tested for anorexia and bulimia nervosa [11,12]. This research provides a small body of evidence for the efficacy of cognitive behavioural therapy in the treatment of bulimia nervosa, but limited, if any, evidence for other psychosocial approaches. Evidence from pharmacological trials has been able to support positive short term effects of treatment using selective serotonin reuptake inhibitors in bulimia nervosa [13,14]. Additionally, pharmacological agents have been mainly tested in adults, and the results may not be generalised to adolescents [4]. Moreover, the use of antidepressant drugs in adolescents is controversial because of potential increase in suicide risk [15]. Progress has been made in psychosocial and pharmacological treatment of adolescent anorexia nervosa, but not for the adult expression of this disorder [4]. In general, it might be stated that current treatments for anorexia and bulimia nervosa are only moderately successful, indicating that an advancement of psychological and physical treatments is urgently needed.

Since a distorted body image and exercise behaviour are central in the course of both disorders [16–18], and patients perceive improving self-esteem and body experience as core constructs which influence their treatment [19], physical therapy might be a treatment modality that has great potential. In the 1980s Vandereycken, Probst, and Meermann [20] recommended the addition of physical therapy (including adapted physical activity, yoga, tai chi, dance, and mirror feedback) to treatment programmes. A recent review [21] has demonstrated that aerobic exercise and yoga can benefit individuals with a binge eating disorder. The results suggested that aerobic exercise and yoga can decrease the number of binges per day and increase body mass index. Moreover, aerobic exercise can reduce depressive symptoms [21]. Previous reviews [22–24] on physical activity in the multidisciplinary treatment of anorexia and bulimia nervosa

provided some evidence to support the implementation of moderate physical activity for weight restoration in anorexia nervosa and improved body satisfaction, positive mood states and quality of life in both anorexia and bulimia nervosa. The conclusions of these systematic reviews were mainly based on data from uncontrolled trials, and the findings, therefore, should be interpreted with caution. To the best of our knowledge, no systematic reviews of randomised controlled trials for different physical therapy modalities (aerobic and strength training, relaxation training, basic body awareness exercises, yoga and massage) are available. Thus, the question as to whether these physical therapy interventions are an effective addition to the multidisciplinary management of anorexia and bulimia nervosa remains largely unanswered. The purpose of this systematic review was to summarise the evidence from randomised controlled trials examining the effectiveness of physical therapy compared with care as usual or a wait-list condition on eating pathology and on physiological and psychological parameters in patients with anorexia and bulimia nervosa.

Methods

Procedure

A systematic review was undertaken in accordance with the Cochrane handbook [25] and is reported in line with the PRISMA statement [26]. No restrictions were made regarding the language of publication. EMBASE, PsycINFO, PubMed, Cumulative Index to Nursing and Allied Health Literature, Physiotherapy Evidence Database, and the Cochrane Library were searched from their inception until February 1, 2013. Keywords used as part of the search included “anorexia” OR “bulimia” AND “physical therapy” OR “physiotherapy” OR “exercise” OR “rehabilitation”. Two independent reviewers screened the titles and abstracts of publications found in the databases. Each investigator screened and selected articles based on the eligibility criteria, if there was inadequate information to make a decision, a copy of the article was obtained. The next phase of the search strategy involved searching for unpublished studies and for studies potentially overlooked or absent from the databases. This involved hand searching the references (citation chasing) of all retrieved articles. In order to locate unpublished research, we searched web sites housing details of clinical trials, theses, or dissertations.

Quality assessment

Assessments of quality were completed independently by the two reviewers. Disagreements were resolved by discussion. The protocol stated that if no consensus was achieved, a third reviewer should make the final decision. This was not required during this process. Study quality and potential for bias was assessed using the previously validated 5-point Jadad scale [27,28]. The scale focuses on three dimensions of internal validity: quality of randomisation, double blinding, and withdrawals. A score of 0 to 5 is assigned, with higher scores indicating higher quality in the conduct or reporting of a trial. A trial scoring at least 3 is considered to be methodologically strong. Inter-rater reliability of the methodological assessment of the ratings in this study, using the intraclass correlation coefficient (ICC), was 0.96 (95% confidence interval = 0.93–0.97).

Eligibility criteria

Participants

Inclusion in this review was restricted to studies of patients who had a formal diagnosis of anorexia nervosa or bulimia nervosa. When patients with eating disorders not otherwise specified were

included, at least two third of the entire sample consisted of patients who suffer with anorexia nervosa or bulimia nervosa. We did not exclude trials because of the age, nationality, or the gender of the participants.

Interventions

The experimental physical therapy interventions had to comprise of one of the following types of exercises; aerobic exercises, resistance training, relaxation training, basic body awareness therapy, yoga, massage or a combination of these in accordance with the World Confederation for Physical Therapy position statement [29]. Aerobic exercise has been defined here in accordance with Caspersen et al. [30] as physical activity that is planned, structured, repetitive and purposive in the sense that improvement or maintenance of physical fitness or health is an objective.

Control group

The physical therapy intervention of the study could be used alone or in conjunction with other interventions. However, articles were excluded if the specific effects of the physical therapy intervention could not be separated from other active components in the intervention. Standard care was defined as care that people would normally receive had they not been included in the research trial. Such care would include hospitalisation, community psychiatric nursing support, and outpatient care. The control interventions could consist of care as usual or a wait-list condition.

Outcome measures

The outcome measure of each trial was required to consider one of the following measures; eating pathology, anthropometric (body mass index, percentage body fat or lean body mass), physiological (muscle strength or endurance) or psychological (quality of life, anxiety or depression) variables using validated assessment tools.

Study design

Studies were considered eligible for inclusion if they included a randomised controlled trial design that compared physical therapy interventions with a placebo condition, control intervention, or standard care. For a randomised controlled trial to be included, the experimental and comparison interventions must have had similar durations.

Results

Study selection

The initial electronic database search resulted in a total of 7085 articles (see Figure 1). Through additional manual searches of reference lists and searches of Web sites, one other potentially eligible article was identified. After the removal of duplicates and screening of titles, abstracts, or full texts, eight randomised controlled trials [31–38] were included. Only English-language studies were found. On the basis of the first full-text screening, we decided that there was too much heterogeneity in study designs, protocols, physical therapy interventions used and outcome measures to apply a formal meta-analysis or a level of evidence synthesis.

Participants

In total, 213 participants ($\sigma = 9$) with eating disorders were included in the analyses. Bulimia nervosa was diagnosed in 50.7% ($n = 108$), anorexia nervosa in 42.2% ($n = 90$). The formal diagnosis of the remaining 7.1% ($n = 15$) patients was

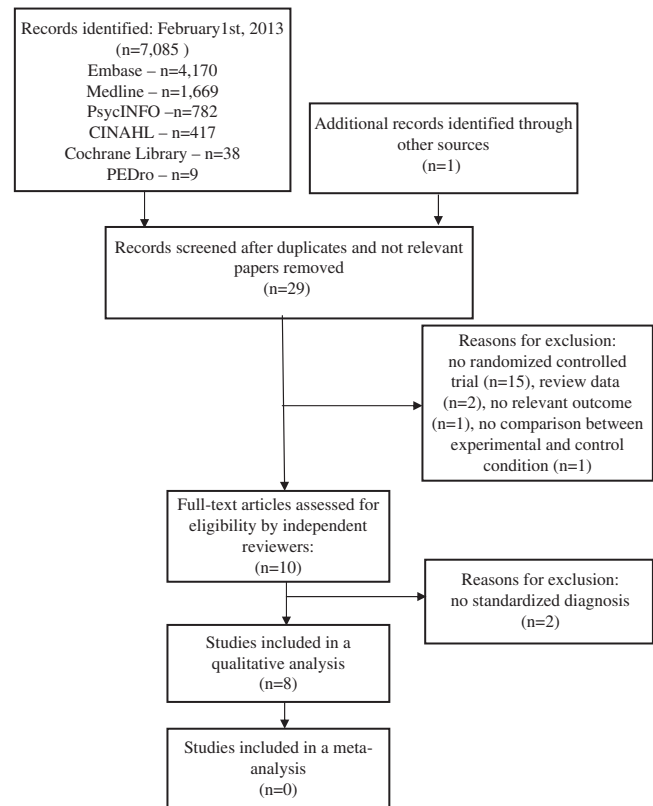


Figure 1. Flow chart of systematic review inclusion and exclusion.

not provided. Only one study [35] included inpatients. The participants ranged in age from 16 to 36 years. Detailed information on the characteristics of the participants is provided in Table 1.

Methodological quality

As can be noticed in Table 1, three of the included studies [36–38] had a Jadad score of at least 3 indicating a strong methodological quality. Major methodological weaknesses included; the small sample sizes, ranging from 12 [32] to 64 [34], a lack of power-analyses and double blinding in all studies [31–38] and the lack of information on the allocation concealment in five studies [31–35].

The effect of physical therapy on eating pathology outcomes

Four studies [31,33,34,38] using the Eating Disorder Inventory each added a different modality of physical therapy to standard care with the following results (see Table 1). The addition of a massage-programme resulted in significantly lower overall Eating Disorder Inventory scores in patients with bulimia [29] ($p < 0.001$) and anorexia nervosa [31] ($p < 0.05$). Adding basic body awareness exercises resulted in lower overall Eating Disorder Inventory scores than standard care alone [36] ($p = 0.015$). Sundgot Borgen et al. [34] found that bulimia patients who followed a combination of aerobic and strength training reported less binges per week ($p = 0.002$) and less post-treatment body dissatisfaction and drive for thinness as measured with the Eating Disorder Inventory than patients who followed cognitive behavioural therapy or nutrition counselling or those allocated to a wait list ($p < 0.001$). Carei et al. [36] demonstrated that following 8 weeks, twice a week, yoga also resulted in significantly lower Eating Disorder Examination scores compared to those in a wait-list control condition ($p = 0.05$).

Table 1. Details of the included randomised controlled trials.

| Authors | Participants | Intervention experimental versus control | Duration | Frequency | Intensity | Relevant outcomes (experimental versus controls) | Relevant instruments | Adverse effects | Co-interventions | Jadad score |
|----------------------------|---|--|----------|-----------------|-----------------------------|---|---|-----------------|---|-------------|
| Field et al. [31] | 24♀ in- or outpatients with BN; 16–21 yrs | massage 15 min in a supine and 15 min in prone position + CAU (<i>n</i> = 12) versus CAU (<i>n</i> = 12) | 5 weeks | 2 × week 30 min | / | lower EDI (−38.9, <i>p</i> < 0.001), CES-D (−9, <i>p</i> = 0.001), dopamine (+64.3 ng/ml, <i>p</i> = 0.05) and urinary cortisol (−129.8 ng/ml, <i>p</i> = 0.05) in massage group versus (+0.5, NS; −7.9, <i>p</i> = 0.05; −32.9 ng/ml, NS; −21.7 ng/ml, NS) in CAU; no significant catecholamine and dopamine changes | EDI CES-D urinary cortisol, catecholamine, dopamine | no | CAU = family + community + non-verbal therapy + nutrition education | 2 |
| Thien et al. [32] | 12 (11♀) outpatients with AN; 17–45 yrs; BMI exercisers = 20.3 ± 1.8, controls = 17.2 ± 1.6 | graded exercise (<i>n</i> = 5): stretching, isometric and cardiovascular exercises + CAU versus CAU (<i>n</i> = 7) (including limiting exercise) | 3 months | 3 × week | low | exercisers increase in BMI of 1.0 ± 1.3 and BF of 0.9 ± 2.1% versus 0.8 ± 1.1 and 0.5 ± 2.6% (<i>p</i> _{group-diff} = 0.37 and 0.39) and improved total SF-36 score (+6.6 ± 7.0) versus (−12.0 ± 25.5) <i>p</i> _{group-differences} = 0.07 | SF-36 | no | CAU = weight + BF measurement | 2 |
| Hart et al. [33] | 19♀ in- or outpatients with AN; 25–9 yrs; BMI in massage group and CAU respectively | massage 15 min in a supine and 15 min in prone position + CAU versus CAU | 5 weeks | 2 × week | / | lower EDI (−22.8, <i>p</i> < 0.05), dopamine (+106.0 ng/ml, <i>p</i> < 0.05), norepinephrine, (+8.9 ng/ml, <i>p</i> < 0.05) in massage group versus (−2.6, NS; −9.6 ng/ml, NS; −4.9 ng/ml, NS) in CAU, lower EDI in massage group: F(1, 17) = 5.3, <i>p</i> < 0.05; no significant CES-D, epinephrine and urinary cortisol changes | EDI CES-D urinary cortisol, catecholamine, dopamine | no | CAU = family + community + non-verbal therapy + nutrition education | 2 |
| Sundgot Borgen et al. [34] | 64♀ outpatients with BN; 18–29 yrs; BMI exercisers = 21 ± 2 | aerobic exercise + stretching (<i>n</i> = 12) versus CBT (<i>n</i> = 14) versus nutrition counselling (<i>n</i> = 17) versus wait list (<i>n</i> = 15) | 16 weeks | 1 × week 60 min | moderate: 50–70% VO2max | significant less binges/week (1.70 ± 2.87) (<i>p</i> = 0.002) and vomiting/week (2.4 ± 2.39) (<i>p</i> = 0.001) after 18 months follow-up in exercise group compared to 4.4 ± 3.37 and 2.70 ± 1.94 in CBT (NS for other conditions); 62% of the exercisers recovered from BN versus 36% in CBT at month 18; drive for thinness and body dissatisfaction on EDI improved most in exercisers (<i>p</i> _{group-differences} < 0.001) | EDI (drive for thinness, body dissatisfaction) | no | no | 2 |
| Chantler et al. [35] | 14♀ inpatients with AN; 15–36 yrs; BMI exercisers = 15.1 ± 1.1, controls = 16.5 ± 1.3 | strength training (2.5 kg dumbbells for upper body + therabands for lower-body + squats and crunches) + CAU versus CAU | 8 weeks | 2 × week 60 min | 3 sets 10 to 15 repetitions | increased BMI (+2.3, <i>p</i> = 0.006 versus (+1.3, <i>p</i> < 0.001), BF (+2.6%, <i>p</i> = 0.0176) versus (+1.9%, <i>p</i> < 0.001 for AC), only increased knee extensor and flexor (both <i>p</i> < 0.001) and elbow extensor (<i>p</i> < 0.01) peak torque in exercisers | isokinetic strength tests on the Cybex Norm | no | CAU | 2 |
| Carei et al. [36] | 50 (46♀) outpatients with AN (n = 29), BN (n = 9) or EDNOS (n = 15); 16.5 ± 2.3 yrs | yoga (viniyoga) versus wait list | 8 weeks | 2 × week | / | lower EDE [−0.36 versus −0.6; F(2, 35) = 3.26, <i>p</i> _{group-differences} = 0.05, <i>η</i> ² = 0.16] 3 weeks post only in the yoga group; also reduction in BDI [F(2, 31) = 5.29, <i>p</i> = 0.01, <i>η</i> ² = 0.26], state anxiety [F(2, 35) = 4.28, <i>p</i> = 0.02, <i>η</i> ² = 0.21], trait anxiety [F(2, 35) = 10.92, <i>p</i> = 0.001, | EDE BDI STAI | no | no | 3 |

(continued)

Table 1. Continued

| Authors | Participants | Intervention experimental versus control | Duration | Frequency | Intensity | Relevant outcomes (experimental versus controls) group-effects | Relevant instruments | Adverse effects | Co-interventions | Jadad score |
|-------------------------------|--|--|----------|--|---|---|----------------------|-----------------|--------------------------------|-------------|
| del Valle et al. [37] | 22 (20 $\frac{2}{3}$) outpatients with AN; 12–16 yrs | strength training + CAU ($n = 11$) versus CAU ($n = 11$) | 3 months | 2 \times week 60–70 min | low (20–30% 6RM) to moderate (50–60% 6RM) | $\eta^2 = 0.38$ and BMI in yoga but no group-effects only improved muscle strength (+13.6 kg versus +0.9 kg) on the seated row test in exercisers ($p_{\text{group-differences}} = 0.009$), not for other strength exercises | 6RM | no | no | 3 |
| Catalán Matamoros et al. [38] | 22 (20 $\frac{2}{3}$) outpatients with AN ($n = 11$), BN ($n = 11$), mean age 28yrs | BBAT + CAU ($n = 14$) versus CAU ($n = 8$) | 7 weeks | 2 weeks 60 min once a week + 5 weeks 90 min twice a week | / | lower EDI, BAT, EAT-40 and the mental SF-36 component in BBAT compared to controls: mean post-scores differences are 26.3, $p = 0.015$; 33, $p = 0.012$; 17, $p = 0.039$ and 13, $p = 0.002$. | SF-36 EDI BAT EAT-40 | no | CAU (pharmacotherapy in 54.5%) | 3 |

AN, anorexia nervosa; BN, bulimia nervosa; EDNOS, eating disorder not otherwise specified; NS, not significant; BMI, body mass index; EDE, eating disorder.

Examination, BDI, Beck Depression Index, CAU, care as usual, EDI, Eating Disorders Inventory, Center for Epidemiological Studies Depression Scale, BF, body fat, SF36, Medical Outcomes Survey Short Form-36, CBT, cognitive behavioral therapy, VO2max, maximum oxygen uptake, STAI, State and Trait Anxiety Inventory, 6RM, 6 repetitions maximum, BBAT, Basic Body Awareness Therapy, BAT, Body Attitude Test, EAT-40, Eating Attitude Test-40.

The effect of physical therapy on psychological outcomes

As can be noticed in Table 1, patients with bulimia [31] ($p < 0.001$), but not those with anorexia [33] reported significantly lower depressive symptoms after a massage therapy programme. Significantly lower state ($p = 0.02$) and trait ($p < 0.001$) anxiety and depressive scores ($p < 0.01$) were also found in anorexia and bulimia nervosa patients following yoga [36]. Significantly improved post-treatment mental health related quality of life scores were observed and in both patient groups after adding basic body awareness therapy [38] ($p = 0.002$).

The effect of physical therapy on physiological outcomes

Two studies [35,37] examined the effectiveness of adding low intensity strength training to care as usual in patients with anorexia nervosa (see Table 1). Both studies reported significant increases in muscle strength. The study of Chantler et al. [35] also demonstrated that adding low intensity resistance training to the standard care of patients with anorexia nervosa resulted in a higher body mass index ($p = 0.006$) and body fat percentage ($p < 0.001$) compared to standard care alone.

Adverse events

Adverse events were not reported in any of the included studies.

Discussion

General findings

The present review demonstrates that the existing literature on physical therapy in anorexia and bulimia nervosa is limited, equivocal and difficult to interpret due to significant methodological shortcomings. Nevertheless, our review has been able to indicate that aerobic exercise and yoga might have beneficial effects on the eating pathology and weight status of patients with anorexia nervosa.

The use of aerobic exercises in the treatment for anorexia nervosa is not without controversy. Many patients with anorexia nervosa engage in excessive exercise, which can contribute to ongoing weight loss. Clinicians often attempt to restrain exercise in these patients, given that it can play a role in the pathogenesis as well as progression of the disorder [1]. However, our review data indicate that those who exercise (aerobic exercise, strength training or yoga) increase in weight and body fat compared with non-exercisers. There are several plausible explanations for the observed weight gain results. First, participation in the exercise programme may have helped to alleviate anxiety and increase comfort with gaining weight. The study by Carei et al. [36] shows that yoga results in significantly less state and trait anxiety. Second, previous research [39] indicates that being given the opportunity to exercise during treatment increases overall compliance with the entire treatment programme, including adherence to meal plans. Third, Calogero et al. [3] suggested that patients in an exercise programme are probably less likely to exercise surreptitiously with a focus on burning calories, whereas patients without opportunity to participate in a supervised exercise setting may exercise less at a level that is detrimental to their health and focused on burning calories.

Interestingly, aerobic exercise and yoga might reduce eating pathology (e.g. number of binges) in patients with bulimia nervosa. The present review indicates that exercise may benefit patients with bulimia nervosa in two ways. First, it may facilitate complete abstinence through psychological pathways related to the recreational nature of the activity itself. For example, the study by Carei et al. [36] demonstrates that those who exercise experience less anxiety and depressive symptoms. Second, it may

contribute to body image improvements. Our review data suggest that bulimic patients who exercise may experience less body dissatisfaction and a reduction of the uncomfortable internal sensations of bloating and distention during eating.

The present review data show improvements in muscle strength in anorexia nervosa patients, although benefits were limited. Myopathy resulting from severe protein malnutrition and reduction of muscular strength is an important clinical feature in anorexia nervosa [40]. In patients with anorexia nervosa myopathy is associated with abnormal accumulations of glycogen within muscle fibres, which are caused by a defect in anaerobic glycolysis [41]. It is therefore questionable as to whether the skeletal muscles of patients with anorexia nervosa would respond positively to a resistance training programme. Since myopathy can be successfully reversed by instituting an appropriate refeeding programme, it is likely that the increased food intake resulted in most of the strength benefits. Nevertheless, a number of neuromotor adaptations as a consequence of strength training might be responsible for the additional muscle strength improvements seen in exercisers. These neural factors include an increased inhibition of antagonists, better coordinated contraction of synergists, increased activation of synergists, inhibition of protective mechanisms and increased motor neuron excitability [40]. To the best of our knowledge, electromyographic responses of strength training in anorexia nervosa have not been conducted. For this reason, it remains unclear whether any of the benefits observed are a result of strength training itself. However, the current results indicate that the skeletal muscles of anorexia nervosa patients react to strength training in the same manner as the general population.

It is of clinical interest to assess strength training at the earliest possible stages of the disease. For example, Valle et al. [37] included very young patients (≤ 16 years) with anorexia nervosa in their study and identified that resistance training was well tolerated and did not have any deleterious effect on patients' health. Importantly, this mode of training did not induce significant losses in their body mass. Despite earlier concerns [42] regarding the safety and efficacy of youth strength training, current public health recommendations aim to increase the number of children and adolescents participating in strength training [43]. Participating in this exercise mode, has the potential to increase bone mineral density, motor performance skills, physical capacity, and overall health status in children and adolescents [44,45], all of which is of relevance for patients with anorexia and bulimia nervosa. To our knowledge, the present review is the first to summarise the evidence of body-oriented physical therapy approaches including massage, yoga and basic body awareness therapy in the treatment of anorexia and bulimia nervosa. Our review findings indicate that when added to standard care, these interventions might be of added value in reducing the eating pathology. Underlying mechanisms for these beneficial effects remain unclear. Field et al. [31] suggest that massage has positive and immediate benefits for attenuating stress hormones in girls and women with anorexia nervosa. Recently, it has been hypothesised in non-randomised studies that body-oriented physical therapy approaches for patients with eating disorders may contribute to novel ways of sensing and interpreting bodily signals, improving emotional awareness, experiencing the body and integrating the body as one's own [45,46].

Limitations

As with any systematic review, there is a potential for selection bias. Screening references of identified trials and systematic reviews may result in an over representation of positive studies in the review, because trials with a positive result are more likely to

be referred to in other publications. Secondly, performance bias may limit our findings. None of the included studies were double-blind. The reported results may exaggerate estimates of treatment effect. Although investigators may not always be able to blind participants to physical therapy interventions, every attempt should be made to collect research data in a blind manner. Third, the heterogeneity among the studies, particularly with regard to the duration and frequency of the experimental intervention and the chosen control/comparison intervention, makes it impossible to define any dose-response relationship. This diversity, as well as the small sample sizes of many of the included studies, limits overall conclusions and highlights the need for further rigorous research.

Clinical implications

The UK National Institute for Health and Clinical Excellence guidelines [47] recommend that people with anorexia and bulimia nervosa should first be offered outpatient treatment and that inpatient care should be used for those who do not respond or who present a high risk for premature death due to suicide or associated physical health problems. Our review data represents a first attempt at demonstrating the added value of physical therapy to conventional treatment for individuals with anorexia and bulimia nervosa in outpatient settings. Clear guidance regarding the type of physical therapy and optimal dose is however still limited by the small number of available randomised controlled trials and the variability of the interventions themselves in terms of frequency, intensity, and duration. Physical therapists should therefore assess the types of exercises or techniques that would best fit a person's preferences.

Future research

For future research the focus should be on high-quality randomised controlled trials with sufficient sample size to be able to draw firm conclusions. Interventions under study should be the ones which seem to be promising, but where evidence is still insufficient, such as massage and basic body awareness therapy. Because of the long-term significantly increased risk of fracture in young patients with anorexia nervosa, there is also a compelling need to define an effective and safe physical therapy related approach to maintain bone integrity in this population. Practice recommendations emphasise the importance of specialised care for the treatment of eating disorders, but such care is not always easily accessible [5]. Hence, integration of other approaches is needed and should be examined. For example, exercise counseling could be delivered by physical therapists trained in basic cognitive-behavioural skills and directed via mobile phones or internet.

Conclusion

This systematic review demonstrated that specific physical therapy interventions, including aerobic and strength training, massage, yoga, and basic body awareness therapy might have beneficial outcomes on eating pathology, body mass index, body fat percentage, muscular fitness and depressive and anxiety symptoms. Future research into specific features of physical therapy interventions, such as tailoring interventions to the needs of people with anorexia and bulimia nervosa may contribute to currently available evidence.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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