

Systematic review

# Is supervised exercise training safe in patients with anorexia nervosa? A meta-analysis

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## Abstract

**Background** Anorexia nervosa is an eating disorder that is often preceded by excessive physical activity. As such, exercise is not often prescribed in the clinical management of individuals with anorexia nervosa.

**Objective** To examine the effects of supervised exercise training in patients with anorexia nervosa.

**Data sources** Five databases were searched from their inception to Week 14 of 2011 using the subject headings ‘anorexia’ and ‘exercise’ to identify relevant studies.

**Eligibility criteria** PRISMA guidelines were followed. Studies that investigated the effects of inclusion of supervised exercise training in clinical management with usual management in patients diagnosed with anorexia nervosa were included in this review. Case reports were excluded.

**Data extraction and synthesis** Two reviewers independently extracted data using a standardised assessment form. Quality assessment was rated for the controlled trials and single-group studies using the PEDro scale and Downs and Black scale, respectively. Fixed or random effect approaches were used to determine effect size, depending on the heterogeneity of the studies.

**Results** Pooled randomised controlled trials and quasi-randomised studies showed no significant effect of supervised exercise training on selected anthropometric measurements, while the single-group studies showed significant improvement in weight and body fat. Although Short Form-36 revealed no training effect, distorted feelings about food and exercise were reduced. Cardiovascular fitness also improved with no decrease in weight.

**Limitations** Heterogeneity of exercise training programmes, small sample size ( $n \leq 20$ ) for 67% of the trials, and inability to exclude publication bias.

**Conclusions** Inclusion of supervised exercise training in the comprehensive management of patients with anorexia nervosa appears to be safe, as no detrimental effect was observed in anthropometry. Strength and cardiovascular fitness were also shown to improve.

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*Keywords:* Eating disorder; Anorexia; Exercise; Meta-analysis

## Introduction

Anorexia nervosa is an eating disorder associated with emaciation, often accompanied by a marked increase in physical activity [1]. The diagnosis of anorexia nervosa is established based on criteria from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) [2], and is characterised by a refusal to maintain minimal weight or

a great fear of gaining weight, a distorted body image and amenorrhoea in postmenarcheal females [2]. Many patients with anorexia nervosa are at risk of medical complications such as bone fractures and hormonal imbalances, which may be caused or exacerbated by extreme amounts of exercise [3]. The prevalence of anorexia nervosa is approximately 0.2% to 0.9% [4], with 40% to 80% of individuals with anorexia nervosa exercising excessively [5]. Given the complexity of eating disorders, estimation of the burden of anorexia nervosa is challenging. In Singapore, the disease burden of anorexia and bulimia accounted for 2.1% of total disability-adjusted life years in those aged 15 to 34 years, and was ranked one of the top 10 causes of disease burden in 2004 [6].

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Management of anorexia nervosa involves treatment of physical, cognitive and behavioural aspects of the condition [7]. Usual management recommended by the American Psychiatric Association includes nutritional rehabilitation, psychosocial interventions (e.g. cognitive behavioural therapy and family-based treatment) and medications (e.g. antidepressants such as fluoxetine) [8]. Such treatments have been studied in both adolescents and adults with anorexia nervosa, but findings are inconclusive [9] and exercise training may be a useful modality with beneficial physical and psychological effects [10]. A review by Hausenblas *et al.* revealed that exercise for patients with anorexia nervosa did not affect weight gain and had positive effects, such as improved body perception, positive mood and quality of life [11]. However, according to a more recent literature review, few studies included exercise training as part of the overall treatment for patients with anorexia nervosa [3].

Exercise is not often prescribed for hospital inpatients with anorexia nervosa, which may be due to a lack of understanding that exercise can be moderated under appropriate conditions, such as during refeeding and stabilisation of body weight [11]. Exercise training may play an important role in the management of anorexia nervosa through lean body mass gain, provision of an outlet for the patient's inclinations towards exercise [12], reduction in anxiety and depression, having a better body image, and improved social behaviour [11]. Although intensive aerobic training would be inappropriate due to its association with overindulgence or high energy expenditure [12], other forms of exercise that are aimed at increasing muscle mass and helping to regulate excessive behaviours would be beneficial [10,13]. Too much exercise has often been implicated in the pathogenesis and progression of anorexia nervosa [14]. As such, it is important to monitor body weight or body mass index (BMI) when exercises are prescribed. Although a narrative review was published recently [3], the studies selected were limited to those with weight restoration using any exercise or structured physical activity programme, and so the review was unable to offer any guidelines on exercise prescription for patients with anorexia nervosa. Thus, the aim of this review was to search the literature systematically and undertake a meta-analysis of data from studies that evaluated the effect of supervised exercise training on anthropometry, as well as describe the psychological and other physiological outcomes in patients with anorexia nervosa after training. This has important implications in a clinical setting to determine if supervised exercise training is safe and beneficial in the management of anorexia nervosa.

## Methods

### Data sources

Study identification began with electronic searching of computerised databases, namely PubMed, EMBASE,

CINAHL, Physiotherapy Evidence Database (PEDro) and Cochrane Central Register of Controlled Trials from inception to Week 14 2011 (Table A, see [supplementary online material](#)). The subject headings used in the search were 'anorexia' and 'exercise'. Secondary searches included hand searching the reference lists of all identified studies and the PubMed 'related articles' function.

### Study selection

Studies were eligible for inclusion if they: (1) recruited patients with anorexia nervosa diagnosed on the basis of DSM-III-R (1987) or DSM-IV (1994) criteria (Table B, see [supplementary online material](#)); (2) investigated the effects of supervised exercise training against usual management recommended by the American Psychiatric Association; and (3) measured changes in selected anthropometric (body weight, BMI, percentage body fat or lean body mass), physiological (muscle strength or endurance) or psychological (quality of life or depression) variables. Where necessary, authors were contacted for those studies that did not report values in absolute terms. Case reports were excluded. Anthropometric data from randomised controlled trials (RCTs) and quasi-randomised trials with a control arm were included for meta-analysis. Psychological data were included for systematic review. All data from single-group studies were also included in the systematic review. There were no articles prior to 1987 that examined the effects of supervised exercise in the treatment of anorexia nervosa.

### Quality assessment

Two reviewers (LWCN and DPN) independently extracted data using a standardised assessment form. Quality assessment for the RCTs and non-randomised trials with a control arm was rated using the 10-point PEDro scale [15]. This scale uses criteria related to blinding, intention-to-treat and loss to follow-up, with a higher score indicative of superior internal validity [15]. Quality assessment for the single-group interventional studies was rated using a modified Downs and Black tool [16], which comprised 27 questions, relating to study description, external validity, internal validity and statistical power [17]. Disagreements were resolved by discussion between the two reviewers and, where necessary, a third person (WPW) was consulted.

### Data extraction and analysis

Consistency between reviewers for both quality assessment methods was calculated using Kappa ( $\kappa$ ) statistics. The  $I^2$  test was used to quantify statistical heterogeneity of all studies with a control arm [18]. A value of  $\geq 75\%$  represents high heterogeneity [19]. A fixed or random-effect approach was used. If  $I^2 \leq 25\%$ , a fixed-effect model was used to estimate the effect size. Hedges'  $g$  or standardised mean difference (SMD) was preferred over Cohen's  $d$  in this

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