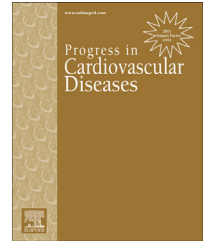


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The Role of Exercise and Physical Activity in Weight Loss and Maintenance

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ABSTRACT

This review explores the role of physical activity (PA) and exercise training (ET) in the prevention of weight gain, initial weight loss, weight maintenance, and the obesity paradox. In particular, we will focus the discussion on the expected initial weight loss from different ET programs, and explore intensity/volume relationships. Based on the present literature, unless the overall volume of aerobic ET is very high, clinically significant weight loss is unlikely to occur. Also, ET also has an important role in weight regain after initial weight loss. Overall, aerobic ET programs consistent with public health recommendations may promote up to modest weight loss (~2 kg), however the weight loss on an individual level is highly heterogeneous. Clinicians should educate their patients on reasonable expectations of weight loss based on their physical activity program and emphasize that numerous health benefits occur from PA programs in the absence of weight loss.

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Rationale for weight loss in overweight and obese patients

In the United States, 66.3% of adults are overweight or obese,¹ which represents a major public health concern. The total medical cost associated with treating obesity exceeds \$140 billion annually, and represents approximately 9.1% of annual medical expenditures.² Obesity is a major risk factor for many cardiovascular (CV) diseases such as coronary heart disease (CHD), heart failure (HF), stroke, ventricular dysfunction, and cardiac arrhythmias.³ The American Heart Association's scientific statement on obesity and weight loss³ recommends

weight loss in overweight and obese patients to reduce the severity of CV risk factors. Weight loss in these patients has been associated with improvements in many cardiometabolic risk factors such as prevalence of the metabolic syndrome, insulin resistance, type 2 diabetes (T2DM), dyslipidemia, hypertension, pulmonary disease, CV disease, and inflammation.³ Clinically significant weight loss ($\geq 5\%$ of baseline body weight) has been shown to be more effective in reducing CV and T2DM risk factors.⁴ Thus, a strong rationale exists for clinicians to advocate that overweight and obese patients attempt at least modest weight loss. Recent epidemiological evidence has emerged showing great-

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Abbreviations and Acronyms

ACSM = American College of Sports Medicine

CRF = Cardiorespiratory fitness

CHD = Coronary heart disease

CV = Cardiovascular

DARE = Diabetes Aerobic and Resistance Exercise

DREW = Dose Response to Exercise in Women

ET = Exercise training

HART-D = Health Benefits of Aerobic and Resistance Training

HF = Heart failure

MET = Metabolic equivalent

PA = Physical activity

STRIDE = Studies of a Targeted Risk Reduction Intervention through Defined Exercise

T2DM = Type 2 diabetes mellitus

er survival in adults with CV diseases with higher obesity levels compared to lower levels, which has been coined “the obesity paradox”.⁵ Although, the findings of the obesity paradox have been verified in several studies within different clinical populations,^{6–8} at the present time, little evidence exists that lower survival is observed in adults with CV diseases after modest or clinically significant weight loss.

High physical activity (PA) levels or exercise training (ET) should be an integral part of any treatment plan for obese individuals regardless of weight loss goals, and

is associated with numerous CV benefits.⁹ High levels of PA and cardiorespiratory fitness (CRF) are inversely associated with CV disease, T2DM and all-cause mortality.¹⁰ Several epidemiological studies even suggest that high levels of PA or CRF attenuate the health risk of obesity.^{11–13} Moreover, CRF levels have been shown to alter the relationship of the obesity paradox,¹⁴ where high CRF level is associated with greater survival in all body mass index (BMI) categories. So above all, clinicians should always encourage their patients to adhere to ET programs or engage in regular PA regardless of the weight loss achieved.

The present American College of Sports Medicine (ACSM) recommendations for physical activity to maintain health⁹ and promote weight loss¹⁵ are summarized in Fig 1. Strong evidence exists that PA can attenuate weight gain in those

at risk for obesity, and many ET programs are capable of producing at least modest weight loss (~2 kg).¹⁵ A question often encountered in the clinical setting from patients is how much exercise is needed to lose weight and what type of ET should be performed. Overall, the changes in weight in response to ET without caloric restriction are highly heterogeneous and individual differences can span weight gain to clinically significant weight loss.¹⁶ Clinicians should consult their patients on what are reasonable expectations based on their specific weight loss program. In the following paper, we will discuss the role of PA and ET in the prevention of weight gain, the expected weight loss from different ET types/modalities, how much PA is necessary to reduce recidivism following weight loss, and further discuss the obesity paradox.

Physical activity and the prevention of weight gain

Changes in weight are affected by the amount of energy expended versus the amount of energy consumed.¹⁷ Therefore, if the energy expenditure remains low, but dietary consumption levels are in excess, weight gain will occur. Several researchers have argued that declines in PA both in occupational¹⁸ and leisure settings¹⁹ may have an important role in the increase in obesity rates over the last 30+ years. Furthermore, many epidemiological studies suggest that PA has an important role in weight gain.^{15,19–21} Williamson et al.²² using data from the National Health and Nutrition Examination Survey observed that low levels of self-reported recreational PA were associated with a 3-fold greater risk of major weight gain in men and almost a 4-fold in women. In a prospective study of 34,079 middle aged women (mean: 52.2 years), Lee et al.²⁰ observed that in women the risk of weight gain over a three year period was 11% greater in women who participated in less than 7.5 metabolic equivalent (MET) · h/wk compared to women who participated in greater than 21 MET · h/wk (approximately 300 min/wk of moderate PA). Several studies using the Aerobic Center Longitudinal Study database have observed that CRF level,²³ PA level,²⁴ and change in PA level²⁴ are inversely associated with future weight gain. Clearly, PA and CRF levels have an important role in weight gain for those at risk.

Researchers have speculated on the amount of PA necessary to prevent weight gain.^{15,21} The ACSM position stand on this topic¹⁵ recommends 150–250 min/wk of moderate to vigorous PA, with an energy equivalent of 1,200 to 2,000 kcal per week. Saris et al.²¹ recommended that PA levels of 225 to 300 min/wk were necessary to prevent the transition of normal weight to overweight or overweight to obese. Thus, clinicians should always recommend that patients engage in regular ET even if they are normal weight, and certainly if they are at risk for becoming overweight or obese.

Weight loss from specific exercise programs in overweight and obese patients

In the following sections, we will discuss several different PA strategies for weight loss in obese patients and describe the

Recommendations for Physical Activity:

- **Maintaining and improving health:** 150 minutes per week
- **Prevention of weight gain:** 150-250 minutes per week
- **Promote clinically significant weight loss:** 225-420 minutes per week
- **Prevention of weight gain after weight loss:** 200-300 minutes per week

Fig. 1 – Current recommendations for amounts of physical activity based on goals for maintaining health, prevention of weight gain, promoting clinically significant weight loss, and prevention of weight gain after successful weight loss.

Recommendations are based on the American College of Sports Medicine position stand of **Appropriate Physical Activity Intervention Strategies for Weight Loss and Prevention of Weight Regain for Adults.**

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