

Exercise Aspects of Obesity Treatment

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INTRODUCTION

The negative effect of obesity is significant in terms of U.S. health care dollars spent, totaling some \$100 billion annually, or 5% to 10% of U.S. health care dollars.¹ An estimated 55% to 60% of adult Americans are overweight, defined as a body mass index (calculated as weight in kilograms divided by height in meters squared) of 25 to 29.99, and 22% more adults are obese, defined as a body mass index exceeding 30 kg/m². The prevalence of obesity is increasing. Weight loss reduces the comorbid disease risks associated with obesity, such as diabetes mellitus, hypertension, cancer, hyperlipidemia, and heart disease.

Weight loss is a process that includes a reduction of caloric dietary intake and an increase in physical activity-related caloric output. This article will review some established guidelines concerning exercise treatment of obesity. A discussion of the dietary component is beyond the scope of this review, but a significant overall reduction in daily total caloric intake should be the main focus rather than macronutrient composition. Reduction of dietary fat intake to less than 30% of total energy intake as part of this overall reduction may also facilitate weight loss.¹ A calorie reduction diet coupled with an exercise program has been shown to be superior to an exercise intervention alone.^{1,2}

The process begins with an assessment of the obese patient for safety before entering an exercise program. The accepted amounts, type, and progression of exercise for healthy individuals are reviewed and are then discussed more specifically for obese patients. Obesity comorbidities such as osteoarthritis and metabolic and cardiovascular disease should be addressed in the exercise recommendations. Psy-

chosocial barriers to an exercise program must likewise be addressed. Finally, maintenance of a healthy ongoing exercise program is vital in preventing weight regain.

PREPARTICIPATION EVALUATION

Exercise candidates should be screened by history and physical examination for comorbid diseases, musculoskeletal disorders, and cardiovascular disease risk factors. This maximizes patient safety and allows appropriate modification of the exercise program based on specific needs. The Physical Activity Readiness Questionnaire is a traditional 7-question tool used to identify individuals who may require a more in-depth medical evaluation.³ The Health/Fitness Facility Preparticipation Screening Questionnaire by the American Heart Association (AHA) and the American College of Sports Medicine (ACSM) is a more comprehensive tool for risk stratification and for determination of signs and symptoms of existing disease.⁴

Coronary artery disease risk factors include family history, smoking, hypertension, dyslipidemia, diabetes, obesity, and a sedentary lifestyle. A negative risk factor is elevated serum high-density lipoprotein cholesterol. Signs and symptoms of cardiovascular, pulmonary, or metabolic disease include chest pain or anginal equivalent, dyspnea with rest or exertion, syncope or dizziness, orthopnea or paroxysmal nocturnal dyspnea, edema, palpitations or tachycardia, claudication, heart murmur, and unusual fatigue with usual activities. This information is then used to assign 1 of 3 risk stratification categories. The low-risk category includes asymptomatic men younger than 45 years and women younger than 55 years with no more than 1 risk factor. The moderate-risk category includes men 45 years or older and women 55 years or older with 2 or more risk factors. The high-risk category includes individuals with the aforementioned signs and symptoms or those with known cardiovascular disease. Hypertension as a risk factor may carry more risk because exercise may aggravate blood pressure levels and because hypertension is associated with other risks.⁵

Candidates in the moderate-risk and high-risk categories should undergo preparticipation cardiac stress testing according to guidelines provided by an ACSM consensus statement.⁵ However, there is

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controversy regarding the usefulness, cost, predictive value, and scientific basis of preparticipation testing.⁶ Distinct testing modality recommendations do not exist, and decisions are individualized or vary with institutional preference or testing availability.⁵ Sample testing options include treadmill testing without imaging, stress echocardiography, nuclear medicine stress testing, dobutamine echocardiography, and cardiopulmonary stress testing. A detailed comparison of the advantages or disadvantages of each test is beyond the scope of this discussion. At our institution, stress echocardiography is a practical testing modality for individuals who can navigate a treadmill. Cardiopulmonary stress testing provides the additional benefit of determining the anaerobic threshold, which is a quantitative measure of fitness and is useful in guiding heart rate targets for exercise intensity planning. This is a basis for determining an individual's maximum oxygen consumption (VO_{2max}), discussed herein. The primary objective of exercise testing in the obese person is exercise prescription and determination of exercise intensity.⁷

Modification of testing protocols that account for levels of deconditioning seen in obese patients and for comorbidities such as hypertension or orthopedic limitations may be necessary.⁵ Testers should be appropriately trained and credentialed according to AHA or ACSM criteria. Participation and additional recommendations for individuals with other cardiac conditions are outlined in conference guidelines and are outside the scope of this discussion.⁸

Additional preparticipation assessment of obese persons includes weight history, motivation, nutrition and eating habits, and body composition. Body composition addresses the distribution of fat. Upper body fat distribution may contribute to heightened comorbid disease risk, and fat loss through exercise may reduce this risk.⁷

EXERCISE SPECIFICS

The following general description of fitness guidelines and exercise prescription serves as a framework for a more detailed discussion of obesity treatment exercise recommendations. Health-related physical fitness includes the following 3 components: cardiorespiratory fitness, body composition, and muscular fitness.⁵ The ACSM and the Centers for Disease Control and Prevention guidelines suggest "30 minutes or more of moderate physical activity on most, and preferably all, days of the week."⁵ Fitness training follows the fundamental physiologic principles of overload and specificity, where physiologic adaptation requires a progressive increase in exercise stimuli specific to the muscles involved and the type of exercise.⁵

An exercise prescription defines the mode, intensity, duration, and frequency of exercise activities. A broad fitness program that uses most major muscle groups transfers the training effect to vocational and recreational activities.⁵ Components of a particular training session include the warm-up, conditioning phase, and cooldown. The 5- to 20-minute warm-up prepares muscles for more vigorous exercise and may reduce injuries. Stretching is recommended following the warm-up and is thought to reduce muscular injury. The conditioning phase involves a cardiorespiratory or resistance training session lasting 20 to 60 minutes. This is followed by a cooldown, which may attenuate postexercise hypotension, allow better dissipation of body heat, remove lactic acid, mitigate the rise in potentially arrhythmogenic catecholamines, and possibly reduce the risk of cardiac events during the recovery period.⁵

Cardiorespiratory conditioning uses large muscle groups in rhythmic dynamic activity. Examples of this mode include running, jogging, cycling, swimming, walking, and aerobic machines. Cardiorespiratory fitness is defined by aerobic capacity or by VO_{2max} . Training intensity is estimated based on calculations using percentages that depend on one's overall level of fitness and stage of progression within an exercise program. Various methods of determining VO_{2max} and estimating the training zones are based on direct measurement or estimations of the heart rate, as heart rate and oxygen consumption per unit time (VO_2) are linearly related.

Direct measurement of VO_{2max} requires special equipment and expertise. Therefore, heart rate estimations, although prone to inaccuracy, are more practical for routine use. Recommended training ranges vary from 40% or 50% to 85% of oxygen uptake reserve (VO_2 reserve) or heart rate reserve or from 64% or 70% to 94% of maximum heart rate.⁵ The VO_2 reserve is the difference between VO_{2max} and resting VO_2 , and the heart rate reserve is the difference between maximum heart rate and resting heart rate. The lower end of these scales represents threshold values for physiologic stimulation, and the higher rates represent adapted training zones for accustomed individuals. Exercise intensity above the upper limit becomes anaerobic, does not provide additional benefit, and may induce injury or performance retrogression.

The duration of exercise sessions should be 20 to 60 minutes. Debate exists concerning the value of performing exercise in shorter cumulative bouts throughout the day. The frequency of cardiorespiratory exercise sessions should be 3 to 5 days per week. Additional benefit derived by training beyond 6 days per week is minimal and is complicated by

higher injury rates. Progression is a concept that describes a participant's adaptation over time, necessitating increased exercise volume stimulus, where volume is a function of intensity, frequency, and duration. Progression consists of initial, improvement, and maintenance stages. In general, intensity and duration are less in the initial stage, where one becomes accustomed to exercising and develops orthopedic tolerance. The initial phase occurs over the first 6 weeks or so of a new program. The improvement stage follows for the next 4 to 8 months and includes a gradual increase in overall exercise stimulus. Increases in duration or frequency should precede increases in intensity. Finally, a long-term maintenance stage focuses on continued participation in enjoyable and varying exercises.

Resistance training is recommended as part of an overall fitness program, as such training alone does little to increase $\dot{V}O_{2\max}$, expends only moderate amounts of calories, and marginally affects the resting metabolic rate.⁵ The benefits of resistance training include bone density improvement and improvement in the performance of activities of daily living. Sets of 8 to 12 repetitions, the last of which results in volitional fatigue, increase muscular strength and endurance. A typical resistance training exercise prescription includes 8 to 10 separate exercises that involve major muscle groups of hips, thighs, legs, back, chest, shoulders, arms, and abdomen. One set of each exercise is deemed adequate performed on 2 or 3 nonconsecutive days per week. The value of the traditional practice of multiple sets per exercise has been disputed.⁵ Resistance training follows a phased progression similar to cardiovascular fitness training, but the variable is increasing resistance.

OBESITY FITNESS GUIDELINES

Obesity results from a cumulative positive energy balance (ie, a sedentary lifestyle plus caloric overconsumption).⁵ Effective intervention programs must concentrate on dietary modification and on energy expenditure. The objectives of an exercise prescription to treat obesity, in decreasing order of priority, are prevention of additional weight gain, reduction of body weight, and long-term maintenance of reduced body weight.⁹ Body weight normalization is too aggressive a target, and slow steady gains over time are more appropriate. Programs should target long-term weight reduction of 5% to 10%.^{5,9} Aerobic exercise and physical activity during the nonexercise parts of the day may also enhance total energy expenditure. Even limited levels of weight loss may have significant positive influences toward health improvement and risk factor management in the presence of hypokinetic diseases. Maintenance of

exercise is a predictor of long-term weight management and of prevention of regain.¹ Exercise training is more effective in reducing body weight in moderate obesity than it is in morbid obesity.⁷

An exercise prescription for obese individuals follows the same framework of mode, intensity, duration, and frequency already described. The volume of exercise needed for weight loss is greater than that which is necessary to improve fitness.¹ Modifications to the standard fitness exercise prescription focus on greater overall energy expenditure. Initial training intensity should be modest (40%–60% $\dot{V}O_2$ reserve or heart rate reserve), account for deconditioning, and emphasize duration and frequency rather than intensity. The $\dot{V}O_{2\max}$ and heart rate during brisk walking are higher in obese persons; therefore, brisk walking may present difficulty as an activity.⁹ The ACSM recommends a training frequency of 5 to 7 days per week, with sessions lasting 45 to 60 minutes.⁵ Longer-duration training at lower intensity is based on the premise that glycogen is the predominant fuel source during the first 20 minutes of exercise, followed by a shift to fat stores after 30 minutes.⁹

The recommended weekly volume of 150 minutes of aerobic conditioning for fitness improvement serves as a minimum for the treatment of obesity. For long-term weight loss and for prevention of weight regain in obese individuals, exercise duration should progress to 200–300 minutes per week.¹ Recently revised guidelines stress the dose effect of physical activity and emphasize greater weight loss and prevention of regain at the level of 250–300 minutes per week.² These guidelines also reiterate the importance of calorie restriction. This level of training obviously poses a challenge, and progression should proceed slowly along with behavioral strategies.¹ The consensus concerning intensity is that moderate-intensity exercise at 55% to 69% of maximum heart rate is appropriate for the management of body weight rather than activity of more vigorous intensity.¹ The value of intermittent exercise bouts is inconclusive at this time.^{1,2}

Obese persons may benefit from a resistance training program, which improves muscular strength and favorably affects functional tasks. Resistance training may also stimulate an increase in fat free mass. However, resistance training does not seem to affect energy expenditure or absolute weight loss.^{1,2,5,9}

Obese exercisers may require accommodations for arthritic conditions, and modifications of weight-bearing activities may be necessary. Because of this increased orthopedic risk, intensity may necessarily be sacrificed for safety, and progression should be

gradual. Obese individuals are also at increased risk for hyperthermia, and the exercise environment should be appropriately adapted.^{5,7} Additional attention must be paid to comorbid diseases and to medications such as those that may affect vision, sensation, heart rate, blood pressure, and blood glucose levels.

CONCLUSIONS

Obesity is a complex malrelationship between energy intake and expenditure that results in a homeostasis that is resistant to change. Obesity clearly has negative health implications that are well documented in consensus literature. Likewise, correction of body weight reduces the incidence and severity of comorbid diseases. A key aspect to this end is a significant amount of physical activity that is appropriately supervised and quantified. The objective of this review was not so much to explore the intricate physiologic details of the treatment of obesity but rather to provide an overview of the preparticipation assessment and practical application of an exercise program for the treatment of obese patients. Many physicians never broach this subject with their patients because of time limitations or comfort-level constraints. This is unfortunate because a physician's recommendations and proper guidance at the point of care are important predictors of patient participation in exercise.⁵

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