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Resistance Training Challenge for Chronic Diseases in Overweight and Obese Adults – A Brief Review

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INTRODUCTION

An imbalance between energy intake and energy expenditure can cause to a condition called obesity (or overweight in a slight degree) which is a major health problem. Based on published data by World Health Organization (WHO), overweight and obesity are defined as a body mass index (BMI) between 25 to 29.9, and a BMI of 30 or more, respectively [1]. Overweight and obesity are the third common hazard attributable to burden of disease and there is a significant relationship between high levels of obesity and chronic illnesses including coronary heart disease (CHD), hypertension (HTN), diabetes and cancers. Restriction of sedentary life style through increasing physical activity is an important part of the most guidelines of health associations to control and decrease the prevalence of overweight and obesity in the world.

Resistance training (RT), also called strength training or weight training, is the use resistance to muscular contraction to build the strength, anaerobic endurance and size of skeletal muscles. During a RT workout the body's musculature attempts to move against an opposing force usually provided by body weight, gravity, elastic bands, weighted bars or dumbbells, and some other type of equipment. RT has several health benefits in both healthy people and patients. It has been concluded that RT has beneficial effects on the body composition of people who are overweight or obese and thus on metabolic and cardiovascular health [2]. Obese men and women may enjoy strength exercises, by being better at strength exercises than aerobic exercises than normal-weight people, facilitating long-term behavior change. In this mini review we summarize the results of valuable reviews and meta-analysis of the effects of resistance training on body composition, diabetes, cardiovascular disease, blood pressure and psychological factors in overweight/obese adults.

EFFECTS ON BODY MASS AND FAT MASS

Recent guidelines on exercise for weight loss and weight maintenance include RT as a part of the exercise prescription. It's important to note that RT is associated with a decrease in fat mass and a concomitant increase in lean body mass and thus has little or no effective change in total body weight [3,4]. Although guidelines of professional organizations have historically focused on endurance or aerobic training for weight loss and maintenance [3], recent guidelines and position statements targeting body weight reduction and maintenance have suggested that RT may also be effective for fat loss [5]. There are conflicting reports about the effect of RT on fat mass so that some randomized controlled trials find significant decrease in fat mass, while others report a slight change or no change [3]. The overall available body of literature supports the use of RT as an effective intervention to mobilize the visceral and subcutaneous adipose tissue in the abdominal region [4].

Studies show that RT induces significant gains in lean body mass and strength; hence a program including RT is needed for increasing lean mass in middle-aged, overweight/obese individuals [3]. An important concern about proper obesity management in older adults is that weight loss might accelerate the age-related decline in muscle and bone mass and resultant sarcopenia and osteopenia [6]. Progressive resistance training is the best-studied form of exercise to increase muscle strength and improve muscle mass and function and should be considered the primary intervention for sarcopenia [7].

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Although the energy expenditure associated with resistance training is not large, resistance training may increase muscle mass which may in turn increase 24 h energy expenditure and lead to reduce fat mass and body weight [5,8]. Skeletal muscle is an important determinant of resting metabolic rate. The potential consequences of age-related reduction in skeletal muscle mass are diverse, including reduced muscle strength and power, reduced capacity for lipid oxidation, reduced resting metabolic rate, and increased abdominal adiposity [4].

EFFECTS ON TYPE 2 DIABETES AND CARDIOVASCULAR DISEASE

There is little research directly examining the longitudinal associations of RT with occurrence type 2 diabetes and cardiovascular disease risk. Nevertheless, existing data support the inclusion of strength training in physical activity regimens for reduced risk of type 2 diabetes and cardiovascular disease, independent of aerobic exercise [9]. RT improve insulin-stimulated glucose uptake in patients with impaired glucose tolerance or manifest T2D. RT may improve glucose and insulin responses to a glucose load in diabetic men and women, and also improves insulin sensitivity in diabetic or insulin-resistant middle-aged and older men and women. In addition, high-intensity RT can decrease glycosylated hemoglobin levels in diabetic men and women, regardless of age [4].

Several study demonstrated that RT has the potential to lower risk factors for CHD (total cholesterol, low-density lipoprotein cholesterol, and plasma triglyceride), independent of changes in body weight or body composition [4]. No information is available about the effect of RT on patients with dyslipidemia alone. A recent study [10] showed that isometric and isokinetic muscle strength for dyslipidemic patients with a low BMI (less than 25 kg/m^2) was statistically significantly higher than patients with a high BMI. Hence an exercise program for dyslipidemic patients with a high BMI should include muscle-strengthening exercises in order to positively influence both their metabolic profiles and functional status. Moderate-intensity RT is safe and recommended for healthy individuals, patients with stable CHD and patients with congestive heart failure, considering that left ventricular function remained into the normal ranges when aerobic and RT were compared [11].

Progressive RT promotes an improvement in markers of oxidative stress in older women independent of the load-management RT system [12]. RT can reduce exercise-induced oxidative stress in overweight and obese older adults, associated with CVD. A potential mechanism for this reduction could include contraction-induced antioxidant enzyme up-regulation [4]. Further research is needed to determine an optimum dose and intensity of muscle-strengthening exercises for the reduction of type 2 diabetes and cardiovascular disease rates.

EFFECTS ON BLOOD PRESSURE

The American College of Sports Medicine [13] recommends dynamic aerobic endurance training for at least 30 min daily, preferably supplemented with dynamic resistance exercise for HTN. RT may reduce resting blood pressure (BP), possibly by reducing peripheral resistance and improving endothelial function. However, several cardiology societies exclude isolated RT from the list of non-pharmacological recommendations to control BP [11]. RT alone decreases systolic and diastolic BP in pre-hypertensive and hypertensive subjects. The randomized controlled trials studies support the recommendation of RT as an effective tool for management of systemic HTN [11].

Both low-intensity isometric and moderate-intensity dynamic RT may lower systolic and diastolic BP [14]. Data from a small number of isometric RT studies suggest this form of training has the potential for the largest reductions in systolic BP and isometric handgrip activity may become a new tool in the non-pharmacological treatment of high BP [15]. It's important to note that increased frequency of RT (more than three times per week) is associated with a higher BP reduction. This is one superiority of RT compared to aerobic training, which is usually performed with a higher frequency (four to seven times per week) [11].

There wasn't show significant effect of RT on diastolic BP. The meta-analysis confirmed the opinion that RT may benefit resting BP. The effect of RT on resting systolic BP and diastolic BP seems to be dose-dependent, since decreases in resting BP were more pronounced when the RT program was of high volume. The BP-lowering effect of RT seems to be independent of weight loss [4].

The exact physiological mechanisms responsible for the reduction of BP are still unclear. The reduction in peripheral vascular resistance, resting heart rate, double product and arterial stiffness are the factors influence post-exercise hypotension [11]. Some studies have shown that RT improves biosynthesis and activity of endothelial nitric oxide synthase, leading to physiological levels of nitric oxide production, which has a key role in the control of vascular tone, mediating reduction in BP [16].

PSYCHOLOGICAL EFFECTS OF RT

Despite a strong theoretical basis for expecting positive effects of RT on psychological outcomes, the evidence for psychological effects of these exercises is unclear [17]. Physical exercise is one the best way for increasing the confidence in different individuals. Scientific evidence show that people who have psychological problem such as anxiety, if do exercise training (aerobics or RT), can observe positive changes in their responsibilities, senses, interests and happiness [17]. Obesity may limit the ability of doing active exercises such as running or cycling, RT is a better recommendation for benefits achievement of physical training. Overweight or obese individuals are stronger (in the

absolute sense) and better at (absolute) strength exercises compared with normal-weight people. RT is easier for overweight people compared with aerobic exercises.

Exercises have possible positive effects on a number of psychological outcome measures (e.g. self-efficacy, self-esteem, inhibition and psychological disorders such as anxiety and depression) in overweight or obese populations. These effects seem comparable to and sometimes stronger than those of aerobic and diet interventions. Due to a lack of data both conclusions are provisional [17].

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