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REVISIÓN / REVIEW

EFFECTS OF RESISTANCE TRAINING ON THE BODY FAT IN OBESE PEOPLE. SYSTEMATIC REVIEW

EFECTO DEL ENTRENAMIENTO CON CARGAS SOBRE LA GRASA CORPORAL EN PERSONAS OBESAS. REVISIÓN SISTEMÁTICA

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ABSTRACT

Nowadays obesity is a disease of high prevalence, that's why scientific community is interested to research it. A line of relevant investigation is to analyze effects of strength training on reduction of obesity. This paper reviews the bibliographic research until the year 2011 which analyzed if the strength training reduces body fat of obese people. Results found are divergent. Half of studies conclude that training with loads reduces body fat and the other half do not. However, there are not studies where participants increased their body fat. At the same time, this study reports about some strength training parameters and about guidelines for future research in this topic.

KEY WORDS: health, obesity, strength.

RESUMEN

La obesidad, una de las enfermedades más preocupantes hoy en día, ha impulsado la búsqueda de nuevas estrategias interdisciplinares entre la comunidad científica. Una línea de investigación de actual relevancia es la que analiza en qué medida un programa de intervención con cargas tiene efecto sobre la reducción de la obesidad. En este trabajo se revisa la producción bibliográfica hasta el año 2011 que ha investigado el efecto de los programas basados única y exclusivamente en entrenamiento con cargas, sobre la grasa corporal en personas obesas. Los resultados son divergentes, pues la mitad de estudios concluyen que el entrenamiento con cargas reduce la grasa corporal y la otra mitad no, si bien en ningún estudio se ha incrementado significativamente la grasa corporal de los participantes. Se aportan cuáles han sido los parámetros de entrenamiento y se sugieren pautas para la investigación a corto plazo sobre este particular.

PALABRAS CLAVE: salud, obesidad, fuerza.

INTRODUCTION

Athletes use resistance training to increase their muscular strength, but few years ago its benefits on health condition have been widely studied (12, 19, 37, 42). In this way, institutions like the National Strength and Conditioning Association or the American College of Sports Medicine include resistance training in their exercise guidelines and prescriptions for people who want to increase their health (8, 43). In fact, some authors had observed a negative relationship between muscular strength and prevalence of obesity (22).

The big public health that obesity, overweight and related syndromes suppose have promoted the research on new strategies that could help in reducing such diseases (24, 27, 31, 32). At this respect, a highly topical research line is that analyzing the positive effects that resistance training has on body composition (3, 5, 30), since many investigations have shown that this kind of training could lead a reduction of total body fat (7, 26, 38, 40, 41), or even visceral fat, which is potentially the most dangerous (18, 20, 21).

However, most papers studying this topic use multi-factorial approaches that also include other kind of exercise (i.e., aerobics) and/or diet modifications (13, 23, 25). Thus, the role of the resistance training itself on reducing body fat is still unclear, since its effects may be blurred by other variables.

Thereby, the purpose of this systematic review is to know the effect of interventions based exclusively on resistance training on the body fat of overweight/obese people.

METHODS

Databases and search pattern

Pubmed and SportDiscus databases were revised without any temporal filter.The search was conducted on January 2014. In order to find studies using exclusively resistance training programs to analyze its effects on body fat on overweight/obese people, the following search pattern was used: (obes* OR “overweight”) AND (“resistance training” OR “strength training” OR “weight training” OR “weight lifting”) AND (“fat” OR “body composition”) NOT (“diet”).

Inclusion criteria

To homogenize the search results, in order to compare studies to find common conclusions, the following inclusion criteria were used:

- Randomized trials with control group.
- Overweight or obese participants.
- Interventions based exclusively on resistance training programs.
- No diet modifications.
- Body fat measured using dual-energy X-ray absorptiometry (DEXA).

A detailed scheme of the paper-selection process can be found on Figure 1.

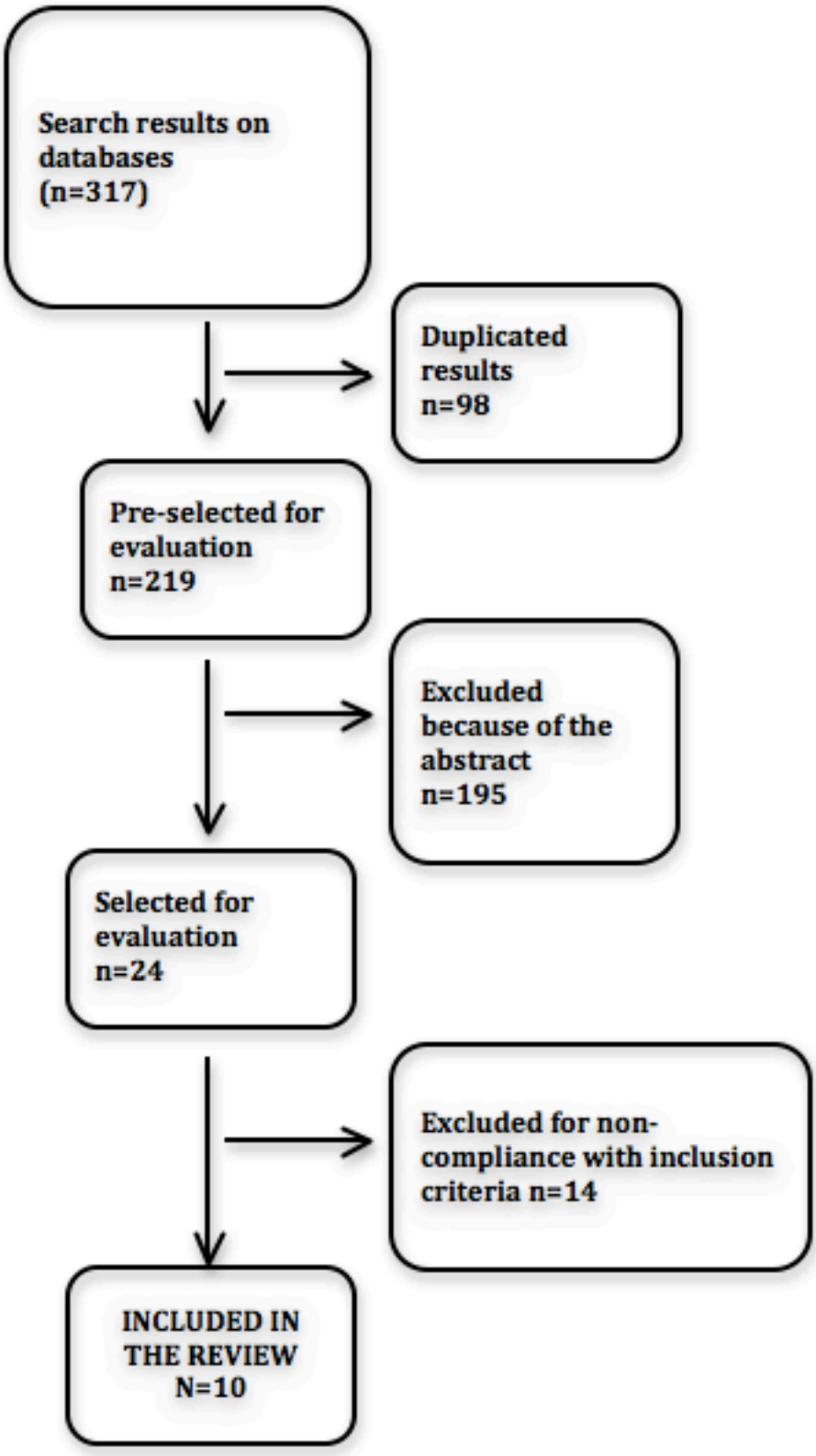

FIGURE 1. Databases search process scheme

RESULTS

The search found a total of 317 results. Ninety-eight of them were duplicated references among databases. Also, 195 references were excluded because of the information included in the abstracts, which didn't match the inclusion criteria. Finally, 24 papers were completely analyzed, with 14 being eliminated of the review for not matching the inclusion criteria (1, 4, 7, 9, 10, 14-16, 28, 29, 35, 39, 41, 44).

The 10 resulting papers (2, 6, 11, 17, 26, 33, 34, 36, 38, 40) match all the inclusion criteria. Details of participants profile, programs designs and main results can be found on Table 1. It should be noted that some papers measured some other variables in addition to body fat, but these weren't analyzed for not being the purpose of this systematic review.

TABLE 1. Information of the studies included in the systematic review

Author	Journal year;Vol:Pag.	Title	Purpose	Participants	Resistance training program	Main variables	Main results
Olson et al.	International Journal Of Obesity 2007; 31(6):996-1003	Changes in inflammatory biomarkers following one-year of moderate resistance training in overweight women	To evaluate the effects of 1-year of resistance training on inflammatory and health markers on overweight women.	28 (12 control, 16 resistance training) overweight women (BMI>25kg/m2), 24–44years	9 exercises, 3 sets with 8-10 repetitions, twice a week during a year	Muscular strength, body composition, blood pressure, lipid profile.	No significant changes on total body fat or %body fat were observed after the intervention
Kwon et al.	Korean Diabetes Journal 2010; 34(2):101-110.	The effects of resistance training on muscle and body fat mass and muscle strength in type 2 diabetic women	To investigate the effects of low-intensity resistance training on body fat, muscular strength, cardiovascular fitness and insulin sensitivity on overweight diabetes-II women	28 overweight women with diabetes type II (45-65 years, BMI=27.1±2.3) 13 resistance training, 15 control group	40 minutes, theraband-based program, 6 exercises, 3 sets with 10-15 repetitions, about 40-50%RM, three times per week for 12 weeks	Body fat, lean mass, muscular strength, cardiovascular fitness, insulin sensitivity	Both total body fat and abdominal fat lowered significantly in comparison with the control group ($p< 0.05$)

Schmitz et al.	The American Journal Of Clinical Nutrition 2007; 86(3):566-572.	Strength training and adiposity in premenopausal women: strong, healthy, and empowered study.	To assess the benefits of the resistance training on body and intra-abdominal fat	164 (82 resistance training, 82 control) 25-44 years overweight and obese women (BMI 25–35 kg/m2)	8-10 exercises, 2 sets with 8-10 repetitions. 2 years intervention	Total body and intraabdominal fat	After the 2 years intervention, the %body fat ($p < 0.05$) and intra-abdominal fat ($p < 0.05$) were significantly reduced
Olson et al.	Medicine & Science in Sports & Exercise 2006; 38(9):1558-1564	Moderate Resistance Training and Vascular Health in Overweight Women	To examine the effects of 1 year of resistance training on vascular structure and body composition on overweight women	30 (15 control, 15 resistance training) 24-44 years old overweight women (BMI>25kg/m2)	9 exercises, 3 sets with 8-10 repetitions twice a week during a year	Vascular function and structure, body composition, blood pressure, lipid profile	There were no significant changes on body fat after the intervention

Bouchard et al.	Menopause 2009; 16(1):66-72.	Impact of resistance training with or without caloric restriction on physical capacity in obese older women	To investigate the impact of resistance training without caloric restriction on fitness and body composition on middle-aged and elderly obese	48 obese women (%body fat 46.4%) with ages between 55-75 years 12, resistance training, 12 control, other 24 caloric restriction	9 exercises, 3 sets with 8 repetitions, 80%RM, three times per week for 12 weeks	Body weight, total body fat, lean mass, BMI and many functional tests	No significant changes on body fat were observed after the resistance training intervention
Shaibi et al.	*Medicine and science in sports and exercise 2006 38*(7):1208-1215.	Effects of resistance training on insulin sensitivity in overweight Latino adolescent males	To examine the effects of 16 weeks of resistance training on young people with high risk of diabetes type II	22 obese adolescent (15 years old; BMI = 32.5 ± 1.6). 11 resistance training, 11 control group	5 exercises, 1-3 sets with 8-15 repetitions, 60-95%RM, twice a week for 16 weeks	Muscular strength, body composition, insulin sensitivity	The percent of body fatwas reduced significantly after the training ($p<0.05$) in the resistance training program with respect to the control group
Donges et al.	*Appl Physiol Nutr Metab. 2012;37(3):499-509*	Effects of resistance or aerobic exercise training on total and regional body composition in sedentary overweight middle-aged adults	To investigate the effects of 10 weeks of resistance training on total and relative body fat on middle-aged, sedentary, overweight men and women	61 men and women (years between 45-65 years; BMI>27kg/m2), 35 resistance training, 26 control group	7 exercises, 2-3 sets with 8-10 repetitions, 70-75%RM, three times per week for 10 weeks	Muscular strength, aerobic capacity, total and relative body fat	Total body fat didn't change significantly on women ($p>0.05$), but did on men ($p<0.05$).

Ho et al.	*BMC Public Health. 2012;12:704*	The effect of 12 weeks of aerobic, resistance or combination exercise training on cardiovascular risk factors in the overweight and obese in a randomized trial	To study the effects of 12 weeks of resistance training on cardiovascular risk factors on overweight and obese men and women	64 men and women (40-64 years; BMI>25kg/m2), 16 resistance training, 16 control group, 32 other kind of aerobic training	5 exercises, 4 sets with 8-12 repetitions, 70%RM, 5 times per week for 12 weeks	Cardiovascular risk profile and body composition	There were no significant differences after training on total body fat or %body fat, although significant differences were found on the group who combined resistance training with aerobics
Alberga et al.	*Phys Sportsmed. 2013;41(3):103-9*	The effects of resistance exercise training on body composition and strength in obese prepubertal children	To study the effects of resistance training on obese preadolescent children	19 boys and girls with ages between 8-12 years, BMI>95th percentile for their age and sex, 12 resistance training, 9 control group	75 minutes per session, twice per week for 12 weeks. More details couldn't be found.	Body composition (%body fat, %lean mass, height, weight) and upper and lower-body muscular strength	There weren't significant changes on %body fat or fat mass index after the training
Roberts et al.	*Metabolism. 2013;62(5):725-33*	Resistance training increases SHBG in overweight/obese, young men	To study if 12 weeks of resistance training can increase the sex hormone-binding globulin and body composition on obese and overweight adolescents	49 participants (18-35 years, BMI >27 km/m2), 36 resistance training, 13 control group	7 exercises, 6-15 repetitions, 60-80%RM, three times per week for 12 weeks	Different hormonal markers, total body fat, %body fat, %lean mass, BMI	Participants on the resistance training group reduced their total body fat and %body fat significantly with respect to the control group ($p<0.05$)

As seen on Table 2, just the half of the studies shown significant reductions on the body fat after a resistance training program.

TABLA 2. Change on body fat on the revised papers

Results	Reference	Absolute total body fat change (kg.)	Percent of change of total body fat (%)	Statistical signification (P)
Statistically significant *	Kwon et al. (2010)	-1.75	-8.2	< 0.001*
	Schmitz et al. (2007)	-3.19	-10	< 0.05*
	Shaibi et al. (2006)	-2.5	-6.7	< 0.05*
	Donges et al. (2012)	-1.5	-5	< 0.05*
	Roberts et al.	-1.5	-7.1	< 0.05*
No significant	Bouchard et al. (2009)	0.3	0.87	> 0.05
	Olson et al. (2006)	-0.1	-0.3	> 0.05
	Olson et al. (2007)	-0.5	-1.5	> 0.05
	Ho et al. (2012)	-0.3	-0.5	> 0.05
	Alberga et al. (2013)	No reported	No reported	> 0.05

DISCUSSION

The analysis of the revised papers shows different effects of the resistance training on the body fat reduction: half of the studies found significant reductions on body fat after the training, while the other half found no significant changes. When body fat reduction occurs, losses between 1.75 and 3.2 kg were found, which means a percent of change between 5% and 10%. On the other hand, in these investigations where no significant changes were found, body fat variations between -0.5 and 0.3 kg were observed, resulting in a percent of change between -15% and 0.8%. These findings shows that resistance training can, at least, avoid the increase of body fat, which is something very positive in a context in which American sedentary women between 25-44 years old gain 1 kg of fat per year (38).

With respect with resistance training programs designs, studies present big differences on the configurations of duration and intensity of the training. Thus the studies that found significant changes after a resistance training program, a 10 (11), 12 weeks (26, 36), 16 weeks (40) or 1 year (38) program duration were used. For its part, the studies that found no significant changes after a resistance training program, program duration lasted 1 year (33, 34) or 12 weeks (2, 6, 17). Moreover, training intensity is described poorly and varies from 40% to 95%RM (6, 26, 40) which highlights the great heterogeneity of the programs used on the revised papers.

Under the above, the following is suggested to investigate this topic in the future:

1. To define exactly the training intensity.

2. To compare different training intensities to observe which one produce greatest benefits.

3. To compare similar programs with different durations, to observe which one has more effects on body fat reduction.

4. To analyze the effects of the resistance training on body fat reduction on different populations, and to compare the effects on each one (i.e., children, elderly, men, women).

These recommendations could lead a better understanding of the effects of the resistance training on the reduction of body fat, since, at present, the diversity on the programs used in the literature can't allow us to extract accurate conclusions about the more optimal program design. However, the review conducted in this study allows us to provide some general conclusions about the use of resistance training for reducing the body fat. These conclusions are detailed in the following section.

CONCLUSIONS

This systematic review found very heterogeneous studies. Although training methodologies and the effects of the intervention varies from one study to another, common conclusions have been extracted from all of them.

First, resistance training, at least, can avoid the increase of total body fat in all of the studies revised, and on the half of the studies, significant reductions up to 10% of the body fat were observed. Thus, resistance training is one valid strategy to be considered to reduce, or at least prevent the increases of body fat in obese and overweight people.

Second, despite the methodological differences observed among the studies revised, all of them used 2-3 sessions per week, with more than 5 exercises at a intensity above 40%RM and durations above 40 minutes per session. Thus, this seems to be an adequate recommendation to design a resistance training program to reduce or prevent the increase of body fat in obese and overweight people.

Summarizing, resistance training is a good alternative approach to be considered in the interventions designed to reduce the body fat.

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