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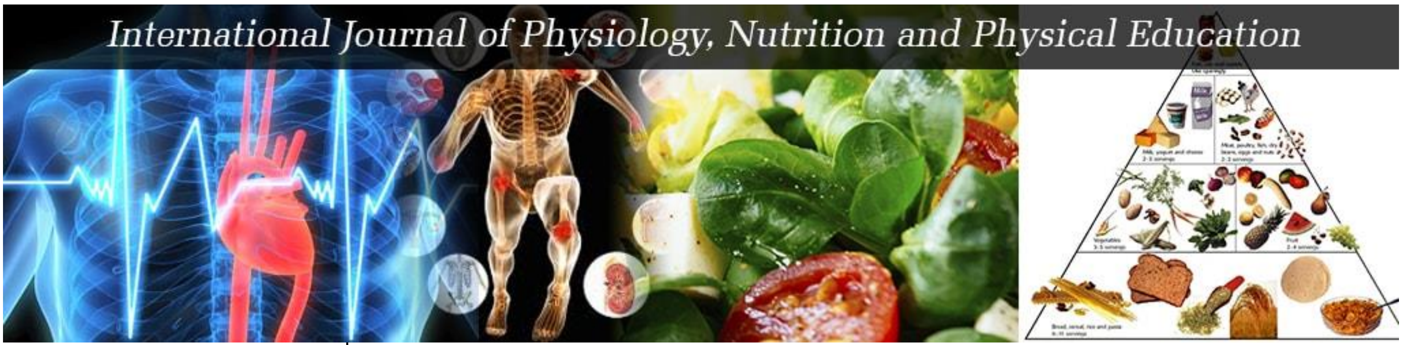

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Impact of circuit resistance training on body composition on young male

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Abstract
The purpose of this study was to determine the effects of circuit type resistance training on body composition and bone status in young males. Twenty eight moderately active male volunteers were randomly assigned to 12 weeks of circuit resistance training (CRT) (n=15; 24.3±1.4 years) or control (C) (n=13; 24.8±2.1 years). Total body fat (%BF), fat mass (FM), fat-free mass (FFM), bone mineral content, and bone mineral density (BMD) measurements were performed with dual-energy X-ray absorptiometry. At the end of the 12-week training period, there was a decrease ($p<.05$) in the CRT group % BF (-1.63%), FM (-1.03kg), an increase in FFM (1.46kg), and no change ($p>.05$) in body weight or BMD. In C, no significant ($p>.05$) changes were observed. CRT bone mineral density values were significantly ($p<.05$) higher (.003g/cm) after the 12 week training period versus the control group values (-.005g/cm). Results suggest that 12 weeks of circuit resistance training in moderately active young males had a positive effect on body composition and bone status, with no effect on body weight. Additional studies may identify effects of circuit resistance training on body composition and bone mineral density in women and aging.

Keywords: circuit resistance training, body composition, young male

Introduction

Body composition is of great interest to coaches and athletes. Body size influences physical performance in many sports. Body characteristics such as height or arm length remain relatively unchanged with training. Other components such as fat and fat-free mass respond to diet and exercise practices [10]. Body composition consists of absolute and relative amounts of muscle, bone and fat tissues, water, minerals and other components of total body mass [5]. Researchers, in general, refer to body composition in terms of fat percentage, fat mass (FM), and fat-free mass (FFM), with fat-free mass as body structures excluding fat-mass [16]. Body composition is related to maximal performance, physiological parameters and training-based adaptations. For example, with two individuals having the same fat-free mass, a higher body fat percentage or fat mass suggests a decreased performance in weight-bearing physical activities such as jumping and running [10]. Monitoring the body composition of athletes on a regular basis provides useful information for training adjustments, where optimal body weight and composition are required for optimal performance [15]. Body structure and size are related to genetics and changes in development [16]. Bodyweight and body composition are directly related to energy balance. Energy balance is influenced by expenditure from physical activity, recreational exercise, and occupational exercise [5, 6]. Studies suggest that regular exercise has a positive effect on body weight, body composition, and aging [2, 4, 5]. A variety of exercise modes benefits body composition, improves health, and enhances exercise performance. Moderate-intensity cardiorespiratory exercise and weight training, regardless of gender, are effective for decreasing body fat percentage, fat weight, and body weight [5]. Resistance training helps build fat-free mass and bone-mineral status [12, 16], as well as promoting positive changes in body composition [3, 11, 13, 14]. Changes in biochemical, neurological and morphological components from strength training generally results in positive changes in body composition [1]. Improvements in fitness components, muscular strength and size, fat-free mass, and decreased body fat have a positive effect on athletic performance [6]. Bone-mineral status in early adulthood is a major factor in the incidence of bone fractures. Bone-mineral status is in a constant state of change [9, 12].

Bone-mineral status is influenced by force mechanics, hormonal changes, and dietary mechanisms [9]. Individuals who are physically active show greater bone mineral density versus sedentary individuals [8]. According to Wilmore & Costill (1994), resistance exercise increases strength, muscular endurance and flexibility. Circuit resistance exercise may affect body composition through an increase in fat-free body mass, muscular strength, and bone-mineral status. In this context, the aim of this study was to investigate the effects of circuit resistance trainings (CRT) on body composition and bone status in young males.

Methodology and data analysis

Participants

Twenty-eight moderately active males volunteered to participate in this study and were randomly assigned to circuit resistance training (CRT) (n=15; 24.3±1.4 years) or a control (C) group (n=13; 24.8±2.1 years). Physical characteristics of the subjects are presented in Table 1. The subjects did not smoke and none participated in resistance training. All subjects were informed of the purpose of the study, completed a medical history form, and signed a written consent form.

Table 1: Baseline Characteristics of the subjects (mean _+ SD)

Variables	CRT n=15	C n=13
Age yr	24.3-+1.4	24.8-+2.1
Weight kg	71.0-+7.8	73.4-+10.1
Height cm	175.7-+5.1	174.1-+5.8
%BF	21.4-+4.6	22.6-+6.8
FM kg	14.7-+4.2	16.3-+6.6
FFM kg	56.4-+5.0	56.7-+5.4
BMD g/cm	1.243-+.086	1.265-+.096

% BF = percent body fat, FM = fat mass, FFM = fat free mass, BMD = bone mineral density

Anthropometric Measurements

Weight and Height: All measurements took place under laboratory conditions. Participation were instructed to refrain from eating or drinking within two hours of the appointment and to empty the bladder before measurement were taken. Body weight and were measured by using a mechanical scale with height rod. Weight graduation was 50g, and measure rod graduation was 1mm. Subjects were weighed in the morning, wearing shorts and T-shirt and in bare feet. Body composition and bone mineral Status: Body composition was assessed by dual-energy X-ray absorptiometry (DXA) using the GE Lunar DPX Pro. The total body scan provided values for bone mineral content, non-bone lean tissue and fat mass (FM) in the whole body and in the arms, legs, trunk, android, and gynoid, separately. Fat-free mass (FFM) was defined as the sum of non-bone lean tissue and bone mineral content.

Exercise program

After completing the pre-test measurements, the CRT group participated for 12 weeks at 3 days per week in resistance exercise. All subjects were instructed not to change regular daily activities and dietary habits. The resistance training program was a circuit training model that included the following 15 exercises: barbell curl, preacher curl, pushdown, triceps extension, back press, lateral raise, chest press, pec deck fly, lat pull down, seated row, leg press, leg extension, supine leg curl, machine hip extension, and crunch. Each training session began with a 5–10 minute warm-up. The resistance training sessions began with a 5-10 minute warm-up, followed by 3 sets for each exercise and 12–14 repetitions per set. The maximum intensity was approximately 50–60% of one repetition. Each resistance-training session lasted approximately one hour. The control group refrained from participation in aerobic or resistance exercise during the 12-week study period. The training protocol is presented in Table 2.

Table 2: Training protocol for the circuit resistance training group

Weeks	Repetitions	Rest between sets	Rest between exercises	Workload (1RM %)
1-3	10-12	45 sec	90 sec	50
4-6	10-12	45 sec	90 sec	50
7-9	12-14	30-45 sec	60-90 sec	60
10-12	12-14	30-45 sec	60-90 sec	60

Results

The major findings are changes in body composition in young male participants in a 12-week CRT program with diet not controlled. Pre- and post-training body composition results of CRT are presented in Table 3. After training, CRT showed a decrease in percentage BF (t=-5.07; *p*<.05), FM (t=-3.74; *p*<.05), an increase in FFM (t=5.06; *p*<.05), with no significant change in body weight (t=1.33; *p*>.05) or BMD (t=1.16; *p*>.05).

Table 3: CRT responses to 12 weeks of resistance training

	Mean_+ SD	Mean	SD	t	df	P
Weight 2kg Weight 1	71.2_+7.7 71.4_+7.1	.45	.35	1.28	14	.281
% Body Fat 2 % Body fat 1	19.9_+4.9 21.9_+4.8	-1.27	1.26	-5.55	14	.010
Fat Mass 2kg Fat Mass 1	13.5_+4.4 14.3_+4.6	-1.14	1.52	-3.29	14	.002
Fat Free Mass 2kg Fat Free Mass 1	57.6_+5.9 56.7_+5.5	1.03	1.11	5.07	14	.001
Bone Mineral Density2g/cm Bone Mineral Density1g/cm	1.240_+.085 1.245_+.086	.003	.010	1.18	14	.259

Significant at *p*<.05

The pre- and post-test body composition results of the control group are presented in Table 4. The control group showed no significant change in body weight (*t*=-.28; *p*>.05), BF percentage (*t*=.55; *p*<.05), FM (*t*=.29; *p*<.05), FFM (*t*=-.07; *p*<.05), and BMD (*t*=-1.18; *p*>.05).

Table 4: Control group (c) results.

	Mean_+ SD	Mean	SD	t	df	P
Weight 2kg Weight 1	73.2_+9.7 73.4_+10.1	-.15	1.95	-.28	12	.781
% Body Fat 2 % Body fat 1	22.9_+6.9 22.9_+6.8	.27	1.76	.55	12	.590
Fat Mass 2kg Fat Mass 1	16.5_+6.4 16.3_+6.6	.14	1.72	.29	12	.778
Fat Free Mass 2kg Fat Free Mass 1	56.6_+4.9 56.7_+5.5	-.03	1.19	-.07	12	.942
Bone Mineral Density2g/cm Bone Mineral Density1g/cm	1.260_+.095 1.265_+.096	-.005	.014	-1.18	12	.259

Table 5: Baseline comparisons between CRT and the control group (c)

Variables	Groups	n	Mean_+SD	t	P
Weight kg	CRT	15	71_+7.8	-.70	.490
	C	13	73.4_+10.1		
% Body Fat	CRT	15	21.4_+4.6	-.56	.577
	C	13	22.6_+6.8		
Fat Mass	CRT	15	14.7_+4.2	-.79	.437
	C	13	16.3_+6.6		
Fat Free Mass kg	CRT	15	56.4_+5.0	-.16	.870
	C	13	56.7_+5.4		
Bone Mineral Density gr/cm	CRT	15	1.243_+.086	-.65	.517
	C	13	1.265_+.096		

The results after the 12-week period between CRT and control are presented in Table 6. There were significant differences between CRT and control in BF (t=-3.33; p<.05), FM (t=-2.20; p<.05), FFM (t=3.40; p<.05), and BMD (t=2.06; p<.05), with no significant differences in body weight (t=.99; p>.05).

Table 6: Comparisons between CRT and the control group (c) after 2 week of resistance training

Variables	Groups	n	Mean_+SD	t	P
Weight kg	CRT	15	.45_+1.45	.99	.332
	C	13	-.17_+1.84		
% Body Fat	CRT	15	-1.63_+1.24	-3.33	.003
	C	13	.27_+1.75		
Fat Mass	CRT	15	-1.03_+1.06	-2.20	.038
	C	13	.14_+1.72		
Fat Free Mass kg	CRT	15	1.46_+1.0	3.40	.002
	C	13	-.07_+5.4		
Bone Mineral Density gr/cm	CRT	15	1.243_+.086	2.06	.005
	C	13	1.265_+.096		

Significant at p<.05

Findings and discussion

In the present study, the effects of CRT with no dietary restriction on body composition parameters (BF percentage, FM, FFM, BMD, and body weight) were examined. Results suggest that 12 weeks of CRT improves body composition parameters and bone status of young male subjects.

Resistance training is a common mode to increase FFM and decrease BF percentage (11, 14, 26, 29). In CRT, significant differences were found in percentage BF, FM, and FFM in response to twelve weeks of training. The CRT group exhibited a significant decrease in BF (-1.63%), FM (-1.03 kg), a significant increase in FFM (1.46 kg), with no change in body weight or BMD. In the control group, there were no significant changes in BF, FM, FFM, or BMD. The literature supports the findings of the present study. Shaw *et al.* (2009) studied the effects of resistance exercise training on abdominal fat, with no restriction on energy intake.

Twenty-five healthy male subjects (25±1 years) participated in a resistance exercise program for 16 weeks, 3 times per week. At the end of the 16-week period, significant decreases were observed for BF, total skinfold, and body mass index (BMI). Ferreira *et al.* (2010) conducted a study on 14 sedentary females (33–45 years old) using a 10-week, 3-days-per-week CRT program for body composition. No significant changes were found in waist circumference and waist to hip ratio. The results suggested that CRT increased FFM and decreased FM and BF percentage. Forty-seven females and 26 males (mean 20.3 years) volunteered for a study conducted by Wilmore (1974) with resistance exercise for 10 weeks, 2 days per week. At the end of the 10-week period, body weight did not change but relative FM decreased by 10% and 7.6% for males and females, respectively. Results from other studies vary with respect to resistance exercise and body composition. Brown and Wilmore (1974) conducted research in which 7 female national throwers (aged 16–23) engaged in resistance exercises for six months, three days per week. At the end of the six-month period, all showed a considerable gain in strength, with no change in body weight or BF percentage. In 81 healthy volunteer subjects (male=35, female=46; aged 65–85) in response to 22 weeks of resistance training at 3 days per week, Hanson *et al.* (2009) found an increase in FFM with no difference in BF percentage in both the males and females. In a study by Harber *et al.* (2004), a circuit resistance training program of 10 exercises for 10 weeks at 3 times per week in young adult men (aged 18–35) found no differences in body weight, FFM, FM, or percentage BF. One of the aims of the present study was to examine the effects of CRT on bone status in young males. During adulthood, one goal of physical activity is to maintain bone mass and bone health. In adults, bone mineral density response to exercise training is unclear [2]. In the present study, at the end of the 12-week period, there were no significant within-group differences in bone mineral density in CRT or the control group. However, bone mineral density was significantly higher in CRT at the end of the 12-week period versus the control group. Almstedt *et al.* (2011) conducted a study on recreationally active men (n = 12) and women (n = 12) aged 18–23 to reveal the effects of a 24-week resistance-training program on bone mineral density. Results indicated that resistance training was effective in. Increasing BMD in the young men. The females in the study who followed the same protocol did not receive the same benefits. Ryan *et al.* (2004) investigated the effects of 6 months of progressive whole-body resistance training on body composition in younger men (n=12) and women (n=7) aged 20-29 years and older men (n=10) and women (n=10) aged 65-74 years. Results found an increase in muscle mass and improved bone mineral density of the femoral region in both the healthy young and older men and women. Limitations in the current study included conducting the study only on young men. Resistance training in young women and the elderly may reveal different results. Long-term effects of treatment beyond 12 weeks may be considered.

Conclusion

The present study found that a 12 week resistance training program increased FFM, and decreased percentage BF and FM in young moderately-active males. Bone mineral density values were significantly higher after training in CRT versus control, with no significant changes in body weight in CRT or control.

References

1. American College of Sports Medicine. Position stand: Appropriate intervention strategies for weight loss and prevention of weight regain for adults. Medicine and Science in Sports and Exercise 2001;33(12):2145-2156.
2. Andersen RE, Jakicic JM. Interpreting the physical activity guidelines for health and weight management. Journal of Physical Activity and Health 2009;6:651-656.
3. Broeder CE, Burrhus KA, Svanevik LS, Wilmore JH. The effects of either high-intensity resistance or endurance training on resting metabolic rate. American

Journal of Clinical Nutrition 1992;55:802-810.
4. Falls H (ed.). Exercise physiology. New York and London, AP: Academic Press 1968.
5. Heyward V. Advanced fitness assessment & exercise prescription (2nd ed.). Champaign, IL: Human Kinetics Publications 1991.
6. Hoffman J. Physiological aspects of sport training and performance (1st ed.). Champaign, IL: Human Kinetics Publications 2002.
7. Jakicic JM, Otto AD. Treatment and prevention of obesity: What is the role of exercise? Nutrition Reviews 2006;2:57-61.
8. Karlsson MK, Nordqvist A, Karlsson C. Physical activity increases bone mass during growth. Food and Nutrition Research 2008;52:1-8.
9. Katch VL, McArdle WD, Katch FI. Essentials of exercise physiology (4th ed.). Baltimore, MD: Lippincott Williams & Wilkins 2011.
10. Kelly PJ, Nguyen T, Hopper J, Pocock N, Sambrook P, Eisman J. Changes in axial bone density with age: A twin study. Journal of Bone and Mineral Research 1993;8(1):11-17.
11. Kraemer WJ, Fleck SJ, Deschenes MR. Exercise physiology integrating theory and application (1st ed.).Baltimore, MD: Lippincott Williams & Wilkins 2012.
12. Kwon HR, Han KA, Ku YH, Ahn HJ, Koo BK, Kim HC *et al.* The effects of resistance training on muscle and body fat mass and muscle strength in type 2 diabetic women. Korean Diabetes Journal 2010;34:100-110.
13. Lohman TG. Exercise training and bone mineral density. QUEST 1995;47:354-361.
14. Marra C, Bottaro M, Oliveira RJ, Novaes JS. Effects of moderate and high intensity aerobic exercise on the body composition of overweight men. Journal of Exercise Physiology-online 2005;8(2):39-45.
15. Ucan Y. Effects of different types of exercises on body composition in young men and women. Life Science Journal 2013;10(3):1799-1806.
16. Venkata RY, Surya KMVL, Sudhakar RS, Balakrishna N. Effect of changes in body composition profile on VO max and maximal work performance in athletes. Journal of Exercise Physiology-online 2004;7(1):34-39.
17. Wilmore JH, Costill D. Physiology of sport and exercise. Champaign, IL 1994.