

THE EFFECT OF AN CIRCUIT STRENGTH TRAINING PROGRAM ON THE MUSCLE STRENGTH, BODY IMAGE AND ANXIETY OF ANXIOUS UNDERWEIGHT MALE COLLEGE STUDENTS

UTJECAJ PROGRAMA KRUŽNOG TRENINGA NA MIŠIĆNU SNAGU, SLIKU O SAMOM SEBI TE ANKSIOZNOST STUDENATA NISKOG STUPNJA UHRANJENOSTI

Sajad Jafari, Farhad Rahmani-nia, Hamid Arazi

Department of Exercise Physiology, Faculty of Sport Sciences, University of Guilan, Rasht, Iran

SUMMARY

The purpose of this study was to compare the effects of 8-week circuit-strength training on muscle strength, body image and anxiety of anxious underweight male college students. Hence, forty underweight male college students anxious were divided into 2 groups: a strength training group (N=20) and a control group (N=20). Subjects in strength training group trained an 8-week, 3 days per week full body progressive circuit-strength training, whereas control subjects did not participate in any training activity. The anthropometrical, body composition, body image (Multidimensional Body Self-Relations Questionnaire), anxiety (Spielberger state-trait Anxiety Inventory), muscle endurance and one repetition maximum in six exercises were measured before and after an eight-week training period. The results showed that 8-week strength training elicited significant ($P < 0.05$) increase in upper- and lower body strength as measured by 1RM as well as legs' and arms' muscle hypertrophy. In addition, strength training group had a significantly greater improved increase in body image (BI) and reduced social physique anxiety (SPA) than control group. This study provides support for the use of weight training to improve body image and anxiety, these may be derive from considerable physical changes results from resistance training such as significant increase in muscle endurance, strength and muscle mass.

Keywords: Resistance Training; Muscle Strength; Body Image, Anxiety; Underweight

SAŽETAK

Svrha ovog istraživanja bila je usporediti učinke osmotjednog kružnog trening jakosti na snagu mišića, sliku o samom sebi te na tjeskobu studenata niskog stupnja uhranjenosti muškog spola. Četrdeset studenata niskog stupnja uhranjenosti koji su bili anksiozni oko toga su podijeljeni u 2 skupine: skupina treninga jakosti (N = 20) i kontrolna skupine (N = 20). Eksperimentalna skupina je trenirala 8 tjedana, 3 dana tjedno, kružnim treningom snage koji je uključivao sve mišićne skupine. dok kontrolni ispitanici nisu sudjelovali u nikakvom tjelesnom vježbanju. Izmjerene su antropometrijske karakteristike, sastav tijela, slika o svome tijelu (Multidimensional Body Self-Relations Questionnaire), anksioznost (Spielberger state-trait Anxiety Inventory), mišića izdržljivosti i jedno maksimalno ponavljanje (u šest vježbi mjereni) su prije i nakon osam tjedana. Rezultati su pokazali da je trening snage od 8 tjedana izazvao značajno povećanje ($P < 0,05$) u snazi gornjeg i donjeg dijela tijela mjereno s 1RM. Osim toga, skupina u treningu jakosti je imala značajno poboljšanje u doživljaju slike tijela (BI-body image) i smanjenje socijalnog stupnja anksioznosti (SPA) od kontrolne skupine. Ova studija pruža dokaze u korist korištenja treninga s utezima za poboljšanje slike tijela i smanjenje tjeskobe što vjerojatno proizlazi iz osjećaja bolje tjelesne pripremljenosti i tjelesnog izgleda zbog značajnog porasta mišićne izdržljivosti, snage i mišićne mase.

Ključne riječi: trening jakosti, mišićna jakost, slika o svom tijelu, anksioznost, pothranjenost

INTRODUCTION

Health has an important role in life of individuals and it increased life expectancy, therefore, it should be paid more attention to health and well-being of all individuals. An important matter that its role in health and wellbeing may be neglected, is body image (32). Body image refers to the accuracy of the perception of the person's bodily size and to the thoughts and feelings associated with the individual's view of the body (4). Because negative body image is a principal component and predictor of a variety of health problems such as depression, obesity, body dysmorphic disorder, and eating disorders, (2,26) it is important to examine its antecedents and consequences. Historically, the research literature on body image has focused predominantly on women, girls and overweight persons. Research suggests that being underweight may also have negative psychosocial consequences. Recently, however, greater interest in underweight male body image has emerged (6,17,9). In comparison with women, who tend to become increasingly dissatisfied with increases in body weight, both underweight and overweight men report more body dissatisfaction than their averageweight peers (11).

In societies, it would be expected that based on this pressure, individuals to be dissatisfied with their own personal body image. This body dissatisfaction plus other important factors such as life daily problems (educational problem, psychological and social problem ...) are cases which lead to physical and mental problems such as depression, narcotic drugs abuse and anxiety (21).

Although traditional treatment of body image problems has consisted primarily of cognitive-behavioral therapy, more recently, exercise has become more popular as a treatment modality. (12,15) Researchers have previously documented the positive changes that occur in physical fitness following either aerobic or strength training, but a few studies has been shown that strength training is associated with greater improvements in body satisfaction than aerobic training (3,31).

Selected studies have focused on the effects of strength training on body image. For example, Tucker and Maxwell (1992) investigated the effects of weight-training on body image of females participating in a 15-week, 2-days-per-week weight-training program, compared with a non-exercising control group. With pretest scores controlled, the weight-training group had significantly higher posttest scores than controls in both general well-being and body cathexis, defined as the degree of satisfaction a person feels about various parts and processes of the body (30,22). The authors concluded that strength training enhances both body image and overall feelings of well-being. Characteristics of women who experienced the greatest improvements included those who were heavier, shorter, and who were not involved in any other regular physical activity during the program. The researchers surmise that heavier, previously

inactive participants were less fit, and therefore had more potential for improvement. In a rare study comparing weight-training with aerobic exercise, Tucker and Mortell (1994) found that middle-aged women who engaged in a home strength training program three times per week for 12 weeks markedly improved body cathexis more than women participating in a walking program of the same frequency and duration (31). In a more recent study, Ahmed, Hilton, and Pituch (2002) investigated the effects of weight-training on body image in female university students. After 12 weeks of strength training, participants experienced significantly more strength and improved body image despite a slight increase in percent body fat. They also reported improved health and physical fitness. Williams and Cash (2001) investigated the effects of a six-week circuit weight-training program on college students. Their results showed that even a relatively brief program reduced social physique anxiety and improved appearance evaluation and body dissatisfaction among both males and females. Despite the exclusive use of strength training in this study, the circuit training method they employed may have had aerobic benefits (33). In a wide-ranging literature review, McAuley has considered the relation between exercise and both positive and negative psychological health. In line with other review articles, McAuley reported a positive relationship between exercise and self-esteem, self-efficacy, psychological well-being, and cognitive functioning, and a negative relationship between exercise and anxiety, stress, and depression. yet, evidence supporting this assertion is limited (27).

Giving that strength training has considerable effects on psychological health and there are few data relating its effect on body image and anxiety among underweight young college students. The primary aim of this study was to explore the effect of an 8-week circuit-strength training (ST) on body image and anxiety in underweight male college students anxious.

METHODS

Subjects

Forty underweight male college students anxious volunteered to participate in this study. Eligible subjects were underweight and untrained students in University of Guilan. Participants were ineligible if they were currently doing resistance training, had extensive experience in resistance training, or if they had a medical condition or physical injury preventing testing or training. These participants were randomly divided into either a strength training group or a control group (Table I). Subjects were informed of the experimental risks, and they signed an informed consent document before the investigation. The Institutional Review Board of the University approved the research protocol. Subjects were on their ordinary diet, not permitted to use nutritional supplementation, and did not consume anabolic steroids or any other anabolic agents known to increase performance.

Table 1. Means \pm standard deviations for physical characteristics in both groups.

Tablica 1. Aritmetičke sredine i standardne devijacije tjelesnih karakteristika u obje grupe

Variables		Strength training group	Control group
N.		20	20
Age (y)		20.20 \pm 1.23	21.45 \pm 1.60
Height (cm)		177.90 \pm 5.89	181.12 \pm 3.91
Weight (kg)		59.21 \pm 5.30	58.48 \pm 2.29
% body fat		9.75 \pm 2.38	8.11 \pm 1.88
Somatotype	endomorph	3.05 \pm 0.74	2.39 \pm 0.53
	mesomorph	3.35 \pm 0.56	2.46 \pm 1.10
	ectomorph	4.76 \pm 0.58	5.46 \pm 0.77

Body composition testing

Height (to the nearest cm) and weight (to the nearest 0.1 kg) were recorded with the subjects dressed in exercise clothes and without shoes. Skin fold measurements (mm) were obtained from seven sites (Triceps, Midaxillary, Subscapular, Suprailiac, chest, abdomen, and front thigh) on the right side of the body by the same investigator using a skin fold caliper. The percent of body fat was calculated using seven site formula (28).

Muscular strength testing

Maximal muscular strength in upper and lower body was assessed using one repetition maximum (1RM) protocol. Each participant performed a warm-up set using a resistance that was approximately 40-60% of his

perceived maximum and then performed 3-4 subsequent trials to determine the 1RM. A 3- to 5-minute rest period was provided between each trial (16). Upper body strength was assessed using barbell bench press, barbell curl, and wide-grip pull down, and lower body strength was determined using leg extension, lying leg curl and leg press (Table II).

Muscular endurance testing

Subjects performs as many bent knee sit-ups as possible within 60 seconds. Subject can rest between reps if unable to sit-up continuously. Subject encouraged to perform one or two trial repetitions before test. The test was to evaluate the abdominal and hip flexor endurance for subjects (Table II) (20).

Table 2. Means \pm standard deviations for upper- and lower-body strength and hypertrophy in both groups.

Tablica 2. Aritmetičke sredine i standardne devijacije mjera jakosti i snage

Measurements	Strength training group		Control group	
	Baseline	Week 8	Baseline	Week 8
1RM barbell bench press (kg)	57.95 \pm 9.09	66.15 \pm 11.11 ^{*†}	58.60 \pm 7.74	57.20 \pm 6.29
1RM barbell curl (kg)	30.50 \pm 7.34	36.15 \pm 4.57 ^{*†}	25.50 \pm 9.95	26.10 \pm 11.11
1RM wide-grip pull down (kg)	52.95 \pm 7.33	56.50 \pm 8.78 ^{*†}	51.45 \pm 6.73	49.80 \pm 9.98
1RM leg extension (kg)	60.45 \pm 9.69	79.05 \pm 13.09 ^{*†}	62.60 \pm 6.79	61.15 \pm 5.72
1RM lying leg curl (kg)	58.80 \pm 8.98	65.55 \pm 9.42 ^{*†}	59.05 \pm 6.43	57.60 \pm 7.74
1RM leg press (kg)	146.80 \pm 28.62	172.75 \pm 26.61 ^{*†}	146.29 \pm 27.71	139.54 \pm 18.79
Muscular endurance (Rep)	40.15 \pm 24.60	66.90 \pm 18.79 ^{*†}	40.50 \pm 26.76	37.60 \pm 23.16
Arm circumference (mm)	238.31 \pm 18.82	256.60 \pm 15.87 ^{*†}	238.76 \pm 17.89	236.75 \pm 18.50
Leg circumference (mm)	104.66 \pm 13.36	116.86 \pm 13.34 ^{*†}	105.38 \pm 11.66	100.85 \pm 21.55
Percent body fat	9.57 \pm 2.38	8.33 \pm 2.33 ^{*†}	8.11 \pm 1.88	7.92 \pm 2.09

*Different from baseline exercise (P<0.05); † Different from control group (P<0.05).

Circuit-strength training program

The circuit ST group trained an 8-week, three days per week full body progressive circuit strength training, whereas control subjects did not participate in any training activity and maintain their normal physical activity and nutrition behaviors for the study period. An exercise physiologist supervised the sessions. Before commencing each session, participants completed 10 min warm up that include jogging and dynamic stretching (i.e. leg swings, body weights squats). The circuit-strength training sessions consisted of 3-circuit of 8-station and 12 to 15 repetition in each station (Than Machine lumbar extension and sit up), including barbell bench press, barbell curl, wide-grip pull down, leg extension, lying leg curl, leg press, Machine lumbar extension and sit up, with 20 second recovery between stations and 3-minute between the circuits. Every 2-week, strength training intensity was progressively increased (45% 1RM weeks 1-2, 50% 1RM weeks 3-4, 55% 1RM weeks 5-6, 60% 1RM weeks 7-8).

Body image assessments: MBSRQ

Multidimensional Body Self-Relations Questionnaire (MBSRQ) is a 69-item inventory designed to assess body image. The MBSRQ is body image investment (the level of importance an individual places on body image) and evaluation (the level of satisfaction or dissatisfaction with one's body image) across several domains (i.e., health, appearance, fitness, and illness). This measure contains 10 subscales, only the appearance orientation subscale was used for the purposes of the current study. The appearance orientation subscale examines the extent to which an individual is invested in, or the importance she places on, her appearance. It comprises 12 items, each rated on a 5-point Likert scale. Higher scores indicate the individual places greater importance on how she looks, pays attention to her

appearance more, and engages in grooming behaviors. Therefore, this measure of investment is consistent with Cash et al. conception of motivational salience, or adaptive investment. Lower scores indicate that the individual is apathetic regarding her appearance, does not place much importance on her looks, and does not expend much effort on grooming behaviors (6,21).

The Spielberger State-Trait Anxiety Inventory (STAI)

The Spielberger state-trait anxiety inventory (STAI) is a 40-item questionnaire which provides separate measures of state and trait anxiety with 20 questions each. The State-Trait Anxiety Inventory (STAI) is reported to be reliable and valid and has been used extensively in research and clinical practice. The development of STAI was initiated in 1964 by Spielberger and Gorsuch and STAI-Form X was published in 1970. On the basis of accumulated knowledge gained from extensive research with the STAI, a revision of the scale began in 1979, and eventually Form Y was published in 1983 (24). The STAI comprises separate self-report scales for measuring state and trait anxiety, consistent with the definitions given above. The S-Anxiety scale (STAI Form Y-1) consists of twenty statements that evaluate how the respondent feels "right now, at this moment". The T-Anxiety scale (STAI Form Y-2) consists of twenty statements that evaluate how the respondent feels "generally". The State Anxiety scale required respondents to rate the intensity of their feelings (e.g., "I feel nervous") at the time they were completing the questionnaire using a 4-point Likert-type scale: 1=not at all, 2=somewhat, 3=moderately so, and 4=very much so. Similarly, the Trait Anxiety scale required respondents to rate the frequency of their feelings (e.g., I am secure) in general using a 4-point Likert-type scale: 1 = almost never, 2 = sometimes, 3 = often, and 4 = almost always. Each STAI item is given a weighted score of 1 to 4.

Table 3. Means±standard deviations for measures of body image, state anxiety and trait anxiety in both groups.
Tablica 3. Aritmetičke sredine i standardne devijacije mjera slike o samom sebi i stupnja anksioznosti

Measures	Strength training group		Control group	
	Baseline	Week 8	Baseline	Week 8
Body image	3.30±0.352	3.61±0.212**†	3.13±0.27	3.20±0.15
State anxiety	48.65±4.22	39.30±10.39**†	52.90±4.51	55.50±5.29
Trait anxiety	49.55±3.21	38±9.23**†	50.95±4.24	53.40±5.20

*Different from baseline exercise (P<0.01); † Different from control group (P<0.01).

Study design

The study utilized a pretest–posttest control group design. The circuit-strength training sessions consisted of 3-circuit of 6-station and 12 to 15 repetition in each station, with 20 second recovery between stations and 3-minute between the circuits. All participants answered questionnaires a day before and after study period. To ensure that feedback from 1RM tests would not affect

participants' body image scores, questionnaires were administered before the 1RM test. All measures were administered at baseline and at the end of the 8-week strength-training program.

STATISTICAL ANALYSIS

Descriptive statistics were calculated as the mean and standard deviations (mean ± SD). The data were

analyzed using a 2x2 ANOVA (group vs. pre/post test measurement) for repeated measures using the Statistical Software (SPSS 16.0, Chicago, IL, USA). The differences detected by the ANOVA were located with Scheffe post hoc tests. The Pearson product moment correlation coefficient was used. All of the tests were two tailed, and an alpha level of $p < 0.05$ was regarded as statistically significant.

RESULTS

Means and standard deviations for measures of body image, state anxiety and trait anxiety at baseline and week 8 for strength training group and control group are presented in Table III. The 2 (groups)x2 (pre- vs. post-test) general liner model revealed significant effects of group and time for body image, state anxiety and trait anxiety ($p < 0.05$). These results indicate that strength training group experienced significant increases in body image from baseline (3.30 ± 0.352) to week 8 (3.61 ± 0.212), significant increases in State anxiety from baseline (48.65 ± 4.22) to week 8 (39.30 ± 10.39), also, significant increases in Trait anxiety from baseline (49.55 ± 3.21) to week 8 (38 ± 9.23). In addition, body image was significantly higher in strength training group compared to the control group ($P < 0.05$) (Figure 1), as well as, State and Trait anxiety were significantly lower in strength training group when compared to the control group ($p < 0.05$) (Figures 2, 3). As shown in Table II, significant effects of group and time for upper- and lower-body strength and hypertrophy were observed. Together, these results demonstrate that the eight-week circuit-strength training program was effective in improving upper- and lower-body strength and hypertrophy. Computation of Pearson's product correlations indicated no significant relationship between improvements in body image and decreases in state-trait anxiety in strength training group. No significant correlations emerged between changes in body image and state-trait anxiety with improving upper- and lower-body strength and hypertrophy.

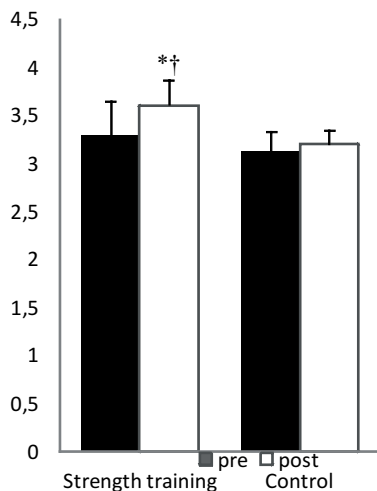


Figure 1. Body image at baseline and week 8 for strength training group and control group. Values expressed as mean ±SD. *Different from

baseline exercise ($P < 0.01$); † Different from control group ($P < 0.01$).

Slika 1. Inicijalne i finalne razlike u slici o samome sebi. Vrijednosti izražene kao AS ±SD. *Razlika od inicijalne vrijednosti $P < 0.01$; † Razlika od kontrolne grupe ($P < 0.01$).

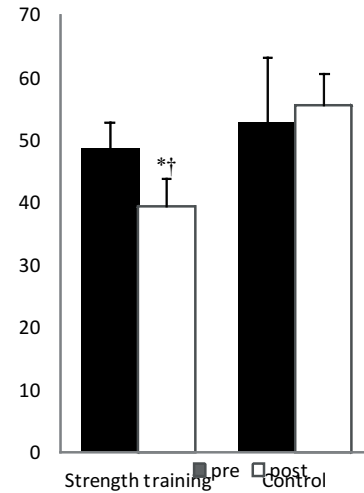


Figure 2. State anxiety at baseline and week 8 for strength training group and control group. Values expressed as mean ±SD. *Different from baseline exercise ($P < 0.01$); † Different from control group ($P < 0.01$).

Slika 2. Inicijalne i finalne razlike u stanju anksioznosti. Vrijednosti izražene kao AS ±SD. *Razlika od inicijalne vrijednosti $P < 0.01$; † Razlika od kontrolne grupe ($P < 0.01$).

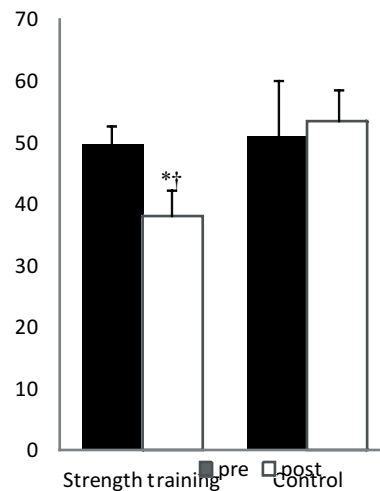


Figure 3. Trait anxiety at baseline and week 8 for strength training group and control group. Values expressed as mean ±SD. *Different from baseline exercise ($P < 0.01$); † Different from control group ($P < 0.01$).

Slika 3. Inicijalne i finalne razlike u stupnju visoke anksioznosti (neuroticizam). Vrijednosti izražene kao AS ±SD. *Razlika od inicijalne vrijednosti $P < 0.01$; † Razlika od kontrolne grupe ($P < 0.01$).

DISCUSSION

Body self-image is a psychological construct which has gained increasing attention in current years, and researchers reported that active groups have a better concept of their bodies and body image than sedentary groups (6). A negative body image can induce many psychological and physiological problems in both sexes, including obesity, body dysmorphic, eating disorders, depression, social anxiety, impaired sexual functioning, poor self-esteem, and diminished quality of life (2,26).

Our aim was to investigate whether an 8-week circuit ST program could affect muscular strength, muscular endurance, hypertrophy, body image and state-trait anxiety in underweight male college students anxious. This study demonstrates that 1) upper- and lower-body muscular strength and hypertrophy (arm and leg muscle mass) is increased after an 8-week circuit ST, 2) muscular endurance is increased after an 8-week circuit ST, 3) body image is improved after an 8-week circuit ST, and 4) state-trait anxiety is decreased after an 8-week circuit ST program.

The finding that muscular strength is increased after an 8-week circuit ST program is consistent with previous studies indicating that chronic ST program increase upper- and lower body strength. (6,21,33) Also, upper- and lower body hypertrophy was significantly increased after circuit ST program as well as significant decrease was observed in body fat mass. These findings are consistent with previous studies showing significant improvement in body composition after long-term ST program (21,8).

All of these changes, increased muscle strength, hypertrophy and decreased body fat mass, may help individual approximate their body ideals, thus improving body satisfaction. The findings of this study suggest that circuit ST program was significantly improved body satisfaction levels of underweight male college students anxious. These changes didn't observe for the matched control subjects. These findings are in line with previous studies that reported significant improvement in body image after ST program ranging from 6- to 16-week. This result is not surprising, however, because the increased muscle mass that doubtless accompanied the increase in strength would have altered body composition in the direction of more muscle mass and less fat (31,33,14).

The findings of our study showed that changes in body image didn't significantly correlate with improvements in strength gains and changes in body composition. Although researchers have found that individuals who exercise have a more positive body image and changes in body composition than non-exercisers, (31,14,1) others have found that exercisers have worse body image and changes in body composition than non-exercisers (29). In particular, the researchers found that participants who exercised for weight control or improved "tone" had lower body satisfaction, and that exercising for the purposes of health and fitness was related to enhanced body satisfaction (14).

Body image has been defined as "a person's mental image and evaluation of his or her physical appearance

and the effect of these perceptions and attitudes on behaviour" (10). The way a person perceives his/her body is influenced by a variety of factors including the degree of importance their physical appearance has to their overall sense of self (25). It has been noted that many women experience a discrepancy between their actual and perceived body shape (18). Research highlights the impact a disturbance in body image can have on an individual's quality of life (5,19). In a non-clinical student sample, body image attitudes have been found to have a negative effect on self-reported self-esteem, interpersonal confidence, eating and exercise behaviours, grooming activities, sexual behaviours and experiences and 7 emotional stability (5). In adolescents, poor body image is associated with self-reported low self esteem, elevated anxiety, depression and somatisation in a community sample (19). Body image dissatisfaction has also been found to correlate with eating disorders (13).

A Substantial body of research has focused on the relationship between body size and depressive symptoms in adolescents. anxiety disorders (e.g. social phobia and obsessive-compulsive disorder) have been found to occur frequently in persons with poor body image (21). Individuals with social anxiety disorder report low quality of life, as well as substantial impairment in social, occupational, and educational functioning (21).

Anxiety, a central construct in theories of personality and psychopathology, is generally conceived to have two major structural elements: state anxiety and trait anxiety. Whereas state anxiety refers to transitory unpleasant emotional states and associated activation of the autonomic nervous system, trait anxiety refers to stable individual differences in anxiety proneness in situations perceived as dangerous and threatening (23). Although several instruments are available to assess anxiety, the State-Trait Anxiety Inventory (STAI) (23) has been one of the most widely used assessment tools for both research and clinical purposes. In the current study, state and trait anxiety was significantly reduced after 8-week circuit ST program. Our findings are consistent with Williams and Cash (33) and Rahmani-nia et al (21) findings', who reported 6 and 8 week circuit weight training reduced social physique anxiety.

The results of the current study suggest that chronic circuit ST can be used to potentially improve an individual's state body image. These findings may have implications for individuals who are looking to improve their body image or who have high body image concerns, as participation in 8 week circuit ST program may result in a positive improvement in body image. Regular strength training may be used as an option for treatment to improve body image, or in conjunction with other forms of treatment, in particular with groups known to experience poor body image (e.g., overweight individuals, young women, individuals with bulimia nervosa). Future research should examine the effects of chronic strength training on body image in other populations (e.g., women, children, etc) to determine if other groups also benefit from a chronic strength training. Further research should also examine the effect of resistance training with different intensities on body

image. Finally, investigation of the mechanisms of state body image changes as a result of chronic strength training could be investigated.

CONCLUSIONS

The current study examined the effect of an 8-week circuit ST program on muscular endurance and strength, hypertrophy, body image and state-trait anxiety in underweight male college students anxious. The findings from the current study supported the hypotheses, with participation in the 8-week circuit ST program associated with decreases in the state-trait anxiety and increases in body satisfaction, also, change in muscular endurance and

strength and hypertrophy. These finding are important as participation in circuit ST program may have positive implications for participants regarding body image attitudes and state-trait anxiety. These findings have practical implications as they could be used to help individuals experience a positive improvement in body image variables with participation in circuit ST program.

ACKNOWLEDGEMENTS

The authors would like to thank the participants for their willing cooperation in this study. Also, Special thanks to University of Guilan for the financial support.

References

1. Ahmed C, Hilton W, Pituch K. Relations of strength training to body image among a sample of female university students. *The Journal of Strength & Conditioning Research*. 2002;16(4):645-8.
2. American Psychiatric Association A, Association AP. *Diagnostic and statistical manual of mental disorders*. 1994.
3. Caruso CM, Gill DL. Strengthening physical self-perceptions through exercise. *The Journal of sports medicine and physical fitness*. 1992;32(4):416.
4. Cash TF. Body-image affect: Gestalt versus summing the parts. *Perceptual and Motor Skills*. 1989;69(1):17-8.
5. Cash TF, Fleming EC, Alindogan J, Steadman L, Whitehead A. Beyond body image as a trait: The development and validation of the Body Image States Scale. *Eating Disorders*. 2002;10(2):103-13.
6. Cash TF, Pruzinsky T. *Body image: A handbook of theory, research, and clinical practice*: Guilford Press New York; 2002.
7. Cash TF, Szymanski ML. The development and validation of the Body-Image Ideals Questionnaire. *Journal of Personality Assessment*. 1995;64(3):466-77.
8. Campbell A, Hausenblas HA. Effects of Exercise Interventions on Body Image A Meta-analysis. *Journal of Health Psychology*. 2009;14(6):780-93.
9. Corson PW, Andersen A. Body image issues among boys and men. *Body image: A handbook of theory, research, and clinical practice*. 2002:192-9.
10. De Panfilis C, Rabbaglio P, Rossi C, Zita G, Maggini C. Body image disturbance, parental bonding and alexithymia in patients with eating disorders. *Psychopathology*. 2003;36(5):239-46.
11. Drewnowski A, Yee DK. Men and body image: Are males satisfied with their body weight? *Psychosomatic Medicine*. 1987;49(6):626-34.
12. Finkenber ME, Dinussi JM, Mccune SL, Mccune ED. Body esteem and enrollment in classes with different levels of physical activity. *Perceptual and Motor Skills*. 1993;76(3):783-92.
13. Furnham A, Badmin N, Sneade I. Body image dissatisfaction: Gender differences in eating attitudes, self-esteem, and reasons for exercise. *The Journal of Psychology: Interdisciplinary and applied*. 2002;136(6):581-96.
14. Henry RN, Anshel MA, Michael T. Effects of Aerobic and Circuit Training on Fitness and Body Image Among Women. *Journal of Sport Behavior*. 2006;29(4).
15. Holmes T, Chamberlin P, Young M. Relations of exercise to body image and sexual desirability among a sample of university students. *Psychological reports*. 1994;74(3):920-2.
16. Levinger I, Goodman C, Hare DL, Jerums G, Toia D, Selig S. The reliability of the 1RM strength test for untrained middle-aged individuals. *Journal of science and medicine in sport*. 2009;12(2):310-6.
17. Lundgren J, Anderson D, Thompson J, Shapiro J, Paulosky C. Perception of teasing in underweight persons: A modification of the perception of teasing scale. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*. 2004;9(2):139-46.
18. Markham A, Thompson T, Bowling A. Determinants of body-image shame. *Personality and Individual Differences*. 2005;38(7):1529-41.
19. Newman DL, Sontag LM, Salvato R. Psychosocial aspects of body mass and body image among rural American Indian adolescents. *Journal of Youth and adolescence*. 2006;35(2):265-75.
20. Pollock ML. *Health and Fitness Through Physical Activity*. 1978.
21. Rahmani-Nia F, Arazi H, Rahimi R, Piri-Kurd K, Hossaini K. Effects of an eight-week circuit strength training program on the body images and anxiety in untrained college students. *Med Dello Sport*. 2011;64:297-308.
22. Secord PF, Jourard SM. The appraisal of body-cathexis: body-cathexis and the self. *Journal of Consulting Psychology*. 1953;17(5):343.
23. Spielberger CD, Barratt ES, University FS. *Anxiety: current trends in theory and research*: Academic Press; 1972.
24. Spielberger CD, Gorsuch RL, Lushene RE. *Manual for the state-trait anxiety inventory*. 1970.
25. Spurgas AK. Body image and cultural background. *Sociological Inquiry*. 2005;75(3):297-316.
26. Stice E. Risk and maintenance factors for eating pathology: a meta-analytic review. *Psychological bulletin*. 2002;128(5):825.
27. Stratton G, Jones M, Fox K, Tolfrey K, Harris J, Maffulli N, et al. Bases position statement on guidelines for resistance exercise in young people. *Journal of sports sciences*. 2004;22(4):383-90.
28. Thompson WR, Gordon NF, Pescatello LS. *ACSM's guidelines for exercise testing and prescription*: Hubsta Ltd; 2009.
29. Tiggemann M, Williamson S. The effect of exercise on body satisfaction and self-esteem as a function of gender and age. *Sex roles*. 2000;43(1-2):119-27.
30. Tucker LA, Maxwell K. Effects of weight training on the emotional well-being and body image of females: predictors of greatest benefit. *American Journal of Health Promotion*. 1992;6(5):338-71.
31. Tucker LA, Mortell R. Comparison of the effects of walking and weight training programs on body image in middle-aged women: An experimental study. *American Journal of Health Promotion*. 1993;8(1):34-42.
32. Wilfley D, Rodin J. Cultural influences on eating disorders. *Eating disorders and obesity: A comprehensive handbook*. 1995:78-82.
33. Williams PA, Cash TF. Effects of a circuit weight training program on the body images of college students. *International Journal of Eating Disorders*. 2001;30(1):75-82.