

THE EFFECTS OF A 6-WEEK STRENGTH AND ENDURANCE CIRCUIT TRAINING ON BODY IMAGE OF HIGH SCHOOL GIRLS

Lucia Plevková, Janka Peráčková

*Comenius University in Bratislava, Faculty of Physical Education and Sport, Department of Sport Sciences in
Educology and Humanities, Slovakia*

Summary: The aim of this study was to extend the knowledge about the influence of strength and endurance circuit training intervention on body image of the female high school students. Our hypothesis was: The objectively and subjectively measured body image among the 16 – 17 years old females will be significantly improved after the participation in 6-week strength and endurance circuit training. We used experiment with 2 groups from 2nd class from the secondary school: experimental (intervention) group consists of 15 female students ($\bar{x}_{\text{age}} = 16.99 \pm 0.29$ years) and control group consists of 20 female students ($\bar{x}_{\text{age}} = 17.11 \pm 0.36$ years). The experimental factor was the strength and endurance circuit training, practicing during 6 weeks (twice a week), performed during the physical education lessons. The body image of the girl was measured using 2 methods: the objective one was the somatometry (body height, body weight and Body Mass Index), subjective measurements of the body image were the Silhouettes – Contour Drawing Rating Scale (Thomson & Gray 1995). After these 6 weeks we succeeded in every measurement of the body image – the significant effect was noticed in the experimental group in pre- and post-test on Body Mass Index ($p = 0,003$) and on Contour Drawing Rating Scale ($p = 0,003$). According to the received knowledge we suggest to integrate this movement program to the lessons of the physical and sport education for the female adolescents.

Keywords: body image, high school female students, strength and endurance, circuit training

Introduction

Body image, which has been studied for over a century, was defined as a multifactorial construct consisting of affective, cognitive, perceptual, and behavioral components (Cash and Pruzinsky 2002; Cash 2011). It reflects how individuals think, feel, see, and act toward their

bodies (Cash 2004). Tylka and Wood-Barcalow (2015) defined positive body image as the love, respect, and acceptance that people have for their bodies. Despite many components of body image, the researchers tend to investigate only its negative or pathological aspects. Statistics revealed that poor body image is associated with low self-esteem, which is believed to cause the anxiety and depression; moreover, it can play a significant role in the eating disorder etiology (Polivy and Herman 2002). Many researches revealed a positive impact of physical activity on children's as well as adult's, especially on female's body image (Duncan 2009; Campbell and Hausenblas 2009). The relation between the exercise and body image is complex and as Williams and Cash (2001) noted, there is a need to do the research concerning the role of regular exercise on the body image. The aim of the study was to extend the knowledge about the influence of strength and endurance circuit training on the body image of 16-17-years-old females. Our hypothesis was: The objectively and subjectively measured body image among the 16-17-years-old females will be significantly improved after the participation in 6-week strength and endurance circuit training. And our task: To recognize and to compare pre- and post-test of objectively and subjectively measured body image of 16-17-years-old females in a given experimental and control group.

Methods

Subjects

Experimental (intervention) group: 15 female students from 2nd grade ($\bar{x}_{\text{age}} = 16.99 \pm 0.29$ years, $\bar{x}_{\text{height}} = 167.73 \pm 6.66$ cm, $\bar{x}_{\text{weight}} = 58.10 \pm 6.78$ kg) of Ladislav Novomeský secondary school in Bratislava. Before the beginning of our study, we informed every girl and their parents about the main information concerning the aim, procedure and the conditions of the realization of our study.

The participants had to follow these two instructions to stay in a given experimental group:

1. to take part in 10 from 12 physical education lessons of strength and endurance circuit training,
2. to take part in providing the pre-test and post-test information.

Control group: 20 female students from 2nd grade ($\bar{x}_{\text{age}} = 17.11 \pm 0.36$ years, $\bar{x}_{\text{height}} = 169.80 \pm 5.01$ cm, $\bar{x}_{\text{weight}} = 59.50 \pm 6.78$ kg) of Ladislav Novomeský secondary school in Bratislava, which had only standard lessons of physical education and take part in a providing the pre-test and post-test information.

Study design

Firstly, we applied the pre-test on experimental and control group, which consisted of:

1. Objective indicator of body image – using the somatometry:
 - a) body height – it was measured by height measurement on the wall and on the floor. Our girls did not wear the shoes, stood with their feet together in front of the wall, they had to be with their head, back, buttock and heels right close to the wall and look straight ahead. The body height was then the distance between floor and vertex (highest point on cranium) – we measured to the nearest 0.5 cm;
 - b) body weight – we measured with the digital scale on the floor. They had to stay in the centre of the digital scale and we measured to the nearest 0.5 kg;
 - c) weight status – Body mass index – was determined as kg/m^2 – the body weight divided by the square of the body height.
2. Subjective indicator of body image – measured using the Silhouettes:
 - a) Contour Drawing Rating Scale (CDRS) from Thomson & Gray (1995) (Figure 1) – consisted of 9 silhouettes ranging from thin to fat. Every girl chose one silhouette in two steps: first of all, she was supposed to choose the most similar silhouette to their actual figure and in the second step to choose the silhouette that she would like to look like (ideal silhouette). After the choices were made, we calculated degree of dissatisfaction with body of every single girl, which provide us the difference between actual figure and ideal figure.

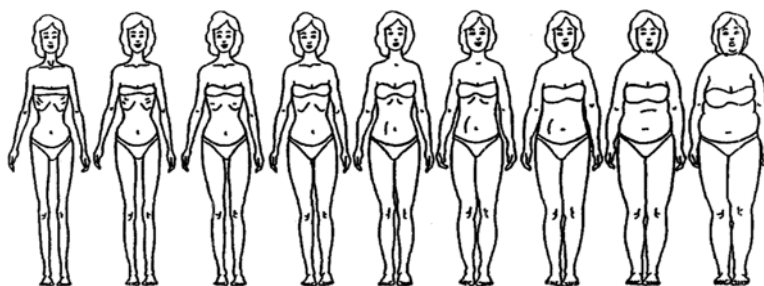


Figure 1
Contour Drawing Rating Scale (CDRS) (Thomson & Gray 1995)

Secondly, the experimental group participated in 6-week strength and endurance circuit training during the physical education lessons. Every lesson with the intervention program was performed twice a week for the next 6 weeks, lasted 45 min and consisted of the following parts:

1. warm up (5 – 12 min),

2. strength and endurance circuit training (20 – 35 min) – we used 8 – 12 numbers of exercises, 3 circles, while the duration of every exercise in the circles was 30 seconds, the recovery cycle between the two exercises was 15 seconds, the recovery cycle between the two circles was 2 min,
3. cool down (3 – 10 min).

The control group had only the regular lessons of physical education and sport. The third step was to apply the post-tests on the experimental and control group which included methods of objective and subjective body image.

Statistical analysis

In our study we used comparative analysis as an experimental method focused on the clarification of the issues related to our topic. During the procession of the results, we used the basic descriptive characteristics such as: the arithmetic mean, the extent of variation, variance and standard deviation. We used the Wilcoxon T-test to compare the pre- and post-test measurements in each group. The Mann-Whitney U test was used to reveal the statistically significant differences in changes among our experimental and control group.

Results

The integration of the strength and endurance circuit training into lessons of physical education has proved to be a good choice. The average BMI of the experimental group decreased and they were less dissatisfied with their bodies.

Objective indicator of body image – body mass index

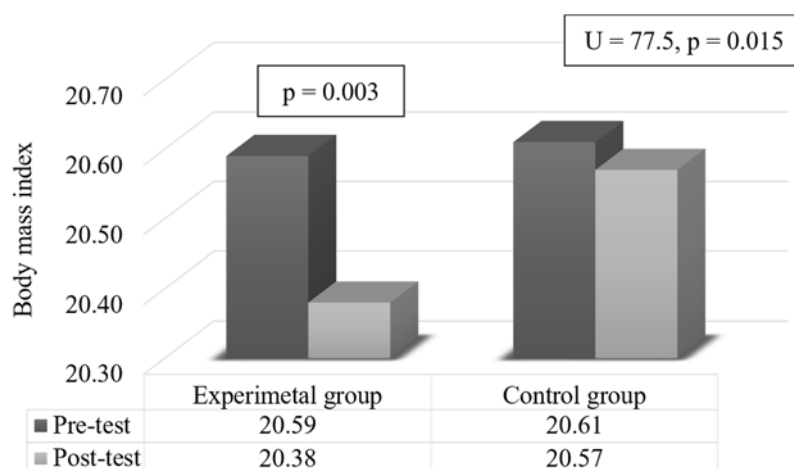


Figure 2
Pre-test and post-test of Body mass index

In the pre-test measurement of the experimental group was the average BMI 20.59 ± 1.97 , in post-test measurement the average of BMI has decreased on 20.38 ± 1.91 (Figure 2), while the average body height stays the same (166.73 ± 6.67 cm), the average body weight has decreased from 58.10 ± 6.78 kg to 57.53 ± 6.76 kg. From 15 female students, 13 have decreased their BMI, no one had the same BMI and 2 increased Body mass index (the same effect was with body weight). The minimal value of BMI has decreased from 17.1 (pre-test) to 16.9 (post-test) and maximum has decreased too, from 32.1 (pre-test) to 31.8 (post-test). The results of the Wilcoxon test revealed the significant effect on BMI in pre- and post-test measurements in the experimental group ($Z = -3.010$, $p = 0.003$).

The average BMI in the control group was in the pre-test 20.61 ± 1.87 (Figure 3), while the average body height was 169.80 ± 5.01 cm and the average body weight 59.50 ± 6.78 kg. After the six weeks the average BMI has decreased to 20.57 ± 1.86 , the body height was the same like in the pre-test and the average body weight has decreased to 59.38 ± 6.67 kg. From 20 female students, 9 of them have decreased their BMI (maximal decrease was 0.5), 6 girls have their BMI increased and 5 students had the same value of BMI in the pre- and post-test measurements. The minimal value of BMI has increased from the value 17.7 to 17.9; the maximal value of BMI has increased too, from 24.2 to 24.6. The results of the Wilcoxon test revealed no significant changes in the BMI in the pre- and post-test measurements in the control group ($Z = -1.319$, $p = 0.187$).

Subjective indicator of body image – countour drawing rating scale

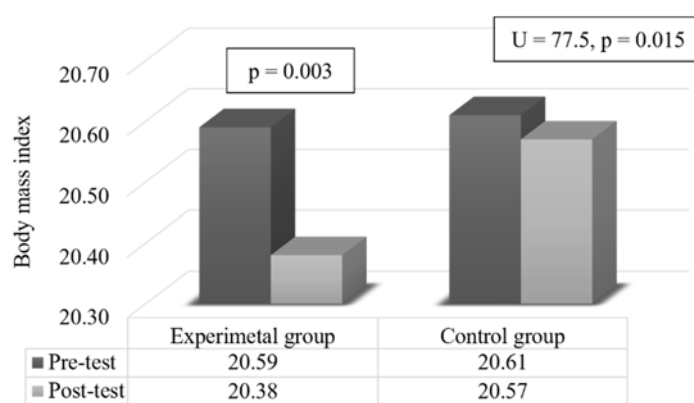


Figure 3
Pre-test and post-test of Contour Drawing Rating Scale

Before the application of our movement program, 16-17-years-old female students from the experimental group ranked their body dissatisfaction from 0 to 4 points (the highest possible 8), while the average was 1.67 ± 1.11 points. In the pre-test measurement the only one girl was

satisfied with her body, 10 girls found themselves fatter than their ideal figure and 4 girls found themselves slimmer than their ideal body. After the movement program, the body dissatisfaction was ranked from 0 to 4 points too, but we noticed the decrease of their average body dissatisfaction to 1.07 ± 1.28 points. 7 girls were satisfied with their body, 6 found themselves fatter and 2 found themselves slimmer than their ideal figure. The results of the Wilcoxon test revealed significant change in the Contour Drawing Rating Scale in pre- and post-test measurement in the experimental group ($Z = -3.000$, $p = 0.003$).

For the comparison of the changes during the 6-weeks, we used the control group that had only the regular lessons of physical education. After these 6-weeks, the control group has the same results in the pre- and post-test: the average body dissatisfaction was 1.70 ± 1.22 points. 16 girls found themselves fatter than their ideal silhouette, no one thought that she is slimmer and 4 girls were satisfied with their body. The results of the Wilcoxon test revealed no significant differences between the pre- and post-test in the control group ($Z = 0.000$, $p = 1.000$).

With these results we confirmed our hypothesis, because we found out that the statistically significant positive changes have occurred in BMI and the results of Contour Drawing Rating Scale among the experimental group.

Discussion

Accessible researches and studies have indicated contradictory outcomes. Some of them have reported a significant relationship between physical activity and body image (Burgess, Grogan & Burwitz 2006; Fountoulakis & Grogan 2014; Peráčková & Peráček 2016; Plevková, Peráčková, Pačesová, Kukurová & Mókušová 2018; Plevková 2019). Some have found no significant improvement of body image or no changes after physical activity intervention (Aşçi, Kin & Koşar 1998; Zabinski et al. 2001; Peráčková, Chovancová, Kukurová & Plevková 2018).

Especially in relation to women, more current studies report the positive impact of the physical activity on body image (Tucker & Maxwell 1992; Tucker & Mortell 1993; Williams & Cash 2001; Abbott & Barber 2011; Nayir et al. 2016; Peráčková & Peráček 2016; Plevková, Peráčková, Pačesová, Kukurová & Mókušová 2018; Plevková 2019). The study of Duncan et al. (2009) implied that, in contrast to the control group, participants in 6-week circuit training significantly improved body esteem scores in post intervention. In study of Southern (2014), circuit training participants decreased the waist circumference subcutaneous adipose tissue and that led to the better appearance.

Conclusion

Realization of the research was focused on the expansion of the knowledge about the influence of strength and endurance circuit training on the body image among the 16-17-years-old females. Time allocation of the experiment was six weeks, the frequency of the exercise was twice a week for 45 minutes within the lessons of physical and sport education. According to the results of the research and analysis we can say with regard to the hypothesis stated: We confirmed the hypothesis, which talked about the fact, that the participation in 6-week strength and endurance circuit training will significantly improve objective and subjective measurement of the body image among 16-17-years-old females. After the 6 weeks we succeeded in the objective and subjective measurements of body image – the significant change in the experimental group in pre- and post-test on BMI ($p = 0.003$) and on the Contour Drawing Rating Scale ($p = 0.003$). According to the received knowledge, we suggest to integrate this movement program to the lessons of physical and sport education for the adolescent girls.

ACKNOWLEDGEMENT

This research was supported by the Grant No. UK/331/2016 the Comenius University in Bratislava and the VEGA grant No. 1/0726/17.

References

1. ABBOTT, B., & B. BARBER, 2011. Differences in functional and aesthetic body image between sedentary girls and girls involved in sports and physical activity: Does sport type make a difference? In: *Psychology of Sport and Exercise*. **12**(3), pp333-342. doi: 10.1016/j.psychsport.2010.10.005.
2. AŞÇI, F. H., KIN, A., & N. S. KOŞAR, 1998. Effect of participation in an 8-week aerobic dance and step aerobics program on physical self-perception and body image satisfaction. In: *International Journal of Sport Psychology*. **29**(4), pp. 366-375.
3. BURGESS, G., S. GROGAN & L. BURWITZ, 2006. Effects of a 6-week aerobic dance intervention on body image and physical self-perceptions in adolescent girls. In: *Body Image*. **3**(1), pp. 57-66. doi: 10.1016/j.bodyim.2005.10.005.
4. CAMPBELL, A., & H. HAUSENBLAS, 2009. Effects of Exercise Interventions on Body Image. In: *Journal of Health Psychology*. **14**(6), pp. 780-793. doi: 10.1177/1359105309338977.

5. CASH, T. (2004). Body image: past, present, and future. In: *Body Image*. **1**(1), pp. 1-5. doi: 10.1016/s1740-1445(03)00011-1.
6. CASH, T. F., 2011. Cognitive-behavioral perspectives on body image. In T. F. CASH & L. SMOLAK (Eds.) *Body image: A handbook of science, practice, and prevention*. pp. 39-47. New York, NY: Guildford press.
7. CASH, T. F. & T. PRUZINSKY, (Eds.), 2002. Future challenges for body image theory, research, and clinical practice. In: T. F. CASH & L. SMOLAK (Eds.) *Body image: A handbook of theory, research, and clinical practice*. pp. 509-516. New York, NY: Guildford press.
8. DUNCAN, M., Y. AL-NAKEEB & A. NEVILL, 2009. Effects of a 6-week circuit training intervention on body-esteem and Body Mass Index in British primary school children. In: *Body Image*. **6**(3), pp. 216-220. doi: 10.1016/j.bodyim.2009.04.003.
9. FOUNTOULAKIS, C. & S. GROGAN, 2004. An investigation of the links between body image and exercise participation. In: *Sport & Exercise Psychology Review*. **10**, pp. 19-30.
10. NAYIR, T., E. USKUN, M. V. YÜREKLI, H. DEVRAN, A. ÇELİK & R. A. OKYAY, 2016. Does Body Image Affect Quality of Life?: A Population Based Study. In: *PLoS ONE*. **11**(9), pp. 1–13. doi: 10.1371/journal.pone.0163290.
11. PERÁČKOVÁ, J. & P. PERÁČEK, 2016. Body Image športujúcich a nešportujúcich adolescentov. [Body Image of adolescent athletes and nonathletes.] In: PERÁČKOVÁ A KOL. *Telesné sebaopínanie školskej športujúcej a nešportujúcej populácie. [Physical body self-perception of school athletes and nonathletes population.]* pp. 6-136. Bratislava, Slovakia: Comenius University in Bratislava. ISBN 978-80-223-4244-5.
12. PERÁČKOVÁ, J., A. CHOVANCOVÁ, K. KUKUROVÁ & L. PLEVKOVÁ, 2018. Self-evaluation of body image in sport active and sport inactive adolescent girls. In: *Acta Gymnica*. **48**(3), pp. 109-114. doi: 10.5507/ag.2018.014.
13. PLEVKOVÁ, L., 2019. *Vplyv diferencovaných pohybových programov na motorickú výkonnosť a body image mladších a starších žiačok. [The Influence of differentiated motion programs on motor performance and body image of younger and older female pupils.]* Bratislava. Comenius University in Bratislava. Dissertation. Faculty of Physical Education and Sports, Department of Sport Sciences in Educology and Humanities.
14. PLEVKOVÁ, L., J. PERÁČKOVÁ, P. PAČESOVÁ, K. KUKUROVÁ & O. MÓKUŠOVÁ, 2018. The effect of 6-week strength and endurance circuit training intervention on body image in Slovak primary school girls. In: *Journal of Physical*

- education and Sport*. **11** Supplement issue 1, Art 64, pp. 459-464. Doi: 10.7752/jpes.2018.s164.
15. POLIVY, J., & C. HERMAN, 2002. Causes of Eating Disorders. In: *Annual Review of Psychology*. **53**(1), pp. 187-213. doi: 10.1146/annurev.psych.53.100901.135103.
 16. SOTHERN, M., 2014. *Safe and effective exercise for overweight youth*. Boca Raton: CRC Press, Tylor&Francis Group.
 17. THOMPSON, M. & J. GRAY, 1995. Development and Validation of a New Body-Image Assessment Scale. In: *Journal of Personality Assessment*. **64**(2), pp. 258-269. doi: 10.1207/s15327752jpa6402_6.
 18. TUCKER, L., & K. MAXWELL, 1992. Effects of Weight Training on the Emotional Well-Being and Body Image of Females: Predictors of Greatest Benefit. In: *American Journal of Health Promotion*. **6**(5), pp. 338-371. doi: 10.4278/0890-1171-6.5.338.
 19. TUCKER, L. & R. MORTELL, 1993. Comparison of the Effects of Walking and Weight Training Programs on Body Image in Middle-Aged Women: An Experimental Study. In: *American Journal of Health Promotion*. **8**(1), pp. 34-42. doi: 10.4278/0890-1171-8.1.34.
 20. TYLKA, T. & N. WOOD-BARCALOW, 2015. What is and what is not positive body image? Conceptual foundations and construct definition. In: *Body Image*. **14**, pp. 118-129. doi: 10.1016/j.bodyim.2015.04.001.
 21. WILLIAMS, P. & T. CASH, 2001. Effects of a circuit weight training program on the body images of college students. In: *International Journal of Eating Disorders*. **30**(1), pp. 75-82. doi: 10.1002/eat.1056.
 22. ZABINSKI, M., K. CALFAS, C. GEHRMAN, D. WILFLEY & J. SALLIS, 2001. Effects of a physical activity intervention on body image in university seniors: Project GRAD. In: *Annals of Behavioral Medicine*. **23**(4), pp. 247-252. doi:10.1207/s15324796abm2304_3.