The acute effect of different intensity aerobic and resistance training exercise on the body image in adult women

E. Carpio-Rivera a,b, J. Moncada-Jiménez a,b,*, W. Salazar-Rojas a, G. Araya-Vargas a,c

a School of Physical Education and Sports, University of Costa Rica, Costa Rica
b Human Movement Sciences Research Center (CIMOHU), University of Costa Rica, Costa Rica
c School of Human Movement Sciences and Quality of Life, National University, Costa Rica
*Corresponding Author Ph: +506 2511-2909; Email: jose.moncada@ucr.ac.cr
DOI: https://doi.org/10.34256/ijpefs2144
Received: 09-09-2021, Revised: 04-11-2021; Accepted: 06-11-2021; Published: 11-11-2021

Abstract: The purpose of the study was to evaluate the acute effect of different intensity aerobic (AE) and resistance training (RT) exercises on BI in adult women. Participants were 62 adult women (19.47 ± 2.53 yr., range 18 a 33 yr.), who were randomly assigned to three sessions of either: 1) Control group, 2) Low-intensity AE, 3) High-intensity AE, 4) Low-intensity RT, or 5) High-intensity RT. Before and immediately following each experimental intervention, BI, body weight, and arm and leg circumferences were measured. Three familiarization sessions were performed every 7 days before the AE and RT experimental interventions. Also, 5-RM tests were performed one week before the RT experimental interventions. Data were analyzed using mixed 3-way ANOVA, mixed 4-way ANOVA, and post-hoc analysis. An acute effect of RT on BI was observed, regardless of the exercise intensity, women felt more muscular immediately following the RT session. Regardless of the exercise intensity, 30-min of acute RT exercise changed BI perception, contrary to 30 min AE.

Keywords: Body image, Aerobic exercise, Resistance training, Exercise intensity, Women

Dr. Elizabeth Carpio-Rivera holds a Ph.D. in Human Movement Sciences from the University of Costa Rica-National University, a doctoral internship at the Universidad Federal de Sergipe in Brazil. She also holds a M.Sc. in Human Movement Sciences from the University of Costa Rica. She has taught courses in research methods, statistical analysis, and measurement and evaluation in health. She is currently a full-time professor and researcher at the University of Costa Rica.

Dr. José Moncada-Jiménez: holds a Ph.D. in Biomedical Sciences from the University of Costa Rica, a post-doctoral internship at Baylor University in Texas, USA, and postgraduate studies at The Ohio State University, in Ohio, USA. He also holds a M.Sc. in Movement Sciences with a specialization in Exercise Physiology from Springfield College, in Massachusetts, USA. He is the founder of the Human Movement Sciences Research Center (CIMOHU) of the Vice-rectory for Research of the University of Costa Rica. He has taught courses in research methods, statistical analysis, exercise physiology, and measurement and evaluation. He is currently a full-time professor and researcher at the University of Costa Rica.

Dr. Walter Salazar-Rojas has a master’s degree in Human Performance from the University of Indiana and a Ph.D. in Exercise Science from the Arizona State University. He has been a professor and researcher at the University of Costa Rica for over 25 years. He performed as Olympic Coach for the Costa Rican National Track and Field Team in the Olympics Games of 1996, 2008, 2012, and 2016.
Dr. Gerardo Araya-Vargas obtained an Ed.D. in Education from the University La Salle in Costa Rica. He also holds a M.Sc. in Human Movement Sciences from the University of Costa Rica. He has taught courses in research methods, statistical analysis, and sport psychology. He is currently a full-time professor and researcher at the University of Costa Rica and a part-time faculty at National University in Costa Rica.
2.3 Measurement instruments

2.3.1 Study Design

The randomization process depicted in Figure 1 was carried by following the procedures described by CONSORT 2010 Statement [20]. Participants were randomly assigned to one out of five experimental groups: a) control group (CG), b) low-intensity AE (LIAE), c) high-intensity AE (HIAE), d) low-intensity RT (LIRT), and e) high-intensity RT (HIRT).

2.3.2 Intervention

Participants in the CG (n = 14) played a passive table game “Jenga” (Hasbro, Inc., Rhode Island, USA) for 30-min. Participants took turns removing one wooden block at a time from a tower constructed of 54 blocks. Each block removed was placed on top of the tower, creating a progressively taller and more unstable structure. The game stops when the tower falls.

Participants in the LIAE group (n = 12) pedaled 30-min on a cycle ergometer, maintaining an intensity of 50% of the maximum heart rate (HRmax) [11, 21, 22]. In the HIAE group (n = 12), participants pedaled 30-min on a cycle ergometer maintaining an intensity of 80% HRmax [11, 21, 22].

Participants in the LIRT group (n = 10) performed six RT exercises: 1) knee extension, 2) knee flexion, 3) horizontal bench press, 4) inclined press, 5) neutral grip pull-down, and 6) neutral grip seated row. The participants performed four sets of 16 repetitions for each exercise, using a tempo of 2:2 (i.e., two concentric phase movements and two eccentric phase movements), 50% of five maximal repetitions (5-RM), and 60-s rest between sets and exercises. The 5-RM were assessed following procedures described by others [23]. Finally, participants in the HIRT group (n = 14) performed the same six RT exercises described above in four sets of 10 repetitions for each exercise using a tempo of 2:2, 80% of 5-RM, and 60-s rest between sets and exercises. To the best of our knowledge, the proposed RT protocols were not tested in previous research. However, the choice of RT protocols obeyed the American College of Sports Medicine [24] recommendations for untrained individuals (i.e., working larger muscle groups, alternating exercises that work the lower body and upper body, allowing the trained muscle groups to rest). Participants in the AE and RT groups performed three familiarization sessions before the start of the experimental interventions. These sessions were separated by 7-days, and in the RT groups, neuromuscular coordination was stimulated by using weight-free machines. Finally, the participants in the RT groups performed the 5-RM test [23] on each of the six exercises comprised in the experimental protocols one week following the last familiarization session.

2.3.3 Measurements

Participants completed the respective experimental condition on three different sessions separated by 7-days apart. Before and immediately following each exercise session (sessions 1, 2, and 3), participants completed their self-perceived BI using two instruments (Contour Drawing Rating Scale and Muscularity Rating Scale). In addition, body weight, arm, and dominant leg circumferences were assessed by following a protocol described previously in the literature [16]. These assessments were also performed before and immediately after each of the three exercise sessions. Also, before starting each of the three sessions, each participant was asked if they had performed any other exercise during the week. This question was asked to control that the participants who made up the experimental groups and the control group did not carry out an activity unrelated to the training protocols of the research. For this question, the participants declared that they had not carried out any other exercise and thus continued participating in the present study.

2.4 Statistical analysis and sample size calculation

Statistical analyses were performed with the IBM-SPSS Statistics, version 18 (IBM Corporation, Armonk, New York). Descriptive statistics are presented as mean and standard deviation (M ± SD) unless otherwise noted. In this study, a control group was used to compare against the other experimental groups; therefore, a nested design was chosen [25, 26]. Three-way mixed ANOVA on dependent variables BI, body weight, arm, and leg circumferences were computed. The factors were the experimental groups (CG, AE, RT), sessions (first, second, third), and measurements (pre-test, post-test). Four-way mixed ANOVA on dependent variables BI, body weight, arm, and leg circumferences were computed. The factors were the experimental groups (CG, AE, RT), sessions (first, second, third), measurements (pre-test, post-test), and exercise intensities (50%, 80%). Follow-up analyses using the Bonferroni post hoc test were carried when significant interactions and main effects
were found. Statistical significance was set \textit{a priori} at 
\( p<0.05 \).

\textit{A posteriori} sample size calculation was 
computed using an alpha level of 0.01, a beta power of 
80\%, and a minimum difference to detect 1.1 points in 
the perception of BI with a standard deviation of 1.06. 
We found that at least eight individuals were necessary 
for each experimental group. This sample size was 
exceeded, since as reported, the groups consisted of 
10 (LIAE), 12 (HIAE), 10 (LIRT), 14 (HIRT), and 14 
(CG) participants. Also, the statistical power calculation 
was carried out \textit{a posteriori}. This computation showed 
that a minimum difference to detect of 1.1 points in BI 
perception, using an alpha level of 0.01, a variability of 
1.06 points in the SD, and a sample size of 10, 12, and 
14 participants, respectively, the statistical power was 
99\% [27].

3. Results

The study was completed by 62 women 
(Figure 1). Table 1 shows the descriptive statistics of 
the characteristics of the participants, according to 
experimental group.

Descriptive statistics (M ± SD) for BI using two scales are presented in table 2. Figures are presented 
by experimental condition and exercise session. Similarly, the summary of the descriptive statistics for 
the body weight, leg circumference, and arm circumference are presented in table 3.

\textbf{Self-perceived BI (Contour Drawing Rating Scale).} No statistically significant acute effect of AE and 
RT were found on BI by 3-way (F=0.57, \( p=0.69 \)) or 4-way (F=0.23, \( p=0.79 \)) ANOVA. A significant double 
interaction was found between measurement and physical activity type (F=11.71, \( p<0.0001 \)). Simple 
effects \textit{post hoc} analysis revealed that the differences 
were found only in the post-test measurement. Women in the LIAE group self-perceived themselves as being 
more endomorphic than women in the LIRT group (F=53.76; \( p<0.05 \)); women in the LIRT group self-
perceived themselves as being more endomorphic than 
women in the HIRT group (F=52.09; \( p<0.05 \)), and 
women in the HIAE group self-perceived themselves as 
being thinner than women in the LIAE group (F=11.36; 
\( p<0.05 \)).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{flowchart.png}
\caption{Flow diagram of the progress through the phases of a parallel randomized trial of five groups [20].}
\end{figure}
Table 1. Descriptive statistics for the sample.

| Variable          | Group | n  | M ± SD   | Minimum | Maximum | 95% CI    | p =       |
|-------------------|-------|----|----------|---------|---------|-----------|-----------|
| Age (years)       | LIAE  | 12 | 19.83 ± 1.95 | 18.00   | 23      | 18.60 - 21.07 | 0.470     |
|                   | HIAE  | 12 | 19.00 ± 1.13 | 18.00   | 21      | 18.28 - 19.72 |          |
|                   | LIRT  | 10 | 19.00 ± 1.70 | 18.00   | 23      | 17.78 - 20.22 |          |
|                   | HIRT  | 14 | 18.93 ± 1.27 | 18.00   | 22      | 18.20 - 19.66 |          |
|                   | CG    | 14 | 20.23 ± 4.52 | 18.00   | 33      | 17.82 - 23.04 |          |
|                   | **Total** | **62** | **19.47 ± 2.53** | **18.00** | **33** | **18.82 - 20.11** |          |
| Weight (kg)       | LIAE  | 12 | 58.93 ± 11.70 | 41.83   | 77.07   | 51.50 - 66.36 | 0.510     |
|                   | HIAE  | 12 | 57.51 ± 9.11  | 46.44   | 78.30   | 51.72 - 63.30 |          |
|                   | LIRT  | 10 | 59.77 ± 7.21  | 48.25   | 69.00   | 54.62 - 64.93 |          |
|                   | HIRT  | 14 | 53.25 ± 6.96  | 42.50   | 65.45   | 49.23 - 57.27 |          |
|                   | CG    | 14 | 58.99 ± 14.32 | 44.56   | 94.00   | 50.72 - 67.25 |          |
|                   | **Total** | **62** | **57.52 ± 10.35** | **41.83** | **94.00** | **54.89 - 60.15** |          |

Note: LIAE: low-intensity aerobic exercise (50% HRmax), HIAE: high-intensity aerobic exercise (80% HRmax), LIRT: low-intensity resistance training (50% 5-RM), HIRT: high-intensity resistance training (80% 5-RM), CG: control group, 95%CI: 95% confidence intervals, p-values are shown for between-groups comparisons.

Table 2. Descriptive statistics for body image by experimental condition and session. Data are presented as mean ± SD.

| Measurement                      | Group | 1          | 2          | 3          | n  |
|----------------------------------|-------|------------|------------|------------|----|
| **Contour Drawing Rating Scale** | Pre-test | 5.67 ± 1.92 | 5.75 ± 1.91 | 5.67 ± 1.83 | 12 |
|                                  | LIAE  | 5.33 ± 1.30 | 5.25 ± 1.42 | 5.33 ± 1.44 | 12 |
|                                  | HIAE  | 5.50 ± 0.97 | 5.50 ± 1.08 | 5.50 ± 1.08 | 10 |
|                                  | LIRT  | 4.86 ± 1.51 | 5.07 ± 1.21 | 4.79 ± 1.19 | 14 |
|                                  | HIRT  | 4.64 ± 1.50 | 4.86 ± 1.41 | 4.86 ± 1.35 | 14 |
|                                  | CG    | 5.67 ± 2.10 | 5.75 ± 1.66 | 5.75 ± 1.60 | 12 |
|                                  | HIAE  | 5.00 ± 0.95 | 4.83 ± 1.19 | 5.08 ± 1.24 | 12 |
|                                  | LIRT  | 5.00 ± 1.41 | 5.00 ± 1.15 | 5.00 ± 1.15 | 10 |
|                                  | HIRT  | 4.86 ± 1.46 | 5.21 ± 1.25 | 4.71 ± 1.14 | 14 |
|                                  | CG    | 4.79 ± 1.48 | 4.86 ± 1.35 | 4.86 ± 1.35 | 14 |
| **Muscularity Rating Scale**     | Pre-test | 3.75 ± 0.62 | 4.00 ± 0.85 | 4.08 ± 0.90 | 12 |
|                                  | LIAE  | 4.33 ± 0.66 | 4.17 ± 0.72 | 4.25 ± 0.87 | 12 |
|                                  | HIAE  | 4.50 ± 0.97 | 4.30 ± 1.06 | 4.30 ± 1.06 | 10 |
|                                  | LIRT  | 4.00 ± 0.88 | 3.93 ± 0.92 | 4.14 ± 0.95 | 14 |
|                                  | HIRT  | 3.86 ± 0.53 | 4.14 ± 1.03 | 3.86 ± 0.66 | 14 |
|                                  | CG    | 4.17 ± 0.83 | 4.00 ± 0.85 | 4.08 ± 0.79 | 12 |
|                                  | HIAE  | 4.33 ± 0.65 | 4.50 ± 0.90 | 4.50 ± 1.00 | 12 |
|                                  | LIRT  | 4.90 ± 1.10 | 5.40 ± 1.35 | 5.10 ± 0.99 | 10 |
|                                  | HIRT  | 4.14 ± 0.95 | 4.57 ± 1.16 | 4.86 ± 1.29 | 14 |
|                                  | CG    | 3.86 ± 0.53 | 4.14 ± 1.03 | 3.86 ± 0.66 | 14 |

Note: LIAE: low-intensity aerobic exercise (50% HRmax), HIAE: high-intensity aerobic exercise (80% HRmax), LIRT: low-intensity resistance training (50% 5-RM), HIRT: high-intensity resistance training (80% 5-RM), CG: control group.
Table 3. Descriptive statistics for body weight, leg circumference and arm circumference by experimental condition and session. Data are presented as mean ± SD.

| Measurement          | Group | Exercise Session | n |
|----------------------|-------|------------------|---|
|                      |       | 1                | 2 | 3 | n  |
| Body Weight          |       |                 |   |   |   |
| Pre-test             | LIATE | 58.93 ± 11.70    | 58.80 ± 11.67 | 58.89 ±11.48 | 12 |
|                      | HIAE  | 57.51 ± 9.11     | 57.56 ± 9.23  | 57.43 ± 9.20  | 12 |
|                      | LIRT  | 59.77 ± 7.21     | 59.92 ± 7.04  | 59.98 ± 7.26  | 10 |
|                      | HIRT  | 53.25 ± 6.96     | 53.30 ± 7.01  | 53.36 ± 7.10  | 14 |
|                      | CG    | 58.99 ± 14.32    | 58.89 ± 14.35 | 58.98 ± 14.40 | 14 |
| Post-test            | LIATE | 58.88 ± 11.72    | 58.76 ± 11.66 | 58.86 ±11.45  | 12 |
|                      | HIAE  | 57.47 ± 9.06     | 57.45 ± 9.22  | 57.36 ± 9.18  | 12 |
|                      | LIRT  | 59.80 ± 7.18     | 59.85 ± 7.02  | 59.98 ± 7.25  | 10 |
|                      | HIRT  | 53.19 ± 6.97     | 53.25 ± 6.97  | 53.34 ± 7.08  | 14 |
|                      | CG    | 58.95 ± 14.33    | 58.95 ± 14.33 | 58.93 ± 14.36 | 14 |
| Leg Circumference    |       |                 |   |   |   |
| Pre-test             | LIATE | 46.57 ± 3.99     | 46.95 ± 4.89  | 46.96 ± 4.41  | 12 |
|                      | HIAE  | 45.78 ± 5.45     | 45.18 ± 5.37  | 45.03 ± 5.58  | 12 |
|                      | LIRT  | 46.66 ± 3.52     | 47.01 ± 3.55  | 47.05 ± 3.79  | 10 |
|                      | HIRT  | 45.86 ± 3.01     | 45.96 ± 3.56  | 46.17 ± 3.04  | 14 |
|                      | CG    | 47.68 ± 5.34     | 47.14 ± 5.13  | 47.14 ± 5.18  | 14 |
| Post-test            | LIATE | 46.86 ± 3.75     | 46.91 ± 4.60  | 47.16 ± 4.37  | 12 |
|                      | HIAE  | 46.03 ± 4.78     | 45.74 ± 5.05  | 45.49 ± 5.85  | 12 |
|                      | LIRT  | 47.07 ± 3.57     | 47.36 ± 3.57  | 47.25 ± 3.72  | 10 |
|                      | HIRT  | 45.79 ± 3.99     | 46.56 ± 3.51  | 46.39 ± 3.84  | 14 |
|                      | CG    | 47.61 ± 5.43     | 47.25 ± 5.18  | 47.21 ± 5.25  | 14 |
| Arm Circumference    |       |                 |   |   |   |
| Pre-test             | LIATE | 23.73 ± 2.80     | 24.05 ± 2.90  | 23.95 ± 2.99  | 12 |
|                      | HIAE  | 22.54 ± 2.49     | 22.63 ± 2.53  | 22.41 ± 2.84  | 12 |
|                      | LIRT  | 24.36 ± 1.37     | 24.10 ± 1.26  | 24.24 ± 1.35  | 10 |
|                      | HIRT  | 23.57 ± 1.77     | 23.11 ± 2.03  | 22.93 ± 1.82  | 14 |
|                      | CG    | 23.68 ± 3.08     | 23.79 ± 2.96  | 23.79 ± 2.96  | 14 |
| Post-test            | LIATE | 23.83 ± 2.94     | 24.23 ± 3.01  | 23.88 ± 3.05  | 12 |
|                      | HIAE  | 22.63 ± 2.57     | 22.73 ± 2.68  | 22.54 ± 2.83  | 12 |
|                      | LIRT  | 24.72 ± 1.78     | 24.62 ± 1.05  | 24.36 ± 1.15  | 10 |
|                      | HIRT  | 23.97 ± 1.81     | 23.36 ± 1.95  | 23.14 ± 1.79  | 14 |
|                      | CG    | 23.75 ± 3.07     | 23.82 ± 2.95  | 23.82 ± 2.95  | 14 |

Note: LIAE: low-intensity aerobic exercise (50% HRmax), HIAE: high-intensity aerobic exercise (80% HRmax), LIRT: low-intensity resistance training (50% 5-RM), HIRT: high-intensity resistance training (80% 5-RM), CG: control group.

Self-perceived BI (Muscularity Rating Scale). A statistically significant acute effect on BI was found when performing RT between the pre- and post-test measurements during the second (F=49.32, p<0.05) and third (F=39.94, p<0.05) sessions. Women felt more muscular at the end of the exercise in both exercise sessions. In addition, post-hoc analysis showed that in the post-test, participants felt more muscular as the RT sessions progressed. There was no effect of the RT and AE exercise intensity on the BI (F=1.73, p=0.18). The change (Δ%) from pre- to post-test in muscularity and contour perception showed a similar pattern across experimental conditions (Figure 2).

Body weight. A statistically significant acute body weight reduction was found in the three exercise sessions by 3-way (F=12.82, p<0.001) and 4-way (F=15.72, p<0.001) analyses. The acute reduction was
observed in all participants, including women in the CG, resulting in a mean weight reduction of 4 g during the first session, 4 g during the second session, and 5 g during the third session.

Leg circumference. The 4-way ANOVA showed a main measurement effect statistically significant (F=4.82, p=0.03), which demonstrates an acute increase in leg circumference in the three exercise sessions. The increase was observed in all participants, including women in the CG, resulting in mean increments of 0.14 cm during the first session, 0.32 cm during the second session, and 0.23 cm during the third session.

Arm circumference. A significant acute increase in arm circumference was observed in participants in the RT groups as detected by 3-way (F=5.48, p=0.007) and 4-way (F=6.33, p=0.02) analyses. Regardless of the exercise intensity, the increase in arm circumference was found in the three sessions, with mean increases of 0.38 cm during the first session, 0.36 cm during the second session, and 0.17 cm during the third session. This acute effect was not observed in the other experimental groups (LIAE, HIAE, CG).

![Figure 2. Change (Δ%) from pre- to post-test in muscularity and contour perception in women on the experimental conditions. LIAE: low-intensity aerobic exercise (50% HRmax), HIAE: high-intensity aerobic exercise (80% HRmax), LIRT: low-intensity resistance training (50% 5-RM), HIRT: high-intensity resistance training (80% 5-RM), CG: control group.](image)

4. Discussion

This study determined the acute effect of AE and RT exercises performed at low- and high-intensity on the self-perceived BI of young women. The responses to acute exercise in this study indicated that a single session of 30-min of AE was insufficient to change BI in young women. This finding was similar to those reported by others [1], and in the opposite direction as reported by others [11, 12]. The training session duration might be a plausible explanation for the differences detected between studies [1] since it has been demonstrated that when implementing AE sessions lasting between 38-min to 60-min, participants reported significant changes in BI [11, 12]. Therefore, the duration of an AE session seems to play an important role in the acute changes in the self-perceived BI.

Salci and Ginis [11] attempted to explain which variables could be responsible for mediating the acute effect of AE on BI. The authors found that similar to the chronic AE effect, the factors allowing significant changes in BI were improved self-perceived strength and body adiposity. However, these variables were not assessed in this study, limiting the possibility of corroborating whether 30-min of EA were enough to generate changes in these factors and consequently...
modify BI perception in young women.

A significant acute exercise effect was found on the BI in the present study; young women's perceptions regarding their muscularity increased immediately following a RT session. The mean Δ% across three exercise sessions in the HIIE and LIRT conditions were reduced in perceived muscularity and contour. This reduction means that women felt thinner and muscular after exercising at 50% and 80% aerobic and resistance training, respectively (Figure 2). This is the first study (that we are aware of) determining the acute effect of RT on self-perceived BI. No mediator or moderator psychological and/or physiological variables are available at this time that might explain the findings in this study; therefore, more research on the acute effects of RT on BI is warranted. Yet, we reviewed a physiological mechanism related to acute muscle inflammation to explain this finding. Following a RT session, there is a sensation of swelling (edema) caused by body fluids displacement from the blood plasma to the working muscle tissues; this response is also explained by an accumulation of metabolic by-products of exercise. The acute muscle inflammation is transient, and it lasts for a short period of time when fluids return to the blood shortly after the end of the exercise session [28].

Thus, the association between the acute perception of young women feeling more muscular and the acute muscle inflammation is supported. This finding was observed with the acute increase in arm circumference only in the participants performing the RT program (LIRT and HIRT). The variables body weight and leg circumference failed to explain the effect of exercise on self-perceived BI. The RT exercise stimulus on these two variables (body weight and leg circumference) was not strong enough to change the BI compared to the CG. It is important to note that the acute effect of the RT program (LIRT and HIRT) was found only with one BI scale (i.e., Muscularity Rating Scale). This result outlines the importance of being cautious in the selection of the BI instrument because the measurement instruments based on figures can limit the participant's choice to identify with any of the body silhouettes [29-31].

In the present study, we demonstrated that the intensity of the AE or RT may not affect the self-perceived BI. This finding confirms previous meta-analytical evidence [8, 9], showing that exercise intensity at which the exercise is performed does not acutely affect the self-perceived BI. The main strength of this study was to evaluate the acute effect of AE and RT of different intensities on body image since, as previously mentioned and as far as is known, it is a pioneering study on the subject. This allowed advancing the study of this line of research. However, it is essential to mention that limitations should be considered in future studies. For example, it would be necessary to conduct a priori analysis of the sample calculation and statistical power, include male participants, and complete sessions involving longer training sessions. These limitations could be recommendations or methodological improvements to be used in future research, mainly considering the need to develop studies that deepen the acute effect that different types of exercise can generate and possible variables to be manipulated (e.g., session duration, sets, repetitions, volume, duration and type of rest) on the body image self-perception.

5. Conclusion

In conclusion, the results show that regardless of the intensity, the RT exercise causes an acute effect that allows the study participants to feel more muscular immediately after the session ends. In this way, our results agreed with previous literature, showing the importance of acute exercise as a possible intervention for people wishing to modify their self-perceived BI. In addition, the study also provides information for exercise-based interventions targeting improvements on the BI of people with BI dissatisfaction. Finally, the significant effect of RT on the BI of young women elicits further research on this topic.

References

[1] J.F. Hayes, G.E. Giles, C.R. Mahoney, R.B. Kanarek, Breakfast food health and acute exercise: Effects on state body image, Eating behaviors, 30 (2018) 22-27. [DOI] [PubMed]
[2] M. Meneses-Montero, J. Moncada-Jiménez, Imagen corporal percibida e imagen corporal deseada en estudiantes universitarios, Revista Iberoamericana de Psicología del Ejercicio y el Deporte, 3(1) (2008) 13-30.
[3] M. Arroyo, L. Anstotegui, E. Pereira, F. Lacerda, N. Valador, L. Serrano, A.M. Rocandio, Body composition assessment and body image perception in a group of University females of the Basque Country, Nutrición Hospitalaria, 23(4) (2008) 366-372. [PubMed]
[4] A. Bahram, M. Shafizadeh, A comparative and correlational study of the body image in active and inactive adults and with body composition
and somatotype, Journal of Applied Sciences, 6(11) (2006) 2456-2460. [DOI]

[5] Y. Brandberg, K. Sandelin, S. Erikson, G. Jurell, A. Liljegren, A. Lindblom, A. Lindén, A. von Wachenfeldt, M. Wickman, B. Arver, Psychological reactions, quality of life, and body image after bilateral prophylactic mastectomy in women at high risk for breast cancer: a prospective 1-year follow-up study, Journal of Clinical Oncology, 26(24) (2008) 3943-3949. [DOI] [PubMed]

[6] J.-H. Kim, S.J. Lennon, Mass media and self-esteem, body image, and eating disorder tendencies, Clothing and Textiles Research Journal, 25(1) (2007) 3-23. [DOI]

[7] K.A.M. Ginis, H.A. Strong, S.M. Arent, S.R. Bray, R.L. Bassett-Gunter, The effects of aerobic-versus strength-training on body image among young women with pre-existing body image concerns, Body image, 11(3) (2014) 219-227. [DOI] [PubMed]

[8] A. Campbell, H.A. Haubenblas, Effects of exercise interventions on body image: A meta-analysis, Journal of health psychology, 14(6) (2009) 780-793. [DOI] [PubMed]

[9] H.A. Haubenblas, E.A. Fallon, Exercise and body image: A meta-analysis, Psychology and Health, 21(1) (2006) 33-47. [DOI]

[10] J.-J. Yoo, D. Willoughby, L. Funderburk, Understanding the effect of resistant training and amino acid supplement on weight perception and body image, American Journal of Health Studies, 34(2) (2020). [DOI]

[11] L.E. Salci, K.A.M. Ginis, Acute effects of exercise on women with pre-existing body image concerns: A test of potential mediators, Psychology of Sport and Exercise, 31 (2017) 113-122. [DOI]

[12] S. Vocks, T. Hechler, S. Rohrig, T. Legenbauer, Effects of a physical exercise session on state body image: The influence of pre-experimental body dissatisfaction and concerns about weight and shape, Psychology and Health, 24(6) (2009) 713-728. [DOI] [PubMed]

[13] G. Burgess, S. Grogan, L. Burwitz, Effects of a 6-week aerobic dance intervention on body image and physical self-perceptions in adolescent girls, Body image, 3(1) (2006) 57-66. [DOI] [PubMed]

[14] R. Jankauskienė, K. Kardelis, Body image and weight reduction attempts among adolescent girls involved in physical activity, Medicina (Kaunas), 41(9) (2005) 796-801. [PubMed]

[15] F.C. Bull, S.S. Al-Ansari, S. Biddle, K. Borodulin, M.P. Buman, G. Cardon, C. Carty, J.P. Chaput, S. Chastin, Chou R, P.C. Dempsey, L. DiPietro, U. Ekelund, J. Firth, C.M. Friedenreich, L. Garcia, M. Gichu, R. Jago, P.T. Katzmarzyk, E. Lambert, M. Leitzmann, K. Milton, F.B. Ortega, C. Ranasinghe, E. Stamatakis, A. Tiedemann, R.P. Troiano, H.P. van der Ploeg, V. Wari, J.F. Willumsen, World Health Organization 2020 guidelines on physical activity and sedentary behaviour, British journal of sports medicine, 54(24) (2020) 1451-1462. [DOI] [PubMed]

[16] K. Norton, T. Olds, (2000) Anthropometric. A reference book on human body measurements for sports and health education, BIOSYSTEM Servicio Educativo, Rosario, Argentina.

[17] A. Solera-Herrera, E. Carpio-Rivera, J. Garzon-Mosquera, R. Obando-Monge, Influence of the Menstrual Cycle on Blood Pressure Post Resistance Exercise in Young and Healthy Women, American Journal of Sports Science, 7(4), (2019) 164-170. [DOI]

[18] M.A. Thompson, J.J. Gray, Development and validation of a new body-image assessment scale, Journal of personality assessment, 64(2) (1995) 258-269. [DOI]

[19] A. Furnham, P. Titman, E. Sleeman, Perception of female body shapes as a function of exercise, Journal of Social Behavior and Personality, 9(2) (1994) 335-352.

[20] K. Schulz, D. Altman, D. Moher, CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials, Trials, 11(1) (2010) 1-8. [DOI] [PubMed]

[21] A. Meri, (2005) Fundamentals of Physiology, Physical Activity and Sport, Editorial Médica Panamericana, Madrid

[22] J.A. Velasco, J. Cosín, J.M. Maroto, J. Muñiz, J.A. Casasnovas, I. Plaza, L.T. Abadal, Guidelines of the Spanish Society of Cardiology for Cardiovascular Disease Prevention and Cardiac Rehabilitation, Revista Española de Cardiología, 53(8) (2000) 1095-1120. [DOI] [PubMed]

[23] N. Ratamess, B. Alvar, T. Evetoch, T. Housh, W. Kibler, W. Kraemer, Progression models in resistance training for healthy adults, Medicine and Science in Sports and Exercise, 41(3) (2009) 687-708. [DOI]

[24] American College of Sports Medicine (ACSM), (2016), ACSM’s guidelines for exercise testing
and prescription. Estados Unidos: Lippincott Williams & Wilkins.

[25] H. Gutiérrez-Pulido, R. de la Vara-Salazar, (2009) Design and analysis of experiments, McGraw-Hill Interamericana, México D.F.

[26] F. Kerlinger, H. Lee, (2002) Behavioral research. Research Methods in Social Sciences, McGraw-Hill/Interamericana Editores, México, DF.

[27] G. Keppel, T.D. Wickens, (2004) Design and Analysis: A Researcher's Handbook, Pearson Prentice Hall, New jersey, Estados Unidos.

[28] W.L. Kenney, J. Wilmore, D. Costill, (2015) Physiology of sport and exercise, Human Kinetics, Champaign, IL

[29] G. Cafri, J.K. Thompson, Measuring Male Body Image: A Review of the Current Methodology, Psychology of Men & Masculinity, 5(1) (2004) 18-29. [DOI]

[30] S.M. Lynch, D.A. Zellner, Figure preferences in two generations of men: The use of figure drawings illustrating differences in muscle mass, Sex roles, 40(9-10) (1999) 833-843. [DOI]

[31] T.M. Stewart, H.R. Allen, H. Han, D.A. Williamson, The development of the Body Morph Assessment version 2.0 (BMA 2.0): tests of reliability and validity, Body image, 6(2) (2009) 67-74. [DOI][PubMed]

**Funding**

No funding was received for conducting this study.

**Authors Contribution**

All the authors equally contributed, read and approved the final version of this work.

**Ethics Approval**

This study was approved by Institutional ethics committee.

**Informed Consent**

Written consent was obtained from the participants

**Conflict of interest**

The Authors have no conflicts of interest to declare that they are relevant to the content of this article.

**Does this article screened for similarity?**

Yes