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PSYCHOLOGICAL RESPONSES TO ACUTE RESISTANCE EXERCISE IN MEN AND WOMEN WHO ARE OBESE

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ABSTRACT
Levinger, I., Goodman, C, Hare, DL, Jerums, G, Morris, T, and Selig, S. Psychological responses to acute resistance exercise in men and women who are obese. J Strength Cond Res 23(5): 1548-1552, 2009—The purpose of the study was to investigate the psychological response to the very first session of resistance exercise on positive well-being (PWB), psychological distress (PD), and perception of fatigue in untrained men and women who are obese. Forty-five (male = 22, female = 23) untrained, middle-aged volunteers (mean ± SEM, 51.0 ± 1.0; range, 40—69 years) participated in the study. Participants were divided into 4 groups according to sex and obesity level (i.e., men who are obese, men who are nonobese, women who are obese, women who are nonobese). The threshold for obesity was defined as waist circumference ≥94 cm for men and 80 cm for women. Measures included body composition, aerobic power, muscle strength, and quality of life (Short Form 36, SF-36). Before and after resistance exercise, participants completed the Subjective Exercise Experience Scale (SEES). Paired sample t-tests were used to assess changes in SEES scores within groups pre- and post-exercise and repeated-measures analysis of variance were used to assess changes in SEES scores between groups. Exercise increased the perception of PWB in both women who are obese and nonobese, without changes in PD or fatigue. Women in the change in PWB after exercise was negatively correlated with most scales of the SF-36, particularly with the mental health dimension (r = -0.55, p < 0.01). No significant changes in PWB, PD, or fatigue were found in men who are obese. Acute resistance exercise improved PWB in women who are obese and nonobese and those with lower self-perceived quality of life scores at the start improved the most. In addition, resistance exercise did not increase feelings of distress in either women or men who are obese.

KEY WORDS resistance exercise, psychological distress, obesity, well-being

INTRODUCTION
The incidence of obesity and related metabolic and cardiovascular morbidity and mortality have increased worldwide over the past 2 decades (23). In addition to the physiological, endocrinological, and vascular consequences of obesity, obesity has psychological effects, including depression and lower scores for health-related quality of life (2,4).

Exercise training (resistance and aerobic forms) improves clinical profiles of individuals with metabolic disease (3), cardiovascular disease (8), and obesity (18). Regular physical activity has a positive effect on psychological parameters. Both aerobic (16) and resistance (10) training improve quality of life in individuals with multiple metabolic risk factors. Resistance training has also been shown to alleviate depression in elderly volunteers (20).

Psychological responses to an acute bout of exercise may be an important determinant of continued participation in regular physical activity. It has been reported that a single bout of aerobic exercise can improve mood and increase positive feelings in apparently healthy individuals (7). Some investigators, however, have reported that for some individuals who are obese, a single bout of aerobic exercise can lead to negative feelings toward exercise and participation in regular physical activity due to increased muscle pain and fatigue (5).

To date, the literature related to the effects of acute exercise on well-being and psychological stress has focused on responses to aerobic exercise. To our knowledge, the effects of the first resistance exercise on positive well-being (PWB), psychological distress (PD), and the perception of fatigue in men and women who are obese and nonobese have not been examined. The purpose of the current study was to investigate the psychological responses to the first resistance exercise.
session in men and women who are obese, compared with men and women who are nonobese. Previously, we reported that women with multiple metabolic risk factors have lower capacity to perform activities of daily living and lower quality of life, compared with healthy women (11).

**METHODS**

**Experimental Approach to the Problem**

The study was part of a larger study that examined the effects of resistance training on quality of life and functional capacity (10) and metabolic risk factors (12) in middle-aged individuals.

**Subjects**

Forty-five (male = 22, female = 23) middle-aged volunteers (mean ± SEM, 51.0 ± 1.0; range, 40–69 years) participated in the study. Before participation, participants were assessed to determine their metabolic risk factors. Participants were divided into 2 groups according to sex and then were allocated to one of 4 groups, men who are nonobese, men who are obese, women who are nonobese, and women who are obese (Table 1). The threshold for obesity was defined as waist circumference ≥94 cm for men and 80 cm for women (24). Some volunteers had hypertension (n = 21), insulin resistance (n = 16), dyslipidemia (n = 14), and diabetes (n = 1). A number of participants were on beta-blockers (n = 2), calcium channel blockers (n = 1), angiotensin-converting enzyme inhibitors (n = 3), diuretics (n = 1), statins (n = 2), metformin (n = 1), and hormone replacement therapy (n = 6). Participants were included if they had not been involved in regular aerobic training (more than 90 minutes a week) for the preceding 6 months or resistance exercise in the preceding 5 years and were excluded if they had preexisting cardiac disease. Participants were informed of the nature of the study and then signed informed consent.

The study protocol was approved by the Victoria University and Austin Health Human Research Ethics Committees.

**Procedures**

**Anthropometric Measurements.** Height was measured barefoot using a stadiometer to the nearest 0.5 cm. Weight was measured without clothes using a scale (August Sauer GmbH, Allstadt, Germany) to the nearest 0.05 kg. Waist circumference was measured with a steel tape and taken as the minimum circumference between the iliac crest and the lower border of the ribs. Three measurements were taken and the mean of the 2 closest measures was recorded.

**Muscle Strength.** The full description of the muscle strength test has been reported previously (10). In brief, relative muscle strength was calculated as total muscle strength (the sum of 7 different resistance exercises, consisting of chest press, leg press, lateral pull-down, triceps pushdown, knee extension, seated row, and biceps curl) divided by body mass (kg). Muscle strength was evaluated utilizing the 1 repetition maximum (1RM) method. The 1RM was assessed 5–7 days after the acute exercise session to calculate the respective exercise intensity.

**Acute Session of Resistance Exercise.** To assess the psychological response to the first resistance exercise session, PWB, PD, and fatigue were assessed immediately before and after the first-time participants performed a resistance exercise session. In addition, this session served as a familiarization for the 1RM test. The session commenced with 3 minutes warm-up (walking on a treadmill at a self-selected speed) followed by 45–50 minutes of resistance exercises. The session included the same 7 exercises that were tested for maximal strength outlined above. Each exercise commenced with light weights, with participants performing 10 repetitions at an average of 21.7 ± 6.7% of 1RM (calculated after the exercise), followed by 2–3 sets of 2–5 repetitions of moderate intensity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males Nonobese (n = 6)</th>
<th>Males Obese (n = 16)</th>
<th>Males Overall (n = 22)</th>
<th>Females Nonobese (n = 10)</th>
<th>Females Obese (n = 13)</th>
<th>Females Overall (n = 23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>49.7 ± 3.3</td>
<td>52.0 ± 2.0</td>
<td>51.4 ± 1.7</td>
<td>50.3 ± 2.0</td>
<td>51.1 ± 1.6</td>
<td>50.7 ± 1.2</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>177.2 ± 3.0</td>
<td>175.0 ± 2.1</td>
<td>175.6 ± 1.7</td>
<td>182.6 ± 1.9</td>
<td>161.1 ± 1.8</td>
<td>161.8 ± 1.3</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>75.9 ± 3.0</td>
<td>95.1 ± 2.1†</td>
<td>89.9 ± 3.0</td>
<td>57.2 ± 2.3</td>
<td>79.3 ± 3.4†</td>
<td>69.7 ± 3.2</td>
</tr>
<tr>
<td>Waist (cm)</td>
<td>86.9 ± 2.8</td>
<td>105.4 ± 2.1†</td>
<td>100.4 ± 2.5</td>
<td>73.8 ± 2.0</td>
<td>92.6 ± 2.9†</td>
<td>84.4 ± 2.7</td>
</tr>
<tr>
<td>Body mass index (kg·m⁻²)</td>
<td>24.2 ± 0.9</td>
<td>31.0 ± 0.9†</td>
<td>29.1 ± 1.0</td>
<td>21.6 ± 0.8</td>
<td>30.6 ± 1.2†</td>
<td>26.7 ± 1.2</td>
</tr>
<tr>
<td>Muscle strength (kg·kg⁻¹)</td>
<td>6.5 ± 0.8</td>
<td>6.5 ± 0.2</td>
<td>6.5 ± 0.2</td>
<td>5.4 ± 0.2</td>
<td>4.4 ± 0.2†</td>
<td>4.8 ± 0.2</td>
</tr>
</tbody>
</table>

*Values are expressed as mean ± SEM.
†p < 0.01 between nonobese and obese.
(58.8 ± 9.2% of 1RM). The last set was 1–2 repetitions at moderate to high intensity (80.6 ± 8.9% of 1RM). Participants recovered for 60–90 seconds between sets, and between exercises, the recovery interval was 90–120 seconds.

**Instruments**

*Subjective Exercise Experience Scale.* Subjective Exercise Experience Scale (SEES) is a validated tool to measure a global psychological response to exercise (13). The scale contains 12 items that are compiled into 3 categories: PWB, PD, and fatigue. Each item is scored on a 7-point Likert scale from 1 (not at all) to 7 (extremely). Questionnaires were completed 3–5 minutes before the exercise session and immediately after the session.

*Short Form 36 Health Survey.* Short Form 36 (SF-36) assesses health-related quality of life as reflected by self-perception of physical function and mental health (15, 22). The survey contains 36 items that are compiled into 8 scales. Four of the scales evaluate physical health dimensions, including physical functioning, role physical (limitation due to physical problems), bodily pain, and general health. The other 4 scales evaluate mental health dimensions, including vitality, social functioning, role emotional (limitations due to emotional problems), and mental health (15, 22). Each scale is attributed a score from 0 to 100, where a higher score represents a higher level of function and health-related quality of life.

**Statistical Analyses**

Multivariate analysis of variance was used to examine the differences in anthropometric measurements between the women who are nonobese and obese and between men who are nonobese and obese. Paired sample t-tests were used to assess changes in SEES scores within group pre- and post-exercise, and repeated-measures analysis of variance were used to assess changes in SEES scores between groups. Spearman’s rho correlation was used to assess the relationship between selected variables. All data were reported as mean ± SEM. Statistical significance was accepted at α = 0.05.

**Table 2.** The correlation between the percentages of change before and after a single session of resistance exercise training in PWB with subscales of SF-36 scores in women.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation with change in PWB (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical function</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>Role physical</td>
<td>-0.41</td>
<td>0.03</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>-</td>
<td>NS</td>
</tr>
<tr>
<td>General health</td>
<td>-0.38</td>
<td>0.04</td>
</tr>
<tr>
<td>Vitality</td>
<td>-0.33</td>
<td>0.07</td>
</tr>
<tr>
<td>Social function</td>
<td>-0.52</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Role emotional</td>
<td>-0.45</td>
<td>0.02</td>
</tr>
<tr>
<td>Mental health</td>
<td>-0.50</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Physical health dimension</td>
<td>-0.39</td>
<td>0.04</td>
</tr>
<tr>
<td>Mental health dimension</td>
<td>-0.55</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

*PWB = positive well-being; NS = not significant.

**RESULTS**

Group characteristics are presented in Table 1. Women who are obese had lower muscle strength relative to body mass compared with women who are nonobese. This was not apparent in men (Table 1). Intensity increased for women (pooled data including both obese and nonobese) from 57.2 ± 10.4% of 1RM for the second set to 79.2 ± 10.7% of 1RM for the last set. The corresponding data for men was 60.3 ± 8.0% of 1RM to 81.8 ± 7.0% of 1RM. There were no significant differences between the sexes for relative exercise intensity. During the warm-up set, the exercise intensity was slightly higher in women compared with men (25.2 ± 5.3 vs. 17.8 ± 6.1% of 1RM, respectively, p < 0.01).

![Figure 1. Change in PWB (positive well-being), PD (psychological distress), and fatigue scores in obese women, nonobese women, and women as one group after acute resistance exercise.](image1)

![Figure 2. Change in PWB (positive well-being), PD (psychological distress), and fatigue scores in obese men, nonobese men, and men as one group after acute resistance exercise.](image2)

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In women, the exercise session significantly increased PWB. This improvement was apparent in all women as a group (pooled data of obese and nonobese) and also in women who are nonobese when analyzed separately (Figure 1). The PWB of women who are obese tended to improve (p = 0.059). Exercise did not significantly change the perception of PD or fatigue in women within or between groups. The change in PWB in women was negatively correlated with most scales of the SF-36 (Table 2). For women, the change in PWB was independent of the number of metabolic risk factors, body mass index, and muscle strength.

In men (pooled data of obese and nonobese), acute resistance exercise significantly increased fatigue levels by 29.4%. This was mostly due to increased fatigue in men who are nonobese (Figure 2). No change was observed for PWB or PD in men (Figure 2).

**Discussion**

The main findings were that the first session of resistance exercise can improve PWB in women who are obese and nonobese without significant changes to PD or fatigue. Women with lower quality of life score had a higher increase in PWB. This form of exercise had no psychological effects on men who are obese.

Therefore, men and women exhibit different psychological responses to the first session of resistance exercise. This might be related to relative exercise intensities, which may be important in psychological response to exercise (21). It is possible that the exercise intensities performed in the current study suited the women more than the men, even though they were well matched for relative intensity. It is possible that some men felt that the session was too easy and they would have preferred to exercise at higher relative intensities.

Men who are nonobese reported a significant increase in fatigue. It is not clear why these men exhibited higher fatigue levels after exercise, whereas the other groups did not, but it is possible that the combination of fatigue with no change in PWB enhanced the perception of fatigue in this group of men.

The improvement in PWB in women in the current study is similar to the improvement in positive feelings after acute aerobic exercise (6,21). The mechanisms behind the improvement in well-being after resistance exercise are unclear. It has been shown that aerobic exercise can increase endorphins (9) that may, in turn, increase positive feeling. However, studies have reported that resistance exercise has a limited effect on endorphin levels (17) or even lead to reduced endorphin levels (14). The change in positive feelings in women participants may be related to increased sense of accomplishment. However, this is speculation, and further studies are needed to clearly define the mechanisms behind the improvement in positive feelings after resistance exercise. However, many individuals who are obese have negative feelings toward aerobic exercise for various reasons, such as comorbidity related to musculoskeletal pain (e.g., osteoarthritis) (5,19) or because of previous negative feelings or experiences (1). As such, for women (both obese and nonobese), it is possible that resistance exercise may be a suitable alternative to aerobic exercise to elicit positive feelings toward exercise, which, in turn, may serve as an important enabler for future participation. This hypothesis should be tested in future studies. Furthermore, in women, change in PWB was negatively correlated with most scales of the SF-36, indicating that those with the lowest quality of life score had the highest improvement in PWB after exercise. As some obese people have mild depression and lower quality of life scores, it appears that resistance exercise may improve positive feelings in those who need it the most.

An important finding of the study was that although participants were sedentary and not familiar with resistance exercise, this form of exercise did not lead to an increase in PD levels before or after exercise. This was despite the inclusion of moderate to high exercise intensity. A potential limitation of the study was the use of a single SEES survey post-exercise. Future studies should include measurements at different time points (such as 30 minutes and 24 hours post-exercise) to examine the durability of the benefit. Another potential limitation is the relatively small sample size.

**Practical Applications**

The first session of resistance exercises improves PWB in women who are obese and nonobese, without increasing PD or influencing fatigue. Women with lower quality of life had greater improvements in PWB. Resistance exercise is a simple and effective way to improve positive feelings in women who are obese and could form an important part of the exercise training regimens for this segment of the population. Importantly, the benefits of resistance exercise training on PWB can be experienced right from the outset and should be included so long as the exercise intensity is made safe. This is especially important in women who are obese and may have had bad experiences with other forms of exercise.

**References**


Psychological Responses to Resistance Exercise


