

**Effects of short-term self-selected resistance training on anxiety and depression scores of
sedentary individuals**

**Efeitos do treinamento resistido auto selecionado de curto prazo sobre escores de
ansiedade e depressão de indivíduos sedentários**

**Efectos del entrenamiento resistido auto-seleccionado a corto plazo sobre las
puntuaciones de ansiedad y depresión de personas sedentarias**

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Abstract

A positive affective experience, making exercise more pleasurable, less stressful, achieving greater satisfaction and intrinsic motivation experience through resistance training may be accomplished by performing self-selected exercises. These exercises can also lead to other

health-related and performance outcomes. Thus, this study aimed to analyze the effects of a short-term self-selected resistance training on levels of anxiety and depression in sedentary individuals. Twenty-one individuals, aged between 20 and 50 years, were assigned to Training Group (TG) and Control Group (CG). The TG underwent 4 weeks of resistance training, 2 sessions per week, with self-selected intensities. Anxiety and depression scores were collected before and after intervention using the Hospital Anxiety and Depression Scale (HAD). The results showed that the TG presented a significant reduction in anxiety scores (8.9 ± 2.0 to 7.1 ± 2.1 ; $p=0.008$) with a large effect size ($d=0.71$). Depression scores showed no significant difference after intervention (6.3 ± 2.6 to 5.4 ± 2.6 ; $p=0.094$), with a small effect size ($d=0.346$). The CG showed slight non-significant increase in depression scores (6.3 ± 3.1 to 6.8 ± 3.7 ; $p=0.297$), with small effect size ($d= 0.146$). In conclusion, resistance training with self-selected intensity reduced anxiety scores and kept depression scores in a healthy level in sedentary individuals.

Keywords: Mental disorders; Strength Training; Physical Exercise; Hospital Anxiety and Depression Scale.

Resumo

Uma experiência afetiva positiva, tornando o exercício mais prazeroso, menos estressante, alcançando maior satisfação e experiência de motivação intrínseca através do treinamento resistido, pode ser alcançada através da realização de exercícios auto selecionados. Esses exercícios também podem levar a outros resultados relacionados à saúde e desempenho. Assim, este estudo teve como objetivo analisar os efeitos de um treinamento resistido auto selecionado de curto prazo sobre os níveis de ansiedade e depressão em indivíduos sedentários. Vinte e um indivíduos, com idades entre 20 e 50 anos, foram alocados no Grupo Treinamento (GT) e no Grupo Controle (GC). O GT realizou 4 semanas de treinamento resistido, 2 sessões semanais, com intensidades auto selecionadas. Os escores de ansiedade e depressão foram coletados antes e após a intervenção usando a Escala Hospitalar de Ansiedade e Depressão (HAD). Os resultados mostraram que o GT apresentou redução significativa nos escores de ansiedade ($8,9 \pm 2,0$ para $7,1 \pm 2,1$; $p = 0,008$) com grande tamanho de efeito ($d = 0,71$). Os escores de depressão não mostraram diferença significativa após a intervenção ($6,3 \pm 2,6$ a $5,4 \pm 2,6$; $p = 0,094$), com um pequeno tamanho do efeito ($d = 0,346$). O GC apresentou leve aumento não significativo nos escores de depressão ($6,3 \pm 3,1$ para $6,8 \pm 3,7$; $p = 0,297$), com pequeno tamanho do efeito ($d = 0,146$). Em conclusão, o

treinamento resistido com intensidade auto selecionada reduziu os escores de ansiedade e manteve os escores de depressão em um nível saudável em indivíduos sedentários.

Palavras-chave: Transtornos mentais; Treinamento de força; Exercício físico; Escala Hospitalar de Ansiedade e Depressão.

Resumen

Una experiencia afectiva positiva, haciendo el ejercicio más placentero, menos estresante, logrando una mayor satisfacción y una experiencia de motivación intrínseca a través del entrenamiento de resistencia, puede lograrse mediante la realización de ejercicios auto-seleccionados. Estos ejercicios también pueden conducir a otros resultados relacionados con la salud y el rendimiento. Así, este estudio tuvo como objetivo analizar los efectos de un entrenamiento de resistencia auto-seleccionado a corto plazo sobre los niveles de ansiedad y depresión en individuos sedentarios. Veintiún individuos, con edades entre 20 y 50 años, fueron asignados al Grupo de Entrenamiento (GT) y Grupo de Control (GC). El GT se sometió a 4 semanas de entrenamiento de resistencia, 2 sesiones por semana, con intensidades auto-seleccionadas. Las puntuaciones de ansiedad y depresión se recopilaron antes y después de la intervención mediante la Escala Hospitalaria de Ansiedad y Depresión (HAD). Los resultados mostraron que el GT presentó una reducción significativa en las puntuaciones de ansiedad ($8,9 \pm 2,0$ a $7,1 \pm 2,1$; $p = 0,008$) con un gran tamaño del efecto ($d = 0,71$). Las puntuaciones de depresión no mostraron diferencias significativas después de la intervención ($6,3 \pm 2,6$ a $5,4 \pm 2,6$; $p = 0,094$), con un tamaño de efecto pequeño ($d = 0,346$). El GC mostró un ligero aumento no significativo en las puntuaciones de depresión ($6,3 \pm 3,1$ a $6,8 \pm 3,7$; $p = 0,297$), con un tamaño de efecto pequeño ($d = 0,146$). En conclusión, el entrenamiento de resistencia con intensidad auto-seleccionada redujo los puntajes de ansiedad y mantuvo los puntajes de depresión en un nivel saludable en individuos sedentarios.

Palabras clave: Trastornos mentales; Entrenamiento de fuerza; Ejercicio físico; Escala hospitalaria de ansiedad y depresión.

1. Introduction

Depression and anxiety affect over 300 million and 264 million people worldwide, respectively (WHO, 2017). Depression has an incidence elevation of 18.4% in ten years, whereas anxiety has 3.6%. Brazil ranks first with the highest prevalence of anxiety in the world with approximately 18.7 million people, representing 9.3% of the entire population,

suffering from this disorder (WHO, 2017). Additionally, approximately 5.8% of the population (11.5 million) of Brazilians are affected by depression. Ranking Brazil as second country with the highest prevalence of this disorder in the American continent (WHO, 2017).

In terms of general personal health, the consequences of these disorders can be massive, considering that it contributes to a low self-esteem, devaluation of life, self-deprecation, hopelessness and physiological arousals, significantly disabling individuals affected by these disorders (Szabó & Lovibond, 2006). Depression is also the major contributor to suicide deaths (WHO, 2017).

In contrast, physical exercise has shown to be an interesting strategy for the treatment of anxiety and depression (Silva et al., 2019; de Melo Araújo et al., 2017). Previous studies reported that physical exercise significantly reduces anxiety and depression scores in adults and elderly population, improving functional autonomy and life quality (Silva et al., 2019; de Melo Araújo et al., 2017; Vancini et al., 2017). A recent meta-analysis showed that different types of physical exercises (i.e. flexibility, strength training, aerobic) have positive outcomes reducing depression scores in middle-aged and elderly participants (Perez-Sousa et al., 2020). The authors also indicated that aerobic and muscle strength exercises shown to be the most efficient exercise types to help to control depression (Perez-Sousa et al., 2020). Physical activity reduces anxiety in non-clinical population is also good to treat anxiety (Rebar et al., 2015). Previous research showed that 24 weeks of resistance training was effective to reduce anxiety symptoms and improved quality of life in older adults with Parkinson (Ferreira et al., 2018).

Physical exercise is recommended to be prescribed and performed under the supervision of a certified fitness instructor or specialist, but self-selected intensity in (SSI) physical exercise has been shown to be efficient on health and performance variables (Nóbrega et al., 2018; Yang & Petrini, 2018). SSI is characterized by exercise intensity chosen by the patient/performer, allowing greater control to the individual, increasing his positive affective experience (Nóbrega et al., 2018; Yang & Petrini, 2018). This method is linked to greater self-efficacy and could lead to more pleasurable or less stressful exercises, enabling greater satisfaction and intrinsic motivation (Anderson & Shivakumar, 2013). Previous research shows that resistance exercise with SSI provides a greater range of motion and greater muscle activation in comparison to the group with prescribed resistance exercise (Nóbrega et al., 2018). Self-selected resistance training (SSRT) can be an interesting option, considering, apparently that there is no type of impairment that could compromise its use, especially during moments as a lockdown, ex. due to pandemic issues, that obligate us a

social isolation as that we are living now due to Sars-Cov-2, that can be a favorable condition to increases anxiety and depression states (Ieraci et al., 2016).

However, to the best of our knowledge, there are no studies that investigated the effects of SSRT on anxiety and depression scores, regardless of the population. Therefore, this study aimed to verify the effects of self-selected resistance training on anxiety and depression scores in sedentary individuals.

2. Material and Methods

2.1 Ethical Procedures

This is an experimental study approved by the University's local Research Ethics Committee (n° 505,430 / 2013) according to the Declaration of Helsinki and the Resolution of the National Health Council of Brazil n° 466/2012.

2.2 Sample

The sample size was calculated a priori considering the minimum necessary to provide at least 80% of statistical power to detect a moderate effect size ($f = 0.35$), totalizing 18 participants ($n \geq 18$). Thus, the sample was initially composed of 26 individuals, randomly assigned to control group (CG) or training group (TG). The intervention (strength training) was conducted in the Laboratory of Translational Exercise Physiology (LAFET) at the State University of Goiás, Southwest Campus Quirinópolis, Brazil. Five participants (19.2%) were excluded due to two consecutive or three total absences during the training period (4 weeks), these strict participation controls were performed to assure completion of at least 75% of the total training sessions. Therefore, at the end of the intervention, a total of 21 (Power=0.86) individuals were included in the sample: four males ($n = 4$) and seventeen females ($n = 17$).

Inclusion criteria was: age between 20 and 50 years old; physical activity level stratified as sedentary, estimated by the International Physical Activity Questionnaire - (IPAQ) short version (Matsudo et al., 2001); exclusion criteria were antidepressant and/or anxiolytic drugs use; any bone, joint and/or muscle injuries or limitations that preclude from physical training.

2.3 Physical Activity Assessment

Immediately after the application of the Informed Consent, the short version of IPAQ – a valid instrument for the adult Brazilian population (Matsudo et al., 2001) was applied to assess the physical activity level of the participants. The questionnaire was applied by a research assistant trained with the instrument who was able to answer any potential question.

2.4 Anxiety and Depression Assessment

Depression and anxiety scores were assessed by the Hospital Anxiety and Depressions Scale (HAD) at baseline and post-intervention to all participants (Zigmond & Snaith, 1983). This scale is considered a reliable instrument to detect states of depression and anxiety (Zigmond & Snaith, 1983). In addition, it has validity and good understanding by respondents (Botega et al., 1995).

2.5 Anthropometric Measurements

Aportable stadiometer (SECA®) was used to measure height. The measurement was carried out with bare feet, feet together, arms relaxed at the side of the body, leaning against the wall with heels, calves, buttocks, back and upper skull. The head positioned in the Frankfurt plane, horizontally aligned the lower edge of the orbital opening with the upper margin of the external auditory canal (IBGE, 2013). Body mass data were collected with a portable digital scale (Elegance APP, Relaxmedic®), in which (IBGE, 2013) participants should be dressed in light clothing, barefoot, with empty pockets and without any accessory, looking ahead (Lohman & Roche, 1988). After that, BMI was calculated ($\text{kg}\cdot\text{m}^{-2}$).

2.6 Training Group

The TG was composed of 11 individuals (9 women). The intervention comprehended four weeks of resistance training with self-selected intensities, twice a week. The training consisted of three sets of the following exercises: lat pulldown, horizontal leg press, seated pulley row and seated bench press. The rest interval between sets was two to three minutes (Garber et al., 2011). One familiarization session was performed with the exercises and machine apparatus, as well as scale of perceived exertion used (OMNI-RES) (Robertson et

al., 2003). Participants also performed one repetition maximum test (1RM) for each exercise to assess their muscular strength at baseline and post intervention (Fleck & Kraemer, 2014). The reproducibility of the 1RM test was previously performed and, if necessary, it was adjusted with the correction factor suggested by Baechle (Baechle & Earle, 2008; Levinger et al., 2009).

2.7 Control Group

The CG, composed of 10 individuals (8 women), was monitored for 4 weeks. This group did not undergo any training intervention and was advised to maintain the same level of physical activity throughout the experiment period. CG received a phone call every other week, and came to the lab for baseline and post-intervention testing battery (after 4 weeks).

2.8 Statistical Treatment

Normality and homogeneity of the data were assessed using the Shapiro-Wilk and Levene's test, respectively. Considering that all variables had a normal distribution ($p > 0.05$). Data were expressed as means and standard deviations. To compare age, height, body mass and BMI, a t-test for independent samples was used. Anxiety and depression scores were analyzed using a 2x2 ANOVA followed by Bonferroni's Post hoc, with interactions between-groups (CG and TG) and within-group (baseline and post-intervention). The hypothesis of sphericity was verified by Mauchly test, and when violated, the degrees of freedom are corrected by the Greenhouse–Geisser estimates. The magnitude of the effect of the comparisons was analyzed using Cohen's d test. Power calculations was made a priori to detect a small effect size ($f = 0.35$) for the main analysis of this study (within-between interaction 2x2 ANOVA), and the final sample size provided a statistical power of 86% ($1 - \beta = 0.86$). The significance level was set at 5% ($p < 0.05$). All procedures were performed using the statistical package Statistical Package for the Social Sciences 21.0 for Windows (SPSS 21.0) and G*Power 3.1.9.2

3. Results

TG and CG had no between-group differences ($p > 0.05$) in age, height, body mass and body mass index (Table 1).

Table 1. Comparison of age, height, body mass and body mass index between groups (control and training) at baseline. Data are expressed as mean and (\pm) standard deviation.

Variables	CG (n=10)	TG (n=11)	<i>p</i>
Age (years)	37.6 \pm 10.4	34.2 \pm 9.6	0.4560
Height (cm)	163.9 \pm 9.3	163.6 \pm 6.2	0.9391
Body mass (kg)	67.7 \pm 15.1	66.1 \pm 10.3	0.7771
BMI (kg·m ⁻²)	25.1 \pm 3.9	24.7 \pm 3.6	0.8231

CG – control group; TG – training group; BMI – body mass index. Source: Authors.

The anxiety scores showed a significant within-group effects ($F = 6.845$; $p = 0.017$). Pairwise analysis identified a significance with large effect size ($p = 0.008$; $d = 0.71$) for the TG in the within-group comparison. Depression scores showed no significant within- or between-group effects ($F = 3.566$; $p = 0.074$; $F = 0.301$; $p = 0.590$, respectively). Pairwise analysis identified a marginal significance with small effect size ($p = 0.09$; $d = 0.35$) for the TG in the within-group comparison (Table 2).

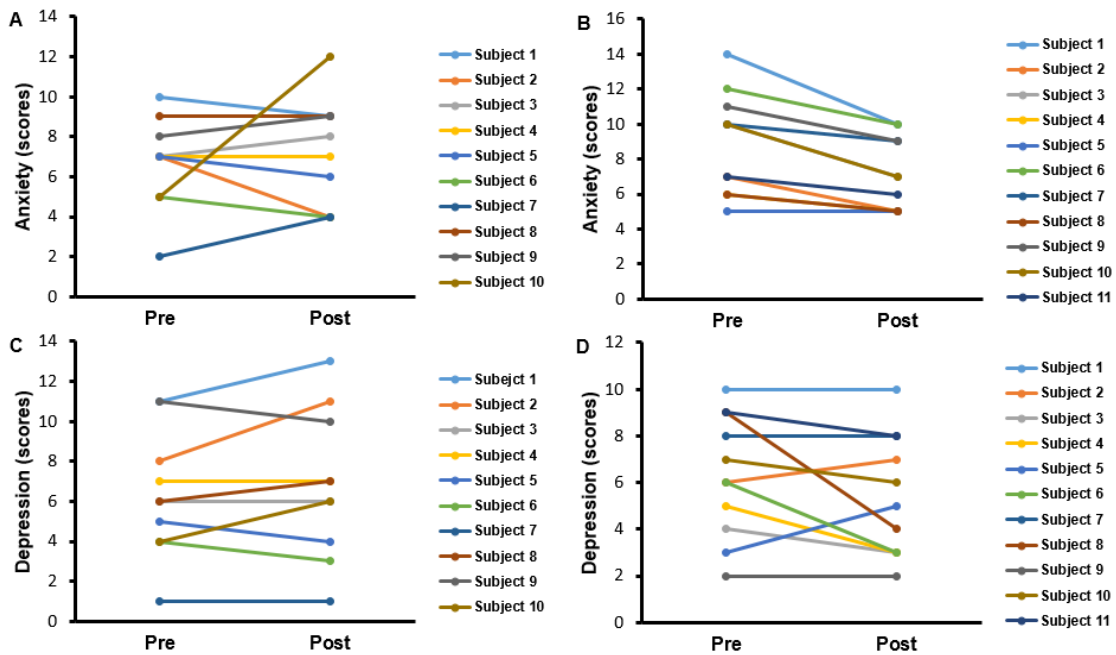
Table 2. Comparison of anxiety and depression scores between (CG and TG) and within groups (pre and post). Data are expressed as mean and standard deviation.

Variables	CG		<i>d</i>	TG		<i>d</i>
	Pre	Post		Pre	Post	
Anxiety	6.7 \pm 2.3 [†]	7.2 \pm 2.7	-0.199	8.9 \pm 2.9	7.1 \pm 2.1*	0.710
Depression	6.3 \pm 3.1	6.8 \pm 3.7	-0.146	6.3 \pm 2.6	5.4 \pm 2.6 [‡]	0.346

CG - Control group; TG - Training group; *d* - Cohen's *d*. * - $p = 0.008$ in relation to the pre of the TG. [†] - $p = 0.067$ in relation to the pre-TG. [‡] - $p = 0.094$ in relation to the pre-TG. Source: Authors.

Individual analysis showed that, from the 11 participants in the TG, 10 (91%) experienced some reduction in the anxiety score. Whereas, in the CG, five (50%) individuals raised their anxiety scores. With regard to depression, six participants in the TG (55%) reduced their scores; and only one participant in the CG (10%) showed a reduction in his score (Figure 1).

Figure 1. Individual data on the anxiety and depression scores of the controls (1A and 1C) and training (1B and 1D).



Source: Authors.

The intensities performed by the participants ranged from 40% to 50% of 1-RM, and the majority of participants performed 15 to 20 repetitions per series. The average of perceived exertion in each exercise was classified as follows: lat pulldown = 4.0 (fairly easy); horizontal leg press = 3.6 (easy); seated pulley row = 4.3 (fairly easy) and seated bench press = 3.6 (easy). It is worth noting that each training session lasted about 35 minutes. In addition, the individuals in the training group presented values of 1-RM after the intervention higher than the baseline in all exercises [lat pulldown = Δ 1.9kg ($p=0.0001$); horizontal leg press = Δ 6.4kg ($p=0.005$); seated pulley row = Δ 3.2kg ($p=0.005$); seated bench press = Δ 6.3kg ($p=0.009$)].

4. Discussion

This study analyzed the effects of four weeks of SSRT on anxiety and depression in sedentary adults. The main finding points out that short-term of SSRT, seems to be able to promote reductions in anxiety symptoms, in addition to showing a marginal significance to decrease depression scores (Table 2).

Regarding anxiety, our results are in line with previous publications where they found benefits from resistance training on this disorder (Gordon et al., 2017). Herring et al. (Herring et al., 2011), found a decrease in feelings of anxiety in adult women after 6 weeks of resistance training with moderate intensity. In the present study, the mechanisms responsible for decreasing anxiety scores after self-selected resistance training were not investigated. However, the decrease can be partly explained by changes in the levels of catecholamines, serotonin and dopamine during and after physical exercise (Meeusen & de Meirleir, 1995), also corticotrophin-releasing factor and adrenocorticotrophic hormone suggesting positive changes in the hypothalamic-pituitary-adrenal axis modulating anxiety (Anderson & Shivakumar, 2013). Furthermore, the self-selected exercise seems to produce a positive affective experience, making the exercise more pleasurable or less stressful, enabling greater satisfaction and intrinsic motivation, which in part may explain changes in anxiety scores and changes, although not significant, in depression scores (Nóbrega et al., 2018; Yang & Petrini, 2018).

Another positive link from SSI may be related to self-efficacy, allowing the individuals to select what they feel like can increase their beliefs their capabilities to organize and execute the courses of action required to produce a given attainment- definition of self-efficacy by (Bandura, 1997), and showed to have some influence on anxiety (Katula et al., 1999) Katula et al., after acute aerobic exercises (self-selected walking intensity up to Balke incremental test) in elderly people, suggested a pattern of relationships that indicate reductions in anxiety under light-intensity activity (Katula et al., 1999). However, as intensity increased to maximal, anxiety levels increase. Nonetheless, self-efficacy was related to anxiety responses only in the moderate-intensity condition, which links to our findings of moderate self-selected intensity. Bodin and Martinsen suggest that exercise targeting self-efficacy was more effective in reducing state anxiety (Bodin & Martinsen, 2004). Thus, extrapolating to resistance exercise, allowing individuals to select their exercise intensity may lead their body and mind to responses that could give a better response to self-efficacy and lower anxiety levels.

With regard to depression values, the results showed that the self-selected resistance training for four weeks does not show statistically significant reductions, although the TG has shown a marginal significance to decrease depression scores. However, Lincoln et al (Lincoln et al., 2011), showed a significant reduction in the state of depression after the training period of 16 weeks resistance training (60-80% 1RM) in type 2 diabetic individuals. This difference could be partially explained due to the training applied in the present study being

different from that reported by Lincoln et al. (Lincoln et al., 2011). In the present study, short-term training (4 weeks) was performed as well as with self-selected loads that, at the end of the experiment, were stratified as moderate, that is, between 40% and 50% of 1RM. It should be noted that the loads self-selected by the participants of the present investigation (beginners in resistance training) are within the intensities previously recommended (Garber et al., 2011).

As a limitation, the fact that the levels of any neurotransmitter that may be related to the symptoms of anxiety and depression have not been measured, seems to be one of them, since, therefore, any physiological explanation about the change in anxiety and depression scores, they will be merely conjectures. Even though, as previously mentioned, the self-selected exercise seems to produce a positive affective experience, making the exercise more pleasurable or less stressful, allowing greater satisfaction and intrinsic motivation, which in part may explain the changes in anxiety scores and changes, although not significant, in depression scores (Nóbrega et al., 2018; Yang & Petrini, 2018). Nevertheless, it is worth mentioning that, to the best of our knowledge, this is the first study that investigated the effects of SSRT on anxiety and depression scores. Thus, it is suggested that further studies be carried out, minimizing the limitations raised here, in an attempt to explain the physiological mechanisms involved in changes in anxiety and depression scores.

As a practical application, the results of the present study suggest that SSRT can be used as an auxiliary method to control anxiety levels and perhaps prevent and help to control depression. In addition, formal physical exercise programs still have a high frequency of non-adherents (~ 45%) and lack of motivation is one of the main reasons (Garber et al., 2011), which, as mentioned above, can be mitigated with self-selected exercise. Thus, alternative methods of physical exercise, such as the self-selected ones, may be an option, as they produce a motivating and lasting atmosphere.

5. Conclusion

It is known that physical activity and exercise positively affect several biological and psychological mechanisms. This study helps to demonstrate that resistance training with SSI is beneficial for reducing anxiety levels, as well as preventing the increase in depression in sedentary adult individuals. Suggesting that the sentence: "let them free", it seems possible to be applied in resistance training, when the objective is to affect the outcome variables investigated here.

However, further studies are needed investigating the effects of resistance training with self-selected intensities in different populations, as well as with children, adolescents and the elderly.

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