ARTICLE

Pilates and aerobic training improve levels of depression, anxiety and quality of life in overweight and obese individuals

O treinamento de Pilates e aeróbio melhoram os níveis de depressão, ansiedade e qualidade de vida em indivíduos com sobrepeso e obesidade

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ABSTRACT

Objective: To compare the effects of Pilates and walking on quality of life, depression, and anxiety levels. **Methods:** Sixty-three overweight/obese participants were randomly divided into: control (n = 20), walking (n = 21), and Pilates (n = 22) groups. Pilates and walking groups attended eight weeks of 60-minute exercise sessions three times per week. Quality of life, depression, and state- and trait-anxiety levels were evaluated before and after eight weeks of training. **Results:** Scores of quality of life, depression, and trait-anxiety improved in the Pilates and walking groups. State-anxiety levels improved only in the walking group. **Conclusion:** Pilates and walking positively impact quality of life, depression and anxiety. The Pilates method could be used as an alternative to improve mood disorders in overweight/obese individuals.

Keywords: exercise; complementary therapies; mental disorders; obesity.

RESUMO

Objetivo: Comparar os efeitos do treinamento com Pilates e caminhada sobre os níveis de qualidade de vida, depressão e ansiedade. **Métodos:** Sessenta e três participantes com sobrepeso/obesidade foram divididos aleatoriamente em grupos: Controle (n = 20), Caminhada (n = 21) e Pilates (n = 22). Os grupos Pilates e caminhada realizaram oito semanas de sessões de exercício de 60 minutos 3 vezes/semana. Os níveis de qualidade de vida, depressão e ansiedade traço e estado foram avaliados antes e após oito semanas de treinamento. **Resultados:** Os escores de qualidade de vida, depressão e ansiedade-traço melhoraram nos grupos Pilates e caminhada. Os níveis de ansiedade-estado melhoraram apenas no grupo caminhada. **Conclusão:** O Pilates e a caminhada impactam positivamente os níveis de qualidade de vida, depressão e ansiedade. O método Pilates pode ser usado como um método alternativo para distúrbios do humor em indivíduos com sobrepeso e obesidade.

Palavras-chave: exercício; terapias complementares; transtornos mentais; obesidade.

Obesity is associated with an increased risk of premature death and morbidities[1]. Physical inactivity, poor dietary habits, and urbanization have contributed to the obesity epidemic[2]. In addition, lower levels of quality of life and psychological disturbances have been associated with obesity[1]. Dankel et al.[3] showed that the duration of the overweight/obesity condition and physical inactivity negatively impacts quality of life levels.

Different types of physical activity can be used as complementary treatments for individuals with obesity[4,5]. Barry et al.[6] concluded that regardless of body mass index (BMI), individuals with lower physical fitness levels had an increased risk of mortality over fit individuals.

Physical training is an effective strategy for improving quality of life and emotional health status[6] and can diminish morbidities associated with obesity, such as depression and anxiety symptoms[1,7,8]. Sui et al.[9] showed that physical fitness is inversely associated with depression symptoms.

In individuals with epilepsy, Vancini et al.[10] demonstrated that low levels of maximal aerobic power impaired the mood state profile. Moreover, Becofsky et al.[1] noted that a low level

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of fitness is more strongly associated with the onset of elevated depressive symptoms than several other measures of fatness, including BMI, waist circumference, and body fat percentage. To reduce the risk of developing depression, individuals should be encouraged to improve their physical fitness regardless of body fatness.

Aerobic activities, such as walking, have been suggested to improve aerobic physical fitness, quality of life, and mood disorders[1,4]. However, due to monotony and the difficulty of performing weight-bearing activities, adherence to these types of activities can be low, especially among obese individuals.

Alternative exercises, such as Pilates, could be suggested to overweight/obese individuals. Pilates is a form of body/mind training that requires different types of exercise (e.g., balance, endurance, strength, and flexibility) and attention to muscle control, posture, and breathing[11,12]. Niehues et al.[13] noted that Pilates is a method of resistance training (based on isometric exercises) that is low-impact on the joints, which may be very attractive to overweight/obese individuals.

Despite several studies that have been conducted on the physical effects of Pilates training in obese individuals, conclusive results are not possible due to methodological concerns (e.g., the absence of randomized and control trials)[14,15]. To our knowledge, no studies have been conducted to verify the effects of Pilates training on quality of life, depression, and anxiety levels in overweight/obese individuals.

Therefore, our aim was to evaluate the effects of Pilates and traditional aerobic training (walking) on quality of life, anxiety, and depression measures among overweight/obese participants.

METHODS

Study participants

Overweight/obese adults of both sexes (18-66 years) were enrolled in the study. Advertisements were posted on social networks and in a medical school to solicit volunteers.

The inclusion criteria were as follows: BMI (calculated by dividing body mass by height squared) ≥ 25 kg/m^2; at least six months without practising any kind of physical activity; and no history of disease (except obesity).

Initially, 118 participants were assessed for study eligibility by evaluating their health history and performing a medical examination. Forty-six (n = 46) individuals were excluded at this stage. The remaining 72 participants were divided into three groups: control [C (n = 20), female (n = 12, 60%) and male (n = 8, 40%)], walking [W (n = 21), female (n = 20, 95.24%) and male (n = 1, 4.76%)], and Pilates [P (n = 22), female (n = 21, 95.45%) and male (n = 1, 4.55%)]. However, nine participants withdrew from the study for personal reasons. After a clear explanation of the procedures, written consent was obtained. All of the experimental procedures were approved by the Human Research Ethics Committee of the University and conformed to the principles outlined in the Declaration of Helsinki.

The general characteristics of the individuals who participated (n = 63) in the study are given in Table 1.

Table 1. Demographic characteristics of the cohort components.

Groups / Variables	C	W	P	Statistical analyses
BMI (kg/m^2)				
Mean ± SD	31.9 ± 4.0	30.3 ± 3.3	31.1 ± 4.0	F (2, 60) = 0.95, p = 0.39
Median	30.5	29.9	30.2	
Maximum	40	37	41	
Minimum	26	25	28	
Age (years)				
Mean ± SD	41.7 ± 12.6	42.4 ± 7.0	55.9 ± 6.6*	F (2, 60) =16.79, p < 0.05
Median	45.5	42	56.5	
Maximum	58	61	66	
Minimum	18	33	40	
Body mass (kg)				
Mean ± SD	86.2 ± 17.6	79.0 ± 10.6	82.6 ± 9.9	F (2, 60) = 1.55, p = 0.22
Median	78.9	81.1	80.6	
Maximum	114	100	111	
Minimum	62	58	68	
Height (cm)				
Mean ± SD	165.6 ± 10.3	161.3 ± 7.6	161.1 ± 6.3	F (2, 60) = 2.03, p = 0.14
Median	163.5	161	160.0	
Maximum	194	173	181	
Minimum	154	141	148	

C: control (n = 20); W: walking (n = 21); P: Pilates (n = 22); BMI: body mass index. *Different in relation to C and W groups (p < 0.05).

Study design

A randomized (experimental groups - walking and Pilates), blinded and controlled study was carried out. Due to the nature of the interventions, it was not possible to blind the participants and coaches involved. However, the professionals involved with the tests and measurements were blinded and made aware of allocation details only after data analysis.

The study was organized in three phases: pre-intervention, treatment period, and post-intervention. In the three days before and after the treatment intervention, all of the participants underwent follow-up evaluations: anthropometry and a cardiopulmonary exercise test (CPET).

In the two days before and after the treatment intervention, all of the participants underwent the following follow-up evaluations: quality of life assessment using the 36-Item Short Form Health Survey (SF-36) questionnaire, depression assessment using the Beck Depression Inventory, and State-Trait Anxiety Inventory (IDATE). Lastly, the participants were given eight weeks of treatment intervention, three times per week, 60 min/session, on non-consecutive days.

When a participant missed three or fewer training sessions, these sessions were made up at the end of the program. However, when four or more sessions were missed, the participant was excluded from the study. As the C group did not follow an experimental protocol, for ethical reasons, the opportunity to participate in the P or W program was offered, according to the volunteer's interest, after the conclusion of the study.

Cardiopulmonary exercise testing

A CPET was performed to establish the ventilatory threshold (VT). The heart rate (HR) of the VT was used as the target during the walking sections. Before the CPET, the participants were provided with a standardized set of instructions explaining the tests. On completion of these preliminary procedures, each participant performed a treadmill test (Inbrasport, ATL, Porto Alegre, Brazil) to identify the VT. During the CPET, the participants were verbally encouraged to exercise for as long as possible. Respiratory gas samples were analyzed breath-to-breath using a gas analyzer (Quark, Cosmed, Italy). The HR was recorded using an HR monitor (Polar Electronics, FS1, Finland). The VT is a method of assessing aerobic fitness and was determined independently by two experienced investigators.

Quality of life assessment

Quality of life was evaluated with the SF-36, translated and validated for Brazilian Portuguese[16,17]. This questionnaire comprises 36 questions, grouped into eight domains: functioning capacity (1), limitations because of physical aspects (2), pain (3), general health (4), vitality (5), social functioning (6), limitations because emotional problems (7), and mental health (8). Subscale scores range from 0 to 100, with 100 as the best, most positive life quality in that area and 0 is the worst.

Depression and anxiety assessment

The Brazilian version of the Beck Depression Inventory was used[18]. There are 21 clinical symptoms of depression, and 10 additional items cover affective, behavioral, somatic, and interpersonal aspects of depression. Each item consists of a series of four statements scaled to indicate increasing depressive symptomatology. For this instrument, scores of 5 to 9 are considered normal, scores between 10 and 18 reflect mild-to-moderate depression, scores from 19 to 29 reflect moderate-to-severe depression, and scores from 30 to 63 reflect severe depression[19].

Anxiety levels were evaluated using the State-Trait Anxiety Inventory. This is a self-reported assessment that includes separate measures of state- and trait-anxiety. It is a 40-item scale consisting of two 20-item subscales (i.e., state and trait) to assess anxiety. The state-anxiety scale describes the individual's feelings at a particular time and under specific conditions, whereas the trait-anxiety scale describes the usual feelings of the individual. The scores for both the state- and trait-anxiety scales can vary from a minimum of 20 to a maximum of 80. A score higher than 30 indicates the presence of anxiety, a score of 31 to 49 indicates an intermediate level of anxiety and a score greater than or equal to 50 indicates a high degree of anxiety[19].

Training intervention
Pilates protocol

All of the volunteers in the P group used HR monitors (Suunto, Ambit, Finland) to monitor HR during all training sessions. The sessions were performed at a Pilates studio in groups of five participants each and were led by qualified professionals who had been trained and experienced in the method for longer than seven years. The sessions were divided into the following three stages: Pre-Pilates (general warm-up of 10 minutes); Pilates training, which consisted of general conditioning (45 minutes for beginners and intermediates) with the original Pilates repertoire of mat exercises (mat Pilates) and used the following equipment: reformers, Cadillacs, chairs, magic circles, and dumbbells; and cool-down (respiratory exercises for five minutes). The repertoire of Pilates exercises was adapted and adjusted for obese/overweight individuals as required.

Walking protocol

An individual, supervised exercise program was developed for each volunteer based on the HR obtained at the VT in the cardiopulmonary test. This program consisted of performing eight weeks of moderate aerobic training in a park with a flat terrain, three times/week, with sessions of 60 minutes. Each one-hour session was divided into warm-up (10 minutes), walking (40 minutes) and cool-down (10 minutes). A walking activity performed at the VT intensity was selected to decrease orthopedic injuries in individuals with obesity. All of the participants used an HR monitor during all training sessions.

Statistical analyses

The data were expressed as the mean ± standard deviation. All of the variables were normally distributed according to the Kolmogorov-Smirnov test and exhibited homogeneous variability based on the Levene's test. The intervention effects were assessed using one-way analysis of variance and complemented with the Newman-Keuls *post hoc* test when the threshold of significance was reached. Statistical significance was set at an alpha value of 0.05 (Statistic software/version 6.0, 2002).

RESULTS

Exercise session intensity

The HR of exercise sessions (average of all sessions recorded in beats per minute - bpm) for the W group was 123.2 ± 10.9 bpm. This HR represents approximately 70% of the HRmax (159.7 ± 16.3 bpm) reached in the CPET. However, the HR reached for the P group was 86.3 ± 6.1 bpm. This represents approximately 59% of the HRmax (145.6 ± 21.4 bpm) reached in the CPET. The HR during exercise training sessions was significantly higher (29.9%) in the W group when compared to P group (p < 0.0001).

Quality of life

In the quality of life assessment (SF-36, Table 2), the following results were observed for the different domains.

Regarding the "functioning capacity" and "general health" domains, there were no significant differences in the intra- (before *vs.* after training) or inter-group comparisons (C *vs.* W *vs.* P). For the "limitations because of physical aspects" domain, the W group (54.7 ± 42.3) showed a significantly lower score (36.1%) before training compared with the C group (85.7 ± 24.5). The W group (54.0 ± 21.2) showed a significantly lower score (29.5%) in the "pain" domain before training compared to the C group (76.6 ± 17.1). In addition, the W group exhibited significantly different pain scores between the before (54.0 ± 21.2) *vs.* after (72.8 ± 17.1) training conditions, for an increase of 25.8%. In the "vitality domain", the W group (51.4 ± 24.3) had significantly lower scores (25.8%) before training when compared to the C group (69.3 ± 15.3). For the W group, the vitality score worsened significantly (by 7.8%) when comparing the scores obtained before (51.4 ± 24.3) and after (47.4 ± 22.7) training. The P group (54.0 ± 21.2) showed a significantly lower score (22%) before training when compared to the C group (69.3 ± 15.3). In addition, Pilates training (P group) significantly improved their vitality score by 28% (47.4 ± 22.7 before *vs.* 65.9 ± 18.7 after training). With respect to the "social functioning domain" the W group exhibited a significant improvement of 20.3% (70.2 ± 27.2 before *vs.* 88.1 ± 16.0 after training). Pilates training resulted in a significant improvement of 29.2% in the social functioning score after training (57.7 ± 28.9 before *vs.* after 81.5 ± 24.9 after training). As well, the P group (57.7 ± 28.9) had a

significantly lower score (30.7%) before training when compared to the C group (83.3 ± 25.7). For the domain "limitations because of emotional problems", the W group (49.2 ± 46.7) showed a significantly lower score (36.7%) before training when compared to the C group (77.8 ± 37.0). In addition, for the W group, the "limitations because of emotional problems" score was significantly increased (49.2 ± 46.7 before *vs.* 87.3 ± 22.3 after training). The P group (54.0 ± 21.2) showed a significantly lower score (14.8%) before training when compared to the C group (46.0 ± 40.0). Lastly, Pilates training led to a significant increase of 40.8% in this quality of life domain (46.0 ± 40.0 before *vs.* 77.8 ± 33.9 after training). Regarding the "mental health domain", the W group (59.2 ± 21.6) had a significantly lower score (23.2%) before training when compared to the C group (77.1 ± 16.3). For the W group, the mental health score was significantly improved by 21.8% following training (59.2 ± 21.6 before *vs.* 75.8 ± 15.3 after training). The P group (60.0 ± 19.3) had a significantly lower score (22.1%) before training when compared to the C group (77.1 ± 16.3). Lastly, Pilates training led to a significant improvement of 19% in the mental health score (60.0 ± 19.3 before *vs.* 74.1 ± 22.4 after training). All statistical data are shown in Table 2.

Using the Beck Inventory Depression assessment, it was observed that the W group (score: 18.7 ± 6.9) had a significantly higher score (36.3%) before training compared to the C group (11.9 ± 6.9). For the W group, the levels of depression were significantly decreased, by 35.2% following training (18.7 ± 6.9 before *vs.* 12.1 ± 6.7 after training). In the P group, training led to a significant decline (27.5%) in depression levels (16.7 ± 6.8 before *vs.* 12.1 ± 6.4 after training). All of the statistical data are shown in Table 2.

With respect to anxiety, the W group exhibited significantly diminished levels of trait-anxiety (15.1%) following training (44.2 ± 10.5 before *vs.* 37.5 ± 7.7 after training). In addition, the levels of trait-anxiety were decreased significantly (14.1%) in the P group following training (45.3 ± 10.3 before *vs.* 38.9 ± 10.8 after training). Lastly, in the W group, we observed that the levels of state-anxiety significantly declined (18.5%) after training (43.6 ± 10.0 before *vs.* 35.5 ± 7.9 after training). All of the statistical data are shown in Table 2.

DISCUSSION

The purpose of the present study was to evaluate the impact of walking and Pilates on quality of life, depression, and anxiety levels in overweight/obese individuals. Our primary results were as follows. The W group showed improvements (pre- vs. post-training comparisons) in the quality of life domains of social functioning (20.3%) and mental health (21.8%). In addition, there were significant decreases in the levels of depression (35.2%), trait-anxiety (15.1%), and state-anxiety (18.5%) in the pre- *vs.* post-training comparison. For the P group, improvements (pre- vs. post-training comparisons) were observed in the quality of life domains of

Questionnaires	C (n = 20)			W (n = 21)			P (n = 22)			One way ANOVA
	B	A	Δ (%)	B	A	Δ (%)	B	A	Δ (%)	
SF-36 domains	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD		
1	79.5 ± 16.2	84.0 ± 13.4	+10.4 ± 32.6	67.8 ± 15.4	80.7 ± 13.5	+24.6 ± 36.3	70.2 ± 17.2	75.5 ± 17.0	+12.5 ± 31.2	$F_{(2,60)} = 1.1114$, p = 0.33576
Median	80	85		65	85		70	75		
Maximum	100	100		95	95		95	95		
Minimum	30	50		45	50		20	40		
2	80.9 ± 29.5	83.3 ± 29.9	+11.2 ± 79.8	54.7 ± 42.3	85.7 ± 24.5	+21.7 ± 37.2	65.5 ± 33.0	76.2 ± 34.9	+6.0 ± 55.7	$F_{(2,50)} = 0.26498$, p = 0.76829
Median	100	100		75	100		75	100		
Maximum	100	100		100	100		100	100		
Minimum	0	0		0	25		0	0		
3	76.6 ± 17.1	74.7 ± 20.1	-1.8 ± 19.4	54.0 ± 21.2	72.8 ± 17.1	+83.4 ± 196.2	64.7 ± 20.4	75.0 ± 23.7	+30.1 ± 63.8	$F_{(2,60)} = 2.7172$, p = 0.07419
Median	72	74		51	72		62	84		
Maximum	100	100		100	100		100	100		
Minimum	41	31		10	51		22	10		
4	71.6 ± 17.1	77.1 ± 11.9	+12.1 ± 24.1	70.4 ± 16.4	78.3 ± 17.8	+14.5 ± 27.3	75.3 ± 14.0	80.5 ± 9.9	+10.4 ± 23.6	$F_{(2,60)} = 0.14169$, p = 0.86818
Median	77	72		72	82		77	82		
Maximum	100	100		92	97		97	92		
Minimum	35	57		35	37		40	57		
5	69.3 ± 15.3	69.3 ± 16.1	+1.9 ± 19.9	51.4 ± 24.3	70.5 ± 19.9	+162.4 ± 399.1	47.4 ± 22.7	65.9 ± 18.7	+105.2 ± 176.4	$F_{(2,60)} = 2.1869$, p = 0.12114
Median	75	100		55	75		50	70		
Maximum	90	30		80	95		80	95		
Minimum	25	100		5	20		5	15		
6	83.3 ± 25.7	88.1 ± 17.4	+5.3 ± 28.4	70.2 ± 27.2	88.1 ± 16.0	+48.7 ± 77.5	57.7 ± 28.9	81.5 ± 24.9	+73.6 ± 164.4	$F_{(2,58)} = 2.1366$, p = 0.12725
Median	100	100		75	100		62.5	87.5		
Maximum	100	100		100	100		100	100		
Minimum	0	37.5		25	50		0	0		
7	77.8 ± 37.0	90.5 ± 26.1	+12.9 ± 52.2	49.2 ± 46.7	87.3 ± 22.3	+15.3 ± 63.3	46.0 ± 40.0	77.8 ± 33.9	+58.9 ± 93.6	$F_{(2,42)} = 1.9978$, p = 0.14832
Median	100	100		66	100		33.3	100		
Maximum	100	100		100	100		100	100		
Minimum	0	0		0	33.3		0	0		
8	77.1 ± 16.3	79.2 ± 14.2	+4.5 ± 15.1	59.2 ± 21.6	75.8 ± 15.3	+43.7 ± 54.1[*]	60.0 ± 19.3	74.1 ± 22.4	+31.1 ± 46.9[#]	$F_{(2,60)} = 4.7130$, p = 0.01256
Median	80	84		60	80		60	80		
Maximum	100	100		92	96		88	96		
Minimum	44	44		24	52		12	4		
Beck	11.9 ± 6.9	9.8 ± 5.7	-14.8 ± 30.4	18.7 ± 6.9	12.1 ± 6.7	-30.6 ± 32.3	16.7 ± 6.8	12.1 ± 6.4	-21.8 ± 49.7	$F_{(2,60)} = 0.88186$, p = 0.41931
Median	10	9		19	10		15	12		
Maximum	34	22		35	34		31	26		
Minimum	3	3		6	6		5	4		
STAI Trait	37.8 ± 9.3	35.7 ± 7.7	-3.7 ± 15.7	44.2 ± 10.5	37.5 ± 7.7	-12.9 ± 15.9	45.3 ± 10.3	38.9 ± 10.8	-14.0 ± 13.4	$F_{(2,60)} = 2.9466$, p = 0.06016
Median	35	36		44	38		43	36		
Maximum	55	55		65	52		78	67		
Minimum	20	20		29	28		34	26		
STAI State	38.0 ± 8.4	39.0 ± 10.5	+3.3 ± 20.2	43.6 ± 10.0	35.5 ± 7.9	-16.4 ± 19.8[*]	41.0 ± 9.8	37.6 ± 11.3	-6.9 ± 25.8	$F_{(2,60)} = 4.1850$, p = 0.01989
Median	37	36		41	34		40	40		
Maximum	61	61		70	52		73	73		
Minimum	26	21		32	22		29	29		

[*]p < 0.05 (Control vs. Walking); [#]p < 0.05 (Control vs. Pilates). SF-36 domains: Functioning capacity - 1; Limitations because of physical aspects - 2; Pain – 3; General health - 4; Vitality - 5; Social functioning - 6; Limitations because emotional problems - 7; Mental health - 8. STAI: State- Trait Anxiety Inventory

vitality (28%), social functioning (29.2%) and mental health (19%). In addition, there were significant decreases in the levels of depression (27.5%) and trait-anxiety (14.1%) when comparing pre- and post-training measures.

Effects of physical exercise on quality of life

The practice of physical activity has an important role in health promotion and is a key variable to increasing multi-dimensional aspects of quality of life[4]. On the other hand, better levels of quality of life are a motivator to augment physical activity practice. Physical activity can improve psychological variables such as cognitive function, social relationships, and mood status, which creates a positive health cycle. In this way, alternative practices (such as Pilates, which is a body/mind exercise), in addition to traditional activities (for example, walking), have been used in an attempt to improve the adherence levels of overweight/obese people in physical activity programs.

It is important to note that walking and Pilates programs significantly benefited health status and quality of life in over-weight and/or obese individuals. In agreement with these results, several previous studies, in healthy and diseased groups, have demonstrated beneficial effects of physical activity on several quality of life and mental health parameters[7,8,20,21,22].

Pilates exercise could be an alternative strategy for promoting health status and quality of life improvements in both nonclinical and clinical populations[23,24,25,26,27]. However, studies on the effects of Pilates training on quality of life and health status in overweight and/or obese individuals are scarce.

Studies on quality of life in health samples

Longitudinal and cross-sectional studies have shown a positive association between physical activity (level and behavior) and a better mental health and perception of quality of life[7].

Cruz-Ferreira et al.[28] demonstrated that mat Pilates training improved the perception of health status in healthy women. Vieira et al.[26] evaluated the effects of Pilates training on SF-36 quality of life components in healthy female and male individuals (beginners, experienced, and ex-practitioners) and found that physical function, general health, and mental health were all improved. Finally, García-Soidán et al.[25] showed that 12 weeks of Pilates training significantly improved physical and emotional quality of life domains in middle-aged individuals. Therefore, our results are in agreement with the literature.

Studies on quality of life in clinical samples

In healthy people and those with chronic diseases, a positive association between physical activity levels and quality of life could provide motivation to become more physically active, more so than the remote perspective of decreasing and mitigating the risk and prognosis of diseases. This premise could be applied to overweight/obese people[3] despite of the scarcity of studies on the effects of Pilates in this population.

Kofotolis et al.[29] studied the impact of eight weeks of Pilates training and trunk-strengthening exercises on quality of life in women with chronic low back pain. These authors demonstrated that the Pilates group had a greater improvement in self-reported quality of life compared to the trunk-strengthening exercise group. It is important to point out that Pilates could be a complementary method of training with the potential to improve the functional capacity of obese individuals.[13] It is possible that this benefit is related to improved body composition and a reduction in both obesity and BMI after Pilates training[14,15,30]. In agreement with the literature, we also observed improvements in the quality of life of overweight and obese individuals after Pilates training.

Effects of physical exercise on anxiety and depression

Emotional malfunction seems to inhibit the positive perception of the physical benefits to the quality of life of people with psychological disorders and chronic diseases[5]. In this sense, the presence of depression and anxiety may have a negative effect on several dimensions of quality of life, including physical functioning, which may negatively impact quality of life levels. This could be even more present in overweight and obese individuals because of the locomotion and weight-bearing difficulties[1]. Although there are many studies on the practice of physical activity in anxiety and depression levels (acute and chronic), the literature on the effects of Pilates is scarce, particularly in overweight/obese individuals. Ekici et al.[23] demonstrated that four weeks of Pilates training in women with fibromyalgia improved state- and trait-anxiety levels. It is important to note that we observed improvements in the levels of depression and anxiety after Pilates training in overweight/obese individuals.

In conclusion, different types of physical activity may contribute to improvement in quality of life. In addition, mental and emotional benefits may be the trigger motivator factors for people's perception of physical activity programs, especially for overweight/obese people. We found that eight weeks (three sessions/week) of Pilates and aerobic training, with monitored and progressively-adjusted intensity, positively impacted quality of life, depression and anxiety. Similar to traditional exercises, such as walking, which is routinely prescribed for overweight/obese individuals, Pilates training may be used as an effective alternative approach to improve overall patient health, self-esteem, emotional and psychological state, mood, and motivation. In this way, Pilates could be an important component in a strategy to achieve the difficult task of losing weight.

Practical applications

Our study was a randomized, blinded, and controlled trial showing that, similar to traditional activities (e.g., walking), Pilates training can be used as an alternative strategy to improve quality of life, depression, and anxiety in overweight/obese individuals. The strengths of our study were that our experimental design consisted of three randomly-allocated groups (control,

walk, and Pilates). Moreover, few participants left the study (nine out of 70) during the course of training. A low loss of participation is an advantage in longitudinal studies. Lastly, the intensity of the training program was controlled throughout the experimental protocol for the walking and Pilates groups. These adjustments were made in each session when necessary to achieve an exercise overload that caused the desired adaptations.

Limitations

Every questionnaire study has subjective questions that can lead to loss in accuracy and reliability. Another factor to note is that the participants began from high base values for most of the analyzed variables. This fact may explain in part why we did not observe significant differences between the different time points and groups analyzed. Other limitations include that the age range of the participants was broad (18-66 years), all groups included both women and men (but disproportionately between the control and exercised groups), and the mean age for the Pilates group was significantly higher than for the control and walking groups.

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