Original Article

Multilateral methodology in physical education improves coping skills, resilience and physical fitness in drug addicts

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ABSTRACT

Drug addiction may cause health problems and social exclusion. Therefore, we investigated the effects of 8-week multilateral physical education intervention (i.e., aerobic-anaerobic exercise at moderate-intensity plus behavioural training), as an adjunct to treatment for drug dependent patients, on psychological and physical fitness variables. 34 male participants (19-71 years) were assigned to an experimental group (n = 17) that performed multilateral intervention, or a control group (n = 17) that did not. At baseline and after 8-week, COPE-NVI, CD-RISC and physical fitness tests assessed coping skills, resilience and fitness levels. Adherence to exercise was 100% and, after intervention, significant improvements ($p < .05$) in the skills and strategies adopted to cope with stressful events and ability to deal with negative experiences were found. In addition, the physical fitness components as static and dynamic balance, anaerobic power and coordination, and endurance of the upper body musculature significantly improved ($p < .05$) in experimental group. Findings highlighted the positive relationship between increased physical fitness and improved functional and adaptive modalities used to cope with stressful events and negative experiences. Therefore, multilateral intervention could improve mental and physical wellbeing in drug addicts by proving to be a key tool in promoting social inclusion.

Keywords: Social inclusion; Physical activity; Self-efficacy; Life quality; Wellbeing.

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INTRODUCTION

Substance abuse, such as illicit drugs, is one of the largest public health issues in the world. In Italy, 22% of adults between 15 and 64 years of age use drugs (EMCDDA, 2018). The problem of drug use may lead to social exclusion, manifested by more family problems, poorer health, increased likelihood of unemployment, increased crime, etc. (Neale, 2006). Furthermore, individuals with substance use disorders face elevated risks of multiple comorbid mental and physical health problems (Adrian & Barry, 2003; Schuckit, 2006). Despite widely available treatment programs, typically incorporating elements such as psychoeducation, social support and medication, at least 60% of individuals with substance use disorders are likely to relapse within one year of treatment (McLellan, Lewis, O'brien, & Kleber, 2000; Ramo & Brown, 2008), suggesting a need for innovative approaches to treatment.

Researches indicate that physical activity levels are generally inversely related to substance use disorders. One study showed that those engaging in physical activity or related behaviours (e.g. planning physical activity) during treatment for substance use report lower substance use than those not engaged in these activities (Weinstock, Barry, & Petry, 2008). Mechanistically, physical exercise, which is characterized as a planned, organized, and repeated body movement that aims to promote or maintain physical fitness (ACSM, 2018), activates the same reward pathway as drugs of abuse, through increases in dopamine concentrations and dopamine receptor binding (Greenwood et al., 2011; MacRae, Spirduso, Cartee, Farrar, & Wilcox, 1987). These effects may be particularly beneficial at preventing drug use and reducing initial vulnerability to drug use. Furthermore, compared to methadone and buprenorphine drug-replacement therapies, physical exercise has been recognized as a potential add-on treatment for substance use disorder. For example, studies showed that subjects with regular physical exercise showed lower rates of substance use disorder compared to people with less exercise (Ströhle et al., 2007), and regular physical exercise in adolescence provided a preventive effect on illicit drug use in adulthood (Korhonen, Kujala, Rose, & Kaprio, 2009).

Research suggests that exercise may reduce the likelihood of relapse among individuals with substance use disorders by decreasing negative mood/affect and/or increasing positive mood/affect (Hoffman, & Hoffman, 2008), two related but independent constructs influencing drug use (Cheetham, Allen, Yücel, & Lubman, 2010). Furthermore, engaging in exercise increases self-efficacy, which encourages continued exercise (Marcus & Owen, 1992), and it may increase self-efficacy for attaining and maintaining abstinence from substance use (Read et al., 2001). Exercise has been proposed to broaden the repertoire of possible behaviours and to provide alternative coping strategies for emotion regulation (Hobson & Rejeski, 1993) and contribute to tension relief, stress reduction, and a more positive attitude (Read et al., 2001). The literature also supports an inverse relationship between regular engagement in exercise and mental health problems (Lavie, Milani, O'Keefe, & Lavie, 2011; Ströhle, 2009), particularly depression and negative mood/ affect (Carek, Laibstain, & Carek, 2011; Ströhle, 2009). In addition, it has been demonstrated that engaging in regular exercise often leads to feelings of enhanced wellbeing, vitality, energy, and motivation to adopt an overall healthier lifestyle (Puetz, O'connor, & Dishman, 2006).

However, the optimal dose (e.g. type, duration, intensity) of exercise required to maximize its acute effects on mood/affect is the topic of ongoing research (Williams, 2008). Individuals with substance use disorders are often extremely sedentary; therefore, an initial program of light to moderate intensity activity is likely to be preferable to more vigorous activity, and adherence may be greater for moderate exercise (Abrantes et al., 2001), but this has yet to be established. Some studies found benefits with more vigorous exercise (Greenwood, & Fleshner, 2011; Smith & Lynch, 2012) and a progression to vigorous exercise is often recommended in exercise programs. Unfortunately, there is a lack of studies examining the role of exercise during drug abuse treatment (Donaghy & Ussher, 2005). Previously mentioned studies used exercise interventions mostly aerobic, and Williams (2000) conducted one small, uncontrolled pilot study, for 12 weeks consisting of once weekly strength training groups plus recommendations for aerobic exercise during the rest of the week; the results reported that exercise was helpful in maintaining abstinence.

Thus far, few studies have examined the effectiveness of the aerobic exercise as adjunct to substance abuse treatment, and nothing is known about anaerobic exercise effect. Therefore, the purpose of this study was to investigate an 8-week moderate-intensity physical education intervention conducted with a multilateral methodology as an adjunct to treatment for drug dependent patients. We examined the combined aerobic-anaerobic and behavioural training effects on psychological and physical fitness variables among drug dependent patients. In addition, we hypothesized that a supervised multilateral educational intervention improves coping skills, resilience, physical fitness and exercise adherence in this drug dependent population.

MATERIALS AND METHODS

Research design

In this research, a randomized controlled study design that included pre- and post-testing (at weeks 1 and 8, respectively) was used to evaluate whether an 8-week multilateral physical education intervention could produce improvements. This outcome was identified by statistically significant improvements in the psychological (i.e., COPE-NVI and CD-RISC) and physical fitness (i.e., body mass index, stork balance stand, functional reach, lateral sidestep and push-up tests) variables.

Participants

Thirty-four male participants were recruited from a local therapeutic community for the recovery of drug addicts. The inclusion criteria were: (a) over 18 years of age, (b) sedentary, i.e., they did not regularly participate in physical activity (for at least 20 minutes per day, three days per week) for the past six months, and (c) were currently engaged in outpatient substance abuse treatment. Exclusion criteria included: (a) a history of psychotic disorder or current psychotic symptoms, (b) marked organic impairment, and (c) physical disabilities or medical problems or use of medications that would prevent or hinder participation in a program of moderate-intensity exercise. Before entering the study, informed consent was obtained from each participant. The procedures followed were in accordance with the ethical standards of the responsible institutional committee on human experimentation and with the Helsinki Declaration.

Participants were ranked according to their age, paired, and randomly allocated to either the experimental group (n = 17; range age, 29-71 years; mean age, 47.6 ± 12.1 years; body mass, 74.8 ± 11.0 kg; height, 1.77 ± 0.06 m) that performed a multilateral physical education intervention, or control group (n = 17; range age, 19-69 years; mean age, 42.9 ± 13.1 years; body mass, 73.6 ± 8.4 kg; height, 1.76 ± 0.06 m) that did not. However, the control group will carry out the same intervention program at a later date. The study was carried out between the months of April and June 2018. All participants completed the study.

Testing procedures

Assessments were made at baseline (pre-test) and repeated after 8 weeks (post-test). First, the anthropometric measurements were collected. Body height (in cm to the nearest 0.1 cm) was measured using a SECA® stadiometer, and body weight (in kg to the nearest 0.1 kg) was measured using Tanita® digital scales. The subjects were barefooted and wore light clothing during the measurements. Body mass index (BMI) was calculated as body weight (kg) divided by the square of body height (m^2).

After anthropometrics, the following psychological measures were collected: *(1)* Coping Orientation to Problems Experienced-New Italian Version (COPE-NVI), and *(2)* Connor–Davidson Resilience Scale (CD-RISC). Next, the following physical fitness measures were collected: *(1)* static balance (Stork balance stand test), *(2)* dynamic balance (functional reach test), *(3)* anaerobic power and coordination (lateral sidestep test) and *(4)* endurance of the upper body (push-up test). All participants were tested and trained in a gym located inside the therapeutic community. One week before pre-test, two familiarizations sessions were held. Initial and final test measurements were made at the same time of day and under the same experimental conditions. A standardized warm-up procedure consisting of 5 min of jogging at a comfortable speed was performed before physical fitness test. All measurements were performed and supervised by the same exercise professionals, that is Adapted Physical Education Specialists.

Psychological assessment

Coping Orientation to Problems Experienced-New Italian Version (COPE-NVI) is utilized to assess coping, the use of skills and strategies adopted to face stressful and difficult events. COPE-NVI is a 60-item self-report questionnaire exploring 15 different types of coping, grouped in 5 large essentially independent dimensions: Social Support (SS), Avoidance Strategies (AS), Positive Attitude (PA), Problem Solving (PS), and Transcendent Orientation (TO) (Sica et al., 2008). Response options presented in a 4-point Likert scale format ranging from 1 = I usually don't do this at all, to 4 = I usually do this a lot. Higher scores indicate that coping skills and strategies are used more often. The Cronbach's alpha coefficient for the subscales ranged from .76 to .85.

The *Connor–Davidson Resilience Scale (CD-RISC)* (Campbell-Sills & Stein, 2007) Italian version (Di Fabio & Palazzeschi, 2012) was employed to assess resilience. Resilience is the ability to deal with negative experiences (Grotberg, 1995), to cope and continue to withstand adversity in an adaptive way (Campbell-Sills & Stein, 2007) and to implement adaptive strategies to deal with the discomfort and adversity (Tugade & Fredrickson, 2004). The CD-RISC has 10 items with response options presented in a 5-point Likert scale format ranging from 0 = not true at all to 4 = true nearly all the time. Higher scores indicate a higher level of resilience achieved by the person. The Cronbach's alpha coefficient was .91.

Physical fitness testing

Stork balance stand test evaluated postural static balance (McCurdy & Langford, 2006). Participants were tested on the dominant and non- dominant leg. The participants were instructed to lift and hold the contralateral leg against the medial side of the knee of the stance leg while keeping his hands on the iliac crests. The trial ended when the heel of the involved leg touched the floor, the hands came off the hips, or the opposite foot was removed from the stance leg. This test was conducted with eyes opened only. The participants performed three attempts and the best time (sec.) was recorded for analysis. High test-retest reliability has been reported for this test with an intraclass correlation coefficient (ICC) of 0.96.

The *functional reach test* is a dynamic measure of balance (Duncan, Weiner, Chandler, & Studenski, 1990). FRT is the maximum distance that one can reach forward while standing and maintaining a fixed base of support. To perform the functional reach test, the participants stand comfortably parallel to a wall, make a fist, and raise their arms to 90 degrees of flexion. A yardstick is place parallel to the subject's raised arms. The examiner measures and records the placement of the end of the participant's third metacarpal along the yardstick, this being termed Position 1. In Position 2, the subject reaches as far forward as possible without losing his balance and the examiner measures and records the placement of the same landmark along the yardstick. Functional reach is defined as the mean difference between Position 1 and Position 2 over three trials. If the participant touches the wall or requires any assistance from the examiner, it invalidates the trial.

The examiner guards all participants at a supervision level of assistance during the manoeuvre. The test-retest reliability reported a high reliability for this test (ICC = 0.98).

The *lateral sidestep test* was used to assess anaerobic power by change of direction while maintaining control and balance. This test requires a combination of speed, balance, power and coordination (McCormick, 2014). On a non-slip floor, two cones were placed in line at 4.6 meters apart. From the starting position at the centre line, at the command 'go', the participant sidestepped to the right and reached down and touched the base of the cone. The participant then sidestepped to the left and touched the base of the left cone. Then he returned to the centre line. The participant repeated these lateral movements as quickly as possible for 30 seconds and completed two trials, with a five minutes rest period. The score was expressed as the number of complete cycles in 30 seconds and the highest score was recorded. The test-retest reliability reported a high reliability for this test (ICC = 0.94).

Push-up test assessed endurance of the upper body musculature (Gibson, Wagner, & Heyward, 2018). To start, subjects lay prone on the mat with their legs together and hands pointing forward under the shoulders. They pushed up from the mat by fully extending the elbows and by using either the knees as the pivot point. The upper body and head were kept in a straight line. The subject returned to the down position, touching the chin to the mat. The stomach and thighs did not touch the mat. Subjects performed as many consecutive repetitions (no rest between repetitions) as possible; there was no time limit. The repetitions that did not meet the indicated criteria were not counted. The test ended when the subject was unable to maintain proper push-up technique over two consecutive repetitions; the total number of correctly executed repetitions was recorded.

Multilateral physical education intervention
There were two components to the multilateral physical education intervention: 1) moderate-intensity aerobic-anaerobic exercise, and 2) group behavioural training component.

In present study the American College of Sports Medicine guidelines were followed (ACSM, 2018). All sessions were conducted under direct supervision of exercise professionals, specialists in Adapted Physical Education, to ensure safety, proper intensity, and appropriate exercise technique. Additionally, the mode, frequency, intensity, duration, and progression in an individual exercise log were recorded to ensure adequate training. For the intervention period all participants were asked not to perform any physical activity outside the therapeutic community gym.

The 8-week study period followed the initial data collection, with the experimental group that performed a physical education program consisting of three-per-week training sessions lasting 60 minutes each. Every single training session was divided into a 10-min warm-up (i.e., postural education exercises and stretching of all major muscle groups), a 40-min main training period (i.e., aerobic and resistance training), and a 10-min cooldown period (i.e., stretching again and/or postural education exercises). The intervention program focused on physical activities that use large muscle groups rather than small groups, since most daily living tasks depend on these large muscle groups.

During the main training period, *cardiorespiratory training* consisted of progressive 30-min of walking and/or jogging at an intensity that ranged from 40% to 60% of heart rate reserve. Heart rate was monitored by the participants and the exercise professionals during training using a Polar heart rate monitor (Target model, Kempele, Finland). The duration of the aerobic exercise was initially 16 min and, based on the recommendations in the literature (ACSM, 2018), the aerobic-exercise period was increased by 2 min a week, such that it was 30 min during week 8.

Resistance training consisted of 10-min of exercises with free weights and/or resistance bands, at an intensity ranging from 50% to 70% of 1RM for lifts involving the lower body and from 40% to 70% of 1RM for lifts involving the upper body. 8-10 exercises for major muscle groups, 1 or 2 sets of 8 to 12 reps, and a rest 1-3 min between exercises and sets, were performed with a gradual increase in resistance (1-2 kg) following two consecutive symptom-free sessions.

Flexibility was trained before and after main period by stretching exercises performed maximally on all major muscle groups (1-3 sets per muscle group) but avoiding pain, especially in joints. Duration was gradual from 10 to 30 s per stretch, repeating one to three times for a total of 60 s per stretch.

Postural education exercises were carried out both in the warm-up and cooldown period, and consisted of breathing, proprioception and balance exercises.

Group Behavioural Training Component. Given the demonstrated efficacy of behavioural modification strategies in increasing physical activity (Woodard & Berry, 2001), this weekly, brief (15–20 minutes) group intervention based on cognitive and behavioural techniques was incorporated as a component of the multilateral physical education intervention. Through these weekly groups, co-led by both an exercise professional and psychologist, participants were guided as to how to increase overall fitness through behavioural changes in their daily lives. Each brief group session was focused on a certain topic designed to increase overall motivation resulting in improved exercise adherence and maintenance.

Statistical analyses

All analyses were performed using SAS JMP® Statistics (Version <14.1>, SAS Institute Inc., Cary, NC, USA, 2018) and the data are presented as group mean values and standard deviations. Normality of all variables was tested using Shapiro-Wilk test procedure. Levene's test was used to determine homogeneity of variance. A multivariate analysis of variance (MANOVA) was used to detect differences between the study groups in all baseline variables. Training-related effects were assessed by 2-way analyses of variance (ANOVA) with repeated measures (group x time). When 'Time x Group' interactions reached the level of significance, group-specific post hoc tests (i.e., paired t-tests) were conducted to identify the significant comparisons.

Cohen's *d* effect size was calculated as post-training mean minus pre-training mean divided by pooled SD before and after training, and interpreted as small, moderate and large effects defined as 0.20, 0.50, and 0.80, respectively (Cohen, 1992). Partial eta squared (η^2_p) was used to estimate the magnitude of the difference within each group and interpreted using the following criteria (Cohen, 1992): small ($\eta^2_p < .06$), medium ($.06 \leq \eta^2_p < .14$), large ($\eta^2_p \geq .14$). The reliabilities of the psychological and fitness measures were assessed using Cronbach's alpha coefficient and intraclass correlation coefficients, respectively; scores from .8 to .9 were considered as high reliable, while values above > .9 were considered as very high reliable (Cohen et al., 2011). Percentage changes were calculated as [(posttraining value – pretraining value)/pretraining value] x 100. We accepted $p \leq .05$ as our criterion of statistical significance, whether a positive or a negative difference was seen (i.e., a 2-tailed test was adopted).

RESULTS

All participants received the treatment conditions as allocated and the adherence to training was 100%. All participants completed the multilateral intervention program and no major adverse effect and no major health problem were noted in the participants over the 8-week period. Both groups did not differ significantly at baseline in age, anthropometric characteristics, as well as in psychological measures ($p > .05$). Pre- and post- intervention results for all outcome measures are presented in Table 1.

Table 1. Changes in psychological and physical fitness measures after an 8-week multilateral physical education intervention

	Experimental group (n = 17)				Control group (n = 17)			
Variables	**Pre-test**	**Post-test**	**Difference Absolute [ES]**	**%**	**Pre-test**	**Post-test**	**Difference Absolute [ES]**	**%**
Psychological								
COPE-NIV SS subscale	33.5 (8.2)	38.5 (9.1)†*	4.9 [0.80]	14.6	33.4 (8.3)	32.5 (6.4)	-0.8 [0.22]	-2.4
COPE-NIV AS subscale	26.4 (7.0)	20.2 (5.7)†*	-6.2 [1.09]	-23.5	29.3 (8.0)	29.2 (7.0)	-0.1 [0.00]	-0.3
COPE-NIV PA subscale	33.0 (6.8)	35.3 (5.5)†*	2.3 [0.48]	7.0	34.1 (6.9)	32.2 (6.1)*	-1.8 [1.00]	-5.3
COPE-NIV PS subscale	30.6 (8.2)	35.3 (7.8)†*	4.7 [0.84]	15.4	30.2 (8.0)	30.2 (6.5)	0.1 [0.00]	0.3
COPE-NIV TO subscale	25.1 (6.3)	25.4 (6.2)	0.2 [0.00]	0.8	23.5 (5.7)	23.7 (5.4)	0.2 [0.00]	0.9
CD-RISC	15.7 (4.2)	18.4 (4.3)†*	2.6 [0.87]	16.6	13.8 (3.5)	13.8 (3.5)	-0.1 [0.00]	-0.7
Physical fitness								
Body mass index (kg·m^{-2})	23.8 (3.4)	23.8 (3.3)	-0.1 [0.00]	-0.4	23.7 (2.8)	23.7 (2.8)	0.1 [0.00]	0.4
Stork balance L (s)	20.7 (9.7)	29.0 (4.3)†*	8.3 [0.97]	40.1	21.7 (10.0)	22.1 (10.0)	0.4 [0.52]	1.8
Stork balance R (s)	20.1 (10.4)	30.0 (3.0)†*	9.9 [0.96]	49.3	25.0 (8.4)	25.1 (8.3)	0.1 [0.60]	0.4
Functional reach test (cm)	26.9 (8.3)	35.2 (8.9)†*	8.2 [0.75]	30.5	30.4 (6.9)	30.4 (6.9)	0.1 [0.00]	0.3
Lateral sidestep test (reps)	12.2 (2.6)	14.6 (1.8)†*	2.4 [0.89]	19.7	8.8 (2.8)	8.2 (2.3)*	-0.5 [0.00]	-5.7
Push-up test (reps)	16.1 (5.7)	21.5 (7.3)†*	5.5 [0.58]	34.2	9.9 (4.4)	9.3 (3.7)*	-0.6 [0.00]	-6.1

*Note: values are presented as mean (± SD); COPE NIV: Coping Orientation to Problems Experienced-New Italian Version (SS: social support; AS: avoidance strategies; PA: positive attitude; PS: problem solving; TO: transcendent orientation); CD-RISC: Connor–Davidson Resilience Scale Italian version (10 items); L=left leg; R=right leg; ES = Cohen's d effect size. *Significantly different from pre-test (p < .01). †Significant 'Time x Group' interaction = significant effect of the intervention program.*

Psychological measures

Statistical analyses detected significant main effects of 'Group' for COPE-NIV AS subscale ($F_{1,32} = 6.84$, $p = .013$, $\eta^2_p = .18$) and CD-RISC ($F_{1,32} = 6.73$, $p = .014$, $\eta^2_p = .17$).

Significant main effects of 'Time' were observed for COPE-NIV SS ($F_{1,32} = 4.66$, $p = .038$, $\eta^2_p = .13$), AS ($F_{1,32} = 16.27$, $p < .001$, $\eta^2_p = .34$) and PS ($F_{1,32} = 7.51$, $p = .01$, $\eta^2_p = .19$) subscales. In addition, a significant main effect of 'Time' for CD-RISC ($F_{1,32} = 7.57$, $p = .01$, $\eta^2_p = .19$) was detected.

Significant ‘Time x Group’ interaction was found for COPE-NIV SS ($F_{1,32} = 9.14$, $p = .005$, $\eta^2_p = .22$), AS ($F_{1,32} = 15.08$, $p < .001$, $\eta^2_p = .32$), PA ($F_{1,32} = 10.63$, $p = .003$, $\eta^2_p = .03$) and PS ($F_{1,32} = 7.15$, $p = .012$, $\eta^2_p = .18$) subscales. Furthermore, a significant main effect of ‘Time’ for CD-RISC ($F_{1,32} = 8.27$, $p = .007$, $\eta^2_p = .24$) was detected. The post hoc analysis revealed significant changes ($p < .01$) from pre- to post-testing for COPE-NIV (SS, AS, PA and PS subscales) and CD-RISC in the experimental group and significant changes ($p < .01$) for COPE-NIV PA subscale in the control group (see Table 1).

Physical fitness measures

Statistical analyses revealed significant main effects of ‘Group’ for Lateral sidestep test ($F_{1,32} = 38.74$, $p < .001$, $\eta^2_p = .55$) and Push-up test ($F_{1,32} = 26.76$, $p < .001$, $\eta^2_p = .46$).

Significant main effects of ‘Time’ were observed for Stork balance stand test on left ($F_{1,32} = 15.63$, $p < .001$, $\eta^2_p = .33$) and right leg ($F_{1,32} = 15.22$, $p < .001$, $\eta^2_p = .32$), Functional reach test ($F_{1,32} = 47.98$, $p < .001$, $\eta^2_p = .60$), Lateral side step test ($F_{1,32} = 19.93$, $p < .001$, $\eta^2_p = .38$) and Push-up test ($F_{1,32} = 16.31$, $p < .001$, $\eta^2_p = .34$).

Significant ‘Time x Group’ interaction was found for Stork balance stand test on left ($F_{1,32} = 13.18$, $p = .001$, $\eta^2_p = .29$) and right leg ($F_{1,32} = 14.76$, $p < .001$, $\eta^2_p = .32$), Functional reach test ($F_{1,32} = 46.63$, $p < .001$, $\eta^2_p = .59$), Lateral side step test ($F_{1,32} = 48.66$, $p < .001$, $\eta^2_p = .60$) and Push-up test ($F_{1,32} = 26.23$, $p < .001$, $\eta^2_p = .45$). The post hoc analysis revealed that the experimental group showed significantly greater improvements from pre- to post-testing for outcome variables ($p < .01$) than control group (see Table 1).

DISCUSSION

It was demonstrated that drug abuse may cause mental and physical health problems and social exclusion, thus some researchers have examined the role of physical activity in recovery from substance use disorders to prevent relapses and promote social inclusion. However, very little research has been conducted to examine the application of exercise interventions in adults with drug dependence. In addition, little attention has been given to lifestyle modification, although many patients in substance abuse programs express interest in incorporating exercise into their recovery (Read et al., 2001). Therefore, to address this existing gap in the literature, we developed a combined aerobic-anaerobic and behavioural training as an adjunct to treatment for drug dependent patients. In this study, sedentary drug dependent patients were engaged in an 8-week moderate-intensity aerobic-anaerobic training intervention conducted with a multilateral methodology. Results revealed excellent adherence to exercise with significant improvement in the skills and strategies adopted to face stressful and difficult events and to deal with negative experiences and continue to withstand adversity in an adaptive way. In addition, physical fitness components as postural static and dynamic balance, anaerobic power and coordination, and endurance of the upper body musculature, were enhanced after 8-week multilateral intervention.

Findings highlighted the positive relationship between increased physical fitness and improved functional and adaptive modalities used to cope with stressful events and negative experiences, thus confirming previous researches (Carek et al., 2011; Daley, 2008; Hobson & Rejeski, 1993; Lavie et al., 2011; Marcus & Owen, 1992; Puetz et al., 2006; Read et al., 2001; Salmon, 2001; Ströhle, 2009). Significant higher scores in the positive attitude (PA) and problem solving (PS) subscales mean that the subjects, after multilateral intervention, could more often act less impulsively, elaborate critical experience in positive and/or growth terms, accept their own situation, take action to deal with stress, reflect and develop strategies to address the problem, and avoid distractions to deal more effectively the problem.

In the transcendent orientation (TO) subscale, no significant difference was highlighted indicating that the subjects sought comfort in a religious belief as before the intervention. Whereas the positive changes in social support (SS) subscale indicate that the subjects, more often, could ask for advice, assistance and information, get moral support, reassurance and understanding, and give vent to their feelings. However, this could mean a lack of personal effectiveness. These findings do not confirm previous studies that support that engaging in exercise increases self-efficacy (Marcus & Owen, 1992), useful for attaining and maintaining abstinence from substance use (Read et al., 2001). These two strategies, i.e. social support and transcendent orientation are not connected with psychological wellbeing (Sica et al., 2008). When used in stressful conditions, these two behavioural modalities are not sufficient on their own to guarantee a condition of wellbeing. Indeed, relying solely on social support and/or religion could reinforce a certain passivity on the part of the individual. However, the study participants belong to the therapeutic community for the recovery of drug addicts, where they require moral support and understanding. Therefore, we speculate that the multilateral intervention did not reduce the self-efficacy because the participants was subjected to drug abuse treatment as people with specific vulnerabilities.

In present study, the avoidance strategies (AS) subscale showed lower scores after intervention. This suggest that the subjects, less often, could make fun of the situation by joking, react as if stress did not exist, avoid the problematic situation, be distracted and use substances to tolerate stress. These results showed that the multilateral intervention was effective in improving wellbeing, self-efficacy and life quality. This may confirm that higher scores in the SS subscale do not depend by the intervention. In addition, scores showed in CD-RISC highlighted greater ability of the patients to thrive despite adversity (Beasley, Thompson, & Davidson, 2003), after multilateral intervention. Exercise improved resilience that correlates positively with optimism (Tugade & Fredrickson, 2004) and self-efficacy (Marcus & Owen, 1992). In fact, it is known that positive coping techniques may contribute to resilience (Rice & Liu, 2016). Thus, it could be confirmed that physical activity and exercise activate neurochemical mechanisms (Greenwood et al., 2011; MacRae et al., 1987), improving mood (Carek et al., 2011; Dua & Hargreaves, 1992; Hoffman, & Hoffman, 2008; Ströhle, 2009), self-efficacy (Marcus & Owen, 1992; Read et al., 2001), coping strategies (Hobson & Rejeski, 1993), positive attitude (Read et al., 2001) and anxiety (Carek et al., 2011; Ströhle, 2009).

Multilateral intervention enhanced physical fitness of the participants that showed greater performances in some health and skill related components. Thus, patients could have a better awareness of the body than previously. Indeed, multilateral physical education intervention improved health and wellness, as the physiological (Abrantes et al., 2001; Donaghy & Ussher, 2005; Fischetti & Greco, 2017; Greenwood, & Fleshner, 2011; Smith & Lynch, 2012) and psychological (Carek et al., 2011; Hobson & Rejeski, 1993; Hoffman, & Hoffman, 2008; Lavie et al., 2011; Marcus & Owen, 1992; Puetz et al., 2006; Read et al., 2001; Ströhle, 2009) benefits of exercise have been well documented. In addition, physical activity, and specifically exercise, is a potential non-pharmacological treatment for addiction that targets systems implicated in both early and late stages of the addiction process and has secondary health benefits (e.g., prevention of obesity and secondary diseases such as diabetes) (Weinstock et al., 2008). However, in this research the BMI has not changed, but this could be caused by the short duration of the intervention.

Limitations of this study include the Hawthorne effect, where people could improve their performance in response to the fact that they are part of the study, and the short duration of the experimental intervention that does not allow to adequately study what is caused by the manipulation of the independent variable. In addition, ≥ 150 min/week of aerobic exercise at moderate intensity was recommended by ACSM (2018) and, in this short study, it was not possible to reach this goal. But the simultaneous use of behavioural modification strategies gives us hope in increasing the physical activity in drug addicts even after this study. Furthermore, it is essential that follow-ups are carried out after the end of the training period, so that abusers have the opportunity to carry on with their training.

CONCLUSIONS

In summary, the present study showed the effectiveness of the multilateral methodology, i.e. moderate-intensity aerobic-anaerobic training plus group behavioural training, in improving coping skills, resilience and physical fitness of the drug addicts, with a 100% exercise adherence. These novel results could explain the optimal dose of exercise required to maximize its effects on mental and physical wellbeing in this people with specific problems as an adjunct to therapeutic treatment. Furthermore, this could help drug addicts avoid the social exclusion risk, as physical and sport activity is considered an important tool for social inclusion (Coalter, 2005). However, physical activity itself may not be the solution to preventing substance abuse and relapse, but as a component of wider programs of personal and social development, it could be a part of the solution.

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CONFLICT OF INTEREST STATEMENT

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AUTHORS' CONTRIBUTION

Francesco Fischetti designed the study, interpreted the data, wrote and revised the manuscript. Stefania Cataldi collected and interpreted the data and wrote the manuscript. Piergiorgio Di Terlizzi collected and interpreted the data. Gianpiero Greco designed the study, carried out the statistical analysis, interpreted the data, wrote and revised the manuscript. All authors contributed intellectually to the manuscript, and all authors have read the manuscript and approved the submission.

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