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Original Article

Karate as anti-bullying strategy by improvement resilience and self-efficacy in school-age youth

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Abstract:

Bullying is characterized by power imbalances in relationships, which can lead to negative social consequences. Youth with higher levels of resilience and self-efficacy are less likely to engage in aggressive behaviours or be victims of bullying. Karate, a martial art emphasizing respect, self-regulation and health promotion, may be an effective alternative to the anti-bullying failing approach of institutions. Therefore, the purpose of this randomized controlled study was to examine the effect of a 12-week karate-based intervention on resilience and self-efficacy. 100 students from 3 high schools, aged 14-16 years, were randomly assigned to experimental group (n=50) that performed technical Shotokan karate practice and psychoeducational activities (90 min., once per week), or wait-list control group (n=50). Before and after intervention, two standardised psychometric instruments were used: CYRM-28 assessed individual capacities and resources, relationship with primary caregiver, contextual factors and total resilience; SEQ-C measured academic, social, emotional and total self-efficacy. Two participants from karate group withdrew during intervention. A significant 'Time x Group' interaction was detected for all dependent measures ($p < 0.05$) with moderate to large effect size. Significant increases from baseline were found for all scores on the resilience and self-efficacy scales ($p < 0.05$). The results suggest that psychosocial intervention based on Karate may improve the resilience and self-efficacy of youth and make them less likely to engage in aggressive behaviour or be bullied. Thus, Karate should be considered an effective alternative to the anti-bullying failing approach of the institutions.

Key words: martial arts; Shotokan; wellbeing; psychosocial intervention; externalizing behaviours.

Introduction

Bullying is a controversial issue, however there is no standard definition of bullying (Rigby, 2008), and it is difficult to establish a definition inclusive of all bullying behaviours (Lines, 2008). Research suggests bullying can be characterized as (1) a type of aggression (Pellegrini, 2004), (2) systematic and repeated (Olweus, 1993), and (3) based upon an imbalance of power (Bouman et al., 2012). These behaviors occur both directly and indirectly and can lead to negative social consequences (D'Elia, 2019, D'Isanto, 2016, Gaetano, 2012). Examples of commonplace power differences in school include being able to physically hurt others, numerical (group) superiority, being more confident or assertive than others, having greater verbal dexterity, having superior social or manipulative skills, and having greater status and corresponding capacity to impose will on others (Rigby, 2008). Antibullying strategies are the main approach addressing bullying in schools (Farrington & Ttofi, 2009) and claim substantial support to address bullying. However, antibullying approaches are often found to achieve no reduction or observe increases in bullying behaviour (Moore & Woodcock, 2017a; Rigby, 2002).

Resilience is a complex construct (Kaplan, 2006) that is defined as the attainment of positive outcomes, adaptation or developmental milestones in the face of significant adversity, risk, or stress (Goldstein & Brooks, 2006). Different conceptualisations describe resilience as: (a) a protective process; (b) the interaction of protection and risks; and, (c) a conceptual tool within predictive models (Elias, Parker, & Rosenblatt, 2006). The operational definition of resilience varies and has included: hardiness, optimism, competence, self-esteem, social-skills, achievement, and absence of pathology in the face of adversity (Prince-Embury, 2007). The research examining the relationship between bullying and resilience is not extensive (Sapouna & Wolke, 2013), and findings include: (a) students with a strong resilience profile were less likely to engage in aggressive behaviours or be bullied than those who reported fewer developmental strengths (Donnon, 2010); (b) bullying appeared to decrease if social skills were improved in victims, and that nonchalance strategies and emotional regulation were useful (Lisboa & Killer, 2008); and (c) resilience to bullying was improved if the student had a peer or family member with whom to disclose (Bowes, Maughan, Caspi, Moffitt, & Arseneault, 2010; Rivers & Cowie, 2006).

In a recent meta-analysis Harwood, Lavidor, & Rassovsky (2017) reported that martial arts training had a positive effect on mental health outcomes. Analysis found that martial arts training increases wellbeing and

reduces externalizing behaviours in youth, such as aggression, anger, and violence. In addition, martial arts teach self-control and a more positive response to physical challenges, enhance self-esteem, teach and induce greater emotional stability, self-confidence and assertiveness. However, studies examining the psychological effects of martial arts training exhibit significant methodological problems that limit the generalisability of findings (Vertonghen & Theeboom, 2010). In addition, the effects of martial arts on self-efficacy are somewhat unknown. Self-efficacy refers to how individuals perceive their ability to competently engage in specific activities (Bandura, 2012). Self-efficacy has been shown to be important correlate and even predictors of mental health, and this is true in youths where higher levels of this construct are typically accompanied by lower levels of anxiety and depression (Bandura et al. 1999; Muris, 2002). Furthermore, the youth—particularly males—with higher social self-efficacy are somewhat more likely to resist pressure to engage in risky behaviors, such as delinquent behaviour and being victimized (Ludwig & Pittman, 1999). In short, to date the efficacy of martial arts-based social interventions has received little research attention (Hartmann, 2003).

Karate is a martial arts discipline that is widely practiced in the Western world as a form of self-defence and is considered both as a discipline that allows one to achieve physical and mental balance and as a tool for health prevention (Chang, Yeh, Pai, & Huang, 2018; Douris et al., 2004; Jansen, Dahmen-Zimmer, Kudielka, & Schulz, 2017; Palermo & Greydanus, 2011; Qasim, Ravenscroft, & Sproule, 2014). Accordingly, we may speculate that Karate, a martial art emphasizing respect, self-regulation and health promotion, may be an effective anti-bullying alternative approach (Hartmann, 2003; Macarie & Roberts, 2010). Thus, the purpose of this study was to examine the effects of 12 weeks of karate-based intervention on resilience and self-efficacy in adolescents. It was hypothesized that intervention would improve the resilience processes and perceived self-efficacy.

Material & Methods

Study design

The study was a 12-week high school-based intervention that has been evaluated using a randomized controlled study. Data were collected and recorded at baseline (Pre-test) and after 12 weeks (Post-test). After pre-test and randomization, the experimental group received a karate-based intervention program. The control group received the same intervention program after the post-intervention assessment. The design has been facilitated by use of standardised tests, which increase the validity and reliability of data as such instruments have been developed and normalised using larger samples and have been piloted to ensure test items actually measure what is intended (Cohen & Swerdlik, 2005).

Participants

One-hundred adolescents from three local high schools were recruited to participate in the study. The sample consisted of 50 males and 50 females with an age range from 14 to 16 years and a mean age of 14.6 ± 0.7 . The socio-economic status of all participants was reported as high average. Power calculations were conducted to determine the sample size required to detect changes in the dependent measures resulting from karate training. An a priori power analysis (Faul, Erdfelder, Lang, & Buchner, 2007) with an assumed type I error of 0.05 and a type II error rate of 0.10 (90% statistical power) was calculated and revealed that 46 participants in total would be sufficient to observe medium 'Time x Group' interaction effects. Participants were excluded if they had a chronic paediatric disease or had an orthopaedic condition that would limit their ability to perform exercise. All participants and their parents received a complete explanation in advance about the purpose of the experiment and the parents provided written consent to the study. The procedures followed were in accordance with the ethical standards of the responsible institutional committee on human experimentation and with the Helsinki Declaration. The study was conducted from February to April 2019.

Procedures

The recruitment occurred from schools within an area of close proximity to where one of the researchers was working. The school staff distributed information and consent forms to all students to be recruited and their parents. Participants were verbally reminded that participation was voluntary, that they could discontinue the survey at any point, and that their responses were confidential and anonymous. Participants were instructed regarding (a) not writing their names on the survey, (b) how to respond to rating scales, and (c) how to correct responses. Participants were not given definitions of bullying, resilience or self-efficacy to not bias their responses. Surveys were then provided to participants.

Randomisation into Karate ($n = 50$; age 14.5 ± 0.7 years; 25 males and 25 females) and wait-list control group ($n = 50$; age 14.6 ± 0.7 years; 25 males and 25 females) occurred after pre-intervention assessments. Participants were pair-matched based on gender and the randomization was carryout by Research Randomizer, a program published on a publicly accessible official website (www.randomizer.org). The researchers were blinded to this randomisation of intervention and control group allocations. Concurrent martial arts training were exclusion criteria for participation in the study, however previous experience of martial arts training was not an exclusion criterion. Ninety-eight participants completed the post-intervention assessment and one male and one female of the karate group did not complete the assessment for unknown reasons.

Measures

To evaluate the effects of the intervention program, two standardised psychometric instruments were used: Child and Youth Resilience Measure (CYRM-28) (Liebenberg, Ungar, & Van de Vijver, 2012; Ungar & Liebenberg, 2011), and the Self-Efficacy Questionnaire for Children (SEQ-C) (Muris, 2001; Suldo & Shaffer 2007).

The *CYRM-28* is a 28-item instrument that measures various aspects of children's and adolescents' resilience. The scale provided a total resilience scale ($\alpha = 0.84$) and three subscales including an individual capacities and resources scale ($\alpha = 0.85$), relationship with primary caregiver scale ($\alpha = 0.84$), and contextual factors scale ($\alpha = 0.82$). Items are scored on a 5-point Likert scale with 0 = not at all, 1 = a little, 2 = somewhat, 3 = quite a bit, and 4 = a lot. The *CYRM-28* is designed as a screening tool to explore the resources (individual, relational, and contextual) available that bolster resilience competence in the face of adversity. Individual resources are individual personal skills (e.g., I am aware of my own strengths), individual peer support (e.g., I feel supported by my friends), and individual social skills (e.g., I know where to go in my community to get help). Relational resources are physical caregiving (e.g., My caregiver(s) watch me closely) and psychological caregiving (e.g., I talk to my caregiver(s) about how I feel). Contextual resources are spiritual (e.g., Spiritual beliefs are a source of strength for me), educational (e.g., Getting an education is important to me), and cultural (e.g., I am proud of my ethnic background). Higher scores indicate greater presence of resilience processes.

The *SEQ-C* is a 24-item instrument that measures various aspects of children's and adolescents' self-efficacy. The scale provided a total self-efficacy scale and three subscales: (1) academic self-efficacy (eight items) which is concerned with the perceived capability to manage one's academic affairs (e.g., "How well can you study when there are other interesting things to do?"); (2) social self-efficacy (eight items) which has to do with the perceived capability for dealing in an effective way with other people (e.g., "How well can you become friends with other children?"); and (3) emotional self-efficacy (eight items) which pertains to the perceived capability of coping with negative emotions (e.g., "How well can you control your feelings?"). The *SEQ-C* scales have good cross-cultural validity (Minter & Pritzker, 2017) and showed a reliable to highly reliable internal consistency ($\alpha = 0.76-0.82$). Items are scored on a 5-point Likert scale with 0 = not at all, 1 = a little, 2 = somewhat, 3 = quite a bit, and 4 = very well. A total self-efficacy score can be computed by summing all items. High score in this questionnaire shows high self-efficacy in the specific function in question.

Intervention program

The intervention was performed on site at participating schools. The intervention dose was 90 minutes, once per week for 12 weeks. Each intervention session included:

- a) Psychoeducational activities concerning respect, goal-setting, self-concept and self-esteem, courage, resilience, bullying and peer pressure, self-care and caring for others, values, and, optimism and hope;
- b) Warm-up activities: exercises including jogging, push ups, sit ups, arm swings, trunk twisting, stride jumping, high knees, skipping leg swings, and backward sprinting;
- c) Stretching activities: a variety of stretching exercises were used during the program including achilles' tendon/calf stretches, skier's stretches, quadriceps stretches, hurdler's stretches, straddle stretches, groin stretches, back stretches, and archers;
- d) Technical Shotokan karate practice (i.e., kihon): learning a range of basic technical skills, such as body shifting, proper stances, and offensive and defensive technical abilities. Movements must be performed with proper breathing and posture.

In addition, the following activities were alternated during the program:

- e) Kata, that is a choreographed sequence of movements consisting of combinations of blocks, punches and kicks, performed as though defending against imaginary opponents;
- f) Kumite, that is a match between two opponents in which one symbolically destroys the other with technique and strategy.

Finally, it should be known that aggressive physical contact is not part of Shotokan karate. All sessions were conducted under direct supervision of two black-belt Shotokan karate instructors (at least 2nd Dan) with minimum 8 years of experience, graduates in sports science and sports coaching specialists.

Statistical analyses

Statistical analyses were carried out using SAS JMP® Statistics (Version <14.3>, SAS Institute Inc., Cary, NC, USA, 2018). Data are presented as group mean values and standard deviations. A multivariate analysis of variance (MANOVA) was used to detect differences between the study groups in all baseline variables. A two-way ANOVA (group (karate/control) × time (pre/post-intervention)), with repeated measures on the time dimension, was conducted to examine the effect of karate training on all examined variables. When 'Group x Time' interactions reached the level of significance, group-specific post hoc tests (i.e., paired t-tests) were conducted to identify the significant comparisons.

Partial eta squared (η^2_p) was used to estimate the magnitude of the difference within each group and interpreted using the following criteria: small ($\eta^2_p < 0.06$), medium ($0.06 \leq \eta^2_p < 0.14$), large ($\eta^2_p \geq 0.14$). Effect sizes for the pairwise comparisons were determined by Cohen's d and interpreted as small ($0.20 \leq d < 0.50$), moderate ($0.50 \leq d < 0.79$) and large ($d \geq 0.80$) (Cohen, 1992). The standardized Cronbach's alpha coefficient (Cohen, Manion, & Morrison, 2011) was used as a measure of reliability of the psychological tests (reliable: $0.70 \leq \alpha < 0.80$; highly reliable: $0.80 \leq \alpha \leq 0.90$). Statistical significance was set at $p < 0.05$.

Results

Two participants from karate group withdrew and thus ninety-eight adolescents completed the study. Eighty-two (83.7%) participants reported wanting to continue the training program or participate in another martial arts program after intervention. Both groups did not differ significantly at baseline in age, anthropometric characteristics, as well as in the dependent variables ($p > 0.05$).

Resilience

Changes in total resilience scale and three subscales over 12-week intervention program are reported in Table 1.

Individual capacities and resources: A significant 'Time x Group' interaction ($F_{1,96} = 14.04, p < 0.001, \eta^2_p = 0.13$) and main effect of 'Time' ($F_{1,96} = 12.16, p < 0.001, \eta^2_p = 0.11$) were found, but no significant main effects of 'Group' was detected.

Relationship with primary caregiver: Statistical analysis revealed only a significant 'Time x Group' interaction ($F_{1,96} = 20.74, p < 0.001, \eta^2_p = 0.18$), whereas no significant main effect of 'Time' or 'Group' were detected.

Contextual factors: A significant 'Time x Group' interaction ($F_{1,96} = 17.03, p < 0.001, \eta^2_p = 0.15$) was found but not significant main effects of 'Time' or 'Group'.

Total resilience: A significant 'Time x Group' interaction ($F_{1,96} = 48.86, p < 0.001, \eta^2_p = 0.34$) and main effect of 'Time' ($F_{1,96} = 8.30, p = 0.005, \eta^2_p = 0.08$) were found, but no significant main effects of 'Group' was detected.

The post-hoc analyses revealed a significant increase in scores from pre- to post-test for karate group in: Individual capacities and resources ($p < 0.001, d = 0.88$), Relationship with primary caregiver ($p < 0.001, d = 0.58$), Contextual factors ($p < 0.001, d = 0.63$) and Total resilience ($p < 0.001, d = 1.16$).

Self-Efficacy

Changes in total self-efficacy scale and three subscales are reported in Table 1.

Academic self-efficacy: A significant 'Time x Group' interaction ($F_{1,96} = 6.80, p = 0.011, \eta^2_p = 0.07$) and main effect of 'Time' ($F_{1,96} = 4.79, p = 0.031, \eta^2_p = 0.05$) were found, but no significant main effects of 'Group' was detected.

Social self-efficacy: A significant 'Time x Group' interaction ($F_{1,96} = 12.73, p < 0.001, \eta^2_p = 0.12$) was found but not significant main effects of 'Time' or 'Group'.

Emotional self-efficacy: Statistical analysis revealed only a significant 'Time x Group' interaction ($F_{1,96} = 15.87, p < 0.001, \eta^2_p = 0.14$), whereas no significant main effect of 'Time' or 'Group' were detected.

Total self-efficacy: A significant 'Time x Group' interaction ($F_{1,96} = 26.84, p < 0.001, \eta^2_p = 0.22$) and a significant main effect of 'Time' ($F_{1,96} = 9.42, p = 0.003, \eta^2_p = 0.09$) were found. No significant main effect of 'Group' was detected.

The post-hoc analyses revealed significant improvements from pre- to post-test for karate group in: Academic self-efficacy ($p = 0.020, d = 0.35$), Social self-efficacy ($p = 0.004, d = 0.42$), Emotional self-efficacy ($p = 0.002, d = 0.47$) and Total self-efficacy ($p < 0.001, d = 0.64$).

Table 1 - Changes in resilience and self-efficacy scales after 12-week karate-based intervention.

	Karate group (n = 48)			Control group (n = 50)		
	Baseline	Post-test	Δ	Baseline	Post-test	Δ
CYRM-28 Resilience scales						
Individual capacities and resources	2.95 (0.54)	3.09 (0.54)†*	0.15 (0.16)	3.13 (0.75)	3.12 (0.71)	-0.01 (0.24)
Relationship with primary caregiver	3.08 (0.65)	3.20 (0.59)†*	0.13 (0.20)	3.03 (0.69)	2.97 (0.65)*	-0.06 (0.20)
Contextual factors	2.61 (0.67)	2.76 (0.64)†*	0.16 (0.24)	2.49 (0.82)	2.38 (0.63)*	-0.12 (0.40)
Total resilience	2.88 (0.38)	3.02 (0.37)†*	0.14 (0.12)	2.88 (0.49)	2.82 (0.41)*	-0.06 (0.16)
SEQ-C Self-Efficacy scales						
Academic self-efficacy	2.60 (0.74)	2.83 (0.60)†*	0.23 (0.66)	2.54 (0.73)	2.52 (0.71)	-0.02 (0.14)
Social self-efficacy	2.63 (0.64)	2.79 (0.58)†*	0.17 (0.38)	2.70 (0.65)	2.64 (0.60)	-0.06 (0.24)
Emotional self-efficacy	2.38 (0.53)	2.60 (0.49)†*	0.23 (0.47)	2.52 (0.58)	2.44 (0.54)*	-0.08 (0.27)
Total self-efficacy	2.53 (0.37)	2.74 (0.29)†*	0.21 (0.33)	2.59 (0.32)	2.53 (0.32)*	-0.05 (0.12)

Note: values are presented as mean (\pm SD); Δ : pre- to post-training changes; †Significant 'Group x Time' interaction: significant effect of the intervention ($p < 0.05$). *Significantly different from pre-test ($p < 0.05$).

Discussion

The purpose of this study was to examine the effects of 12 weeks of karate-based intervention on resilience and self-efficacy in youth. The results provided valid and reliable evidence that a psychosocial intervention based on Shotokan Karate could be an effective alternative method to improve wellbeing including resilience and self-efficacy (Hartmann, 2003; Macarie & Roberts, 2010). In addition, interventions using this approach should promote an individual's ability to cope with the effects of bullying. Significant improvements were found in karate group for levels of the overall resilience and resilience sub-factors, as well as for total self-efficacy and self-efficacy subscales. Therefore, our hypothesis has been confirmed and the results agree with previous studies showing the effectiveness of karate in promoting physical and mental balance and in preventing health (Chang et al., 2018; Douris et al., 2004; Jansen et al., 2017; Palermo & Greydanus, 2011; Qasim et al., 2014).

For the intervention group, positive changes in resilience showed a moderate to large effect size for all subscales and total resilience. This is an important achievement because students who report higher levels of resilience may be less likely to engage in aggressive behaviour or be bullied (Donnon, 2010; Lisboa & Killer, 2008; Rigby, 2008). Significant improved relationships with primary caregivers has been particularly important, as family factors, including warm relationships and positive home environments, are associated with increased resilience to bullying (Bowes et al., 2010). It has been shown that resilience to bullying behaviors is improved when people can reveal their experiences to a family member (Rivers & Cowie, 2006). Furthermore, significant improvements in the resources individual, relational and contextual available support resilience competence in the face of adversity (Fischetti, Cataldi, Di Terlizzi, & Greco, 2019; Goldstein & Brooks, 2006; Kaplan, 2006; Naglieri & LeBuffe, 2006; Prince-Embury, 2007) and, thus, bullying (Bowes et al., 2010; Donnon, 2010; Lisboa & Killer, 2008; Rivers & Cowie, 2006; Sapouna & Wolke, 2013).

The effectiveness of Karate Shotokan-based psychosocial interventions on mental wellbeing, emotional stability, self-control and ability to cope with adversity is supported by well-established scientific theories. In addition, our results support previous findings which reported martial arts training improved wellbeing factors such as self-esteem and self-concept (Vertonghen, & Theeboom, 2010). Our study showed increases with moderate effect size for total self-efficacy and with small effect for the subscales. However, control group exhibited decreases for emotional and total self-efficacy and this suggests that intervention had a greater effect on self-efficacy outcomes. Since the victims of bullying report lower self-efficacy than non-victims (Moore & Woodcock, 2017b), the result that total self-efficacy improved for the intervention group and decreased for the control group suggests that the intervention could improve participants' abilities to cope with bullying (Ludwig & Pittman, 1999).

Furthermore, results support previous studies that state that karate practice could have a significant impact on problematic externalising behaviour. Externalising and antisocial behaviours amongst youth are of pressing concern and considered a major public health problem (Krug, Mercy, Dahlberg, & Zwi, 2002). However, it has been suggested that motor and sport activities improve psychological (Fischetti, Latino, Cataldi, & Greco, 2019) and physical fitness (Fischetti & Greco, 2017; Greco, Cataldi, & Fischetti, 2019), cognitive functions and, specifically, executive functions in youth (Diamond & Lee, 2011), and reduce externalising behaviours (Zhou et al., 2007). An effective intervention for the externalising behaviours treatment is provided by martial arts and, in particular, by Karate. The more advanced a student becomes in the traditional martial arts, the lower his or her aggression levels are reported on a range of measures (Nosanchuk & MacNeil, 1989; Reynes & Lorant, 2002). While martial arts appear to attract those children that have higher aggressive tendencies, it seems that throughout the training process assaultive hostility levels drop to below levels of those initially demonstrating normal hostility levels (Daniels & Thornton, 1990; Ziaee, Lotfian, Amini, Mansourmia, & Memari, 2012). Indeed, learning to understand one's boundaries, developing self-control, and physically integrating mind and body can have deep psychological benefits (Jansen & Dahmen-Zimmer, 2012; Weiser, Kutz, Kutz, & Weiser, 1995). Nevertheless, previous review of the effect of martial arts of socio-psychological variables (Vertonghen & Theeboom, 2010) demonstrated the variability of research pertaining to the effect of martial arts on externalising behaviours and highlighted the need for more extensive research.

Some limitations may limit the results of the current study. Given that the study only examined participants from three high school, the findings should be interpreted cautiously, as they may be the result of a localized effect. In addition, as noted in the literature review, both bullying and resilience are complex constructs and lack an agreed academic definition. This presents questions in terms of whether the definitions used in the current study adequately operationalise the constructs. Future research should expand the definition of resilience and bullying. Finally, psychoeducational activities may have had a confounding effect on karate training. Psychoeducation and karate training have been developed as part of a single intervention program, so it is not possible to separate their effects. However, the combination of psychoeducation and martial arts training is widespread in traditional martial arts such as Shotokan karate, so we can consider this limit irrelevant.

This study has some strengths, i.e. it proposes an alternate approach to educational policy and suggests that instead of focusing resources towards eliminating bullying behaviours, policy should focus on promoting mental health through developing wellbeing. Future research should examine the karate-based intervention program's effects on different population samples. Consideration should be given to implementing the

intervention as a universal program with primary school students, selecting specific populations such as participants diagnosed with (a) Autism Spectrum Disorder, (b) intellectual disability, and (c) behavioural disorders such as Oppositional Defiant Disorder. Positive effects of Karate have already been documented in reducing stereotypy in autism (Bahrami, Movahedi, Marandi, & Abedi, 2012), improving quality of life in schizophrenia (Hasson-Ohayon, Kravetz, Roe, Rozenzweig, & Weiser, 2006), and increasing emotional mental state in the elderly (Jansen & Dahmen-Zimmer, 2012), thereby adding further evidence to the wellbeing enhancing mechanisms of the martial arts across a range of populations.

Conclusions

In summary, the findings suggested that a psychosocial intervention based on a traditional martial art, such as Karate Shotokan, may improve the resilience and self-efficacy in adolescents, and make them less likely to engage in aggressive behaviour or be bullied. Evidence supports that anti-bullying policies are inconsistent; therefore, Karate should be considered as an alternative practice to improve individual ability to cope with the effects of bullying and an effective alternative to the anti-bullying failing approach of the institutions. Future research should develop a professional learning program for teachers to facilitate similar programs which could be embedded within a physical education curriculum.

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Authors' contribution

Gianpiero Greco contributed to the research design and conception, statistical analysis, data interpretation, critical review of draft manuscripts, and wrote the manuscript. Stefania Cataldi interpreted data and wrote the manuscript. Francesco Fischetti contributed to the research design, critical review of draft manuscripts and wrote the manuscript. Authors read and approved the final manuscript.

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