

Coaching to enhance the mental toughness of people learning kickboxing

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Abstract

This pilot study investigated whether combining Positive Psychology Coaching (PPC) and kickboxing would progress the development of mental toughness compared to kickboxing alone. The data were derived from 28 participants who voluntarily took a four-week kickboxing course and completed the Mental Toughness Questionnaire (MTQ48) a week before the course commenced and after its completion. Using stratified randomisation for age and gender, 14 participants received a one-hour individual face-to-face coaching session while the other 14 only engaged in kickboxing. The results suggest that PPC may have a role in developing mental toughness when it is combined with vigorous physical exercise.

Keywords: Coaching; positive psychology; mental toughness; physical exercise; kickboxing

Introduction

Mental toughness (MT) appears to be a highly desirable trait as it can enhance performance and wellbeing (Crust, 2008; Gucciardi, Gordon & Dimmock, 2009; Clough & Strycharczyk, 2012). Whilst there are a number of conceptual differences, mental toughness is generally characterised as a multidimensional concept that enables individuals to remain focused, determined and confident; allowing them to cope with, and even thrive in, challenging circumstances (Clough, Earle & Sewell, 2002; Crust, 2008; Gucciardi, et al., 2009; Gucciardi & Mallett, 2010; Clough & Strycharczyk, 2012). The concept of mental toughness, which originally emerged and is predominantly used in sports, has captured broader academic interest as the capacity to effectively manage adversity and consistently pursue desired goals is of critical importance in modern life (Clough & Strycharczyk, 2012). Research into the benefits of enhanced mental toughness has been evident in fields such as education (Crust, Earle, Perry, Early, Clough & Clough, 2014) and business (Marchant, Polman, Clough, Jackson, Levy & Nicholls, 2009), with the most recent interest in its link to both mental (Gerber, Kalak, Lemola, Clough, Perry, Puhse, Elliot, Holsboer-Trachsler & Brand, 2013; Stamp, Crust, Swann, Perry, Clough & Marchant, 2015) and physical health (Crust & Clough, 2005; Levy, Polman, Clough, Marchant & Earle, 2006). The application of mental toughness has been broadened by the development of measurement tools, such as the Mental Toughness Questionnaire 48 (the MTQ48; Clough et al., 2002) which has been shown to have adequate psychometric properties (Horsburgh, Schermer, Veselka & Vernon, 2009). Existing research has identified the characteristics associated with mentally tough individuals through correlational studies, however research into what constitutes an optimal environment for enhancing mental toughness-using the MTQ48 is limited.

Qualitative research has suggested that being challenged either by physical exercise or hardship can develop mental toughness (Bull, Shambrook, James & Brooks, 2005; van Yperen, 2009; Coulter, Mallett & Gucciardi, 2010). However, despite the potential role of challenges in the development of mental toughness, this does not imply that all individuals who experience challenges or adversity may respond positively to these events (Clough & Strycharczyk, 2012). Such experiences may instead translate into trauma. In these

cases, cognitive interventions such as coaching may be beneficial. The purpose of coaching is to promote positive change and wellbeing through the facilitation of learning processes (Berg & Szabo, 2005; van Nieuwerburgh & Green, 2014). PPC (Biswas-Diener & Dean, 2007; Biswas-Diener, 2010) is particularly useful tool for the enhancement of mental toughness as it focuses on the specific elements of this trait. With this understanding, examining interventions that integrate coaching with physical exercise using the MTQ48 will contribute to the existing literature concerning the role of PPC and physical exercise in the development of mental toughness.

Coaching and mental toughness

Coaching is “a one-to-one conversation focused on the enhancement of learning and development through increasing self-awareness and a sense of personal responsibility (van Nieuwerburgh, 2012a). One of the primary interests of coaching is to enhance the wellbeing of individuals through a structured conversation (van Nieuwerburgh & Green, 2014). Here, the coach facilitates the self-directed learning of the coachee through questioning, active listening, and appropriate challenge in a supportive and encouraging climate. Berg and Szabo (2005) also support the use of questions to promote self-responsibility and increase motivation in order to make positive change. One important elements of facilitating positive change is goal attainment (Whitmore, 1992). This is facilitated through the identification of strategies that incorporate self-reflection and the development of coping skills. The key of the goal-oriented process is also emphasised by Spence and Grant (2007), who posit that the exploration and identification of goals increase positive change, which encourages goal attainment.

The enhancing nature of coaching is resonant in the role of mental toughness, where both have a positive impact on wellbeing (van Nieuwerburgh & Green, 2014). Crust and Clough (2011) suggest that central to the enhancement of mental toughness is “the development of independent problem-solving and personal responsibility through a challenging yet supportive learning environment” (p.21). This emphasises the importance of independent decision-making in encouraging individuals to take personal responsibility for their decisions, which in turn promotes self-belief and increases internal motivation. In order to achieve this, individuals must face challenges regularly and learn how to cope with difficulty (Crust & Clough, 2011). Another parallel between coaching and mental toughness is the importance of self-directed learning. This empowers individuals to develop and make meaningful change (Bresser & Wilson, 2010), and to maximise their potential (Biswas-Diener & Dean, 2007; Whitmore, 1992). This connection is further advanced by van Nieuwerburgh (2012b) through his synthesis of coaching aims and Clough et al.’s (2002) four elements of mental toughness (see Table 1). According to van Nieuwerburgh, coaching supports individuals to: feel in control, manage emotions, cope with adversity, identify ways to make positive change, and gain self-confidence. This parallels the characteristics of mental toughness, which are: commitment, challenge, control and confidence. Given these shared characteristics and objectives, the potential role of coaching in the development of mental toughness is promising.

The potential impact of coaching on the development of mental toughness is further suggested by the discipline of positive psychology, which is now seen as the foundation of coaching (Seligman, 2007; Freire, 2013; van Nieuwerburgh & Green, 2014). Positive psychology is defined as the empirically-based study of “the conditions and processes that contribute to the flourishing or optimal human functioning”, with recognition of the existence of adversity (Gable & Haidt, 2005). Particularly, it looks at strengths, virtues, positive emotions, traits and values to promote wellbeing and enhance performance (Seligman & Csikszentmihalyi, 2000). While the discipline fully recognises the presence of adversity, it primarily focuses on enhancing wellbeing and enabling individuals to thrive even in challenging situations. In essence, this is mental toughness, which is seen as a crucial component of a flourishing life and is the focus positive psychology (van Nieuwerburgh & Green, 2014). Thus, in theory, coaching based on the discipline of positive psychology becomes a practical tool for the development of mental toughness.

Components of MT	Sub-components of MT	Description
Control	Emotional	The ability to manage your mood and emotions, and regulate which emotions are reveal to others.
	Life	The ability to believe that you are in control of your life and remain influential rather than controlled (self-efficacy).
Confidence	Ability	The ability to believe in yourself and your abilities regardless of obstacles (self-belief).
	Interpersonal	The ability to be assertive and not intimidated when interacting with others (self-esteem).
Challenge		The ability to identify potential threats and see them as opportunity for self-development.
Commitment		The ability to remain focused and achieve goals in the face of adversity ('stick-ability').

Source: Adapted from Clough et al. (2002)

Table 1 – The 4C's Model of Mental Toughness

The integration of coaching and positive psychology, “Positive Psychology Coaching” (PPC; Biswas-Diener & Dean, 2007; Biswas-Diener, 2010), is still new and lacks empirical evidence. However, research using the cognitive-behavioural, solution-focused approach (CB-SFC; Grant, 2003) that incorporates positive psychology constructs, has been shown to influence elements of mental toughness (van Nieuwerburgh & Green, 2014). For instance, a significant increase in goal commitment and subjective wellbeing was found observed in a 10-week coaching programme that used CB-SFC and the GROW model as a coaching framework (Spence & Grant, 2007). Furthermore, a positive influence on three elements of mental toughness — commitment, control and challenge — resulted from a 28-week, 10-session coaching programme that used CB-SFC with a similar framework to the GROW model (Green, Grant & Rynsaardt, 2007). Beyond the existing theoretical connections, empirical research into the impact of coaching on mental toughness is encouraging, but it is still in its formative phase (van Nieuwerburgh, 2012b). To progress this body of knowledge, the use of measures such as the MTQ48, which is now seen as a reliable and valid measure of mental toughness, is necessary.

Physical exercise and mental toughness

Since much of the existing research on mental toughness has been predominantly investigated among athletes, research findings naturally confirm the association between physical strengthening and mental toughening. For instance, individuals who scored high on all mental toughness subcomponents exerted themselves less during a demanding cycling task (Clough et al., 2002) suggesting greater physical endurance is associated with enhanced mental toughness. Another research showed that injured athletes with greater mental toughness had higher attendance rates to their rehabilitation regimes, which often require significant pain management capacity (Levy et al., 2006). This demonstrates a link between greater mental toughness and an increased level of pain tolerance. A similar connection between pain tolerance and mental toughness was demonstrated in Crust and Clough's (2005) study, where athletes with greater mental toughness were able to endure the stress of physical exertion longer than those with lower mental

toughness. These findings may suggest that engaging in exercise that requires a high level of physical endurance and pain tolerance may contribute to the development of mental toughness.

In support of this, a recent study made a clear connection between vigorous physical exercise and higher mental toughness (Gerber, Kalak, Lemona, Clough, Pühse, Elliot, Holsboer-Trachsler & Brand, 2012). When comparing mental toughness with varying levels of self-reported physical activity, individuals who regularly engaged in vigorous physical exercise demonstrated a higher level of overall mental toughness compared to those who undertook low to moderate intensity exercise. This was the first study investigating the relationship between mental toughness and exercise intensity among the non-athletic, general population. However, these findings are based on correlational research and causality has yet to be determined (Clough & Strycharczyk, 2012). In addition, the participants in these studies are individuals and athletes that already have high levels of mental toughness. Thus, there is a need for further exploration into whether physical toughening leads to mental toughening among the general population.

Given this background, the present study sought to examine whether integrating PPC with vigorous physical exercise, such as kickboxing, would enhance the development of mental toughness in comparison to kickboxing alone. The main interest of the present study is to investigate the optimal environment for the development of mental toughness in the non-athletic population using the MTQ48. However, as there is no academic research examining the development of mental toughness using either PPC or vigorous physical exercise the present study will answer the three following questions:

- (1) Does learning kickboxing have an effect on levels of mental toughness?
- (2) Does receiving coaching while learning kickboxing have an effect of levels of mental toughness?
- (3) Does the combination of coaching and learning kickboxing have an enhanced effect on mental toughness when compared with learning kickboxing alone?

Methodology

Participants

Recruitment of the participants was undertaken at a kickboxing gym in London which offered a four-week course. Participants were those who voluntarily signed up for the kickboxing course but had not yet started. As each course started with an average of 18 students every one to two weeks, participants were recruited from three separate groups over a period of four weeks. Those who met the age criteria, between 18 and 64, were screened for health conditions by using questionnaires (i.e. physically and psychologically healthy with no clinical disorder or illness, and no current medical or drug treatment that may affect physical exercise). There was no restriction on ethnicity or profession. Thirty individuals agreed to participate in the study, however the data of two participants were disqualified as their response to the MTQ48 were missing (see figure 1 for a flow diagram). The final sample used for analysis consisted of 28 participants (7 men, 21 women), ranging in age from 18 to 47 years old ($M = 32.37$ yrs, $SD = 6.94$).

Procedure

The gym management provided prospective participants with an invitation letter that explained the purpose of the study and the voluntary nature of their participation. After agreeing to participate in the study, participant's email addresses were provided to the researcher by the gym management. The researcher contacted the participants by email, assuring their confidentiality and inviting them to ask questions or voice any concerns they had about the study. Consent was obtained via email before they provided their demographic information such as age and gender. In order to examine whether integrating coaching with kickboxing enhances mental toughness compared to kickboxing alone, participants were assigned to Group A (kickboxing & coaching) or Group B (kickboxing). Group A received a one-hour

individual face-to-face coaching session, administered between weeks two and three, while group B did not. Using stratified randomisation, age and gender were equally distributed between the groups. Two different sets of research instructions were sent by email according to the participant's assigned group. During the intervention, both groups participated in a one-hour kickboxing class per week for four consecutive weeks. Both groups completed the MTQ48 online during the week prior to and after the course commenced, which allowed this study to measure the effect of the intervention by comparing pre- and post-responses to the MTQ48. A link to the MTQ48 was sent by invitation email.

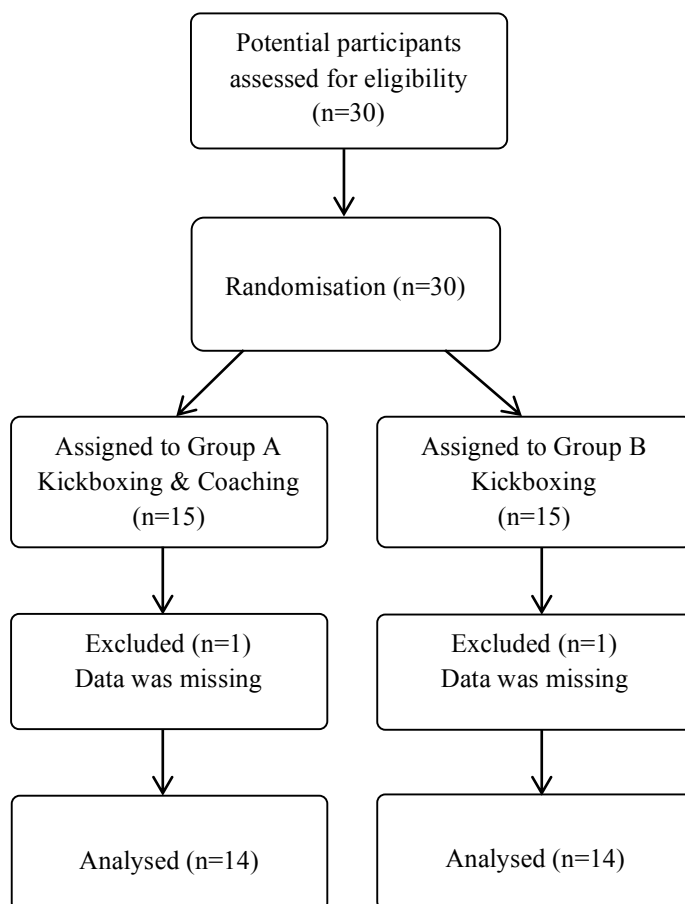


Figure 1 – CONSORT flow diagram

Instruments

Mental toughness questionnaire

The 48-item Mental Toughness Questionnaire (MTQ48; Clough et al., 2002) was used to measure mental toughness, including overall mental toughness and its six subcomponents: challenge, commitment, control-emotion, control-life, confidence-ability, and confidence-interpersonal. Completion of the 48-item questionnaire took on average 10 to 15 minutes, with responses measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Crust & Clough, 2005). The MTQ48 has been widely used, and its adequate psychometric properties have been evidenced using both exploratory and confirmatory factor analysis (Horsburgh et al., 2009).

Coaching framework

To structure the conversation process the GROW model (Whitmore, 1992) was used. This is a behavioural-based coaching model where behavioural changes are encouraged to enable goal attainment (Palmer & Whybrow, 2011). This model has four stages: Goal, Reality, Options and Will. The first two stages, Goal and Reality, are designed to raise the self-awareness of the coachee through the identification of goals followed by the exploration of their current situation. Here, it is important for the coachee to identify the discrepancy between their goal and reality. The last two stages are aimed at helping the coachee develop a sense of personal responsibility by generating options that will lead to goal attainment and creating a plan for future action. The coaching approach used in this research is PPC (Biswas-Diener, 2010). PPC, similar to other coaching approaches, recognises that coachees are resourceful and functional and uses evidence-based techniques including listening, rephrasing and asking questions. However, PPC differs from other coaching approaches as it focuses on identifying and developing strengths, underpinned by scientifically derived knowledge of positive psychology (Biswas-Diener, 2010). Emphasising the positive aspect of an individual's reality is recognised as a significant resource for facilitating desired changes. The coaching framework and examples of the questions are presented in table 2.

The coach was an MSc Coaching Psychology student at a university in London and had more than 48 hours of coaching experience, and was also the researcher. The coaching session involved participants identifying their goals related to mental toughness after reviewing their result of the MTQ48. Participants were asked to bring their result to the session. Each session began with reviewing their result, followed by setting goals and exploring current realities, before identifying options for action. The session concluded by developing a detailed action plan.

Relationship building		
Contracting		
Review the result of the participant's MTQ48		<ul style="list-style-type: none"> • What are your thoughts about your results?
Goal	Identify coachee's overall goals and desired outcome from the session.	<ul style="list-style-type: none"> • Which of the 4Cs would you like to focus on? • What would be the most helpful area to discuss? • What are your aspirations related to mental toughness?
Reality	Raise self-awareness, and explore coachee's current situation and its relationship to the identified goals.	<ul style="list-style-type: none"> • How is your perception of the goal impacting on your ability to function at your best? • What worked? • How do you think you can use your mental toughness to achieve your goal?
Options	Enhance coachee's personal responsibility through self-identification and -assessment of available options to achieve the goals.	<ul style="list-style-type: none"> • What are your options? • If you could do anything what would it be? • Which option is more likely to be successful?
Way forward	Assist coachee's commitment to the selection option through identification of a detailed action plan.	<ul style="list-style-type: none"> • What specific actions will you take? • What will be different when you complete the option?

Source: Adapted from Whitmore, 1992; Biswas-Diener, 2010; van Nieuwerburgh, 2012

Table 2 – Positive psychology coaching framework with GROW model

Kickboxing

Kickboxing was chosen as the vigorous physical exercise for the study because it is highly demanding and involves intense cardiovascular and strength training. The duration of each class was one hour. During class, participants engaged in a range of technical and fitness-oriented activities. The classes comprised of a 10-minute warm-up where participants undertook cardiovascular activities and stretching. The remaining 50 minutes is a combination of technical instruction and strength training, which amounts to approximately 30 minutes and 20 minutes respectively. For the technical instruction component, participants throw punches, kicks and knees individually or in combinations. For the strength training component, participants do a series of high-intensity exercises that target specific muscle groups such as the arms, back, abdominals and legs. There were three different instructors who rotated teaching.

Data analysis

The data were subjected to a 2 x 2 mixed analysis of variance on overall mental toughness and its six subscales, with types of group (coaching & kickboxing, and kickboxing) as the between-subject variable and time of measurement (pre and post) as the within-subjects variable. Data was screened to ensure all dependent variables were appropriate for the use of parametric statistics. Cronbach alpha scores showed the internal consistency of the validated questionnaire.

Results

Table 3 provides the descriptive statistics for pre- and post-responses to the MTQ48 and the results of t-test for baseline characteristics (age and pre-responses). Stratified randomisation was effective as baseline characteristics were equivalent, allowing for the use of the parametric method of data analysis.

	Kickboxing & coaching (n=14)				Kickboxing (n=14)				Pre t-test
	Pre		Post		Pre		Post		
	M	S D	M	S D	M	S D	M	S D	
Age	32.00	7.34	-	-	32.86	7.23	-	-	t = -0.312, p = .758
Overall mental toughness	3.42	.45	3.71	.03	3.45	.61	3.49	.54	t = -0.154, p = .879
Challenge	3.57	.49	3.78	.04	3.75	.57	3.81	.54	t = -0.882, p = .386
Commitment	3.49	.53	3.86	.45	3.56	.81	3.63	.76	t = -0.251, p = .804
Control – emotion	2.92	.56	3.10	.39	3.02	.44	3.00	.38	t = -0.695, p = .493
Control – life	3.53	.68	3.85	.45	3.51	.72	3.59	.64	t = 0.077, p = .940
Confidence – ability	3.35	.46	3.67	.38	3.16	.88	3.16	.68	t = 0.716, p = .480
Confidence – interpersonal	3.65	.78	3.96	.64	3.70	.73	3.77	.64	t = -0.168, p = .868

Table 3 – Descriptive statistics for the responses to the MTQ48 and baseline characteristics

Table 4 shows the interaction effect of time and group. Repeated measures analysis of variance revealed a significant time by group interaction effect for overall mental toughness, control-emotion, and confidence-ability, indicating statistically significant improvements of those scales in the group with coaching, while there was no such change in the kickboxing-only group. There was no change in the remaining scales of challenge, commitment, control-life and confidence-interpersonal in both groups. Further, contrast analysis of paired sample t-test for the group with kickboxing alone was undertaken. The results showed no improvement in any of the scales. When this analysis was repeated for the group with coaching, levels of overall mental toughness, $t(13) = -4.31$, $p = .001$, commitment, $t(13) = -4.12$, $p = .001$, and control-life, $t(13) = -2.72$, $p = .017$, and confidence-ability, $t(13) = -3.79$, $p = .002$, were found to be improved.

	Interaction	Effect size η_p^2	Power
Overall mental toughness	F = 6.699, p = .016	.205	.703
Challenge	F = .971, p = .333	.036	.158
Commitment	F = 3.947, p = .058	.132	.481
Control – emotion	F = 4.233, p = .050	.140	.509
Control – life	F = 3.153, p = .087	.108	.401
Confidence – ability	F = 4.231, p = .050	.140	.508
Confidence – interpersonal	F = 1.932, p = .176	.069	.268

Table 4 – The result of the interaction effect of time and group after the four week

The interaction effect, demonstrated by the data in Table 4, is graphically represented in Figure 2. Although the figures appear to show improvement across all components of mental toughness for the group who received coaching, only the improvements in overall mental toughness, control-emotional and confidence-ability were found to be statistically significant.

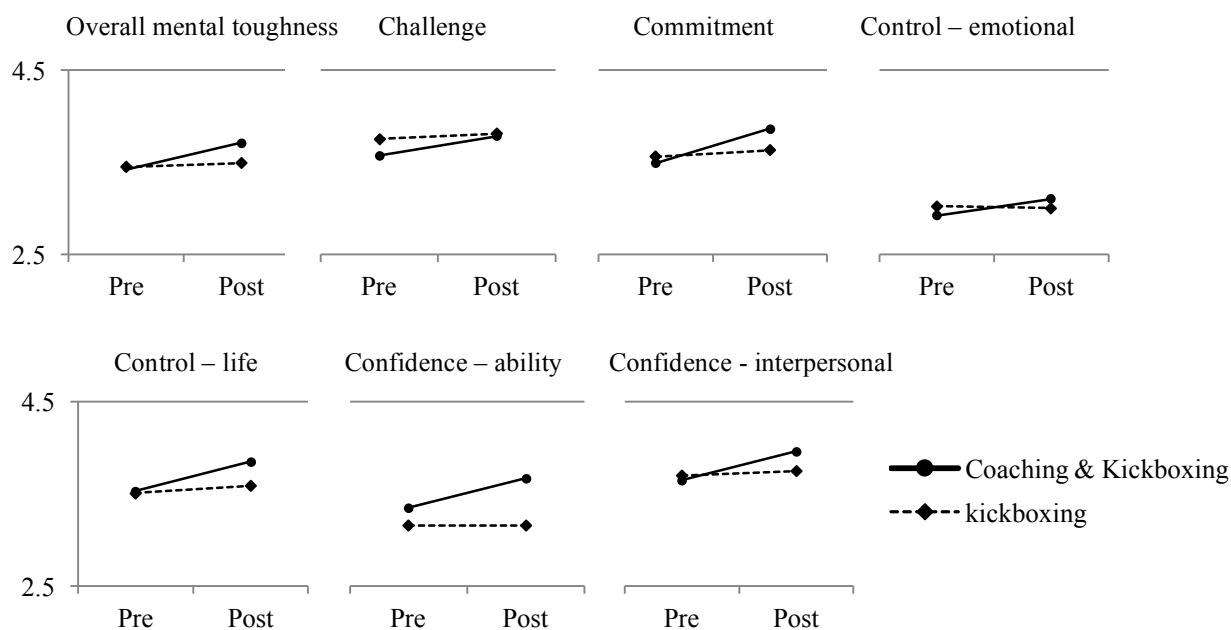


Figure 2 – The interaction effect of time and group

Discussion

This pilot study used a sample of 28 individuals, who voluntarily took a four-week kickboxing course and completed the MTQ48 a week prior to and after the course commenced. The main purpose of the present study was to investigate whether combining PPC and kickboxing would enhance the level of mental toughness compared to kickboxing alone. To date, there is no academic research investigating the impact of either PPC or kickboxing, and as such this pilot study set out to examine three questions:

- (1) *Does learning kickboxing have an effect on levels of mental toughness?* Previous findings in correlational studies showed physical strengthening as a predictor of enhanced mental toughness (Clough et al., 2002; Crust & Clough, 2005; Levy et al., 2006), with a more recent study demonstrating the potential role of vigorous physical exercises in developing mental toughness (Gerber et al., 2012). However, the results of the present study suggested that engaging in vigorous physical exercise such as kickboxing does not contribute to the development of mental toughness. One possible explanation for this may be that the correlational studies do not explain causality but simply allow researchers to identify characteristics associated with the variables (Field, 2009). Whilst the causal relationship between physical strengthening and mental toughening is still unknown, the results of the present study suggest that physical exercise does not lead to mental toughness, but mental toughness may promote individuals to undertake physical exercise. This explanation supports Clough and Strycharczyk's (2012) claim that physical exercise often involves endurance and commitment, and that mental strength is required to control emotions while the body is under stress. That is, individuals who decide to engage in physical exercise might already be mentally tough. The sample of the present study was comprised of individuals who voluntarily signed up to learn kickboxing, and because of this the impact of kickboxing might have had less of an effect on their mental toughness compared to those who are reluctant to engage in kickboxing.

(2) *Does receiving coaching while learning kickboxing have an effect on levels of mental toughness?* The results suggest that coaching provided to individuals who take a four-week kickboxing course may improve their levels of overall mental toughness, commitment, control-life and confidence-ability. The improvement of commitment and control-life is consistent with the previous research examining the impact of the cognitive-behavioural, solution-focused approach (CB-SFC, Grand, 2003), which uses a positive psychology construct (Spence & Grant, 2007; Green et al., 2007). Although learning kickboxing alone did not change the levels of mental toughness, improved mental toughness was observed among the participants who ~~took~~ received coaching. The positive outcome of this study may be due to the nature of PPC as it parallels the components of mental toughness (Seligman, 2007; Freire, 2013; van Nieuwerburgh & Green, 2014). Furthermore, the outcome of the study supports the theoretical explanation for the potential role of PPC to enhance mental toughness for people learning kickboxing.

(3) *Does the combination of PPC and learning kickboxing have an enhanced effect on mental toughness when compared with learning kickboxing alone?* The results showed that participants in the group with coaching made substantial progress in overall mental toughness, control-emotion and confidence-ability, while the participants in the group without coaching did not. Although not all scales improved, the key finding of the present study is that integrating PPC with kickboxing was more effective in developing mental toughness compared to kickboxing alone. Previous research demonstrated the positive impact of a challenging experience on mental toughness (Bull et al., 2005; van Yperen, 2009; Coulter et al., 2010). However, caution is needed as it has been suggested that some individuals may respond negatively to challenges (Clough & Strycharczyk, 2012). Using challenging treatment alone may risk lowering individuals' mental toughness. Crust and Clough (2011) claimed that, in addition to challenging experience, facilitating a supportive environment through cognitive intervention is important. Therefore, the success of the treatment may be due to the combination of both cognitive and physical approaches, where coaching might have allowed individuals to use this challenging experience to become mentally tough.

The findings of the present study are of importance to both researchers and practitioners. First, they advanced the understanding of the role of PPC in developing mental toughness. The efficacy of PPC in developing mental toughness was evidenced in the present study as no improvement was found with kickboxing alone but it was observed when kickboxing was combined with coaching. Second, as this was the first study examining, the effect of coaching and physical exercise on the development of mental toughness, it established a basis for future research on the relationship between mental and physical toughening, and coaching. Third, whilst there is still much debate regarding the influence of environment and genetics on mental toughness (Jones, Hanton & Connaughton, 2007), the results support the view that it is not genetically determined but can be developed through experience (Horsburgh et al., 2009). The findings of this pilot study may encourage a new direction for research and practice using both cognitive and physical training. This is relevant for practitioners in the field of fitness training and coaching as it provides a research-based tool for the development of holistic coaching interventions that will promote overall wellbeing.

Limitations and future research

These findings must be interpreted with appropriate caution. First, as this was a pilot study using a small sample of 28, there is a risk of making inaccurate assumptions about the general population (Lancaster, Dodd & Williamson, 2004). For instance, the findings might have been largely determined by individual differences of the sample, including personality traits and other experiences they had during this study. The length of this intervention was also relatively short. Previous studies examining the effect of coaching on mental toughness were conducted over a 10 to 28 week period (Spence & Grant, 2007; Green et al., 2007). Future research may therefore be advanced by employing a larger sample over a longer intervention.

Second, as participants voluntarily signed up for the four-week kickboxing course, this implies their there may have been pre-existing motivation to engage in vigorous physical exercise. Clough and

Strycharczyk (2012) claimed that because physical exercise often requires mental toughness, people who decide to engage in physical exercise may already be mentally tough compared to those who do not. Although the present study recruited non-athletic participants, the findings may only be applicable to those who are willing to engage in vigorous physical exercise. Further, considering the participant's readiness to learn kickboxing, they might already have engaged in other forms of intense physical exercises. In order to maximise the impact of physical exercise, future research should screen participants based on their level of physical activity.

Third, the direct contact between the author and the participants who received coaching—may have produced demand characteristics in their post-responses. Responses may have been biased because the researcher's expectations regarding the outcome of the study created an implicit demand for on the participants (Orne, 1962). Demand might also have been applied as the coach was also the researcher. In order to minimise this effect, future research could use coaches who are not informed about the research questions. Furthermore, as participants were self-selected members of the kickboxing gym who responded to the research advertisement: 'coaching to enhance the mental toughness in people learning kickboxing' they may have anticipated an increase in their level of mental toughness. Conversely, those who were assigned to the group without coaching might have been aware that their level of mental toughness was not expected to improve, causing an expectancy effect (Rosenthal, 1994). The integrity of the results could be improved if the group without coaching is not informed about the treatment, but are told they have been 'wait-listed'.

Fourth, because research into the efficacy of PPC is in its infancy (Biswas-Diener, 2010) further research could replicate the study without including physical exercise. Another promising area of future research would be investigating the impact of different types of vigorous physical exercise on the development of mental toughness. This may inform practitioners, as well as fitness and health professionals regarding the efficacy of integrating physical exercises with coaching, broaden the application of the intervention.

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