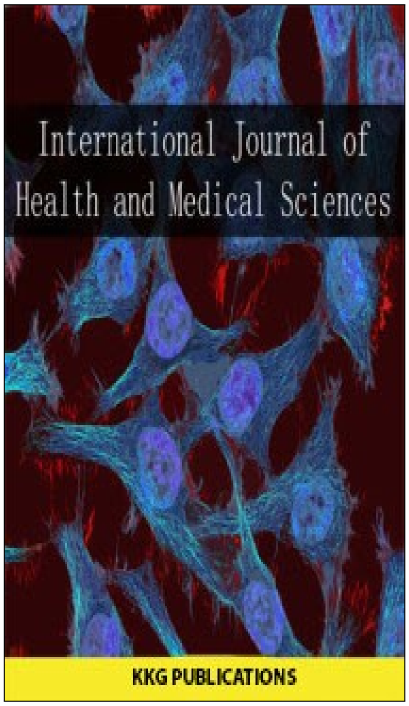

Key Knowledge Generation
Publication details, including instructions for author and subscription information:
http://kkgpublications.com/medical-sciences/

Does Technology Improve Athlete Engagement in Mental Techniques?

BILLYMO RIST [1], ALAN J PEARCE [2]

[1] St. Kilda Football Club, Melbourne, Australia

[2] Faculty of Health, Arts and Design, Swinburne University, Melbourne, Australia

Published online: 27 July 2016

To cite this article: B. Rist and A. J. Pearce, "Does technology improve athlete engagement in mental training techniques?," *International Journal of Health and Medical Sciences,* vol. 2, no. 2, pp. 41-47, 2016.
DOI: https://dx.doi.org/10.20469/ijhms.2.30004-2

To link to this article: http://kkgpublications.com/wp-content/uploads/2016/2/Volume2/IJHMS-30004-2.pdf

KKG PUBLICATIONS

International Journal of Health and Medical Sciences
2016, 2:2 41-47

IJHMS

DOES TECHNOLOGY IMPROVE ATHLETE ENGAGEMENT IN MENTAL TRAINING TECHNIQUES?

BILLYMO RIST [1]*, ALAN J PEARCE [2]

[1] St. Kilda Football Club, Melbourne, Australia
[2] Faculty of Health, Arts and Design, Swinburne University, Melbourne, Australia

Keywords:
Multimedia Recourses
Elite Athletes
Compliance
Mental Training
Smartphone Applications
Technology

Received: 02 June 2016
Accepted: 08 July 2016
Published: 27 July 2016

Abstract. Elite athletes are aware of the potential benefits of mental training techniques to deal with the stressors of training and competition. However, this particular cohort struggles with allocating meaningful time towards mental training programs within the overall training program. This study aimed to test the hypothesis that Smartphone applications will improve athlete engagement with mental training programs. Forty-six male adults (mean age 24 years) who play for one professional Australian Rules football team were recruited to participate in this study. Using a between groups repeated measures design, players were randomized into three groups, participating in one of three applications over four weeks: one group completed a mindfulness application (Headspace), the second group completed a brain training application (Cognifit), and the third was controlled and used a neutral application (Soothing Sounds). Players were assessed pre and post the four-week program on engagement, and measures including sleep (duration and quality), resilience, flow state, determination, and overall wellbeing were checked. Results showed no differences in groups or changes in the dependent variables. However, player engagement was markedly reduced in all groups with compliance falling, compared to initial participation levels, by 43%, 38%, and 42% for the mindfulness, brain training, and neutral applications, respectively. This study demonstrates that Smartphone applications do not improve compliance with mental training programs, or significantly improve outcomes, in this professional athlete environment. Practical applications would include prompting and encouraging athletes to engage in psychological, mental training, as technology alone is insufficient to increase uptake.

INTRODUCTION

Achieving peak performance in sport is a multidimensional construct whereby various factors must work as one in order to achieve success. In addition to physical factors, mental factors have also demonstrated to play a crucial role [1]. Elite athletes train and compete up to two to three times per day, and even as much as seven days per week [2]. Therefore, a high level of psychological resilience is required by elite athletes to reach the top of their respective field. The ability to consistently perform regardless of situation is not only required for performance during pressure moments within the match, but also to handle the daily repetitiveness of training through continually striving for improvement [3]. Psychological skills, also termed as mental skills, training has been recognized as a significant strategy to facilitate and develop an athlete's capacity to focus on performance, and to cope more efficiently with negative situations [4]. Mental skills training has been identified as an important strategy to facilitate and develop an athlete's capacity to focus on performance, and to cope more effectively with negative situations [4]. Mental skills training techniques are used to develop and improve a variety of naturally occurring psychological capacities, which include attention and emotional arousal [5]. Similarly, improving essential cognitive abilities associated with peak mental functioning such as executive functioning, processing speed, and working memory has also demonstrated a significant improvement in cognitive abilities [6] that can be applied to elite athletes.

Mindfulness training has been demonstrated as an effective tool for increasing an athlete's level of mental functioning [7]. Mindfulness has its roots in Buddhist philosophy, emphasizing paying attention in a particular way; purposefully, and nonjudgmentally being in the present moment [8]. Its effectiveness is thought to be because of the parallels between sensations experienced during peak performance, and mindfulness training. Both encompass a state of high concentration, an experience of a transformation of time and a certain loss of self-consciousness [8]. Further, the relaxation component of mindfulness training has been associated with enhancing an athlete's capacity to mentally recover post sporting performance. This focus on the present moment has been linked to

*Corresponding author: Billymo Rist
†Email: billymo.rist@saints.com.au

the psychology of peak performance in sport [8]. Evidence has shown that the strategy of present moment focus is linked with the likelihood of successful performance, by ensuring that unnecessary distractions which may be linked to past or future events do not inhibit momentary concentration [8]. [9] examined the effects of mindfulness training in a group of elite athletes over a six-week period. Demonstrating that athletes who participated in mindfulness training recorded higher levels of the flow state dimensions "sense of control" and "goal clarity" during performance compared to a control group.

However, despite the growth and effectiveness of these psychological interventions, athletes and coaches fail to utilize psychological skills training due to a fear of lost time and personal expense. [10], for example, found that the athletes they examined (n= 20) 100% reported that they would benefit from seeing a sport psychologist, yet only 10% had engaged with one. As stated by participants they failed to access a psychologist because of a fear of lost time for physical conditioning training. In addition, participants were also concerned of the expense when consulting a psychologist [10]. Therefore, a current issue in sport psychology is the availability and efficiency of delivery methods of these psychological interventions for elite athletes. Smartphones provide an extremely viable alternative to past methods of psychological skills training which are often defined as time consuming and expensive [11]. The growth and establishment of mobile devices over the past ten years have vastly affected the user's experience. Smartphones are small, fitting into people's pockets, and carried by the person at all times, and always functioning [11]. Vital features of smartphones are applications (commonly known as 'apps'), which are downloadable software products. However, even with the dramatic increase in availability and use of smartphones and apps, little is known about their efficacy for the delivery of psychological interventions for athlete performance improvement. The aim of this study was to test the hypothesis that smartphone apps will increase engagement in mental training programs by athletes. A second aim of the study hypothesized that athletes who engaged with specific mental training apps will improve in areas of attention, mental well-being and mental recovery, compared to athletes who used a neutral app.

MATERIALS AND METHOD

Participants: Forty-six male adults (M age = 24 years, SD = 4.05 years) who were all elite professional athletes from one professional sporting organization took part in the study. All were fluent in English and had no cognitive or intellectual impairment. Players were randomly assigned to one of three groups. Group 1 completed the mindfulness smartphone application (n=18; Headspace, Version 2.0.1, Headspace Meditation Limited, UK). Group two were assigned to the cognitive brain training smartphone application (n = 16; Cognifit, Version 2.0, Cognifit, USA). Group 3 were assigned to a control smartphone application (n = 12; Soothing Sounds, Version 1.2, Lost Ego Studios Limited, USA). More details regarding the smartphone apps are outlined in Section II.C.

Procedure: All study procedures were approved by the University Human Research Ethics committee, conforming to the Declaration of Helsinki. Following a presentation to players at one professional Australian Rules football club, participants were sent an email and invited to participate in the study. Players who consented to participation were randomly allocated a coded number for anonymity and assigned to one of three groups. Players were notified which smartphone app to download and instructed to utilize their designated smartphone application for 10 minutes per day for 28 days. No compensation for participation was offered in this study. Prior to, and at the end of each week, players were instructed to complete an online (password protected) survey. Along with measuring frequency of engagement via completion of survey each week, the online survey consisted of five individual psychological measures: resilience, flow, sleep, determination, and wellbeing.

Resilience was measured using the Connor Davidson Resilience Scale [12]. This scale possesses good internal consistency with a Cronbach's alpha of .85 [12]. All items pertain to the dimension of resilience, (dealing with stress, and mastery of emotions when faced with adversity). The measure consists of 10 items, (e.g. "able to adapt to change"). Participants were instructed, based on how they felt after the previous week of application use to rate the strength of the agreement to each statement on a 5-point Likert scale ranging from 1 (Not at all true) to 5 (True nearly all of the time). The individual scores from each question were averaged to give an overall score on resilience.

The ability to be "in the zone" (flow state) was measured using the Core Flow State Scale brief version [13]. Possessing good internal consistency with a Cronbach's alpha of .92 [13], the Core Flow State Scale contains target items from each of the nine flow factors, which make up the Long Form Flow Scale [13]. Flow state measure consisted of 10 items that included concentration and focus, a merging of action and awareness, and personal control (e.g., "I was switched on"). Participants were instructed, based on how they felt after the previous week of application use to rate the strength of the agreement to each statement on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The individual scores on each question were averaged to give an overall score on flow.

Sleep, which was measured using the Athens Insomnia Scale [14], consists of 8 items, 5 items pertain to the nocturnal sleep dimension (e.g., "Awakening during the night") and 3 items pertain to the daytime dysfunction dimension (e.g., "Sleepiness during the day"). Participants were instructed, based on how they felt after the previous week of application use to rate the strength of the agreement to each statement on 4-point Likert scale ranging from 0 (No problem) to 3 (Serious problem/did not sleep at all). The individual scores on each question were averaged to give an overall score on sleep. The Athens Insomnia Scale has good Internal consistency with a Cronbach's alpha of .89 [14].

Determination to achieve goals was measured using the Short Grit Scale [15]. With good internal consistency with a Cronbach's alpha of .83 [15], the measure consists of 8 items, 4 items pertain to the perseverance of effort dimension (doing something despite difficulty or delay in achieving success; e.g., "I finish whatever I begin") and 4 items pertain to the consistency of interest dimension (wanting to know or learn and achieve the desired outcome; e.g., "I often set a goal but later choose to pursue a different one"). Participants were instructed, based on how they felt after the previous week of application use to rate the strength of the agreement to each statement on a 5-point Likert scale ranging from 1 (Very much like me) to 5 (Not Like me at all). The individual scores on each question were averaged to give an overall score on determination to achieve goals.

Wellbeing was measured using the Outcome Rating Scale (ORS) [16]. The ORS is a brief alternative to the Outcome Questionnaire 45 [17], which covers a broad range of symptoms and functioning domains, including subjective discomfort, interpersonal relationships, and social role performance. The ORS measures consist of 4 items (overall, individually, interpersonally, socially).

Participants were instructed, based on how they felt after the previous week of application use to rate the strength of their agreement to each statement using a visual analogue scale of 0 (Low) to 100 (High). The individual scores on each question were averaged to give an overall score on wellbeing. The ORS has good internal consistency with a Cronbach's alpha of .90 [16].

Smartphone Apps: The mindfulness smartphone application (Headspace) consists of 10 different guided mindfulness sessions that run for approximately 10 minutes. Participants are verbally guided through the process of achieving a mindfulness state, emphasizing a focus on deep breathing, relaxation of the body, and acceptance of all thoughts. The cognitive brain training smartphone application (Cognifit) has a number of different games and puzzles, which target individual cognitive abilities such as working memory, attention and decision-making. Each challenge runs consecutively and lasts in duration of 10 minutes. The control smartphone application (Soothing Sounds) once activated randomly plays different sounds of nature. It has no other features. Participants in this group were instructed to listen to Soothing Sounds for a 10-minute period.

Statistical analysis: All data were screened for normal distribution using ShapiroWilk tests, and were normally distributed. All data were analyzed using mixed model Analysis of Variance (ANOVA) with repeated measures. Where ANOVA detected differences, post-hoc comparisons were undertaken with Bonferroni adjustment. Data were analyzed using SPSS V23 (SPSS Inc., USA). Descriptive data are presented as mean (±SD). Alpha was set at $p<0.05$ and effect sizes presented as partial eta squared (η^2).

RESULTS

Engagement with Mental Training Apps: As shown in Figure 1, the rate of engagement reduced in all three groups. There was a 43% dropout in the Cognifit group; 38% dropout in the Headspace group, and a 42% dropout in the control group.

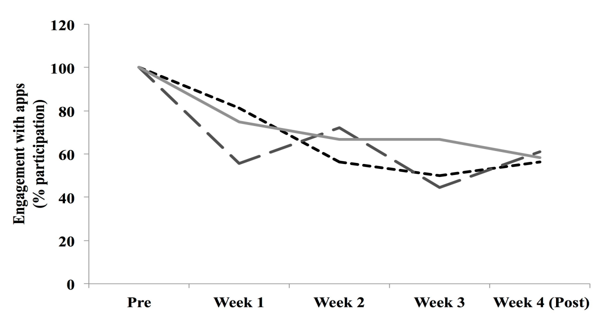

Fig. 1 . Engagement in apps over duration of study

Further, compliance with mental training evaluations (Table 1) showed no differences between the three groups (F (2, 43) = 0.308, *p*= 0.737).

TABLE 1
MEAN (±SD) NUMBER OF EVALUATIONS COMPLETED (MAX 4)

	Cognifit	Headspace	Control
Completed evaluations	2.4 (±1.4)	2.7 (±1.0)	2.6 (±1.2)

Individual Psychological Measures: Resilience (Table 2) showed no significant interaction between the different smartphone applications, and time (F (6, 38) = 0.787, *p*= 0.823). There was no significant main effect for time (F (3, 19) = 0.302, p= 0.586, η^2= 0.046) or group (F (2, 21) = 0.723, *p*= 0.23, η^2 = 0.30).

TABLE 2
MEAN (±SD) FOR RESILIENCE MEASURES (MAX 5)

	Cognifit	Headspace	Control
End of week 1	4.1 (±0.4)	3.6 (±0.4)	3.9 (±0.5)
End of week 2	3.9 (±0.4)	3.8 (±0.3)	4.0 (±0.4)
End of week 3	3.9 (±0.4)	3.6 (±0.4)	4.0 (±0.4)
End of week 4	3.8 (±0.3)	3.7 (±0.3)	3.9 (±0.5)

There was no significant interaction for flow (Table 3) between the different smartphone applications, and time (F (6, 38) = .793, *p*= .334). There was no significant main effect for time (F (3, 19) = 1.207, *p* =.581, η^2 = .160) or group (F (2, 21) = 0.648, *p*= .118, η^2 = 0.184).

TABLE 3
MEAN (±SD) FOR FLOW MEASURES (MAX 5)

	Cognifit	Headspace	Control
End of week 1	3.8 (±0.5)	3.8 (±0.5)	3.5 (±0.4)
End of week 2	3.6 (±0.4)	3.7 (±0.6)	3.1 (±0.5)
End of week	3.8 (±0.4)	3.5 (±0.5)	3.6 (±0.4)
End of week 4	3.7 (±0.6)	3.6 (±0.5)	3.6 (±0.6)

Overall sleep data incorporating both quality and duration, where lower numbers mean better sleep are illustrated in Table 4. Results showed no significant interaction between the different smartphone applications and time (F (6, 38) = 1.721, *p*= 0.049). There was no significant main effect for time (F (3, 19) = 3.148, *p* = 0.143, partial eta squared = 0.332) or group (F (2, 21) = 0.286, *p*= 0.239, η^2 = 0.127).

TABLE 4
MEAN (±SD) FOR SLEEP MEASURES (MAX 3)

	Cognifit	Headspace	Control
End of week 1	0.6 (±0.4)	0.6 (±0.5)	0.7 (±0.4)
End of week 2	0.7 (±0.4)	0.4 (±0.2)	0.6 (±0.4)
End of week 3	0.6 (±0.4)	0.7 (±0.5)	1.1 (±0.4)
End of week 4	0.6 (±0.6)	0.5 (±0.7)	0.7 (±0.6)

Determination (Table 5) showed no significant interaction between the different smartphone applications and time (F (6, 38) = 0.601, p = 0.668.). There was no significant main effect for time (F (3, 19) = 0.528, p = .728, η^2 = 0.077) or group (F (2, 21) = 0.272 p = .250, η^2 = 0.124).

TABLE 5
MEAN (±SD) FOR DETERMINATION MEASURES (MAX 5)

	Cognifit	Headspace	Control
End of week 1	3.8 (±0.5)	3.7 (±0.3)	3.7 (±0.4)
End of week 2	3.6 (±0.6)	3.7 (±0.3)	3.5 (±0.4)
End of week 3	3.5 (±0.4)	3.9 (±0.5)	3.5 (±0.5)
End of week 4	3.8 (±0.4)	3.8 (±0.4)	3.7 (±0.6)

Wellbeing (Table 6) showed no significant interaction between the different smartphone applications and time (F (6, 38) = 1.294, p = 0.671). There was no significant main effect for time (F (3, 19) = 0.525, p= 0.283, η^2 = 0.077), or group (F (2, 21) = 0.245, p = 0.243, η^2 = 0.126).

TABLE 6
MEAN (±SD) FOR WELLBEING MEASURES (MAX 100)

	Cognifit	Headspace	Control
End of week 1	79.8 (±11.7)	76.9 (±6.5)	82.7 (±9.6)
End of week 2	72.6 (±9.4)	79.7 (±7.5)	85.6 (±8.2)
End of week 3	79.6 (±6.1)	73.3 (±11.1)	78.8 (±11.8)
End of week 4	74.8 (±13)	75.2 (±13.9)	78.7 (±10.9)

DISCUSSION

The present study examined whether the use of an alternate medium of delivery (smartphone apps) would improve engagement in mental skills training in an elite athlete population. The second objective was to examine the effectiveness of mindfulness and cognitive brain training apps on various individual psychological measures that influence training and competitive performance.

Both mindfulness and cognitive brain training have previously been demonstrated to be effective interventions in enhancing mental functioning [5, 6]. Combined with efficient and easy to access smartphone technology, it was hypothesized that athletes would engage with these apps (compared to control) and as a result, show effects across a range of psychological attributes. However, results showed that there was no difference in engagement between any of the smartphone apps as well as completion of the online surveys across the duration of the study. Furthermore, there was no significant difference between the mindfulness or cognitive brain training groups compared to each other and to a control application on any of the measures (resilience, flow, sleep, determination to achieve goals or wellbeing) over the four time points. Thus, neither of the hypotheses was supported.

To date, no previous research has examined psychological skills training for athletes using non-conventional methods of delivery, such as smartphone apps. Given that athletes and coaching staff regularly complain that psychological skills and mental training are difficult to fit in due to time and costs [10], the use of trialing smartphone applications would abate these barriers. Smartphone technology is growing at a rapid rate and is efficient and available [11]. The results of the current study are contrary to that of previous research that has investigated the effect of mental skills training [5]. It should be noted, however, that the present study differed from [5]. The present study was only able to undertake a four-week mental skills program, rather 16 weeks [5]. However, the rapid decrease in engagement suggests that a longer intervention may not have yielded any further differences between this previous [5] and present study.

[6] using an intervention of four-weeks duration, demonstrated a significant improvement in cognitive functions such as working memory, and processing speed amongst young non-athlete adults from the general population over a four-week period. This study was not able to replicate these findings. It may be that the population utilized (non-athlete versus professional athletes) may have contributed to the disparate findings. It should be also noted that these authors [6] ensured compliance

by measuring participants before and after every intervention. Our study did not undertake daily measures, as the primary aim of the study was to investigate if professional athletes would be responsible for their own mental training, and that smartphone apps would engage athletes to regularly undertake the training.

CONCLUSION

In conclusion, this study demonstrated that smartphone apps did not retain engagement in a professional athlete population. The loss in retention by the athletes demonstrated in what circumstances athletes will best interact and utilize psychological skills training to improve wellbeing and performance. Elite athletes require significant structure [2, 3], to complete their required daily tasks that incorporate being a professional athlete. It may be that smartphone apps do indeed have an effect, however, coaching staff will need to schedule specific time into their training programs to ensure mental skills training for habit forming in their athletes, just like athletes make it a habit to complete physical training programs for strength, stamina, flexibility, and recovery [18].

Further studies examining smartphone application technology, and in particular how best to maintain engagement, will assist sports psychologists and coaches into how elite athletes' mindsets can be further improved to achieve the mental advantage, which is required to achieve ultimate success in the elite sporting environment.

Acknowledgements

No funding was provided for this study. The authors would like to acknowledge St. Kilda Australian Football League (AFL) club for their participation in the study. AJP is funded, in part, by a research grant from the AFL.

REFERENCES

[1] L. Behncke, "Mental skills training for sports: A brief review," *Online Journal of Sport Psychology,* vol. 6, no. 1, pp. 1-19, 2004.

[2] R. Budgett, "Fatigue and underperformance in athletes: The overtraining syndrome," *British Journal of Sports Medicine,* vol. 32, no. 2, pp. 107-110, 1998.

[3] R. E. Vetter and M. L. Symonds, "Correlations between injury, training intensity, and physical and mental exhaustion among college athletes," *The Journal of Strength & Conditioning Research,* vol. 24, no. 3, pp. 587-596, 2010.

[4] F. L. Gardner and Z. E. Moore, "A mindfulness-acceptance-commitment-based approach to athletic performance enhancement: Theoretical considerations," *Behavior Therapy,* vol. 35, no. 4, pp. 707-723, 2004.

[5] D. J. Edwards and S. D. Edwards, "The evaluation of a psychological skills training programme for rugby players," *African Journal for Physical Health Education Recreation and Dance,* vol. 18, no. 3, pp. 525-534, 2012.

[6] R. Nouchi, Y. Taki, H. Takeuchi, H. Hashizume, T. Nozawa, T. Kambara ,... and R. Kawashima, "Brain training game boosts executive functions, working memory and processing speed in the young adults: A randomized controlled trial," *PloS One,* vol. 8, no. 2, e55518, 2013.

[7] J. Carmody and R. A. Baer, "Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program," *Journal of Behavioral Medicine,* vol. 31, no. 1, pp. 23-33, 2008.

[8] Y. H. Kee and C. J. Wang, "Relationships between mindfulness, flow dispositions and mental skills adoption: A cluster analytic approach," *Psychology of Sport and Exercise,* vol. 9, no. 4, pp. 393-411, 2008.

[9] C. Aherne, A. P. Moran and C. Lonsdale, "The effect of mindfulness training on athletes' flow: An initial investigation," *Sport Psychologist,* vol. 25, no. 2, pp. 177-180, 2011.

[10] T. Ferraro and S. Rush, "Why athletes resist sport psychology," *Athletic Insight,* vol. 2, no. 3, pp. 9-14, 2000.

[11] C. Kratzke and C. Cox, "Smartphone technology and apps: Rapidly changing health promotion," *Global Journal of Health Education and Promotion,* vol. 15, no. 1, 72-82, 2012.

[12] S. Vaishnavi, K. Connor and J. R. Davidson, "An abbreviated version of the Connor-Davidson Resilience Scale (CD-RISC), the CD-RISC2: Psychometric properties and applications in psychopharmacological trials," *Psychiatry Research,* vol. 152, no. 2, pp. 293-297, 2007.

[13] S. A. Jackson and R. C. Eklund, *The Flow Scales Manual,* Morgantown, WV: Fitness Information Technology, 2004.

[14] C. R. Soldatos, D. G. Dikeos and T. J. Paparrigopoulos, “Athens insomnia scale: Validation of an instrument based on ICD-10 criteria,” *Journal of Psychosomatic Research,* vol. 48, no. 6, pp. 555-560, 2000.

[15] A. L. Duckworth and P. D. Quinn, “Development and validation of the Short Grit Scale (GRITS),” *Journal of Personality Assessment,* vol. 91, no. 2, pp. 166-174, 2009.

[16] S. D. Miller, B. L. Duncan, J. Brown, J. A. Sparks and D. A. Claud, “The outcome rating scale: A preliminary study of the reliability, validity, and feasibility of a brief visual analog measure,” *Journal of Brief Therapy,* vol. 2, no. 2, pp. 91-100, 2003.

[17] R. M. Mueller, M. J. Lambert and G. M. Burlingame, “Construct validity of the outcome questionnaire: A confirmatory factor analysis,” *Journal of Personality Assessment,* vol. 70, no. 2, pp. 248-262, 1998.

[18] M. I. Lambert, W. Viljoen, A. Bosch, A. J. Pearce and M. Sayers, “General principles of training,” in *The Olympic Textbook of Medicine in Sport,* M. P. Schwellnus, ed. Oxford, UK: Wiley-Blackwell, 2008.

— This article does not have any appendix. —