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## ► To cite this version:

Maël Goisbault, Noémie Lienhart, Guillaume Martinent, Julie Doron. An integrated mindfulness and acceptance-based program for young elite female basketball players: Exploratory study of how it works and for whom it works best. *Psychology of Sport and Exercise*, 2022, 60, pp.102157. 10.1016/j.psychsport.2022.102157 . hal-03902444

**HAL Id: hal-03902444**

**<https://nantes-universite.hal.science/hal-03902444v1>**

Submitted on 16 Dec 2022

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# An integrated mindfulness and acceptance-based program for young elite female basketball players: Exploratory study of how it works and for whom it works best

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## ARTICLE INFO

### Keywords:

Mental training  
Elite athletes  
Multilevel growth curve analyses  
Moderation  
Social validation  
Mixed methods

## ABSTRACT

In order to better understand how an integrated mindfulness and acceptance-based intervention works and for whom it works best, study objectives were to examine (i) the trajectories of mindfulness skills and performance-related outcomes during the intervention, and athletes' perceptions of the impact of the intervention; and (ii) the potential moderating effects of personality characteristics on changes in targeted variables associated with the intervention. The sample consisted of 40 young elite female basketball players ( $M = 16.33$ ,  $SD = 0.75$  years) from three incoming groups at the French Federal Basketball Center over a 3-year period. All players participated in a 15-week Mindfulness Basketball Integrated program. They completed online questionnaires measuring personality traits 10 months before the intervention, as well as pre-, mid- and post-intervention measurements of mindfulness skills, intensity and directional interpretation of stress, and performance satisfaction. They also participated in semi-structured social validation interviews conducted one month after the intervention. The results of the multilevel growth curve (MGCA) and thematic analyses revealed how the mindfulness skills and performance-related outcomes evolved over the course of the intervention and how these changes were perceived by the athletes. Specifically, the MGCA showed significant linear increases in acceptance, positive stress direction, and performance satisfaction. The complementary social validation data indicated perceived improvements in mindfulness skills and performance. The MGCA also showed that baseline personality traits moderated the effects of the program on acceptance and experience of stress. These findings may be used to inform the design of more effective integrated mindfulness and acceptance-based interventions.

Over the past decade, there has been a proliferation of research interest in mindfulness and acceptance-based interventions (MABIs). Results have shown their beneficial and salutary effects on a wide range of health and well-being outcomes (e.g., anxiety, depression, stress, burnout, quality of life) in clinical (Goldberg et al., 2018) and non-clinical populations (Khoury, Sharma, Rush, & Fournier, 2015). More recently, this research interest has been extended to sport settings for the purposes of improving psychological skills and performance among athletes and coaches (Birrer & Röthlin, 2017; Birrer, Röthlin, & Morgan, 2012; Gardner & Moore, 2017; Röthlin & Birrer, 2020). The available evidence to date suggests MABIs have a positive effect on performance and performance-related outcomes, such as flow state and competitive anxiety (for reviews, see Bühlmayer, Birrer, Röthlin, Faude,

& Donath, 2017; Gardner & Moore, 2017; Noetel, Ciarrochi, Van Zanden, & Lonsdale, 2019; Sappington and Longshore, 2015). However, there has been little research conducted on how the central constructs of MABIs evolve during an intervention and the possible moderating influence of athletes' psychological characteristics. Therefore, a deeper understanding of how MABIs work and for whom they work best is needed in order to design more effective interventions in sport and performance settings (Bühlmayer et al., 2017; Gardner & Moore, 2017; Noetel et al., 2019).

Competitive sport environments involve many situations that place high physical and psychological demands on athletes in ways that are very different from the demands of daily life or clinical contexts (Birrer & Morgan, 2010; Swann, Moran, & Piggott, 2015). Athletes' inner

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experiences (e.g., dysfunctional thinking, unrealistic expectations, fear of failure, perceived stress and pressure) and distracting stimuli (e.g., external events, physical sensations, fatigue) during training and competition can become highly disruptive and undermine their performance (Birrer et al., 2012; Gardner & Moore, 2017). MABIs appear to be particularly relevant in helping athletes manage these disruptive factors effectively and maintain optimal functioning in highly demanding performance environments (Birrer & Röthlin, 2017; Birrer et al., 2012). More specifically, the beneficial effects of MABIs are thought to rely on the development of three central constructs: (a) *attention monitoring* – ongoing awareness of present-moment experiences, (b) *acceptance* – attitude of openness, non-judgment, and non-reactivity to experiences, and (c) *committed action* – consistent commitment to value- and goal-driven behaviors (Birrer et al., 2012; Birrer & Röthlin, 2017; Gardner & Moore, 2017; Henriksen, 2019; Lindsay & Creswell, 2017, 2019; Röthlin, Horvath, Trösch, Grosse Holtforth, & Birrer, 2020).

While sport psychology literature provides accumulated research evidence for the beneficial effects of MABIs in sport contexts (for reviews, see Bühlmayer et al., 2017; Gardner & Moore, 2017; Noetel et al., 2019; Sappington & Longshore, 2015), most of the MABIs used in these contexts originate from non-sport-specific programs that were first designed and conducted for health and well-being purposes (e.g., Acceptance Commitment Therapy, Hayes, Strosahl, & Wilson, 1999; Mindfulness-Based Stress Reduction, Kabat-Zinn, 1990; Mindfulness-Based Cognitive Therapy, Segal, Teasdale, Williams, & Gemar, 2002). Accordingly, the development and application of MABIs meeting the specificities of the population and the demands of elite sport have yet to be considered in a way that directly serves the purpose of enhancing athletic performance (Birrer et al., 2012; Bühlmayer et al., 2017; Gardner & Moore, 2017; Röthlin, Horvath, Birrer, & Grosse Holtforth, 2016; Sappington & Longshore, 2015). Indeed, recent interventional studies have recommended that MABIs should be directly adapted to and integrated into regular training and performance environments (e.g., Doron, Rouault, Jubeau, & Bernier, 2020; Scott-Hamilton, Schutte, & Brown, 2016) for this purpose.

In these interventions, integration is viewed as an excellent way to enhance both content assimilation and athlete commitment (Doron et al., 2020; Scott-Hamilton et al., 2016). For instance, Scott-Hamilton et al. (2016) developed a mindful-spinning exercise during indoor stationary cycling sessions in order to implement mindfulness training with cyclists. More recently, Doron et al. (2020) designed a MABI by adapting the Mindfulness-Acceptance-Commitment program (MAC; Gardner & Moore, 2007) and integrated it into the badminton training of young elite players. Both integrated programs provided positive changes such as increasing flow experience (Scott-Hamilton et al., 2016) or improving awareness skills and decreasing task-irrelevant thoughts (Doron et al., 2020). However, despite these promising insights, more research is needed to further understand how MABIs' central constructs evolve during such interventions. Some, such as acceptance, appear to develop in different ways during interventions and seem to take longer to assimilate and apply than others, explaining potential counterproductive effects, such as an increase in performance worries or no effect on athletic performance (Doron et al., 2020). Thus, investigating how MABIs' central constructs evolve over the course of an intervention is essential for better understanding of how MABIs work.

In addition, identifying the potential moderators that might influence the effects of MABIs appears to be of crucial importance from both theoretical and applied perspectives (Kazdin, 2007; Röthlin, Birrer, Horvath, & Grosse Holtforth, 2016; Sappington & Longshore, 2015; Shapiro, Brown, Thoresen, & Plante, 2011). There are many possible factors that could moderate the effects of MABIs. Sappington and Longshore (2015) pointed out that the influence of an athlete's personality could potentially present a valuable opportunity for research on the effect of MABIs in sport performance settings (Sappington & Longshore, 2015). Given the clear evidence of the relationship between Big Five personality traits and mindfulness skills (for a meta-analysis, see

Giluk, 2009), the moderating role of personality traits on the effects of MABIs in sport performance contexts needs to be further investigated. Researchers have begun to examine the potential moderating effect of personality traits in MABIs within clinical and student populations in other contexts (de Vibe et al., 2015; Krick & Felfe, 2020; Nyklíček & Irmischer, 2017). Their results have shown that mindfulness training has a greater effect on mental distress and subjective well-being in students obtaining higher scores for neuroticism and conscientiousness (de Vibe et al., 2015). However, to the best of our knowledge, these findings have not yet been investigated for MABIs within performer populations. The identification of such potential moderators could help differentiate those athletes for whom a MABI might be most beneficial. This question remains largely unaddressed in sport psychology.

Based on a mixed methods approach (Creswell & Plano Clark, 2017), the first objective of the current study was to examine the trajectories of mindfulness skills (i.e., awareness, acceptance, non-reactivity, non-judgment) and performance-related outcomes (i.e., intensity and directional interpretation of stress, performance satisfaction) over the course of an integrated MABI (i.e., the Mindfulness Basketball Integrated program), and basketball players' perceptions of the impact of the program. The second objective was to explore the potential moderating effects of the Big Five personality traits (i.e., neuroticism, extraversion, conscientiousness, agreeableness, openness to experience) on changes in targeted variables associated with the program.

## 1. Method

### 1.1. Phase 1: Development of the Mindfulness Basketball Integrated (MBBI) program

The MBBI program was developed as an adaptation of the Mindfulness Badminton Integrated program (Doron et al., 2020), in accordance with its authors' recommendations for future development. Consequently, a module was added with the aim of reinforcing the players' commitments to clearly delineated values, goals and committed actions (i.e., module 2), and the length of the program was increased (15 weeks vs. 8 weeks). In addition, the exercises in the MBBI program were designed to be integrated as far as possible into basketball-specific training situations.

The intervention lasted 15 weeks and comprised five progressive modules. *Module 1 "Psychoeducation"* was aimed to create adhesion to the intervention and help the athletes understand the attentional process during basketball training and games, its limitations, and the potential debilitating effects on performance. *Module 2 "Goals & Values"* was aimed to introduce commitment work (i.e., goal and value clarification, goal-setting). The participants identified values and learned the importance of acting in a manner that was congruent with their values instead of being governed by their thoughts and emotions. They were also taught to set clear and specific goals, as well as committed actions at each part of the training sessions (e.g., warm-up, individual skills training, collective drills). *Module 3 "Awareness"* was aimed to introduce the principles of mindfulness and cognitive defusion. Athletes were trained to identify the disruptive stimuli they might encounter during basketball training and games, and to refocus on relevant performance cues in the present-moment. *Module 4 "Acceptance"* was aimed to improve the athletes' awareness of the avoidance strategies they used in response to the disruptive stimuli they might encounter during basketball training and games, and to develop their abilities to adopt an observational and non-judgmental attitude toward their inner experiences. *Module 5 "Performance routines"* was aimed at combining mindfulness, acceptance, and commitment to improve athletes' attentional and emotional regulation strategies during games. To this end, the performance routines and attentional foci used by the athletes were specified and practiced. The performance routines were implemented during key moments of regular training and training games (e.g., free throws, breaks, time-outs). Each module comprised sessions consisting

of different situations, exercises, and discussions, which were incorporated as far as possible into either the basketball or physical training sessions (see Table 1 for further details).

## 1.2. Phase 2: Implementation & evaluation of the MBBI program

### 1.2.1. Research design

With regard to the study's first objective, a mixed methods research design was adopted to further understand the effects of the MBBI program through the collection, analysis and interpretation of both quantitative and qualitative data (Creswell & Plano Clark, 2017). Mixed methods research designs are viewed as particularly relevant in enhancing explanation, understanding and interpretation of the effects of an intervention (Ryba, Wiltshire, North, & Ronkainen, 2020). Consistent with the use of a mixed methods approach, the authors conducted this study from critical realist assumptions, underpinned by ontological realism (i.e., reality exists independently of our conception of it) and epistemological constructivism (i.e., knowledge is fallible and constructed). Specifically, a convergent mixed methods design (QUAN + qual) was used with an emphasis on quantitative data to examine the trajectories of mindfulness skills and performance-related outcomes over the course of the MBBI program, while qualitative data provided in-depth descriptions of athletes' perceptions of the associated changes (Fetters, Curry, & Creswell, 2013). Concerning the study's second objective, an exclusively quantitative approach was adopted to examine the potential moderating effects of personality characteristics on changes in targeted variables associated with the MBBI program.

### 1.2.2. Participants

Forty-eight young elite female basketball players from the French Federal Basketball Center (CFBB) were recruited for this study (see Figure 1 for further information). They represented the best French players of their generation. The final sample was composed of 40 participants aged 15–18 years ( $M = 16.33$ ,  $SD = 0.75$  years) who were all competing at national and/or international level. They had played basketball for an average of 7.97 years ( $SD = 2.76$ , range = 3–12 years) and were training for an average of 14.62 h per week ( $SD = 1.78$ , range = 12–20 h). While the participants were aware of mental skills training and sport psychology, none reported using psychological skills training systematically or having any experience of MABIs. Prior to their participation, all players (or a legal representative if the player was under 18 years old) signed an informed consent form. They were told that they could withdraw from the study at any time and that the confidentiality and anonymity of their data would be respected. The study obtained ethical approval in relation to standard research practices and the guidelines established for research involving people by the French ministry of sports' scientific committee (no. 17r16).

### 1.2.3. Procedure

Prior to the intervention, meetings were held with the coaches of the CFBB to present the MBBI program, explain the main objectives, provide information on the key messages, and make sure the intervention would fit with the athletes' schedules. None of the coaches had ever previously used psychological skills training or a MABI, nor had they worked with sport psychologists to enhance performance or undergone any training in this area. At the end of these meetings, it was agreed that the coaches would contribute to the design of the integrated sessions in regular training based on their basketball expertise, and be involved in the MBBI program as much as possible in order to maximize its impact on the players. They helped to recruit players by asking them to participate in the MBBI program as part of their training program. Specifically, over a 3-year period (2017–2019), each new annual intake to the CFBB was asked to participate in the MBBI program during their first year (i.e., January–May). As indicated in Figure 1, on each of these three occasions, an identical procedure was followed with all the new intakes of players to ensure the instructions, protocol, measurement tools, and

**Table 1**  
The mindfulness BasketBall integrated program.

Module	Goals	Tools	Key messages
<b>Module 1:</b> Psychoeducation	<ul style="list-style-type: none"> <li>• Create adherence to the intervention.</li> <li>• Reframe mental training as a real growth area.</li> <li>• Make players aware of the program's approach and their own functioning.</li> </ul>	<ul style="list-style-type: none"> <li>• Disruptive situations during training sessions.</li> <li>• Work on "clichés" about mental skills training in sport.</li> <li>• Recall and observe own in-game thoughts, emotions &amp; behaviors.</li> <li>• Identify attentional foci related to various basketball-specific themes during training sessions (e.g., technique, attitude, execution, tactic).</li> </ul>	<ul style="list-style-type: none"> <li>• Our attentional capacities are limited, so we cannot be focused on everything all the time.</li> <li>• Self-regulation of our thoughts, emotions, and behaviors is crucial to good performance.</li> <li>• We can still play and be committed to the game even if everything is not perfect.</li> </ul>
<b>Module 2:</b> Goals & Values	<ul style="list-style-type: none"> <li>• Identify and raise awareness of what the athletes value in the pursuit of their goals.</li> <li>• Develop the player's capacity to set him/herself precise and appropriate goals.</li> <li>• Foster the player's commitment and autonomy in his/her own practice.</li> </ul>	<ul style="list-style-type: none"> <li>• Mid- and long-term goal setting, and clarification about why these goals are important.</li> <li>• Daily training diaries.</li> <li>• Setting specific goals and committed actions for each part of training sessions (e.g., warm-up, individual skills training, collective drills).</li> <li>• Individual interviews.</li> </ul>	<ul style="list-style-type: none"> <li>• Our values are our compass.</li> <li>• Setting clear and specific goals enables us to project ourselves and self-evaluate over time.</li> <li>• Our behavior reflects our values.</li> </ul>
<b>Module 3:</b> Awareness	<ul style="list-style-type: none"> <li>• Make players aware of the distractions they can encounter.</li> <li>• Enable players to refocus and bring their attention back to the present moment.</li> </ul>	<ul style="list-style-type: none"> <li>• Mindfulness principles illustrated in basketball situations.</li> <li>• Guided mindfulness exercises before and after training (10').</li> <li>• Interval mindfulness exercises during rest time in training (1'x 1').</li> </ul>	<ul style="list-style-type: none"> <li>• High performance takes place in the present moment.</li> <li>• We have to be able to recognize our own thoughts and emotions and refocus so that they do not distract us from the present moment.</li> <li>• There is no need to struggle against our own thoughts and emotions.</li> </ul>
<b>Module 4:</b> Acceptance	<ul style="list-style-type: none"> <li>• Become aware of avoidance/acceptance strategies and their impact on performance.</li> <li>• Reframe the usefulness of</li> </ul>	<ul style="list-style-type: none"> <li>• Identification and discussion of avoidance/acceptance strategies in specific basketball situations.</li> <li>• Short integrated mindfulness</li> </ul>	<ul style="list-style-type: none"> <li>• Thoughts &amp; emotions are an integral part of competitive sport. Experiencing strong emotions is</li> </ul>

(continued on next page)

**Table 1** (continued)

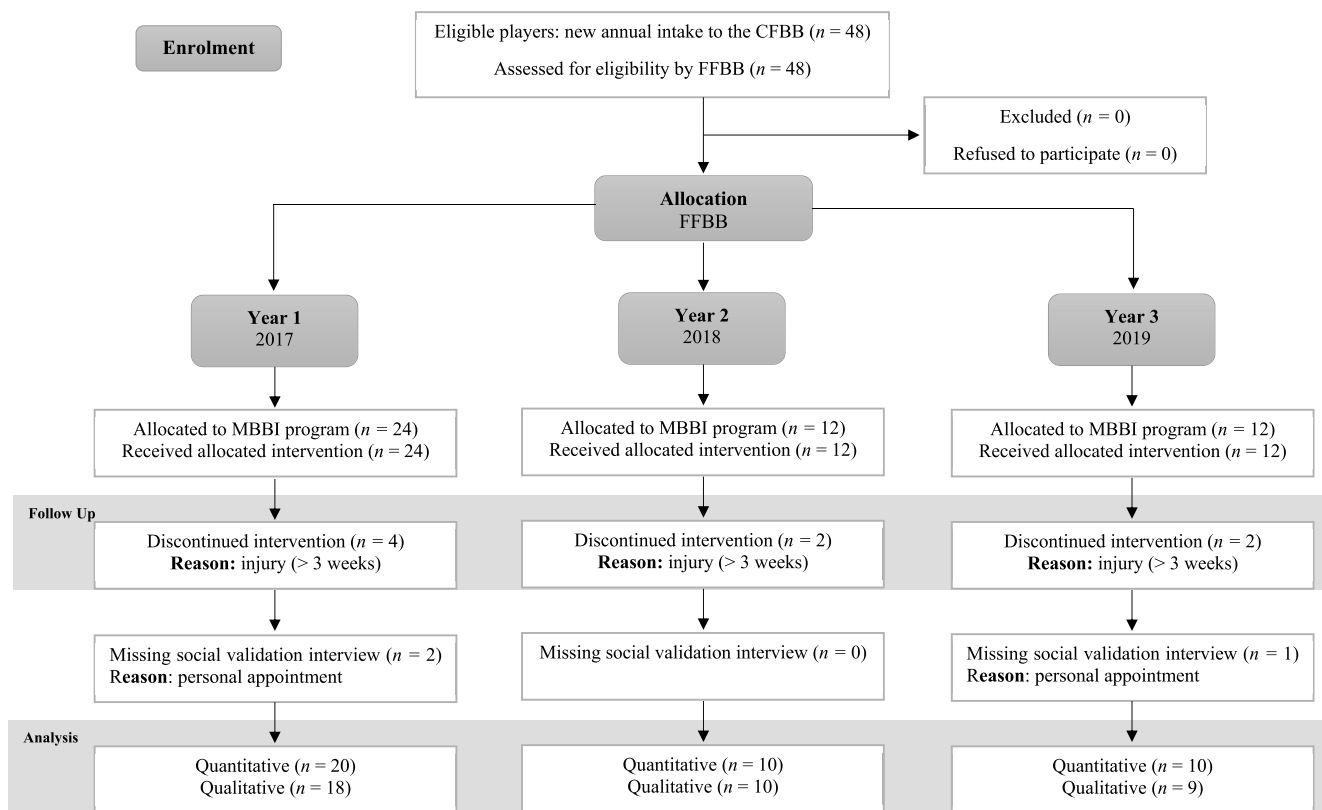
Module	Goals	Tools	Key messages
	emotion in competitive sport.	exercises (45''-1') during key moments of regular training and training games (e.g., free throws, breaks, time-outs).	perfectly normal. <ul style="list-style-type: none"> <li>Performing well means learning to play with emotions rather than against them.</li> <li>Accepting our thoughts and emotions enables us to stay fully available for the game.</li> </ul>
<b>Module 5:</b> Performance routines	<ul style="list-style-type: none"> <li>Distinguish routines and superstitions.</li> <li>Develop a flexible refocusing routine.</li> </ul>	<ul style="list-style-type: none"> <li>Individual interviews.</li> <li>Interests and principles for establishing a refocusing routine.</li> <li>Refocusing routine implementation during key moments of regular training and training games (e.g., free throws, breaks, time-outs).</li> </ul>	<ul style="list-style-type: none"> <li>Routines enable us to bring our attention back to the present moment when we are distracted.</li> <li>Routines enable us to project ourselves in the action.</li> </ul>

implementation of the MBBI program were delivered in exactly the same way (e.g., recruitment, content, duration, key messages, questionnaires, interviews). The MBBI program was always implemented by the same intervener (first author), who is a sport psychology practitioner with experience in conducting MABIs with elite athletes.

Regarding the evaluation, the research design included four quantitative measure time-points. Ten months before the intervention, all players filled out an initial online questionnaire (duration ~30–45 min) that evaluated their baseline personality traits at the time of the CFBB entrance tests (Time 1). They subsequently completed a second online questionnaire (duration ~15–20 min) at three different points in time, measuring mindfulness skills, performance satisfaction, and intensity and directional interpretation of stress: pre- (Time 2- Week 1), mid- (Time 3- Week 7), and post-intervention (Time 4- Week 15). All quantitative data collection occurred in a group setting in a dedicated room at the CFBB and the researcher (the first and fourth authors) remained in the room while the players completed the questionnaire to ensure all queries were given due responses. One month after the program had ended, qualitative data were collected during individual social validation interviews conducted in-person with each MBBI program participant by an impartial external collaborator. The interviewer who had experience in conducting MABIs with athletes did not participate in the implementation of the MBBI program, and the interview session was their first contact with the players. All the interviews were recorded and lasted approximately 30 min.

**1.2.4. Measures**

Personality traits. The French version (Rolland, Parker, & Stumpf, 1998) of the 240-item NEO Personality Inventory Revised (Costa & McCrae, 1992) was used to assess the five basic personality traits (i.e., neuroticism, extraversion, conscientiousness, agreeableness, and



**Fig. 1.** CONSORT chart for the present study demonstrating group sizes for enrolment, allocation, follow-up, and analysis. Note. The 48 eligible players represented 100% of the new CFBB players.

openness to experience). The players answered each question using a 5-point Likert-type scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Each personality trait score was determined from the sum of the respective 48-item scores, with a higher score indicating a stronger alignment with the trait in question.

**Mindfulness skills.** Two subscales of the Mindfulness Inventory for Sport (Thienot et al., 2014) were used to measure mindfulness skills in sport performance contexts: (a) *awareness* (5 items; being aware of disruptive stimuli and their associated internal reactions; e.g., “I am aware of the thoughts that are passing through my mind.”), and (b) *acceptance* (5 items; adopting a non-judgmental attitude toward these stimuli and reactions; e.g., “When I become aware that I am really upset because I am losing, I criticize myself for reacting this way.”). Each of these 10 items was rated using a Likert scale from 1 (*not at all*) to 6 (*very much*). In addition, two subscales of the Five Facets Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Heeren, Douilliez, Peschard, Debrauwere, & Philippot, 2011) were used to measure athletes’ mindfulness skills in a complementary way: (a) *non-reactivity to inner experience* (seven items; allowing the emergence of thoughts and emotions without being overwhelmed by them or feeling the need to react to them; e.g., “I perceive my feelings and emotions without having to react to them”), and (b) *non-judgment* (eight items; adopting an open and observative attitude toward thoughts and emotions rather than considering them as good or bad; e.g., “I make judgments about whether my thoughts are good or bad”). Each of these 15 items was rated using a Likert scale from 1 (*never*) to 6 (*always*).

**Perceived stress intensity and directional interpretation.** The players indicated how they actually experienced stress in competitive matches using two single-item measures (Jones & Swain, 1992) to assess: (a) intensity of stress using a 5-point Likert scale ranging from 0 (*not at all*) to 5 (*extremely*), and (b) directional interpretation of stress using a 7-point Likert scale ranging from -3 (*very debilitating*) to +3 (*very facilitating*).

**Performance satisfaction.** Participants rated their actual performance satisfaction subjectively using a Likert scale from 0 (*totally dissatisfied*) to 5 (*totally satisfied*), as recommended by Biddle, Hanrahan, and Sellars (2001).

**Social validation.** In order to enhance the understanding of the athletes’ responses to the MBBI program, a semi-structured interview guide was developed for social validation purposes (Page & Thelwell, 2013). All interviews were conducted one month after the end of the intervention and aimed to qualitatively investigate athletes’ perceptions of the MBBI program and its associated effects. Main questions (e.g., “In general, what did you think of the program?”, “What have you learned?”, “What was the most useful intervention content (tools, exercises, situations, etc.)?”) were complemented by neutral and non-directional probes (e.g., “Can you explain your answer?”, “Can you give me an example?”). Every aspect of the interview guide was asked in each interview.

### 1.2.5. Data analysis

**Quantitative Analyses.** Regarding the first objective of the study, the MGCA were used to examine the trajectories of mindfulness skills (i.e., awareness, acceptance, non-reactivity, non-judgment) and the performance-related outcomes (i.e., intensity and directional interpretation of stress, performance satisfaction) over the course of the MBBI program (Singer & Willett, 2009). Separate analyses were conducted for each variable. Multilevel models extended multiple regressions to nested data (i.e., data that are hierarchically structured). Specifically, the repeated measurements (Level 1 units of analysis) were nested within the athletes (Level 2 units of analysis) because each athlete completed the measures at three different points in time (i.e., pre-, mid-, and post-intervention). A two-level multilevel model estimated both the average growth and the individual differences in growth. At Level 1, linear trajectory (time) was entered as a predictor to estimate the average intercept ( $\beta_0$ ) and the average linear growth ( $\beta_1$ ). The time

variable was centered on the first wave. Thus, the intercept should be interpreted as the level of athletes’ mindfulness skills, stress intensity and directional interpretation, and performance satisfaction prior to the intervention.

Regarding the study’s second objective, the moderating effects of the personality traits on the changes in mindfulness skills and sport performance-related outcomes associated with the MBBI program were examined. The baseline personality traits were added as predictors in the MGCA models. Thus, the five personality traits (i.e., neuroticism, extraversion, conscientiousness, agreeableness, and openness to experience) as well as their interactions with time were added to the model at Level 2. Group mean centering was used for all Level 1 predictors based on the rationale that grand mean centering or no centering may produce biased point estimates (Doron & Martinent, 2017). Grand mean centering was used for all Level 2 predictors (Doron & Martinent, 2016). Maximum likelihood estimator was used for all the MGCAs and all analyses were conducted using the R package labeled lme4 (Bates, Mächler, Bolker, & Walker, 2015).

**Qualitative Analysis.** In order to provide in-depth descriptions of players’ perceptions of the MBBI program and its associated effects (i.e., Objective 1), the social validation data were examined using a deductive thematic analysis (Braun, Clarke, & Weate, 2016). The first step of the analysis consisted in familiarizing ourselves with the data by transcribing the interviews and reading through the transcripts several times. The data were then deductively analyzed according to two main themes based upon the semi-structured interview guide and the intervention content itself: (i) Appropriateness & Satisfaction, and (ii) Perceived changes related to the MBBI program. In this last theme, the data were assigned to ready categories related to MABI’s central constructs (i.e. attention monitoring, acceptance, commitment) and performance-related outcomes. To strengthen the methodological rigor of the analysis, the data were analyzed independently by the first and last authors, with the other coauthors serving as “critical friends” to discuss and refine data interpretation (Smith & McGannon, 2018).

## 2. Results

### 2.1. How well did the MBBI program work with the young elite female basketball players?

Descriptive statistics of all variables at pre-, mid- and post-intervention are reported in Table 2.

**Table 2**  
Descriptive statistics of all variables at pre-, mid- and post-intervention (N = 40).

Variables	Pre-MBBI	Mid-MBBI	Post-MBBI
	M (SD)	M (SD)	M (SD)
<b>Baseline Personality Traits</b>			
Neuroticism	81.60 (19.00)		
Extraversion	126.25 (12.69)		
Conscientiousness	123.05 (16.24)		
Agreeableness	125.00 (13.59)		
Openness to experience	105.75 (13.08)		
<b>Mindfulness skills</b>			
Awareness	4.13 (0.64)	3.75 (0.89)	3.88 (0.35)
Acceptance	3.09 (0.54)	3.27 (0.79)	3.78 (1.48)
Non-reactivity	24.92 (6.00)	25.06 (5.09)	26.97 (5.41)
Non-judgment	26.14 (7.59)	27.33 (7.79)	30.20 (7.86)
<b>Performance-Related Outcomes</b>			
Stress intensity	2.00 (1.40)	2.23 (1.20)	2.15 (1.25)
Stress direction	.13 (0.79)	.30 (1.14)	.75 (1.01)
Performance satisfaction	2.77 (1.18)	2.90 (1.12)	3.38 (0.75)

*Note.* Baseline personality traits were measured 10 months before the intervention, while mindfulness skills and performance-related outcomes were measured just before the intervention (Week 1).

2.1.1. Results of the MGCA regarding the trajectories of mindfulness skills and performance-related outcomes

The results revealed a significant positive linear effect of time on non-reactivity ( $\beta = .95$ ), non-judgment ( $\beta = 1.93$ ), acceptance ( $\beta = 0.17$ ), directional interpretation of stress ( $\beta = 0.31$ ), and performance satisfaction ( $\beta = 0.30$ ) (see Figure 2 and Table 3).

2.1.2. Results of the deductive thematic analysis regarding athletes' perceptions of the MBBI program and its associated effects

The results highlighted the two overarching themes: (a) Appropriateness of and Satisfaction with the MBBI program, and (b) Perceived changes related to the MBBI program.

Appropriateness and Satisfaction. This theme reflected the players' positive experience of the MBBI program. The analyses revealed that most of the athletes were satisfied with the intervention: "I found that I felt better with the program we followed, I really understood what we

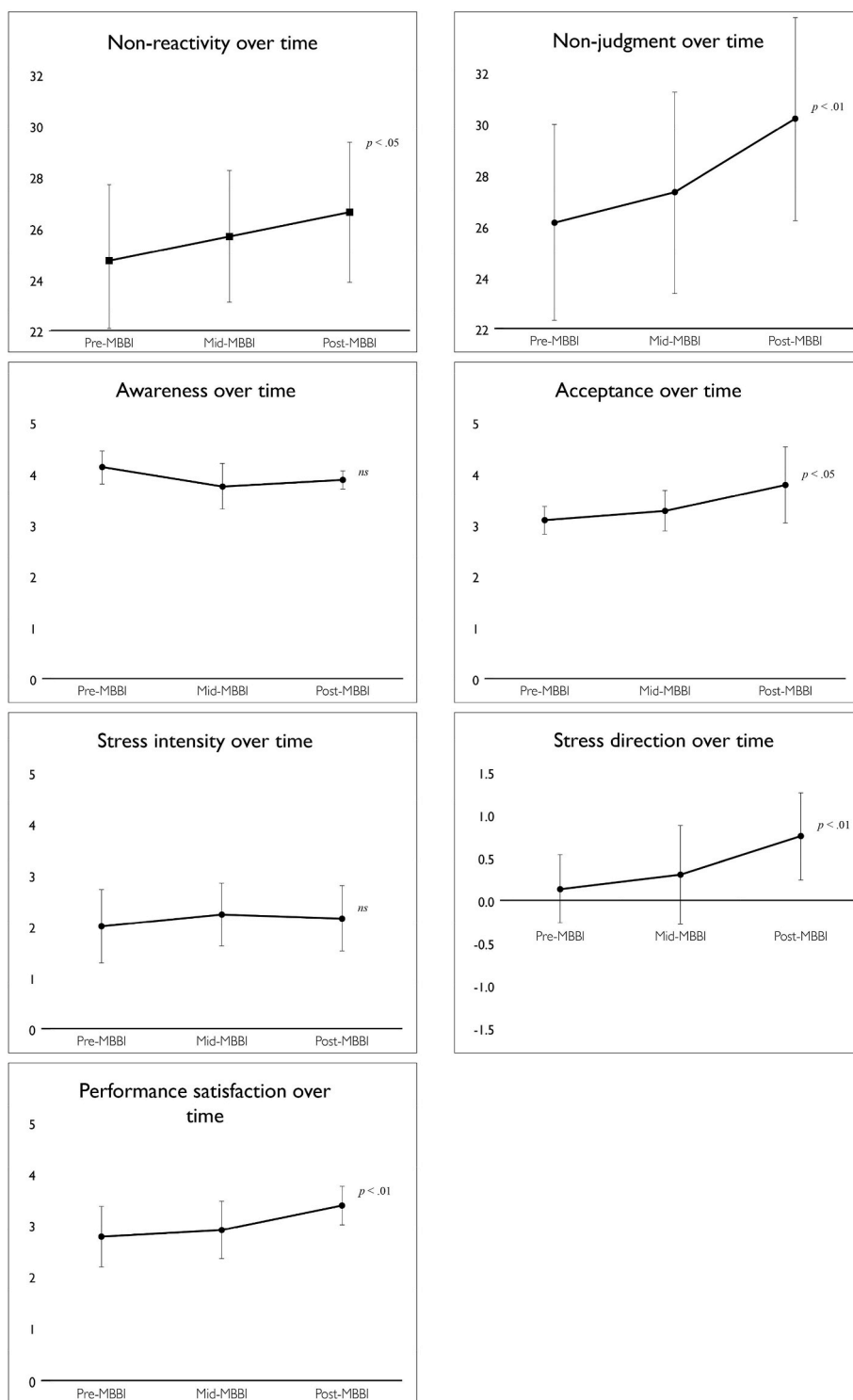


Fig. 2. Evolution of athletes' mindfulness skills and performance-related outcomes over the course of the MBBI program.

**Table 3**  
Growth curve models of mindfulness skills and performance-related outcomes.

	Awareness	Acceptance	Non-reactivity	Non-judgment	Stress intensity	Stress direction	Performance satisfaction
<i>Fixed effects – Estimates (Standard errors)</i>							
Intercept	3.90 (.10)	3.13 (.11)	24.73 (.91)	26.14 (1.12)	2.03 (.20)	.08 (.13)	2.73 (.16)
Time	.09 (.07)	.17* (.07)	.95* 5.44	1.93** (.64)	.09 (.09)	.31** (.10)	.30** (.10)
<i>Random effects – Variance (Standard deviation)</i>							
Intercept	.19 (.44)	.27 (.52)	26.15 (5.11)	34.15 (5.84)	1.16 (1.08)	.10 (.32)	.39 (.62)
Time	.04 (.20)	.09 (.30)	3.45 (1.86)	7.05 (2.66)	.07 (.26)	.04 (.21)	.01 (.11)
-2*log-likelihood	235.0	256	700.8	790.0	352.4	324.2	336.4

Note. \*p < .05. \*\*p < .01.

were doing, I felt good using that program” (Player 27). Overall, they reported that they had continued with the MBBI exercises independently after the program had ended, both in training and in competitive matches. Moreover, they highlighted in particular that they preferred to have the exercises integrated into their regular training rather than in-class sessions: “Because you’re on court, it’s more real-time. I mean, when it’s on court, you feel the effects more” (Player 14).

Perceived changes related to the MBBI program. This second theme reflected the participants’ perceptions of significant changes in the targeted behaviors/variables. This theme comprised four categories: attention monitoring, acceptance, committed action, and performance-related outcomes.

Attention monitoring. Athletes observed positive changes in attention monitoring in three different ways. First, athletes reported a greater awareness of and sensitivity to their internal and external experience:

I’m much more aware of my emotions, because before, well, I just got really angry when there was something I didn’t like or ... and then, I learned to focus on myself - not to bottle up my emotions but to be aware of them without necessarily showing them. (Player 10)

Second, athletes reported an improved ability to notice when their thoughts had started to wander, both in training and in matches:

When my mind started to wander, I’d notice it and come back to reality. I’m more aware of it now. I pay more attention to what I’m thinking, I notice when I’m not concentrating and refocus straight away. Before, it was happening but I didn’t realize it. (Player 9)

Third, for some athletes, the positive changes were due to better identification of task-relevant cues: “Because I was clearer about what I had to do, I was able to focus on the tasks I had to accomplish” (Player 22). In contrast, a few athletes observed no change in attention monitoring, reporting that they had been very aware of their thoughts and emotions prior to the intervention.

Acceptance. Athletes felt that the intervention had enabled them to adopt a more open and non-judgmental attitude toward their thoughts and emotions:

When I had negative thoughts, usually it frustrated me more than anything else, and I was less efficient, whereas now, even if I have negative thoughts, I’m in control, and I tell myself it doesn’t matter and then suddenly it gets better. And when it’s positive too, I get less euphoric, I’m calmer. (Player 16)

However, some athletes acknowledged that they needed more time to learn how to apply acceptance when dealing with their thoughts and emotions: “I understand how I ought to act, what the best choice is depending on my thoughts, but it’s hard to actually do it” (Player 7). In addition, a few athletes had not noticed any change in the way that they dealt with their thoughts and emotions due to the intervention.

Committed Action. Athletes mentioned positive changes in their commitment to value- and goal-driven behaviors, providing three different explanations. First, players explained that the intervention had enabled them to set precise and realistic goals:

It helped me get a better idea of what I needed to focus on. I had goals, but it was the same, they were big and vague, whereas with [the intervener], we dug deeper to find things that would really make it work. (Player 36)

Second, players reported that the intervention had enabled them to better formulate their goals and be more aware of them during regular training:

When we learned about it, I wrote it down, and because we had training just after, well, I thought about what I’d just written. So, I wrote down in my notebook what I wanted to focus on and afterwards, when I was training, like, if I wrote “I have to watch where I place my feet”, I suddenly thought about it on court. (Player 13)

Third, athletes observed that the intervention had helped them to better assess their progress toward achieving their goals on court: “Now I can see which goals are achievable and which aren’t. I couldn’t see that before. I set myself goals that are more compatible with my game, so it helps a lot more” (Player 10). In addition, some athletes did not notice any changes due to the intervention, and a small number reported that they had found the intervention particularly difficult:

I find it hard to set goals in training, I can’t see what I need to do during training. I spend a long time looking, but I still don’t get very far. I set goals but they’re quite broad, not specific. (Player 3)

Performance-related outcomes. Athletes perceived significant and positive changes in their performance. Overall, most of the athletes reported in particular that their emotions were less likely to interfere with or undermine their performance in competitive matches:

Before, I didn’t actually have any tools, I’d be really frustrated, sometimes for the whole match. I was so frustrated, my performance would be a disaster. But now I must admit, I can have a disastrous first half, go back to the locker room, refocus, and then turn things around in the 2<sup>nd</sup> half, changing the whole match. (Player 37)

Moreover, athletes reported that the program had helped them to improve their day-to-day training quality:

Well, it was just that thing of refocusing, and even that thing about setting specific goals, of course I had them in my head I did better at training, or at least I felt I had to do this and that. (Player 12)

Finally, some athletes perceived that the intervention was beneficial to the team’s performance as a whole:

[It was effective] on the team first, we managed to play together better, like, I don’t know, that helped us I think. Like communication, we knew how to talk to one another and stuff like that, or even when we could see someone was drifting off a bit, like, we were able to regroup. (Player 29)

For whom did the MBBI program work best?

The second objective was to examine the moderating effects of the personality traits on the changes in mindfulness skills and sport performance-related outcomes associated with the MBBI program.



Concerning the between-person main effects of personality traits (Level 2 predictors), neuroticism significantly predicted non-reactivity ( $\beta = 0.15$ ) and acceptance ( $\beta = 0.01$ ), whereas extraversion significantly predicted stress intensity ( $\beta = 0.03$ ). Concerning the interaction effects of personality traits\*time (linear slope), both neuroticism\*time and conscientiousness\*time were significantly negatively associated with non-reactivity ( $\beta = -0.06$  and  $-0.07$ , respectively). Hence, the linear trajectory of non-reactivity was higher among the athletes who reported lower levels of neuroticism and conscientiousness ( $\beta = 1.01$  and  $1.02$ , respectively) than those who reported higher levels ( $\beta = 0.89$  and  $0.88$ , respectively). Agreeableness\*time was significantly positively related to non-judgment ( $\beta = 0.11$ ). Thus, the linear trajectory of non-judgment was higher among the athletes reporting higher levels of agreeableness ( $\beta = 2.04$ ) than those reporting lower levels ( $\beta = 1.82$ ). Finally, extraversion\*time was significantly negatively associated with stress intensity ( $\beta = -0.02$ ), whereas openness\*time was significantly negatively associated with stress direction ( $\beta = -0.02$ ). In other words, the linear trajectory of stress intensity and directional interpretation was higher among the athletes who reported lower levels of extraversion and openness ( $\beta = 0.07$  and  $0.29$ , respectively) than those who reported higher levels ( $\beta = 0.11$  and  $0.33$ , respectively) (see Table 4).

### 3. Discussion

The present study aimed to better understand how an integrated MABI works and for whom it works best using a sample of young elite female basketball players. Regarding the first objective, the results of the MGCA and thematic analyses revealed how the mindfulness skills and performance-related outcomes evolved over the course of the MBI program and how these changes were perceived by the players. First, the results of the MGCA showed significant linear increases in acceptance-related variables. The athletes displayed an improvement in their attitudes of acceptance (i.e., acceptance, non-judgment, non-reactivity to experiences) during the intervention. These results were also supported by the complementary social validation data, which revealed that the athletes perceived they were better able to accept their thoughts and emotions in a way that did not interfere with their commitment in training or competitive matches (Birrer et al., 2012; Josefsson et al., 2019; Röthlin et al., 2020). While previous studies have suggested that acceptance may require a large amount of time and practice to be assimilated and applied consistently by athletes (Doron et al., 2020; Lindsay & Creswell, 2017), the length and modalities of the MBI program appear appropriate for this purpose in a sport setting. Nevertheless, some athletes reported that acceptance needed to be practiced in a sustained and prolonged manner in challenging and competitive

situations.

Second, while the results of the MGCA results did not indicate any significant change in awareness over the course of the intervention, the social validation data revealed a more complex picture of the athletes' perceived changes in awareness skills. They showed that the athletes perceived an improvement in monitoring their attention to deal with present-moment experiences and focus on the contextual and performance-relevant cues rather than being overwhelmed or distracted by disruptive stimuli (Bernier, Thienot, Pelosse, & Fournier, 2014; Doron et al., 2020; Goodman, Kashdan, Mallard, & Schumann, 2014; Josefsson et al., 2019; Scott-Hamilton et al., 2016; Vidic, Martin, & Oxhandler, 2017). The gap between the quantitative and qualitative results echoes a question previously raised in the literature about the difficulty of measuring mindfulness skills accurately with the use of self-report questionnaires (Doron et al., 2020; Longshore & Sachs, 2015; Shankland, Kotsou, Cuny, Strub, & Brown, 2017). Shankland et al. (2017) pointed out that participants generally tend to rate their awareness higher prior to a MABI precisely because they are less conscious or unconscious of the fact that their awareness is not as high as they think (Shankland et al., 2017). This could explain why the athletes in this study perceived an improvement in their awareness skills during the intervention, while no significant quantitative change was observed. Further, the social validation data showed that the athletes perceived an improvement in their commitment to value- and goal-driven behaviors as a result of the MBI program, while this skill was not quantitatively assessed. By clarifying specific goals and values, the program enabled the athletes to better evaluate and regulate their behavior when they were faced with interfering thoughts, emotions, and physical sensations either in training or competitive matches (Goodman et al., 2014; Henriksen, 2019). The mixed methods approach used in this study (Ryba et al., 2020) has proved useful in capturing the complexity of the players' experiences and providing a complete understanding of how the central constructs of MABIs evolved over the course of the intervention.

Regarding performance-related outcomes, the results of the MGCA indicated a significant linear increase in facilitating perception of stress related to performance (i.e., stress direction) as a result of the MBI program but no significant change in stress intensity (Birrer et al., 2012; Gardner & Moore, 2007, 2017; Goodman et al., 2014). The change in acceptance skills may have led athletes to positively interpret their competitive match-related stress (Birrer et al., 2012; Gardner & Moore, 2007, 2017; Goodman et al., 2014). The absence of a reduction in stress intensity therefore appears not to have been problematic for the athletes once they had been trained to accept and deal with it effectively (Birrer & Röthlin, 2017). Furthermore, the MGCA showed a significant linear increase in performance satisfaction during the program. This finding

**Table 4**  
Effects of personality traits on the growth curve models of mindfulness skills and performance-related outcomes.

	Awareness	Acceptance	Non-reactivity	Non-judgment	Stress intensity	Stress direction	Performance satisfaction
<i>Fixed effects – Estimates (Standard errors)</i>							
Intercept	3.90*** (.10)	3.13*** (.10)	24.73*** (.81)	28.90*** (5.38)	2.03*** (.17)	.08 (.12)	2.73*** (.15)
Time	.09 (.06)	.17* (.07)	.95 (.39) *	1.93** (.60)	.09 (.08)	.31** (.09)	.30** (.10)
Neuroticism (N)	.01 ( )	.01* (.01)	.15** (.05)	.05 (.07)	-.01 (.01)	.00 (.01)	-.01 (.01)
Extraversion (E)	-.01 (.01)	.00 (.01)	.06 (.07)	.03 (.09)	.03* (.01)	-.01 (.01)	-.02 (.01)
Conscientiousness (C)	.00 (.01)	.01 (.01)	.03 (.06)	-.09 (.08)	.00 (.01)	-.01 (.01)	-.01 (.01)
Agreeableness (A)	.00 (.01)	.01 (.01)	.04 (.06)	-.02 (.08)	-.02 (.01)	.01 (.01)	.00 (.01)
Openness (O)	.00 (.01)	.00 (.01)	-.09 (.07)	.04 (.09)	-.02 (.01)	.01 (.01)	.02 (.01)
N * Time	-.01 (.00)	-.00 (.00)	-.06* (.03)	.00 (.04)	.01 (.01)	.01 (.01)	.00 (.01)
E * Time	.00 (.01)	.00 (.01)	-.03 (.03)	.04 (.05)	-.02* (.01)	.01 (.01)	.00 (.01)
C * Time	-.01 (.00)	-.00 (.01)	-.07* (.03)	-.04 (.05)	.00 (.01)	-.01 (.01)	-.00 (.01)
A * Time	.00 (.00)	-.00 (.01)	-.03 (.03)	.11* (.05)	.01 (.01)	.00 (.01)	-.00 (.01)
O * Time	-.01 (.01)	-.01 (.01)	.03 (.03)	-.02 (.05)	.00 (.01)	-.02* (.01)	-.01 (.01)
<i>Random effects – Variance (Standard deviation)</i>							
Intercept	.14 (.37)	.20 (.45)	19.24 (4.39)	28.90 (5.38)	.76 (.87)	.08 (.29)	.27 (.52)
Time	.02 (.13)	.08 (.28)	1.79 (1.34)	4.99 (2.23)	.00 (.04)	.03 (.18)	.01 (.12)
Residual	.27 (.52)	.24 (.48)	8.77 (2.96)	18.95 (4.35)	.52 (.72)	.61 (.78)	.74 (.86)
-2*log-likelihood	224.2	248.6	683.6	777.2	333.6	312.2	326.0

Note. \*p < .05. \*\*p < .01.

was supported by the social validation data. Most of the athletes reported in the interviews that their participation in the program had enhanced their performance in training and competitive matches. In addition, some players reported that the program was beneficial to team performance (Goodman et al., 2014). The results of the MGCA and thematic analyses thus provide an in-depth understanding of how a MABI works in sport performance contexts (for reviews, see Bühlmayer et al., 2017; Noetel et al., 2019; Sappington & Longshore, 2015).

Regarding the study's second objective, the results provided interesting insights about who would be most likely to benefit from this kind of intervention. The athletes who scored lower either on conscientiousness or neuroticism showed a greater increase in non-reactivity to internal experiences and a better tolerance of a range of thoughts, emotions, and experiences (Hanley, de Vibe, Solhaug, Gonzalez-Pons, & Garland, 2019; Nyklíček & Irrmischer, 2017). Given that higher levels of conscientiousness are associated with increased psychological distress (Nouri, Feizi, Afshar, HassanzadehKeshтели, & Adibi, 2019) and higher levels of neuroticism are associated with emotional instability (de Vibe et al., 2015), athletes scoring lower on conscientiousness and neuroticism may respond better to the MBBI program in terms of the improvement of acceptance skills. In contrast, athletes scoring higher on conscientiousness and neuroticism appear to respond less well to the MBBI program given that they react more readily to emotional experiences. For these athletes, the development of proper emotion regulation strategies may require more time (de Vibe et al., 2015). The results also showed that the athletes who scored higher on agreeableness reported a greater increase in non-judgment of internal experiences. This suggests that individuals who tend to be more cooperative and concerned about others may find it easier to approach thoughts and emotions in a non-judgmental way (Giluk, 2009). Overall, the present findings suggest that the effects of the MBBI program on attitudes of acceptance were greater for athletes with lower levels of conscientiousness and neuroticism, and higher levels of agreeableness.

Furthermore, the results showed the moderating effects of personality traits on performance-related outcomes. Athletes with low scores on openness displayed a greater improvement in the directional interpretation of stress. The MBBI program may have taught them how to be more open to stressful situations and appraise stress in a positive way (Giluk, 2009). However, athletes with low scores on extraversion exhibited a greater increase in stress intensity over the duration of the program. While a low extraversion level is usually associated with stress and negative affect experience (Jackson & Schneider, 2014), an increased awareness of personal thoughts and emotions may indeed "increase attention toward salient distressing stimuli, intensifying negative affective states" (Lindsay & Creswell, 2017). No significant moderating effects of personality were found on changes in performance satisfaction associated with the program. To conclude, this study has shed light on the moderating effects of baseline personality characteristics in a MABI for an elite athlete population and contributed to extending previous research conducted within general populations (de Vibe et al., 2015; Nyklíček & Irrmischer, 2017). Specifically, conscientiousness, neuroticism, and agreeableness appeared to moderate the effects of the MBBI program on athletes' attitudes of acceptance (i.e., non-reactivity, non-judgment), while competitive match-related stress appeared to be moderated by extraversion and openness. As such, the MBBI program seemed to work best for athletes showing lower levels of conscientiousness, neuroticism and openness, and higher levels of agreeableness. However, this study remains mainly exploratory. Further research is needed to provide stronger evidence of the moderating role of individual dispositional characteristics in the impact of MABI in sport settings.

### 3.1. Limitations and future directions

Despite the study's strengths, some limitations should be considered when interpreting the results. The first limitation relates to the lack of

randomized or active control group. The beneficial effects of the MBBI program should accordingly be interpreted with caution. In the context of elite sport, the difficulty of establishing a control group that is equivalent in terms of expertise and demographic characteristics should be recognized and taken into consideration (Birrer & Morgan, 2010). A multiple baseline design could have been considered (Birrer et al., 2012). Secondly, the study was conducted on only a small sample of young elite female basketball players, thus limiting the generalizability of our findings. Future research should try to replicate this study with other elite male and female populations. Furthermore, given that personality traits are less stable in young adults (Lee & Hotopf, 2005), their moderating effects in the MBBI program should also be explored with adult populations. Other potential moderators such as perfectionism and emotional intelligence could also be taken into account to gain a better understanding of which athletes might benefit most from MABIs in sport settings (Röthlin, Birrer, et al., 2016; Sappington & Longshore, 2015). Thirdly, athletes' commitment and committed action were not assessed quantitatively, while athletic performance was only evaluated through subjective performance satisfaction (Röthlin, Horvath, et al., 2016; Sappington & Longshore, 2015). It would also appear necessary to use objective indicators of committed action and performance to provide clear evidence of the effectiveness of MABI for sport performance enhancement.

### 3.2. Practical implications

Overall, the results offer interesting practical implications with regard to the application of MABIs in sport performance contexts. The social validation data indicated that integrating the exercises into regular training sessions during the MBBI program appeared to be particularly appropriate and relevant to the athletes. Given that the exercises were adapted to and illustrated through basketball-specific situations, the MBBI program provided the athletes with opportunities to learn MABI principles and contents in an accessible way. Moreover, the repetition of short exercises during regular training enabled the athletes to directly apply and harness their mindfulness and commitment skills, as well as to monitor their change during the program. This may encourage coaches and practitioners to design and implement MABIs that are adapted to and integrated into athletes' performance environments in order to enhance the assimilation and application of their content (Birrer et al., 2012; Doron et al., 2020; Goodman et al., 2014; Scott-Hamilton et al., 2016). In addition, coaches and practitioners should consider the potential benefits with regard to team cohesiveness and performance of implementing MABIs in group settings, especially in the context of team sports (Goodman et al., 2014).

The results also reinforce the usefulness of taking into account athletes' personality characteristics when conducting MABIs (Sappington & Longshore, 2015). Practitioners should acknowledge that the development of acceptance skills is moderated by conscientiousness, neuroticism and agreeableness personality traits (de Vibe et al., 2015; Nyklíček & Irrmischer, 2017). Coaches and practitioners should therefore pay particular attention to athletes' dispositional characteristics when considering athletes' responses to MABI content, and, if necessary, consider the implementation of specific and adapted additional sessions. For example, these sessions would target specifically acceptance skills of athletes with high conscientiousness and neuroticism.

## 4. Conclusion

Through the original statistical approach (MGCA) and the social validation procedure, the mixed methods approach used has provided further insights into the way mindfulness skills and performance-related outcomes evolve during such an intervention and the perceived impacts of the intervention. The MBBI program's design and implementation in elite sport could be a springboard for the design of MABIs both for individuals seeking to optimize their skills in challenging situations, such

as elite athletes or performers more generally, and for practitioners who help others optimize their performance, such as coaches, psychologists, and consultants. Moreover, this study has addressed a new research avenue in sport psychology regarding our understanding of the moderating effects of baseline personality traits on changes associated with an integrated MABI program. Identifying such potential moderators could help differentiate those athletes who might benefit most from an integrated MABI in sport and performance settings (Sappington & Longshore, 2015). However, it should be borne in mind that this is a new line of research in sport psychology. Future research is needed to provide further insights in this area and better understand which participants might benefit most from MABIs in sport and performance settings.

## Funding

This research was supported by a grant (no.17r16) from the Ministère chargé des Sports (i.e., the French Ministry of Sports) and INSEP (i.e., the French Institute of Sport).

## Declaration of competing interest

The authors declare that they have no conflict of interest.

## Acknowledgments

The authors would like to thank the players and coaches of the Federal Basketball Center who took part in the study, the French Federation of Basketball for organization support, Quentin Rouault who conducted the interviews, and Marjorie Bernier for her expert advice during the design of the MBBi program.

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