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Original Research

Mindfulness-Based Stress Reduction to Enhance Flow and Performance During Basketball Ending Season: A Pilot Protocol

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ABSTRACT

Objective: Numerous studies demonstrated the efficacy of mindfulness in enhancing recovery, and stress management in athletes, in various domains, including attention, emotional regulation, athletic performance. Flow, a state of deep absorption and involvement in an activity, has been identified as a key predictor of excellent performance in sport. This study aimed to evaluate the effectiveness of a 6-week mindfulness protocol to increase athletic performance and facilitate access to the state of Flow during professional basketball playoffs.

Patients and Methods: A sample of 15 male players (mean age 28; standard deviation ±6.5), from Serie A 2 and Serie B national leagues, received a weekly audio track (almost 10 minutes) accompanied by operational instructions, an optional diary, and weekly debriefing. Objective measures of performance (game statistics, Heart Rate Variability) and subjective measures were collected using the following questionnaires: The Flow State Scale, the Mindfulness Inventory for Sport, the Sport Anxiety Scale and the Recovery-Stress Questionnaire for Athletes. The data analysis built on a range of metrics, including single-group pre–post comparisons (repeated measures ANOVA), as well as correlations between mindfulness, Flow, and performance, and Heart Rate Variability and sleep analysis utilizing wearable devices (Oura, Polar).

Results: Preliminary results indicate a marked enhancement in the subjective aspects of Flow, with an average increase evident within the initial week in scores pertaining to task concentration, perception of body control, and spontaneity in action. Sleep data indicate an increase in REM time and a reduction in nighttime awakenings. A significant limitation of this study is certainly the lack of a control group.

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Conclusions: Given the single-group pre-post design and small sample (N=15), findings are preliminary and do not permit causal inference and expectancy/placebo effects cannot be ruled out. For future developments we plan to expand the sample and carry out a comparison control.

Keywords
Mindfulness, Status of Flow, Athletic performance.

ABSTRACT in ITALIANO

Obiettivi: Numerosi studi hanno dimostrato l'efficacia dell'uso della mindfulness nel migliorare il recupero e la gestione dello stress negli atleti in diversi ambiti, tra cui l'attenzione, la regolazione emotiva, le prestazioni atletiche. Il Flow viene definito come uno stato di profonda concentrazione e coinvolgimento in un'attività ed è stato identificato come un fattore chiave per le performance sportive di picco. Il presente studio intende valutare l'efficacia di un protocollo di mindfulness della durata di 6 settimane per aumentare le prestazioni atletiche e facilitare l'accesso allo stato di Flow durante la fase di playoff di pallacanestro professionistica.
Pazienti e Metodi: Un campione di 15 giocatori maschi (età media 28 anni; deviazione standard ±6,5), provenienti dai campionati nazionali di Serie A 2 e Serie B, ha ricevuto una traccia audio settimanale (di circa 10 minuti) da ascoltare una volta al giorno, accompagnata da istruzioni operative e previo addestramento, un diario facoltativo e un debriefing settimanale. Sono state raccolte misure oggettive delle prestazioni (statistiche di gioco, variabilità della frequenza cardiaca) e misure soggettive utilizzando i seguenti questionari: il Flow State Scale, Mindfulness Inventory for Sport, Sport Anxiety Scale e Recovery-Stress Questionnaire for Athletes. L'analisi dei dati ha integrato una serie di parametri, tra cui confronti pre-post e tra gruppi (ANOVA per misure ripetute), nonché correlazioni tra consapevolezza, stato di Flow e prestazioni, e analisi della variabilità della frequenza cardiaca e del sonno utilizzando dispositivi indossabili (Oura, Polar).
Risultati: I risultati preliminari indicano un netto miglioramento degli aspetti soggettivi del Flow, con un aumento medio evidente nella prima settimana nei punteggi relativi alla concentrazione sul compito, alla percezione del controllo del corpo e alla spontaneità nell'azione. I dati sul sonno indicano un aumento del tempo REM e una riduzione dei risvegli notturni. Un limite significativo di questo studio è senz'altro l'assenza di un gruppo di controllo.
Conclusioni: Dato il disegno pre-post a gruppo singolo e il campione ridotto (N=15), i risultati sono preliminari e non consentono inferenze causali; non si possono escludere effetti aspettativa/placebo. Per tale ragione, negli sviluppi futuri, prevediamo di effettuare un controllo comparativo e di ampliare il campione.

Parole Chiave
Mindfulness, Stato di Flow, Performance sportiva.

INTRODUCTION

During last years, mindfulness has attracted growing interest in sports psychology, thanks to numerous studies demonstrating its effectiveness in increasing cognitive and regulatory abilities, improving sleep-wake rhythms, reducing stress, promoting psychological well-being, and enhancing athletic performance [1, 2, 3, 4, 5, 6]. Mindfulness practices allow us to exercise what Gestalt refers to as the "continuum of awareness," or the ability to be in deep contact with the experience unfolding in the present moment, facilitating the reduction of intrusive thoughts and automatic reactions, phenomena that are frequently associated with performance anxiety [7, 8].

Similarly, the concept of Flow has also been the subject of extensive attention in scientific and popular literature in the field of sports. In general, "Flow" can be defined as "a state in which people are so immersed in an activity that nothing else seems to matter; the experience is so enjoyable that people will pursue it even at great expense, for the sheer pleasure of doing so" [9, p. 4]. Some authors have compared the state of Flow to a state of grace. In Mihaly Csikszentmihalyi's book, Good Business: Leadership, Flow, and the Making of Meaning, Ralph Shapey, a well-known contemporary composer, describes the state of musical grace as follows: *"The state of ecstasy is so profound that it takes over the feeling of no longer existing. I have experienced it many times. My hands seem detached from my body, and I have nothing to do with what is happening. I just sit and watch, in a state of amazement and wonder, as the music flows out of me. It is interesting to note that ecstasy is the result of our limited ability to concentrate.*

Our mind is unable to deal with too many stimuli at the same time. If we focus all our attention on a given task, such as climbing a mountain or writing music, we do not observe anything outside that narrow field of perception" [10, p. 63]. Currently, in sports, Flow is defined as a state of deep immersion and involvement in a performance, in which the athlete experiences total concentration, a balance between challenge and skill, a sense of control, and a loss of perception of time [9, 11]. Several studies have shown that Flow is a key predictor of excellent performance, thanks to its link with optimal attentional and regulatory processes [12, 13]. However, the most effective ways to enhance this experience remain an open area of research, subject of discussion that is still little considered and explored.

In this scenario, mindfulness appears to be a promising approach for facilitating the voluntary achievement of Flow, as both conditions share characteristics related to attentional focus and psychophysiological arousal management [14, 15]. Some preliminary studies suggest that interventions based on the principles of mindfulness can increase the frequency and intensity of Flow experiences in athletes, while reducing anxiety and improving the quality of recovery and sleep-wake rhythms [16, 3].

In light of these premises, this pilot study aims to evaluate the impact of a mindfulness-based protocol on Flow state and other psychological and performance variables in a group of professional basketball players, while also exploring the possible relationship between Flow state and objective performance indicators.

MATERIALS AND METHODS

This is a pilot study with the aim to evaluate the effectiveness of a weekly mindfulness protocol to improve sports performance and facilitate access to the Flow state during the playoffs in professional basketball players. The protocol has involved 15 professional basketball players belonging to Serie A2 and Serie B teams during the last six weeks of the competitive season. The players were recruited *via* convenience sampling through team staff contacts; no randomization was performed. The intervention consisted of a structured six-week mindfulness protocol (described in the Table 1). Each week, participants received an informed consent and a guided audio track to listen to daily, lasting between 9 and 12 minutes. The tracks integrated body awareness, breathing, visualization, and grounding techniques, following a defined progression. The last two tracks guide athletes to achieve their Flow state zone. The protocol was entirely digital, accessible *via* smartphone, and was supported by motivational reminders and weekly usage checks.

The assessment measures included:

- Flow State Scale-2 (FSS-2) to measure the subjective experience of Flow. This tool of 36-item measures the subjective experience of Flow through nine key dimensions, including challenge-ability balance, goal clarity, concentration, sense of control, and time transformation [17].
- Sport Anxiety Scale-2 (SAS-2) to measure performance anxiety. This tool of 15 items assesses sport performance anxiety on three factors: Cognitive Worry, Somatic Anxiety, and Concentration Disruption [18].
- Mindfulness Inventory for Sport (MIS) consisting of 15 items and measures the degree of mindfulness applied to sport, divided into three dimensions: awareness, non-judgment, and refocusing [19].
- RESTQ-Sport-36 for recovery quality and perceived stress. A tool of 36 items designed to monitor the balance between perceived stress and recovery, using 12 scales related to stress and recovery factors [20].
- Objective performance statistics (points, assists, rebounds, league rating) collected from official league data.

All psychological measures were administered in two stages: before the intervention (T0) and at the end (T5). Performance scores (points, assists, rebounds, league rating), the FFS-2, sleep data, and HRV were monitored weekly.

Statistical Analysis

All statistical analyses were conducted using SPSS (v.27) and Python (v.3.10). Descriptive statistics were computed to summarize the sample characteristics, including means, standard deviations, and ranges for age and years of competitive ac-

tivity, as well as frequency distributions for playing roles, league participation, and HRV device ownership. To assess changes over time, paired-sample *t*-tests were applied to compare scores between baseline (T0) and subsequent time points. Specifically, comparisons were made for each inventory used (FSS-2, SAS-2, MIS, and RESTQ-Sport-36) between T0 and T5. In addition, trend analyses and graphical representations (line plots) were used to illustrate score progression across six time points (T0-T5) for the FSS-2. To explore the relationship between psychological and performance variables, Pearson's correlation coefficients were calculated between athletes' average Flow scores and performance metrics (points, assists, rebounds, and League Evaluation[1]). Cohen's dz for paired designs, and 95% confidence intervals for the mean difference. A Principal Component Analysis (PCA) was conducted on four performance indicators (Points, Assists, Rebounds, League Evaluation) to derive a composite Performance Score. Finally, a simple linear regression was performed to evaluate the predictive role of Flow on overall performance. The regression model included the composite Performance Score as the dependent variable and the Flow score as the independent predictor. All assumptions for parametric tests (normality, homoscedasticity, linearity) were checked and met. Effect sizes and confidence intervals were computed where appropriate. Given the exploratory scope, no multiplicity adjustment was applied.

RESULTS

The sample consists of 15 professional athletes, with an average age of 28 (SD = 6.05), between a range of 19 and 40 years. The average number of years of competitive activity is 13.07 (SD = 6.36), with a range from 2 to 23 years (Table 2). The distribution of roles on the field is heterogeneous, including guards, forwards, centers, and point guards (Figure 1). 66% percent of the athletes come from Serie A2 and the remaining 34% from Serie B. Only the 40% of the sample owns an HRV device.

The analysis of the average of the FSS-2 during the six weeks of the mindfulness protocol shows an upward trend. The initial average (T0) is 3.30 (SD = 0.58), while at T5 it reaches 4.62 (SD = 0.52), with a significant improvement (t = -4.27, p = 0.0037). The weekly trend graph shows a peak at T5, suggesting a cumulative effect of the intervention (Figure 2). Table 3 presents the results of a paired-sample *t*-test comparing Flow State Scale (FSS) scores before the intervention (T0) and after six weeks of mindfulness training (T5). The analysis shows a statistically significant increase in FSS scores, indicating improved Flow experiences following the intervention (t = -4.27, p = 0.0037). Descriptive statistics for all-time points (T0-T5) are also reported, demonstrating a progressive upward trend across the six-week period. Table 3 reports the results of a paired-sample *t*-test comparing anxiety levels before the intervention (T0) and after six weeks of mindfulness training (T5). Table 4 reports the results of a paired-sample *t*-test comparing anxiety levels before the intervention (T0) and after six weeks of mindfulness training (T5). Among the three subscales, only Worry showed a meaningful trend, with a decrease from T0 (M = 15.33) to T5 (M = 13.33). Although the paired-sample *t*-test did not reach statistical significance (t = 1.51, p = .15), the effect size was in the moderate range (Cohen's d = –0.39), suggesting a potential reduction in performance-related cognitive concerns. In contrast, both Somatic Anxiety (T0: M = 9.60; T5: M = 10.60) and Concentration Disruption (T0: M = 7.73; T5: M = 8.67) showed slight increases, which were not statistically significant. Overall, while the intervention did not significantly alter total anxiety scores, the observed reduction in worry points toward a promising direction for addressing cognitive aspects of sport-related anxiety. The overall averages of the scores obtained by athletes at T0 and T5 on the MIS are as follows: T0 average (before the protocol): 3.58; T2 aver-

[1]The audio tracks were originally produced by *Valeria Cioffi (Psicoempower_Cioffi)*.

[2]The League Evaluation is the official efficiency index reported by the league; it aggregates positive and negative contributions per game. The formula used in this study was: (free throws made – free throws missed) + (2-point field goals made × 2 – 2-point field goals missed) + (3-point field goals made × 3 – 3-point field goals missed) + offensive rebounds + defensive rebounds + assists + fouls drawn + blocks – turnovers – fouls committed – shots blocked. This definition is sourced from Lega Nazionale Pallacanestro (LNP, Italy).

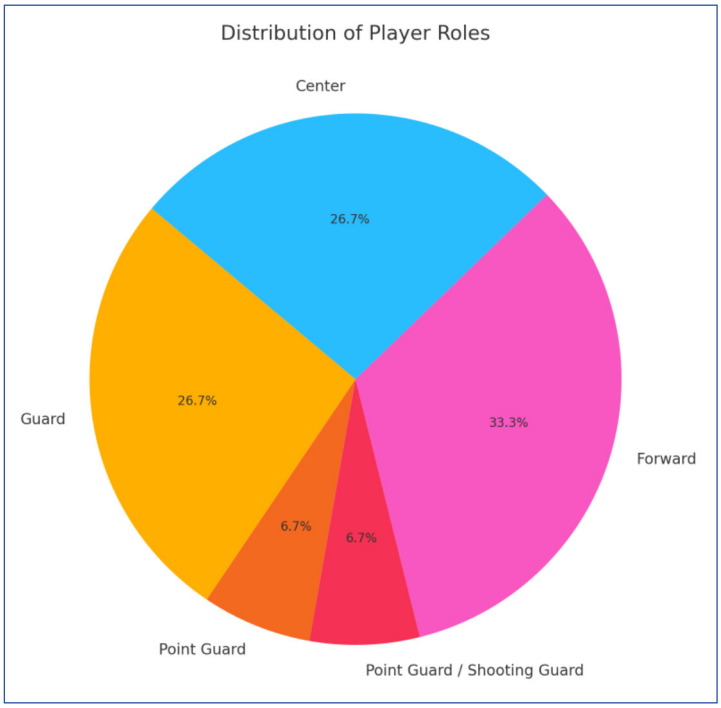

Figure 1. Distribution of Player Roles. The pie chart illustrates the distribution of player roles within the sample of 15 professional basketball athletes. The most represented role is Forward (33.3%), followed by Guard (26.7%) and Center (26.7%). The remaining players include Point Guard (6.7%) and Point Guard/ Shooting Guard (6.7%). This distribution indicates a heterogeneous composition of roles within the sample.

age (after the protocol): 3.40. The comparison of the MIS average scores obtained at T0 and T5 was not significant. The analysis of the subscales of the MIS, with a comparison of T0 *vs.* T5 and a *t*-test for paired samples, did not report any significant results too. The RESTQ-Sport-36 also showed a slight improvement in some subscales, including "sleep quality" with a trend toward significance (Mean T0=3.02; Mean T5= 2.71; *t*-value= 2.084; p = 0.057), although this did not reach statistical significance.

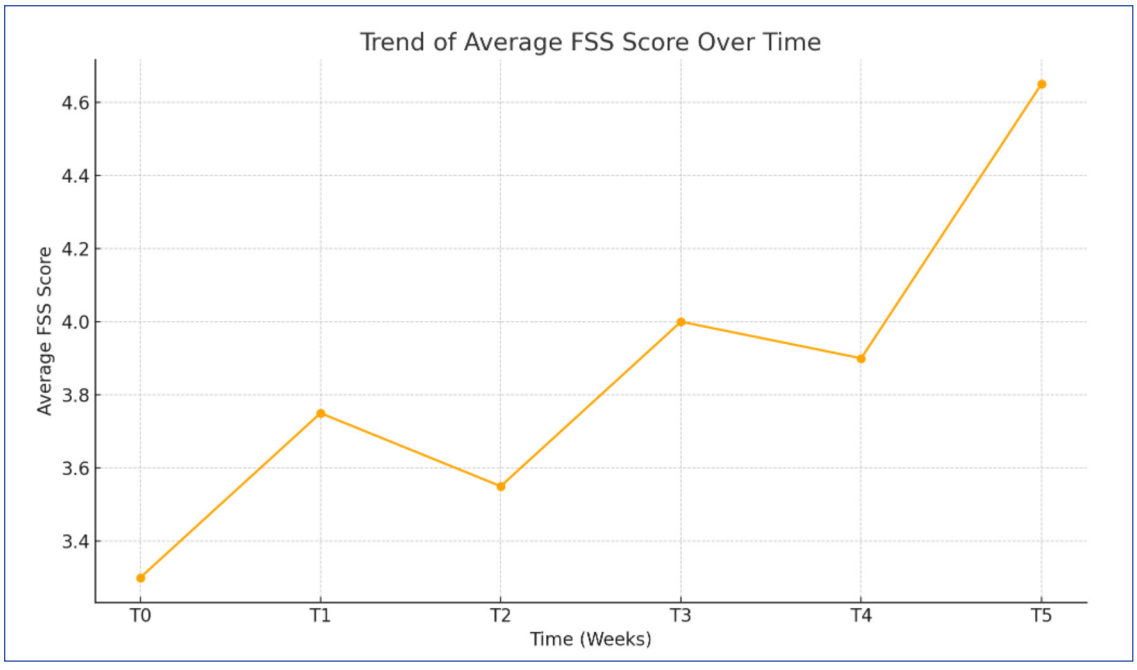

Figure 2. Trend of Average FSS Score Over Time. The line graph illustrates the progression of average Flow State Scale (FSS) scores across six time points (T0-T5) during the intervention period. The data show an overall upward trend, starting from 3.3 at T0 and reaching 4.6 at T5, indicating a consistent improvement in the athletes' flow experience over time, despite minor fluctuations at T2 and T4.

Table 1. Protocol description.

Template for Intervention Description and Replication	Description
Materials	Weekly 9-12-min audio tracks (body scan; breath-focused attention; grounding/present-moment focus; acceptance/non-judgment; competition visualization and pre-performance routine; integrative flow rehearsal). Optional reflective diary.
Procedures	Daily individual listening; weekly debriefs (group or brief 1:1 check-ins, ~10-20 min) to reinforce adherence and troubleshoot barriers.
Provider	A licensed psychologist-psychotherapist/sport mental coach.
SETTING	Remote delivery via smartphone; use in training/competition as needed.
TIMING	Six weeks; ≥1 session/day; reminders 2–3×/week.
Tailoring/Modifications	None.
Fidelity	Adherence tracked via self-reported practice logs and weekly usage checks; summarized as % days practiced.

Pearson's correlation coefficients were computed to examine the association between the athletes' average Flow scores and their performance metrics (points, assists, rebounds, and league evaluation). The results shown in Table 5 revealed that:

- Points: r = 0.65, indicating a strong positive correlation between Flow and points scored.
- Assists: r = 0.26, indicating a moderate positive correlation between Flow and assists.
- Rebounds: r = 0.32, suggesting a low-to-moderate positive correlation between Flow and rebounds.
- League Evaluation: r = 0.59, indicating a strong positive correlation between Flow and the overall league performance index.

These findings suggest that higher Flow scores are associated with better overall performance, particularly in scoring points and achieving higher evaluation ratings. Assists also show a meaningful association, while the relationship with rebounds appears weaker, likely due to role-specific demands and less cognitive influence on this aspect of performance (Figure 3).

A Principal Component Analysis (PCA) was conducted on four key performance indicators: Points, Assists, Rebounds, and League Evaluation (Table 6). The first principal component accounted for 60.1% of the total variance (eigenvalue ≈ 2.40), which is considered adequate for constructing a composite performance index. This exploratory component was used as the Performance Score (PCA) for subsequent analyses. Although variable loadings were not presented in detail, the purpose of this approach was not to explore factor structure but to obtain a robust single summary index. The exploratory component was therefore used exclusively as an aggregated performance measure.

A Pearson correlation analysis revealed a strong positive association between the Performance Score (PCA) and Flow (r = 0.60), indicating that athletes who reported higher levels of Flow also achieved better overall performance (Table 6). This suggests that the subjective experience of

Table 2. Descriptive characteristics of the sample.

Sample Size	15 professional athletes
Age (years)	Mean = 28 (SD = 6.05), Range = 19-40
Years of Competitive Activity	Mean = 13.07 (SD = 6.36), Range = 2-23
Playing Roles	Heterogeneous (Guards, Forwards, Centers, Point Guards)
League Distribution	66% Serie A2, 34% Serie B

Flow may play an important role in influencing objective game performance.

Figure 4 illustrates the relationship between Average Flow scores and the PCA-based Performance Score. The scatter plot shows a positive linear trend, confirmed by the regression line. The model indicates a strong positive association ($\beta \approx 0.85$, $R^2 \approx 0.72$), suggesting that higher Flow levels are associated with improved overall performance as captured by the composite PCA score.

Also, a linear regression was performed to assess the association between Flow scores and PCA Performance Scores (points scored, rebounds, assists and League Evaluation) (Table 7). The β coefficient was 2.11, with an R^2 of 0.361 and statistical significance $p < .001$. This indicates that approximately 36.1%

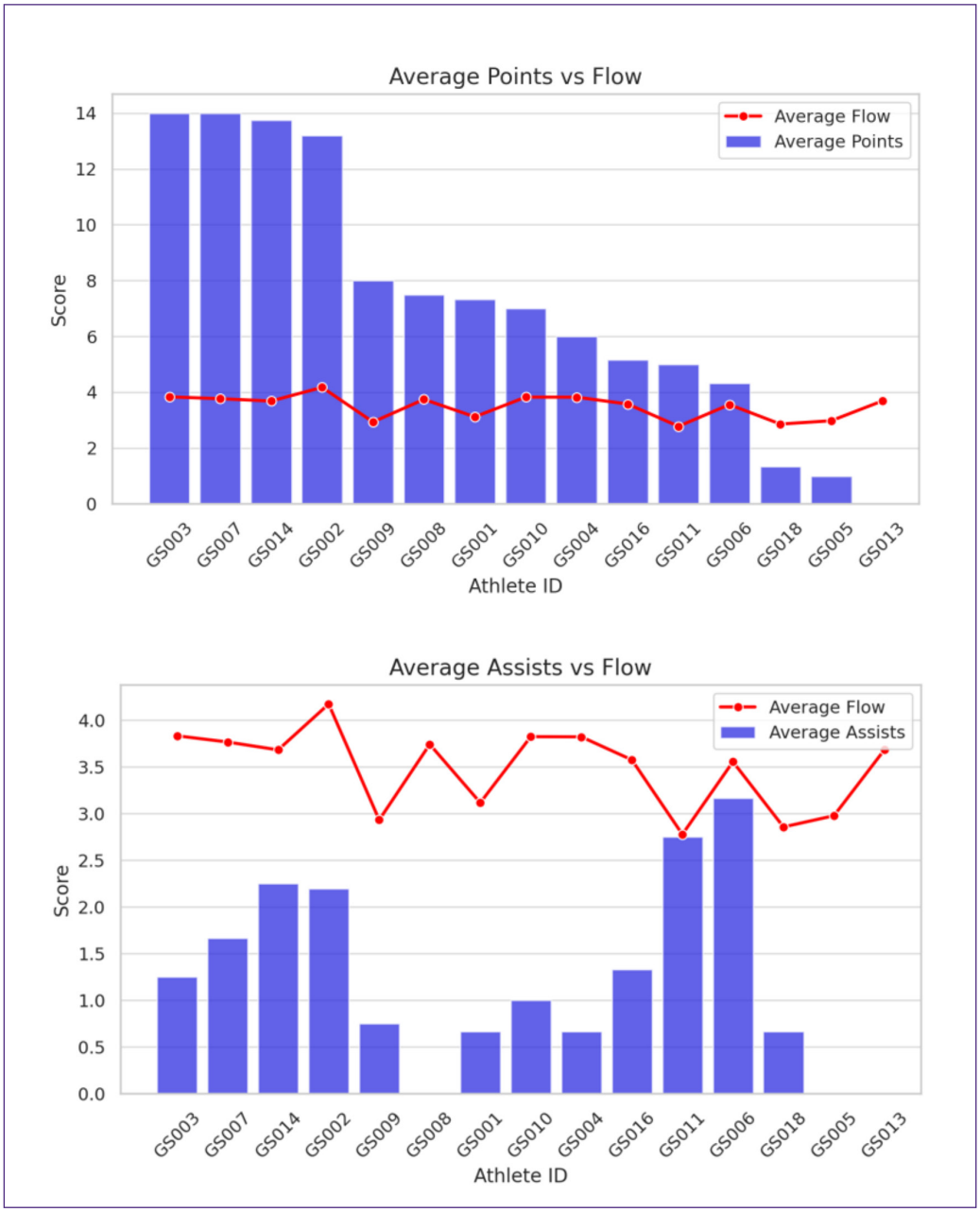

Figure 3. Comparison charts.

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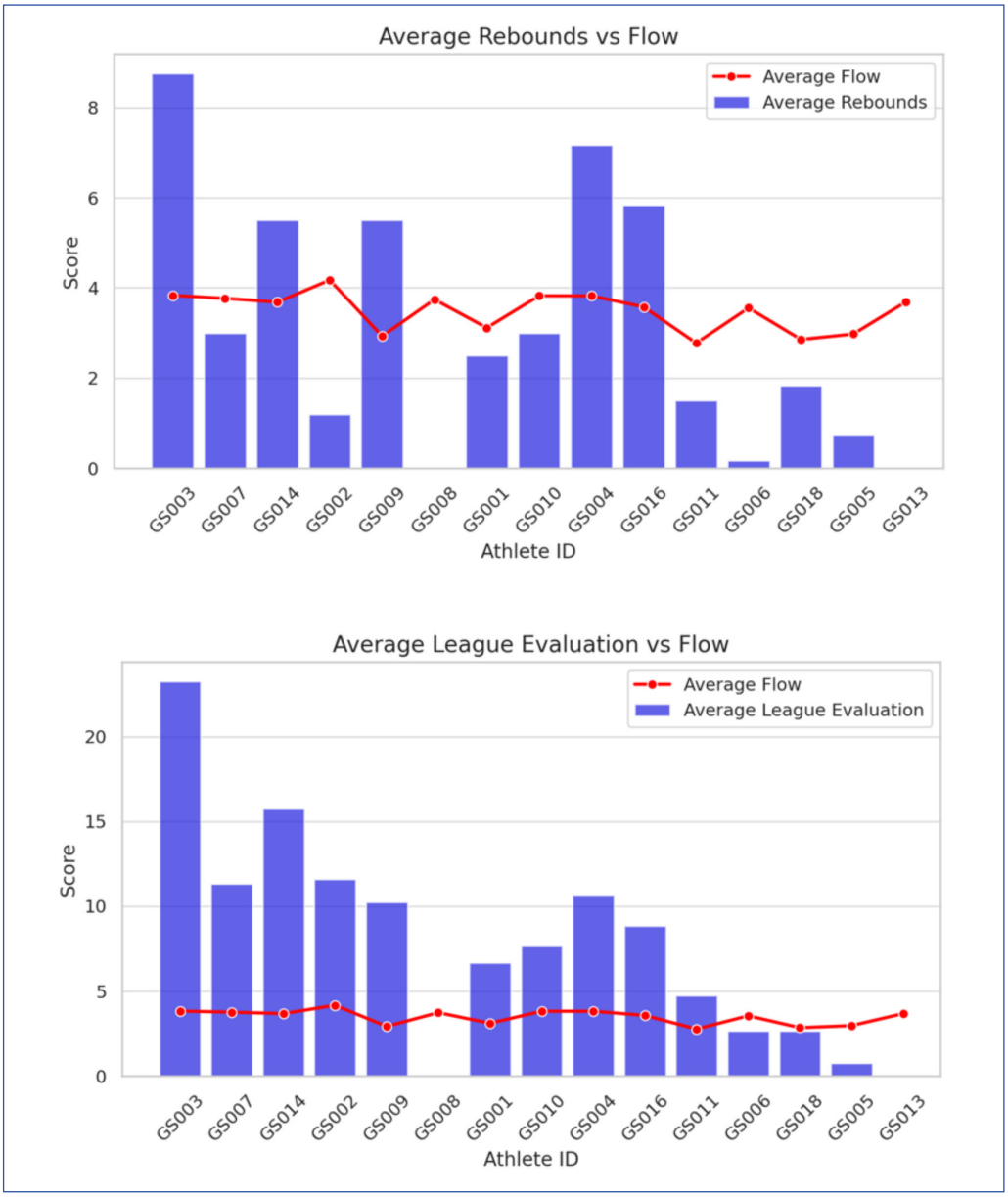

Figure 3. (*Continued*). Comparison charts.

Table 3. Paired sample *t*-test results for Flow State Scale (FSS) between T0 and T5.

Time	Mean	*t*	*p*
T0 *vs.* T5	T0 = 3.30, T5 = 4.62	-4.27	< 0.0037

Time	Mean FSS	STD FSS
T0	3.30	0.57
T1	3.73	0.72
T2	3.55	0.55
T3	4.00	0.85
T4	3.87	0.99
T5	4.62	0.51

Table 4. Paired t-test results for anxiety measures (Sport Anxiety Scale – 2).

SUBSCALE	*t*	*p*	COHEN_D
WORRY	1.55	0.15	-0.39
CONCENTRATION DISRUPTION	-1.07	0.30	0.28
SOMATIC TRAIT ANXIETY	-1.41	0.18	0.36

Table 5. Detailed averages per athlete: performance metrics, flow, and correlations.

Athlete ID	Avg Points	Avg Assists	Avg Rebounds	Avg Evaluation	Avg Flow
GS003	14.00	1.25	8.75	23.25	3.83
GS007	14.00	1.67	3.00	11.33	3.77
GS014	13.75	2.25	5.50	15.75	3.68
GS002	13.20	2.20	1.20	11.60	4.17
GS009	8.00	0.75	5.50	10.25	2.93
GS008	7.50	NA	NA	NA	3.74
GS001	7.33	0.67	2.50	6.67	3.12
GS010	7.00	1.00	3.00	7.67	3.82
GS004	6.00	0.67	7.17	10.67	3.82
GS016	5.17	1.33	5.83	8.83	3.58
GS011	5.00	2.75	1.50	4.75	2.78
GS006	4.33	3.17	0.17	2.67	3.56
GS018	1.33	0.67	1.83	2.67	2.86
GS005	1.00	0.00	0.75	0.75	2.98
GS013	NA	NA	NA	NA	3.69

Correlations between Flow and Performance Metrics. Avg Points: r = 0.648; Avg Assists: r = 0.257; Avg Rebounds: r = 0.317; Avg Evaluation League: r = 0.591.

of the variance in performance scores can be explained by the state of Flow, confirming the positive predictive effect of the Flow experience on athletic performance (Figure 5).

DISCUSSION

The statistical analyses resulting from this pilot study, despite the limitations arising from the small sample size and the absence of a control sample, suggest a significant positive impact of the experimental protocol based on mindfulness on both the state of Flow and anxiety levels of athletes.

In particular, the progressive increase in scores obtained in the questionnaire assessing subjective perception of access to Flow (FSS-2) during the six weeks of the protocol/mindfulness training, culminating in a statistically significant difference between T0 and T5, suggests that the protocol promoted a greater ability of athletes to enter a state of complete "contact" [21] with the performance experience [9, 11]. This finding is consistent with previous evidence demonstrating the effectiveness of mindfulness practices in promoting flow experiences in sports contexts [22, 23].

The findings of the present study suggest that mindfulness training did not significantly reduce overall levels of sport performance anxiety, as indicated by the non-significant changes in the total SAS-2 score. When examining the subscales, an interesting pattern emerged. The Worry dimension showed a moderate reduction from pre- to post-intervention, with a decrease in mean scores (from 15.33 to 13.33) and a moderate effect size (Cohen's d = –0.39), despite the lack of statistical significance. This trend indicates that mindfulness practice may be particularly effective in targeting cognitive aspects of

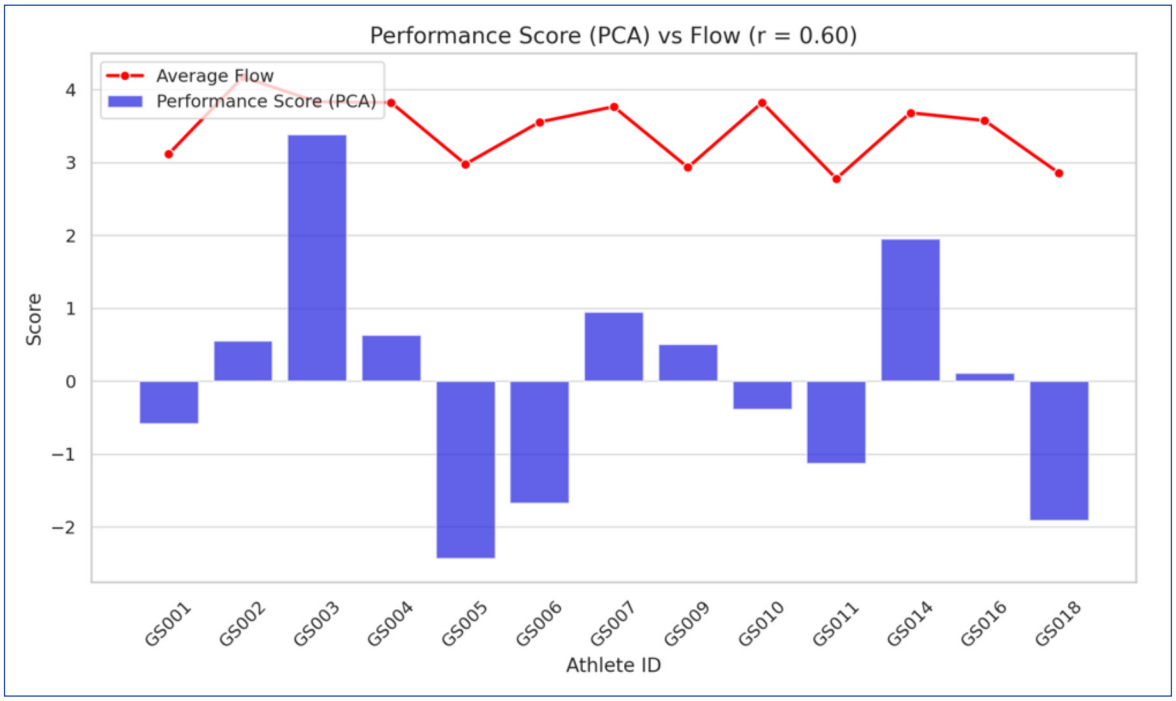

Figure 4. PCA performance score *vs.* flow.

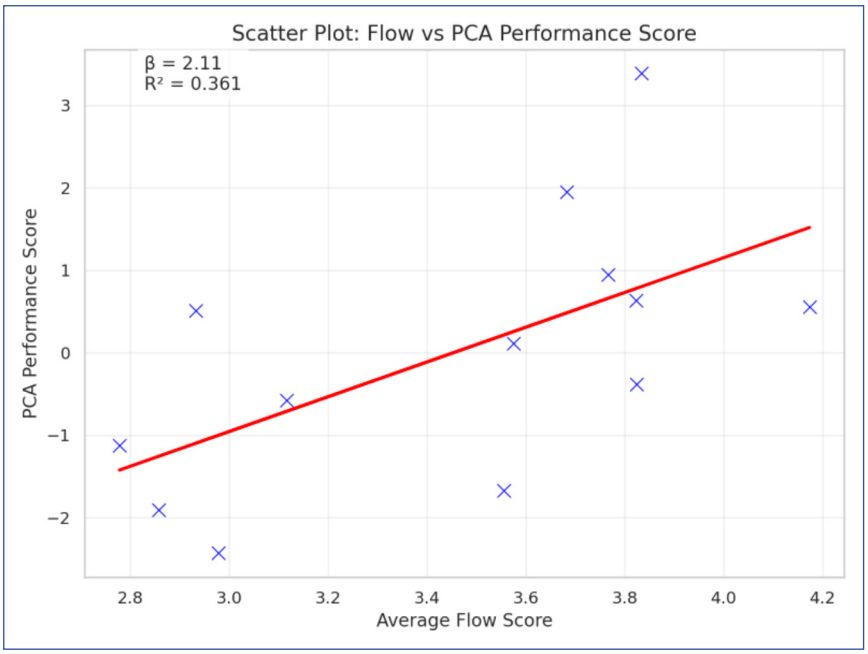

Figure 5. Scatter plot: flow *vs.* PCA performance score.

performance anxiety, such as fear of failure or concerns about disappointing others. Both Somatic Anxiety and Concentration Disruption showed small, non-significant increases after the intervention. One possible interpretation is that while athletes became less cognitively preoccupied, they might become more attuned to bodily sensations and moment-to-moment focus, which could temporarily amplify the perception of somatic tension or attentional fluctuations. This shift may reflect an early stage in the process of integrating mindfulness skills, where athletes first reduce ruminative thoughts but still need further practice to regulate physiological arousal and

maintain concentration under pressure. Taken together, these findings highlight the nuanced impact of mindfulness interventions: rather than producing an immediate global reduction in anxiety, they may first alleviate cognitive worry, with potential long-term benefits for concentration and somatic regulation as practice consolidates [7, 8]. Future research with larger samples and extended training periods is warranted to further explore these trajectories. These results are extremely important, as the scientific community in this field is aware of the role played by anxiety as a factor interfering with sports performance, especially in disciplines where there is highly competitive pressure [24, 25].

On the other hand, no significant changes were found in the average MIS scores and in the RESTQ-Sport-36 subscale. This suggests that the effectiveness of the protocol focuses mainly on attentional and regulatory aspects related to flow, rather than on structural changes in perceived mindfulness skills or recovery quality. In this regard, it should be noted that flow is characterized by a high level of task focus associated with a significant reduction in internal and external distractions [11]. The practice of mindfulness promotes precisely this latter condition, increasing the ability to maintain attention on the present moment and reducing attention dispersion, often related to intrusive thoughts or performance anxiety [23, 26].

In addition to attentional aspects, flow also requires effective regulatory control, which allows athletes to modulate their physiological arousal levels and emotional responses according to the demands of the task. The techniques proposed in the protocol probably facilitated this process, allowing for better management of arousal and emotions during competition, thus promoting the maintenance of an optimal psychophysiological state for performance [7, 22].

The fact that no significant changes emerged in the measures assessing predisposition to mindfulness (MIS), while flow showed a significant increase, suggests that the effectiveness of the protocol focused mainly on contextual and situational skills rather than stable traits. In other words, the intervention seems to have acted on attentional and regulatory processes directly involved in the optimal experience during competition, without significantly altering the general characteristics of awareness. The latter change would probably be desirable with stable and longer-term training, such as mental coaching or an extended intervention, which helps the athlete on a path of self-awareness and awareness of their personality functioning, their script, and their system of beliefs and decisions [27, 28] during sports performance.

However, the almost significant trend observed in the RESTQ's "sleep quality" subscale gives rise to the hypothesis that a longer intervention, or simply one with a larger sample size, could have led to more extensive improvements in psychophysical recovery [29].

The most interesting finding certainly concerns the relationship between flow and performance. The positive correlations that emerged between the average flow scores and the performance indicators collected (points, assists, overall evaluation) confirm what has been reported in the literature on the link between states of optimal experience and performance in competitions [11,30]. The highest correlation with the overall evaluation score of the reference league ($r = 0.59$) suggests that flow not only affects individual technical skills but also seems to have a significant impact on more integrated and complex aspects of performance, such as the ability to read the game and effective decision-making. Flow correlated with points and league evaluation, yet correlation does not imply causation; the association should be interpreted cautiously given the design.

PCA analysis allowed us to synthesize performance variables into a single composite index, explaining over 60% of the variance and confirming the robustness of this approach for performance evaluation [31]. Furthermore, linear regression showed that flow explains 36.1% of the variance in performance, highlighting the relevance of this psychological dimension as a predictor of competitive success. This result reinforces theories that optimizing attentional and motivational states is a determining factor for high-level performance [32, 33].

Overall, the data obtained are promising and confirm the effectiveness of mindfulness-based interventions in improving key psychological variables for sports performance and suggest a central role for flow as a mediator between attention-

Table 6. Performance metrics and PCA score.

Athlete ID	Avg Points	Avg Assists	Avg Rebounds	Avg Evaluation	Performance Score (PCA)
GS001	7.33	0.67	2.50	6.67	-0.58
GS002	13.20	2.20	1.20	11.60	0.55
GS003	14.00	1.25	8.75	23.25	3.39
GS004	6.00	0.67	7.17	10.67	0.64
GS005	1.00	0.00	0.75	0.75	-2.43
GS006	4.33	3.17	0.17	2.67	-1.68
GS007	14.00	1.67	3.00	11.33	0.95
GS009	8.00	0.75	5.50	10.25	0.51
GS010	7.00	1.00	3.00	7.67	-0.38
GS011	5.00	2.75	1.50	4.75	-1.13
GS014	13.75	2.25	5.50	15.75	1.95
GS016	5.17	1.33	5.83	8.83	0.11
GS018	1.33	0.67	1.83	2.67	-1.91

* The correlation between the Performance Score (PCA) and Flow was r = 0.60, indicating a strong positive association.

Table 7. Linear regression results predicting performance from flow scores.

Dependent Variable	Predictor	β Coefficient	R	*p*
PCA Performance Score (points, rebounds, assists, League Eval.)	Flow	2.11	0.361	< 0.001

al processes and competitive results. This evidence supports the opportunity to integrate structured mental training programs into the preparation of professional athletes, in line with recent approaches to sports psychology [25].

CONCLUSIONS

This exploratory study provides preliminary evidence on the effectiveness of a mindfulness-based protocol in increasing and promoting the experience of flow, significantly reducing anxiety levels in professional athletes. The results show a significant improvement in the state of flow and a marked decrease in performance anxiety after just the first few weeks of intervention, elements that are key factors for optimal performance. Although no significant changes were found in measures describing the degree of predisposition to mindfulness, the data suggest that the intervention acted on attentional and situational regulatory processes, influencing the quality of the experience during the competition rather than stable personality traits.

A particularly relevant aspect is the positive correlation found between flow and performance, confirmed by both correlation analysis and linear regression, which attributes a substantial predictive role to flow in terms of performance. This result reinforces the need for psychological interventions aimed at developing attentional-regulatory skills to promote states of optimal experience, with potential benefits for overall performance.

However, this data should be interpreted with caution due to methodological limitations, particularly the small sample size and the absence of a control group. Future studies should include larger samples, controlled experimental designs, and longer-term protocols in order to consolidate the results and further investigate the impact of mindfulness on psychophysical recovery variables and more stable awareness traits. Despite these limitations, the results offer promising

indications for the integration of mindfulness-based mental training programs in the preparation of high-level athletes, in line with the most recent models of sports psychology.

Limitations and Future Prospects

Among the main limitations of the study are the absence of a control group, the limited sample size, and the subjective self-assessment of flow. Internal validity is limited by the single-group pre–post design, small sample size, and the absence of a control group. Potential expectancy and placebo effects may have contributed to the observed changes. Although our research design allowed for the possibility of obtaining objective measures of flow related to psychophysiological parameters, only 40% of the sample had a device for detecting these parameters, which prevented us from obtaining numerically valid measurements for comparison within and between subjects. We anticipate that future studies will include physiological measurements (HRV, EEG), post-intervention qualitative assessments, and larger samples. It would also be useful to compare different mindfulness approaches (MBCT, ACT, Yoga Nidra) to assess their comparative effectiveness in sports contexts.

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Institutional Review Board Statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and the Ethical Code for Research in Psychology of the Italian Association of Psychology (AIP), approved in 2015 and updated in July 2022 to comply with GDPR regulations (aipass.org). The study has been approved by the Ethical Committee of the Department of Psychology of the University of Naples Vanvitelli (n.26/2025). All procedures adhered to ethical standards to protect participants, ensuring anonymity, data confidentiality, and obtaining informed consent.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request (dr.valeria.cioffi@gmail.com). Due to privacy and ethical considerations, the data are not publicly accessible.

Conflict of Interest

The authors declare no conflict of interest.

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