



EFFECTS OF FLOW STATES ON ELITE ATHLETES IN TEAM SPORTS: A SYSTEMATIC REVIEW

EFEITOS DOS ESTADOS DE FLUXO NOS ATLETAS DE ELITE NOS ESPORTES DE EQUIPE: UMA REVISÃO SISTEMÁTICA

EFFECTOS DE LOS ESTADOS DE FLUJO EN ATLETAS DE ÉLITE EN DEPORTES DE EQUIPO: UNA REVISIÓN SISTEMÁTICA

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ABSTRACT

The *flow* state has materialized as a condition of possibility for the search for the best performance in sports, both individual and collective. The objective of this systematic review of studies was to identify which form the “state of *flow*” influenced the sports performance of team sports athletes. Up from references to selected databases (for example, Web of Science Core Collection; SPORTDiscus (EBSCO-Host); PsycINFO and Pubmed), the results showed that 1946 articles were obtained, with the exclusion of duplicate studies (n = 407). Among the 46 articles that emerged from the analysis, the data excluded 37 studies, and considering an amount of 9 articles which were included in the final section of the systematic review and carried out in the period from 2015 to 2020. As a result, the *flow state* enhances a full absorption involvement of team-sport

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athletes. Emotional states tend to be part of an athlete's success. Knowing the three essential fields that comprise this scope (*flow*-mindfulness-performance) allows us to raise questions for the future, inherent to the effects of performance and the magnitude of the athlete's response depending on their individual characteristics, action possibilities, task constraints, and how much this influences their state of *flow* at the individual and collective levels.

Keywords: Flow; mindfulness; team sports; athlete; performance; sport psychology.

RESUMO

O estado de fluxo materializou-se como condição de possibilidade de busca do melhor desempenho em esportes, tanto individuais como coletivos. O objetivo desta revisão sistemática dos estudos foi identificar qual forma do "estado de fluxo" influenciou o desempenho esportivo dos atletas esportivos da equipe. A partir de referências a bases de dados selecionadas (por exemplo, Web of Science Core Collection; SPORTDiscus (EBSCO-Host); PsycINFO e Pubmed), os resultados mostraram que 1946 artigos foram obtidos, com exclusão de estudos duplicados ($n = 407$). Entre os 46 artigos que surgiram da análise, os dados excluíram 37 estudos, e considerando uma quantidade de 9 artigos que foram incluídos na seção final da revisão sistemática e realizada no período de 2015 a 2020. Como resultado, o estado de fluxo aumenta um envolvimento total de absorção de atletas de equipe esportiva. Estados emocionais tendem a ser parte do sucesso de um atleta. Conhecer os três campos essenciais que compõem este escopo (fluxo-mindfulness-desempenho) nos permite levantar questões para o futuro, inerentes aos efeitos do desempenho e da magnitude da resposta do atleta, dependendo de suas características individuais, possibilidades de ação, restrições de tarefas, e o quanto isso influencia seu estado de fluxo nos níveis individual e coletivo.

Palavras-chave: Fluxo; mindfulness; esportes de equipe; atleta; desempenho; psicologia esportiva.

RESUMEN

El estado de flujo se ha materializado como una condición de posibilidad para la búsqueda del mejor desempeño en el deporte, tanto individual como colectivo. El objetivo de esta revisión sistemática de estudios fue identificar qué forma del "estado de flujo" influyó en el rendimiento deportivo de los deportistas de equipo. A partir de referencias a bases de datos seleccionadas (por ejemplo, Web of Science Core Collection; SPORTDiscus (EBSCO-Host); PsycINFO y Pubmed), los resultados mostraron que se obtuvieron 1946 artículos, con la exclusión de estudios duplicados ($n = 407$). Entre los 46 artículos que surgieron del análisis, los datos excluyeron 37 estudios, y considerando un total de 9 artículos que fueron incluidos en la sección final de la revisión sistemática y realizados en el período 2015-2020. Como resultado, el estado de flujo mejora la absorción total de los atletas de deportes de equipo. Los estados emocionales tienden a ser parte del éxito de un atleta. Conocer los tres campos esenciales que componen este ámbito (flujo-mindfulness-performance) nos permite plantear interrogantes para el futuro, inherentes a los efectos del rendimiento y a la magnitud de la respuesta del deportista en función de sus características individuales, posibilidades de acción, limitaciones de tareas, y en qué medida esto influye en su estado de flujo a nivel individual y colectivo.

Palabras clave: Flujo; atención plena; deportes de equipo; atleta; rendimiento; psicología del deporte.

1. Introduction

The flow state has been the object of several studies and interest some researchers in sports psychology and high-performance levels on sports. Some of these investigations (e.g., Schmidt et al., 2020; Deol & Singh, 2016; Zumeta et al., 2016; Chavez, 2008) have correlated flow with the possibility of optimizing athlete's performance in different contexts. The tendency obtained in literature about mental state is taking the athlete to the top of his/her performance.

Csikszentmihalyi (1990) defined the flow state as a mental state in which people are so involved in the task to perform that nothing else seems to matter. They are in a deep state of relaxed concentration and effortless attention. An exceptional state of order in conscience takes place, once his/her thoughts, intentions and feelings are in complete harmony.

Thereby, Csikszentmihalyi (1990) and Jackson and Csikszentmihalyi (1999) suggest that flow state is formed by nine fundamental dimensions (9D): i. challenge-skills balance; ii. action-awareness merging; iii. clear goals; iv. unambiguous feedback; v. concentration on the task at hand; vi. sense of control; vii. loss of self-consciousness; viii. transformation of time and ix. autotelic experience.

Once these nine dimensions (9D) have been identified, it is possible to recognize some movements in the studies about flow state in sports. These movements take, over the years, a distinct research path.

The first moment, beyond focusing on the description and identification of fundamental elements that constitute flow as a concept (Csikszentmihalyi, 1990; Jackson and Csikszentmihalyi 1999), sets the making, validation, and internal consistency pursue for scales that allow flow measurement: *Flow State Scale - FSS1* (Jackson & Marsh, 1996); *Flow State Scale - FSS2* and *Dispositional Flow State - DFS* (Jackson & Eklund, 2002); and its validation to other languages and cultures (e.g., Bittencourt II et. al, 2021 – DFS Brazilian version; Hernandez & Voser, 2019 – FSS2 Brazilian version).

The second movement represents the discovery of conditions that may prevent, interrupt, facilitate, trigger, and restore flow state. This research type (e.g. Kruyt, Grobbelaar, 2019; Sicilia et al., 2017; Jackson, Roberts, 1992) aims

to identify which factors facilitate athletes to achieve flow state and which aspects hinder or make them leave it. According to Sparkes and Partington (2003), the studies about flow state have swung between the description of its main features (i.e., how it is characterized) and the search for means of making it happen and manipulating it.

In the wake of this attempt of handling flow state, a set of investigations sought to correlate it to other theories and psychological constructs that may have an impact on it. In this sense, some research tried to associate flow to personality traits, self-regulation processes, beliefs systems, self-determination, as well as emotions control and mood (Cooper et al., 2018; Stavrou et al., 2015; Gomes et al., 2013; Moreno Murcia et al., 2008; Jackson et al., 1998, 2001; Jackson, 1995).

The third movement arose from the criticism to flow state and its confrontation to other possible mental states as experienced by athletes: clutch state (Swann, Crust, Jackman et al., 2017b, 2017a), mental toughness (Ajilchi et al., 2019; Jackman et al., 2017) and the very unfolding of flow (telic / paratelic flow, Mackenzie et al., 2011). This confrontation, besides bringing new categories to analyze flow state, offered advancements in the way it is induced – flow training (Norsworthy et al., 2018).

Finally, the fourth movement triggered the approach of flow (forms of induction, manipulation, and experimentation of this phenomenon) to alternative therapies, mostly mindfulness (Chen et al., 2019; Bühlmayer et al., 2017; Liberati et al., 2009). Along this movement, it was attempted to explain the advantages of being in such an elevated state of consciousness and the effects over some performance elements. Roebuck et al. (2018) indicates, for example, a requirement for future studies in the sense that they investigate how much flow state influences, mainly, the cognitive-emotional performance of athletes.

Some gaps are notorious among these movements, particularly when it comes to relate flow state to team sports and to its impact on sports performance (Norsworthy et al., 2018; Swann et al., 2018; Stoll, Ufer, 2012). More precisely, these gaps concern invasion team sports once their essence lies on the presence of opponents who constantly confront the team/player goals (Afonso, Garganta & Mesquita, 2012; Martiny, 2012; González, 2004). Such a condition establishes,

by itself, a high level of unpredictability in the game environment. This substantially corroborates to the difficulty of reaching flow states in team sports due to the huge number of factors that must be adapted and controlled (Jackson, Csikszentmihalyi, 1999).

In view of the above, the goal of this systematic review is to investigate the way flow state happens in team sports (i.e., what prevents, interrupts, restores, triggers, facilitates, and hinders the achievement of flow state) and the way it influences athlete's performance or output. Within the scope of this approach, two research questions arise: i. What aspects of athlete's performance in team sports (psychological, physiological, technical, tactical) are directly influenced by flow? and ii. What is the direction (positive / negative) of such an influence/effect?

Therefore, this systematic review sought, at first, to map these indicators that affect flow state in this sports category. A second focus was to understand the impact of flow state on athlete's performance. Thus, part of the relevance of this study lies on the representation of the consequences/effects of flow state on performance.

2. Methodology

This study was carried out following the guidelines of the original checklist of preference reporting items for systematic reviews and Meta-analysis (PRISMA – Liberati et al., 2009). The protocol for this systematic review was registered in the Inplasy protocol 2021110114. Doi 10.37766/inplasy2021.11.0114

2.1 Sources for This Research

The search was conducted in the following electronic databases, namely: Web of Science core Collection; SPORTDiscus (EBSCO-Host); PsycINFO. It was held between October 19th and October 28th, 2020.

The data we have worked with have come from an advanced search option of metasearch tools as well as the strategy of combined search of three groups of indexed descriptors so designated:

"Flow" OR "flow state" OR "Dispositional flow" OR "The fundamentals of flow" OR "flow in sports" OR "Autotelic experience" OR "self-transcendence" OR

"self*" OR "evolving self" OR "optimal experience" OR "Peak moment" OR "peak performance" OR "Peak experience" OR "IZOF" OR "in zone" OR "being in zone" OR "Mindfulness" OR "Meditation" OR "Entropy" OR "Negentropy" AND

"Team sport*" OR "team-sport*" OR "handball" OR "handball" OR "Football" OR "Soccer" OR "Basketball" OR "Rugby" OR "futsal" OR "Hockey" OR "Ice Hockey" OR "water polo" AND

"psychological" OR "mood" OR "emotion*" OR "Mental energy" OR "Mental" OR "Energy" OR "Spiritual" OR "Physiological" OR "Technique" OR "Technical skill*" OR "Skill" OR "Tactical intelligence" OR "tactical" OR "decision-making in team-sport*" OR "decision-making" OR "cognitive performance" OR "cognitive*".

After this methodology, the articles were exported to the bibliographic reference management software: Mendeley, for verification and exclusion of duplicate studies.

2.2 Eligibility Criteria

The studies included in this systematic review followed some criteria: i) only original studies carried out with athletes or student-athletes over 14 years old (Swan, 2016); ii) only studies carried out with team sports and *flow* (a weakness indicated in studies of Norsworthy et al., 2017, 2018); iii) studies published in Portuguese, English and Spanish; iv) studies using qualitative, quantitative or mixed methods; v) studies published between 2015-2020 (appropriate search time reference of Sampaio & Mancini, 2007); vi) studies that used quasi experimental, experimental groups and/or control groups, with preference for studies that included pre-and post-tests; vii) studies that presented methodologies to improve, induce, facilitate, achieve *flow* (e.g., mindfulness, imagery meditation, *flow* training, Integral Yoga, Self-talk); viii) studies that addressed different types of methodology for teaching-learning-training team sports (e.g., global method; situational-active method; traditional method) relating them to the *flow* state and; ix) types of tests used to measure personality traits, nomothetic profile [emotions, energy, mood] associated – [correlation and causality] – with the *flow* state (e.g., Big five personality test; Individual Zone of

Optimal Functions (IZOF); Hedonic orientation of experienced emoticons (Hedonic tone); Self-determination theory; Dispositional *flow* state scale; Satisfaction perception).

The studies we excluded were the ones which: i) only measured the *flow* state, namely, the FSS or DFS or ESM, without correlating it with variables of personality traits, training method and/or sports performance (e.g., cognitive), (cf indicated in the studies by Roebuck et al. 2018); ii) studies that presented samples with individual sports; iii) studies that used measures other than the FSS, the DSF, or the ESM to measure the *flow*; iv) systematic review studies; v) case studies; vi) test validation studies for versions in other languages.

2.3 Data Extraction

Phase 1 – Using the search strategies and keywords, the first step we took was the exclusion of duplicate papers and right after the identification of the relevant titles of the selected articles. For this purpose, a reference program (Mendeley) was used to treat the initial data of the studies. Two independent reviewers selected the remaining articles by reading titles and abstracts. In this reading, it implied observing whether the titles and/or abstracts showed the study population, type of investigation, comparison, and results, in addition to the instruments and techniques for data collection. When titles and abstracts provided insufficient information (e.g., they do not show whether the study was carried out with samples and whether these were only with team sports), the reviewers implemented the complete reading of the article. A third reviewer was requested when there was no agreement on the selection of articles.

Phase 2 – After the initial selection through the titles (i.e., performed by two members of the review team), the reading of the abstracts started. During this process, two members of the research team selected the articles that were read in full, according to the eligibility criteria already pointed out in item 2.1. Finally, when there were disagreements between the two reviewers, a third investigator entered the review process.

Phase 3 – Phase of the complete reading of the articles. The reasons for excluding articles were obtained using the PRISMA *flow* diagram and are described in Figure 1 (Liberati et al., 2009).

Phase 4 - Once the final sample of articles that were part of the systematic review was defined, the information codification phase began, which included: i) the research identification data; ii) the results obtained (i.e., criteria that affected the *flow* state in team sports and the *flow* effects on the athlete's performance), and, finally; iii) the final evaluation of the study.

2.4 Quality of Information

To recognize the quality of information and control the data obtained, in the analysis of the articles, the PRISMA checklist was used (Galvão, Pansani, Harrad, 2015). Consequently, the first procedure for data synthesis was the construction of a control panel (dashboard) to extract information from the analyzed articles. In this panel, the following information was included: i) identification data (1st author and year); ii) experimental design of the study; iii) participants (age, gender, and level of expertise); iv) Type of collective sport/Country; v) intervention model; vi) Instruments; and vii) main results obtained (Roebuck et al., 2018; Stamatelopoulou et al., 2018).

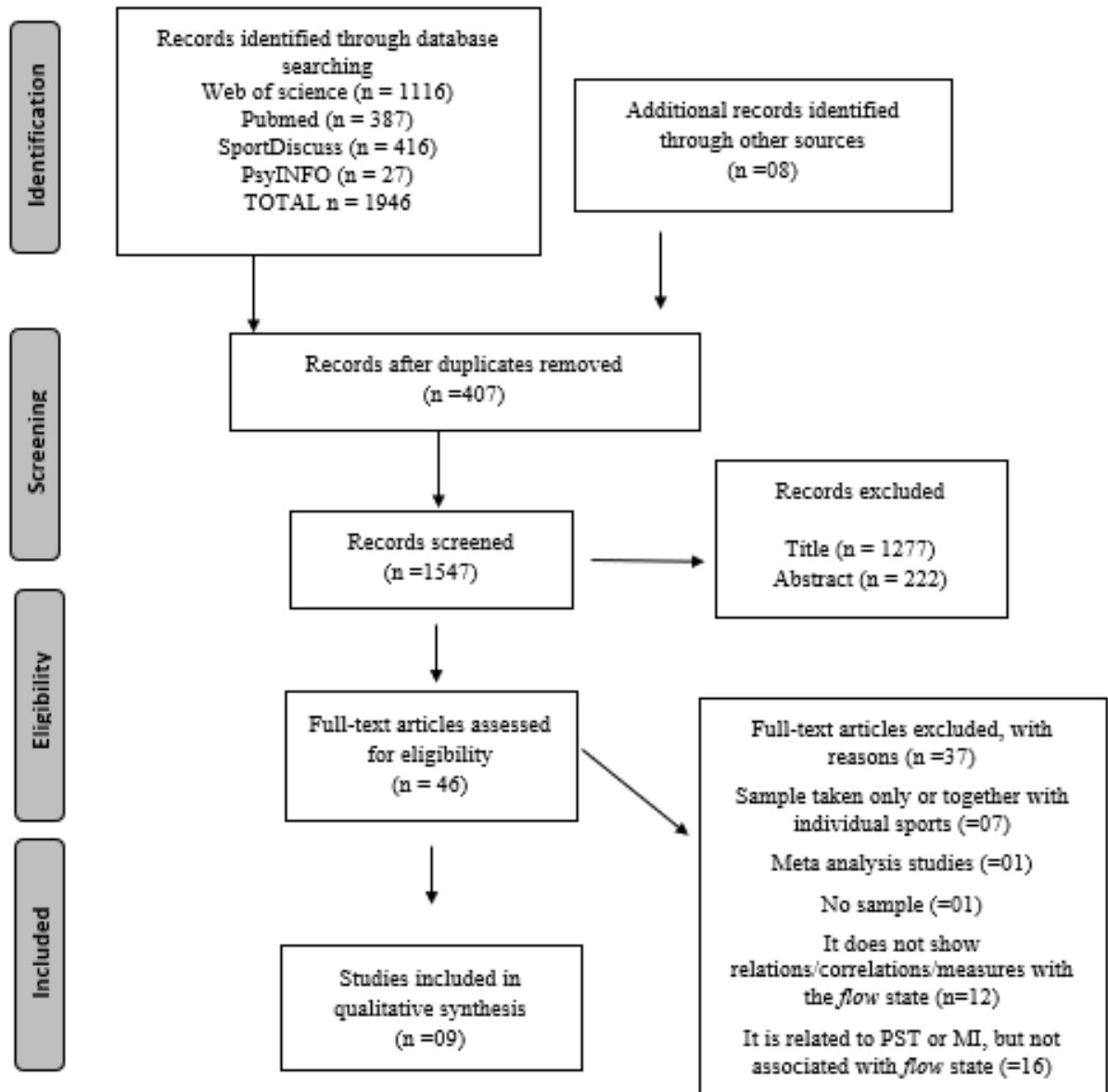
It is important to notice that the results were divided in two categories: i) *flow* state in team sports (i.e., prevent, restore, maintain, disturb, trigger, facilitate and hinder); and ii) effects on performance (psychological, e.g., mood/emotions) – physiological, technical, tactical. Finally, a general evaluation of the article was performed, highlighting the most relevant points of each study (e.g., quality of the sample and the level of expertise of participating athletes in years of practice and level of competition and the quality of methodological interventions) and the main gaps indicated by the studies themselves.

3. Results

The search in the selected electronic databases resulted in a sample of 1946 articles. After excluding duplicate studies (n=407), we began the phase of reading the titles and abstracts. Subsequently, 46 articles were selected for full

reading. From the total of selected articles, 37 were excluded according to the justifications presented in the flow diagram (figure 1), thus totaling 09 articles, which were included in the final analysis of the systematic review. The basic structure of these 9 articles can be analyzed in detail in “Table 1” below.

Figure 1 – Prism *flow* diagram and article selection process for systematic review.



Source: Elaborated by the authors, based on Liberati et al. (2009)

Table 1 – Studies about *flow* in team sports (2015-2020)

Identification		Type	Measurements		Main Results	Affect elements of sport performance
Reference	Study type	Participants	Sport/ Country	Intervention	Instruments	Affect flow
1 (Castillo-Rodríguez et al., 2020b)	Transversal	n=141 boys U16 (14.7 ± 0.5 years)	Soccer/ Spain	-	a) Flow State Scale – FSS 2 b) Ad hoc socio-demographic questionnaire	Inverse correlation between training hours and flow BMI and height affect flow state dimensions. Position in the game affects flow elements differently.
2 (Rochniak et al., 2020)	Transversal	n=160 boys 15–20 years	Basketball / Ukraine	-	a) self-regulation of sports activities survey b) Dispositional Flow State – DFS 2 c) Test of dispositive optimism	Self-motivated and identified regulation, combined with low external regulation and moderate introspective values facilitate the entry into a flow state. Self-regulation autonomy facilitates greater inclination and reflection on the flow components.
3 (Urena Lopera et al., 2020)	Transversal descriptive-inferential traits	n= 141 boys U16 (14.7 ± 0.5 years)	Soccer / Spain	-	a) Flow State Scale -FSS 2 (Spanish version 2008) b) Sport motivation scale c) Ad hoc socio-demographic questionnaire	Athletes who can experience episodes of flow states during competition are practitioners more stimulated by intrinsic motivation – than by extrinsic motivation – relying on more self-determined goals.
4 (Carraca, Serpa, Rosado, Guerrero, et al., 2019)	Quasi-experimental	n= 57 men ±25.68 years. Professional soccer players	Soccer / Portugal	MBSoccerP 8 weeks (9 sections, 90 to 120 minutes each	a) General demographic information sheet. b) Self-Compassion c) Five Facet Mindfulness Questionnaire-FFMQ d) <i>Flow</i> State Scale - FSS-2 e) Brief Symptom Inventory-BSI. f) Acceptance & Action Questionnaire-AAQ II g) White Bear Suppression Inventory-WBSI	Improved mindfulness, self-compassion, and the state of flow Experiential avoidance and psychological inflexibility affect the willingness to flow.
5 (Carraca, Serpa, et al., 2019)	Pilot Study	n= 57 men ±25.68	Soccer / Portugal	MBSoccerP 8 weeks (9	a) Demographics b) Psychological inflexibility. (AAQ)	Self-compassion had no effect on the flow. Psychological

Rosado, & Palmi Guerrero, 2019)	years. Professional soccer players	n = 21 (22 to 30 years) ±26.38 years.	Baseball / Taiwan	sections, 90 to 120 minutes each	c) Mindfulness (FFMQ) d) Dispositional Flow State. (DFS) e) Self-Compassion Scale-(SCS) f) Performance Self-Rating Scale (Athlete's - FAIP-A e Coach's - FAIP-T)	Experiential avoidance/psychological inflexibility affect willingness to flow; Mindfulness favors greater flow, post-intervention; increasing players' attributes of mindfulness, compassion, psychological flexibility, flow, and peak performance.	aspects of performance (stress, anxiety, psychological inflexibility).
6 (Chen et al., 2019)	Pilot Study	n = 21 (22 to 30 years) ±26.38 years.	Baseball / Taiwan	MSPE (4 weeks)	a) Patient health Questionnaire (PhQ-9) b) Beck anxiety inventory (Bai) c) eating disorder examination Questionnaire (eDe-Q) d) Pittsburg sleep quality index (cPQi) e) Flow state scale-2 (Fss-2) f) Revised competitive state anxiety inventory-2 (csai-2R) g) Mindful attention awareness scale (Maas)	Mindfulness corresponded positively with the state of flow.	-
7 (Carraça et al., 2018)	Quasi-experimental design	n = 57 men ±25.68 years. Professional soccer players	Soccer/ Portugal	MBSoccerP 8 weeks (9 sections, 90 to 120 minutes each)	a) General demographic information sheet. b) Self-Compassion c) Five Facet Mindfulness Questionnaire-FFMQ d) Flow State Scale - DFS-2 e) Brief Symptom Inventory-BSI. f) Acceptance & Action Questionnaire-AAQ II g) White Bear Suppression Inventory-WBSI h) Performance Self-Rating Scale (Athlete's - FAIP-A e Coach's - FAIP-T)	Mindfulness increases the flow experience of athletes.	Psychological aspects that interfere with performance (stress, anxiety and thought suppression).
8 (Kawabata, 2018)	Quasi-experimental	n = 135 (n = 124 women n = 11 men) 18 to 26 years	Basketball / Japan	PE intervention	a) The Japanese version of the Dispositional Flow Scale-2 (JDFS-2) b) The Japanese version of the Flow State Scale-2 (JFSS-2)	The intervention program was successful in promoting the flow state.	-
9 (Harris et al., 2017a),	Experimental	n = 35 (Basketball n=18; 2 UK	Basketball/ Netball/ UK	(self-paced sporting task)	a) Quiet eye period b) flow short scale c) performance scale (shooting)	Significant relationship between the "quiet eye" and the flow state and the flow and performance.	The flow state influences technical skill

female;
.±23.88
years)
netball
N=17; all
female;
.±20.00
years

– Free throw
shot

Source: Elaborated by the authors

As we can see, in “Table 1”, it is possible to identify some significant data. For example, there was a great variety of samples, mainly in the age of the athletes (15 to 30 years old). Even so, most surveys were carried out with male athletes.

Another important data concerns the variety of tools used as correlated with the *flow*. However, from all the selected articles, only three (33.33% of the sample) showed an association between flow and performance, that is, to verify how *flow* states, interfere in the athlete's performance.

Another interesting factor is that 66.66% of the studies had some type of intervention. Yet, 66.66% of this amount decided to intervene through meditation therapies, and 33.33% specifically chose technical-tactical training methodologies, related to ways of seeking to induce the athlete to enter a state of *flow* to “manipulate” it in this aspect and, therefore, to improve its performance.

To understand the *flow* state as a condition for the possibility of a better performance, the analysis of the studies pointed to an integrated system that is activated towards athletic identity. In this system, the relationships and interactions made, resulted from the affects and effects which constructs and factors (endogenous and exogenous) had on each other. To arrive at this type of multidirectional relationship between the factors that directly influenced the athlete, we started with the analysis of words, within the 9 articles, which acquired a higher frequency of use, and therefore obtained a greater attribute of value. Using the word count feature of *wordclouds.com*, it was possible to identify the terms that had greater importance in the analyzed studies.

In the first analysis performed, 531 relevant terms were obtained. Of this total, after refining the duplicate ones and excluding transition words (formal) and those that reached an absolute frequency ≤ 1 , a total of 168 terms was reached. Thus, those with the highest number of citations were *flow* (n=57); self (n=34); Mindfulness (n=31); State (n=30); Psychological (=25); Performance (n=24); Soccer (n=22); Sport (n=21); Study (n=21); Player (n=16); Intervention (n=15); Self-compassion (n=15); Anxiety (n=13). In the figure below, we can identify these terms with a higher degree of acuity.

Once the terms with the greatest impact on our research were identified, the results pointed to the existence of three main strands, which surround the “I-athlete” – each one of them with its consequences and interferences, implications, and

fleeting state of consciousness. A second set of factors is related to *psycho-cognitive-emotional* aspects, which involve: i) mood-states (motivation, compassion), studies 3, 4, 5 and 7; ii) personality traits (self-regulation capacity, capacity for psychological flexibility-mindset), studies 2, 4, 5 and 7; and iii) metacognition (attention, capacity for thought suppression, experimental avoidance), studies 4, 5, 6, 7 and 9.

Finally, the third group is related to exogenous factors, which are concerned to: i) difference between the training atmosphere and the competition atmosphere in the *flow* state – studies 1 and 3 –; ii) weekly training hours as a possible predictor of certain index that affects the *flow* dimensions – studies 1, 3 and 4 –; iii) level of expertise (i.e., years of experience as predictors of states of self-determination, self-regulation, stress-anxiety control and which are, therefore, possible indirect indicators of better performance - study 2); and iv) position exercised in the game (study 1), where we can find out, for example, that goalkeepers and forward strikers tend to have different performances in relation to the 9 *flow* dimensions.

A second field focused on the use of interventions based on *mindfulness* and its benefits (studies 4, 5, 6 and 7) in an open attempt to manipulate the athlete's entry into a state of *flow*. Therefore, this approach to Buddhist practices, through psycho-behavioral therapies, indicated a(n) (in)direct (re)discovery in obtaining better performance.

One of the central factors in the search for putting the body in a *flow* state concerns the use of psychic energy. According to Csikszentmihalyi (1990), psychic disturbance (inner entropy) is one of the main forces that negatively affects our consciousness. In a certain transversal way, the author himself recognizes in his theory, and also indicates those Buddhist practices (e.g., yoga and its different branches) as methods that try to reduce this chaos in consciousness. He believes that through them, it is feasible to learn to control the subjective experiences (feelings, emotions, senses) of the body.

The practice of *mindfulness* tends to act in aspects related to metacognition, especially when related to the athlete's learning process as it can be observed within their feelings, their emotions, and their thoughts, not being necessary to represent them objectively. This can generate a better internal state, an inner harmony and balance, and at best, a lesser waste of energy, i.e., a decrease of psychic entropy.

Finally, the third field focused on the elements of performance, namely the direct and indirect effects of *flow*, meditation practices and training based on the athlete's performance. In this sense, studies 5 and 7 presented direct causal relationships between *mindfulness* training and the *flow* state and its indirect relationships with the psychological elements associated with performance. By improving their levels of anxiety, stress control, experimental avoidance, and psychological flexibility, we could see there was a bias towards an improvement in sports performance. Yet, the gap that emerged in this context did not allow us to see, objectively, in the respective studies, the objective aspects of the performance that were optimized.

Furthermore, study 8 only showed a successful causal relationship between the student support training program and the *flow*. In study 9, however, there was a significant causal relationship with an element of performance. When training the technical-closed skill (free throw), there was an improvement in the *flow* input and, therefore, there was a trend of performance improvement.

4. Discussion

For a better elucidation about the *flow* state in team sports, it is relevant to understand this phenomenon as a dynamic state (Chavez, 2008) and, as such, its reach will occur through a continuum among several antecedent elements, causal and consequent relationships. The integrated system identified from the results around it points into this direction. A system that integrates and self-reinforces, at the same time, different cognitive, emotional, and physical reactions. Thus, there are inherent elements to this process that are correlated with it and that, concomitantly, also affect it.

4.1 Flow State Predictors

Regarding the antecedent elements that support this phenomenon, some studies carried out on the *flow* suggest – with some security and significant strength – the existence of factors that scientifically clarify it. These precedents can be configured on at least three aspects: i) disposition and personality traits; ii) motivational states; and iii) by the dimensions of the *flow*.

Concerning personality traits, some studies assume that characters with a more autotelic bias tend to experience the *flow* state better and more frequently (e.g., Stavrou et al., 2007; Jackson et al., 1998; Csikszentmihalyi, 1997; Jackson, 1995;). Although no study in the present review has robustly pointed out, in this sense, the search for the association of *flow* with the psychological (in)flexibility of personality traits, tends to indicate this type of approximation.

One can say that athletes with autotelic personality dispositions tend to be more curious (i.e., more open to experience), to have a lower egocentric level, with low anxiety traits and a strong tendency to use adaptive coping strategies (Marty -Dugas & Smilek, 2018). The opposite also happens with athletes with traits of lesser psychological flexibility who, frequently, in trying to avoid unpleasant emotions, lead their actions on deeply ingrained, entrenched and often immutable values. The studies in the systematic review (Carraça, Serpa, Rosado, & Palmi Guerrero, 2019; Carraça, Serpa, Rosado, Guerrero et al., 2019) suggest that this lack of psychological flexibility affects the disposition to the *flow* state.

Depicting team sports, specifically, we found that athletes with autotelic dispositions and greater psychological flexibility tend also to be less concerned with themselves (i.e., with regards to internal and external evaluations of their “self”), which allows them to obtain more receptive qualities (Stamatelopoulou et al., 2018), to experience greater positive emotions and thus share a better collective engagement in the search for a shared *flow* (shared *flow* – Aubé et al. 2014).

Another important revelation was related to motivational aspects (i.e., mood states and metacognitions). Investigations show a trend towards the pursuit of intrinsic “rewards” (Ersöz, 2016; Moreno Murcia et al., 2008; Urena Lopera et al., 2020), as well as task-oriented goals rather than isolated ego objectives (Gomes et al., 2013; Stavrou et al., 2015.; Vieira et al., 2011) – together with a concept of positive self-efficacy (self-esteem, confidence, focus of attention and regulated anxiety) – tend to facilitate entry into the *flow* state (e.g., Buhlmayer et al., 2017; Leonardi et al., 2019; Menegassi et al., 2018a; Röthlin et al., 2016). For example, more self-determined motivations can be associated with more positive emotional states and, as a result, with the *flow* state (Jiménez-Torres et al., 2012).

When correlating the above-mentioned factors, in the search for a shared *flow*, with dispositions, psychological states (psychological in-flexibility) and personality traits (autotelic or exotelic) of athletes, Zumetta et al. (2016) suggest that it is necessary to develop strategies for group identity. Firstly, this recommendation occurs because interactions in team games can be relevant disturbing factors with regards to the *flow* state (Stamatelopoulou et al., 2018; Swann, Crust, Jackman, et al., 2017c).

Second, the construction of this collective identity (i.e., team cohesion, as indicated by Kruyt & Grobbelaar, 2019) can be applied through an emotional synchrony that would trigger the perception of collective effectiveness of the team (team-efficacy), facilitated by an excellent group atmosphere (Kawabata, 2018). Therefore, it is assumed that the shared *flow* state can emerge from the result of this type of interaction. Thus, a high level of collective effectiveness may have greater probability that its athletes can – more easily – enter a state of *flow* and that this state can even be shared due to a high perception of collective identity and collective effectiveness.

In the review of studies, it was still possible to measure the accumulation of individual and collective experiences (hours of training), the motivational atmosphere ("training atmosphere") and the perception of skills (expertise level and position that the player occupies in the game) as also important *flow* predictors. When these indicators were associated with the 9 dimensions of *flow* and, consequently, with team sports, the study by Swann et al (2012) suggested that three of these dimensions are prerequisites for *flow* to happen (balance between challenge and skills – objectives clear and unambiguous feedbacks). In this perspective, Jackson et al. (2001), in addition to including the dimension of the fusion between action-consciousness as a fourth *flow* predictor element, suggested that these elements significantly contributed to the action's final excellency.

This type of configuration raised some questions related to the fact that such elements, mainly the fusion between action and consciousness – action-consciousness –, can impact the emotions, cognition, and intentions of athletes. For example, to what extent they can predict the quality of decision-making carried out by players, or, in a more restricted sense, how they might be influenced by it.

In a systematic review carried out by Roebuck et al. (2018) and conducted with ultra-marathoners, it was identified how the processes of cognitive functioning of the

athletes, before, during and after the races, are manifested. During the marathon, cognitive processes move between associative thoughts, where attention is focused on the internal bodily sensations experienced (25% of athletes), and dissociative thoughts, where attention is focused beyond these sensations (75% of athletes). Other important notes also cover the domains of cognitive function, for example, on attention, working memory, information processing speed, verbal fluency, and executive function. The review carried out identified, then, that 22.22% of the studies showed that the athletes' cognitive function was reduced after the races. In a complementary understanding, another study pointed out in the review recognized that 10 of the 19 participants showed changes in their mental status (confusion or disorientation) during the test, impacting the performance action.

Although the nature of the activity of ultra-marathoners is an individualized sport (self-paced) without interaction, it is relevant to consider how this fusion between action and consciousness manifests itself and works in the players of team sports with invasion interaction. Mainly the processes of cognitive functioning on the decision-making mechanism (i.e., on the intelligence/awareness factor that supports the action) must be considered.

It is important to be aware and have the knowledge that tactical intelligence within these games must be understood as the confluence of requirements and capacities and, as such, it is a mental construction – a combination of understanding, attention, related speed, and memorization – allows the subject to perform tasks with greater precision and acuity (Afonso et al., 2012; Costa et al, 2002). Otherwise, it is the ability that the player of this category of games must manage and use the information that is presented/captured through the perceptual mechanism. Consequently, and up from this information, it is possible to assemble the project, considering the factors that affect the choice of decision making, aiming at the successful selection of the action to be sent as an output product, at the shortest possible time.

When looking for the development of a new investigation approach which aims to correlate/associate the *Flow* state with the cognition-action processes in team sports, it is important to consider in advance that, according to the position exercised by the player, the *flow* dimensions can be potentialized in a divergent way. This chains

other developments such as personality traits and athletes' dispositions to *flow* based on their roles in the game.

As it is known that goalkeepers have high values when we consider clear objectives and unequivocal feedbacks, and that defenders have a great importance in challenge-skill and concentration balance as well as midfielders have high functions in clear goals, sense of control and autotelic experience (Castillo- Rodríguez et al., 2020), it seems to be relevant to investigate to what extent the athlete's position in the game affects not only his own individual identity, but also the player's group identity and, therefore, the team's collective effectiveness. This condition shows, above all, what their influence is on the established “network” of contacts, in terms of *flow* status, performance and interaction with teammates.

The issue previously exposed tends to be pertinent, since the occurrence of *flow* by a certain athlete can be perceived by others and tends to potentially trigger a “contagion” effect on them (Engeser & Shiepe-Tiska, 2012). Considering also that the experiences of *flow* in a context of more intense social interaction – that is, those who presented communication and against more active communication (e.g., team sports with interaction) – tend to be more significant (Walker, 2010), this situation indicates the emergence of a *flow* experienced collectively. Even so, the big question is to understand: how to experience this group *flow* in team sports, and how its dimensions are activated, i.e., if in a different way, or according to the different roles and sub-roles exercised by the players during the game? In short, there is still a lot to be investigated about the main driving factors that influence these aspects.

These doubts set off other questions that we considered linked to address: can the association of *flow* with the tactical dimension of the action emerge through a transitory process that grows in complexity? One would go from an individual pole (i.e., a state of *flow* centered on individual tactical action) to a group *flow* (i.e., centered on tactical combinations between two, three or four players) to finally arrive at a collective *flow* (i.e., centered on game systems)? These are likely to be important issues to consider in future investigations.

4.2 Causal Relations of Flow

One of the biggest gaps pointed out in several studies about *flow* concerns the

objective ways of trying to convince it to athletes. In fact, one of the biggest paradoxes about the *flow* is whether it happens incidentally (letting it happens) or if it is possible to make it “happen” (making it happens) (Jackson, 1995; Swann, Crust, Jackman et al., 2017c). Of the 9 studies that incorporated this systematic review, 6 of them addressed some type of intervention in order to be able to establish a causal relationship either with the *flow* or in terms of performance improvement. Of these 6 studies, all of them obtained positive relationships between the interventions used with a focus on training psychological skills and the entry and/or increase of *flow*. However, specifically, 4 of them used programs based on mindfulness practice.

A systematic review study on *flow* training (Norsworthy et al., 2017) identified as possible induction methods those interventions based on imagination, hypnosis, mindfulness, and management of pre-performance routines. In analyzing the results, it was pointed out that none of the studies used in the review had (co) related this type of intervention with the specific theoretical dimensions of *flow*. This factor opened a new doubt and some scientific discussion to better understand if intervention on psychological skills can be considered *flow* training.

It was important, thus, to consider the study developed by Bernier et al. (2009) in which a distinction between training of traditional psychological skills (Psychological Skills Training – PST - e.g.: i) arousal control; ii) goal setting; iii) imagery; iv) self-talk; v) precompetitive routine; vi) mental rehearsal), currently self-styled under the umbrella term self-regulation and the mindfulness and acceptance approaches (MAAs) was presented. Both programs do tend to focus on mental abilities – that is, on (meta)cognitive aspects, emotions, and bodily sensations. However, PST seem to work on control and reduction of internal processes, while MAAs tend to act on observation, description, conscious and non-reactive action, and non-judgment (the non-emission of an attribute of value and its consequent mental rumination) of inner experiences.

Thus, a significant set of studies (e.g., Aherne, Moran, & Lonsdale, 2011; Buhlmayer et al., 2017; Röthlin et al., 2016; Scott-Hamilton et al., 2016) has presented the causal effects of MMAs, not only in reaching the *flow*, but also in possible indirect performance indicators. Considering that attention and awareness are central elements in the *flow* experience in athletes and the AOMs seek to keep them focused

on the present moment of action, such configuration assumes a central role in the psychological variables that can affect performance.

The studies identified in this review confirm the assumption made in the previous paragraph. In this case, there tends to be a weakening of negative thoughts, an increase in attentional focus, a decrease in anxiety (somatic and cognitive), and an increase in psychological flexibility. For example, in the study by Bernier et al (2009), the practice of MAAs influenced players to make “correct” tactical decisions (e.g.; identification of the uncovered field zone, according to the defensive position of the opposing team, for possible sending of the ball in an attempt to make it difficult to catch it), since they were able to scan the relevant information coming from the internal (arousal level, emotions) and external (goals to be achieved, potential trajectory of the ball and context/involvement) states.

Another interesting result was obtained from the study by Röthlin et al. (2016), when examining the potential moderators of the effects of PST and MAAs on athletes. Those athletes who had low self-esteem values, with highly ego-oriented goals, were the ones who most benefited from this type of training. This is because athletes in such conditions tend to perceive these performance situations as threats to their basic psychological needs (e.g., autonomy, competence and belonging). When they understand that, they can give rise to more competitive anxiety, greater expectations about negative results and/or cognitive interference.

The weakening of the individual ego appears as another potential shaping of the search for better performance (i.e., on the individual and, consequently, collective level). In the studies included in this review, this aspect plays a central and regulatory role in the search for better collective performance, once the athlete's participation becomes more conscious, less self-centered, more flexible and, therefore, more collaborative – these indicators are relevant in performance within team sports. This configuration seems to clearly indicate for the description of a psychological profile that favors actions based on a cooperative nature, which are essential and central to collective sports in which cooperation and team goals go beyond the individual objectives of each of its elements.

4.3 Effects on Performance

To better understand the consequences of *flow* on the athlete's performance in team sports, it is first important to recognize that performance is the result of a set of factors that influence each other in a multi-variety way. These factors can be physical (bio-kinesio-physiological), psychological (beliefs, affective, emotional, motivational), technical, tactical, nutritional, among others. The second important point is to consider that the psychological demands are different when comparing individual sports versus team sports (Birrer & Morgan, 2010). This tends to be relevant, since situational characteristics, as well as personal attributes, directly affect the quality of experience absorbed by athletes (Da Silva et al., 2018).

In this sense, the athlete's assessment of his performance can occur through direct-objective indicators (e.g., effects of technical-tactical training in relation to efficiency in game actions such as kicking on goal, number of passes, tackles, dribbling, domains, among others), as well as indirect-subjective, which can affect, for example, the reduction of levels of anxiety, attentional control, thought suppression, subjective perception of performance and satisfaction of psychological needs, among others.

Thus, the relationship between *flow* and increased performance has been configured in an open and dynamic perspective. Some studies have shown that it is possible to achieve the best possible performance without being in a state of *flow* (Orta-Cantón & Sicilia-Camacho, 2015; Ortín-Montero et al., 2018; Stavrou et al., 2015; Swann, Crust, Jackman et al., 2017a; Wells, 1998). Furthermore, Kimiecik and Stein (1992) indicated, in their studies, that the improvement of the subjective experience is not necessarily the improvement of the athlete's performance.

These results suggest a certain dissociative and independent sense between these variables. The athlete can thus acquire the peak of their performance without being in *flow*. This condition even expands the possibility of looking for a stronger justification for what is termed "better performance" (which varies substantially from athlete to athlete), along with the reification/depersonalization of other special states of consciousness (e.g., clutch state and mental toughness, as indicated by Swann, Crust, and Vella (2017) and Swann et al.(2017c) as auxiliary conditioning and modelling of sports performance.

On the contrary, other studies (e.g., Chavez, 2008; Garcia et al., 2019; Norsworthy et al., 2018,) identified a positive association or at least a residual and/or bidirectional effect (correlation or causality) between the *flow* state and the best performance. The consequence of the athlete being in *flow* would focus, therefore, on the optimization of his performance, or vice versa. The studies by Koehn and Morris (2012) indicated, for example, that the game result can affect the perception of *flow*. As well as the effects of context (atmosphere) on performance. Training and competition contexts affect performance differently (Koehn & Morris, 2014).

Schimidt et al. (2020) assume, anyway, that a better performance can be achieved when the level of "pressure" (internal and external) that athletes experience – those in which they are subject to exercise the performance of their motor skills – is properly adjusted according to the intrinsic and extrinsic characteristics of the task – the ones they are in harmony with the self-perception of their own abilities.

There is an important aspect to consider about the level of pressure that athletes feel and suffer, it is necessary to say. The principle of diluting responsibility is equally differentiating between individual sports and team sports. While in individual sports pressure situations are centered on the same individual, in team sports responsibilities it can be diluted/shared by all team players. This situation can certainly have an influence on the development of a *flow* state once this difference is recognized in the way individual and team sports athletes deal with responsibilities, recognition and demands. The relevance of this observation is corroborated by the study by Walker (2010) when identifying that, participants with greater interdependence on the team experienced more joy in the *flow* than individuals with less interdependent performance. Therefore, the *flow* experience is better achieved when performed in a group than when it is developed individually. The dilution of responsibility among the team can be, therefore, a predominant factor in reaching the collective *flow* state.

The studies in this systematic review thus pointed, for the most part, to positive gains in partial aspects of performance, whether direct (i.e., increase in the hitting of free throws (cf. study 9 of the review), or indirect (decrease in levels of anxiety, stress and thought control, see study 5 and 7 of the review.) However, these results leave a great deal of discussion on the gaps identified when regarding *flow* to team sports.

4.4 Limitations

The first limitation identified in this systematic review of studies concerns the analysis of the nature of the activity/atmosphere involved/correlated to the *flow* state. It is understood that the *flow* state preserves a certain independence from the nature of the activity, which gives it a kind of universal characteristic.

It is possible to experience *flow* despite the activity to be performed. However, in the sports field, each sport has a different classification system, which implies different operational ways of structure and functioning and, therefore, requires different communication/counter-communication networks, urging demands on different sport performance elements. For example, it cannot be considered that the demands on the soccer athlete are the same as those of the swimming athlete, nor those of marathon runners with weightlifters.

According to Da Silva et al. (2018), the factors that determined the *flow* experience can be different in each sport. In other words, this implies that research on *flow* in sports has not fully considered and analyzed the internal dynamics of activities as factors that most influence it. Thus, Harris et al. (2017) highlighted that continuous task facilitate the *flow* and its occurrence, due to the successive chain of several interrelated actions. To some extent, this argument was evidenced in their own study, and identified in this systematic review.

On the other hand, Jackson and Csikszentmihalyi (1999) already pointed out that it is more difficult to achieve *flow* in team sports, due to the large number of factors involved, which need to be adjusted and controlled. This is one of the reasons for obtaining few studies relating *flow* in the context of team sports (Stoll & Ufer, 2012), especially those with interaction, which contain a low environmental standardization and consequent high demand on the tactical elements of action, the intelligence/consciousness factor and the perception and decision-making mechanisms.

Another important point to consider is the nature of some studies here presented. As we could see, many of them showed difficulties into factorial correlational analysis (i.e., personality constructs and variables) and few about causality (i.e., training process effects on *flow*, and, therefore, on performance) – a major limitation as seen in various searches.

Another methodological limitation demonstrated in this review is the *design* and collection of research data. None of the analyzed studies used a qualitative approach or a mixed approach. In this aspect, Swann et al. (2018) indicated that many investigations on *flow*, when opting for a qualitative approach, used the interview as the main data collection technique.

Although the interview within the qualitative approach is one of the methods that tends to be more appropriate for studies that aim to explore psychological states (cf. Maxwell, 2004), the research that focused on the *flow* state was supported, mostly, on information obtained through the application of interviews about the athlete's career (*career-based interviews*) and not about a "test event" (a single reference event) in a targeted manner. For Swan et al (2018), interviews that are based more on events (*event-focused interviews*) than on the athletes' careers tend to maximize the accuracy of memories and lived experience. This can help the participants to be better able to describe the sensations perceived and felt, minimizing possible distortions caused by the memories/memory.

Another point to highlight in our study review, which cannot be generalized to similar ones, is that, so far, it seems that no study has managed to verify/measure *flow* during action/performance. In this perspective, the tests (e.g., DFS and FSS-2) were mostly applied before and/or after the game/event/career.

At the same time, no test was designed to verify the observational *flow*. The robust construction of a test that allowed identifying "if and when" the athlete was in a state of *flow*, as well as which body language indicators would allow (re)knowing "if and when" the athlete was truly in a state of *flow* was not obtained. Also, no studies were identified in this review in which *flow* was related to tactical intelligence in team sports, with decision-making processes, as well as the identification of studies that have related the role of emotions (IZOF – Haninn, 2000) with the *flow*.

5. Conclusions

Considering the entire scientific scenario built around this systematic review of studies, when we revisit its objectives, we can conclude that:

The *flow* state tends to involve a total absorption in the task by the team sports athletes, as well as a full and harmonious functioning among all the performance

conditioning factors. Therefore, the athlete can enter a new state of consciousness, which involves a set of cognitive, physiological, and affective aspects, which corresponds to an “optimal state” at the psychomotor level (Habe et al., 2019).

Emotional states tend to be part of the athlete's success, since their importance is expressed in their feelings rather than trying to suppress and/or control them, which ends up increasing the intrinsic tension of the athletes, and it can influence the level of performance obtained during the action in team sports (Habe et al., 2019; Martinez et al., 2013). In turn, Goleman (2012) indicates that emotions can contribute to adequate thinking and not to its disorganization, and being so, they interfere (positively or negatively) in the thought process. Cooper et al. (2018) indicate the existence of ample evidence that the emotions experienced before and during a performance can have a significant impact on the result of that performance, making it even be successful or not.

Beliefs and value systems tend to predict the actions of athletes, something that can also be reflected in team sports, especially in the way they think, act, and feel. They can affect the choice of action, effort, persistence, and feelings in the face of adversities during performance (Bandura, Azzi & Polydoro, 2008) – and entry into a *flow* state. An athlete who tends to adopt a self-assertion of anticipated failure (belief) about himself (e.g., "I don't know"; "I can't"; "it's very difficult"), when related to emotions and motivations, is a sign that, according to Samulski (2002), we are facing a person/athlete with a profile oriented towards an eventual failure and with a tendency to avoid challenging situations and emotional relationships of “shame”. In turn, the challenge versus motor skill relationship is the first major predictor of entry into a *flow* state (Csikszentmihalyi, 1997, 1993).

The tactical component of performance tends to be influenced by the integrated regulation of various aspects and by the decrease in motivation levels (i.e., greater individual demotivation seems to obtain a lower probability of presenting higher tactical knowledge) and, therefore, the motivating element in the context of training and/or competition can have a significant impact on anxiety and tactical performance indicators (Menegassi et al., 2018). In this follow-up, it is important to emphasize that no study was obtained that allowed to correlate the *flow* with the tactical performance and, even less, with the decision-making process in team sports.

A relevant aspect that emerged from this study is that there is a tendency for “team sports” games to be circumscribed to a spatiotemporal paradigm during action, being marked by unpredictability, randomness and high variability of behavior and actions. In other words, the athlete is constantly confronted with a vast set of problems (not foreseen) a priori, in anticipation of the action, which has not yet elapsed (Garganta & Oliveira, 1996). This situation can raise some “restlessness” in the teacher-coach that transcends the normal teaching-learning-training process in the process of learning and training motor skills and in the assessment of the physical capacities of athletes in team sports. All these conditions highlight the tactical dimension of action and “intelligence” in a broad sense. Thus, several open questions still emerge regarding the process of making/training tactically intelligent players at the level of team sports. Finally, it is important to say that no study was obtained that associated sports training methodologies to the *flow* state and its impact on the tactical performance of athletes in team sports.

The identification of an “integrated system” that surrounds the athlete's technical and tactical involvement in team sports, together with the (re)cognition of the three essential fields that incorporate it (i.e., *flow*-mindfulness-performance), allows us to raise some questions for the future inherent to the effects of performance and the magnitude of the athlete's response as a function of their individual characteristics, action possibilities, task constraints, and how much this influences their state of *flow* at the individual and collective level . This procedure may allow the simultaneous measurement of the impact of these variables on team sports, something that requires further studies to better understand the doubts left open in the present study.

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