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Attentional Focus Repercussions on Athletes' Performance: A Systematic Review

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ABSTRACT

Athletes performance has been the subject of discussions and major investments in sports training aimed at preventing injury. The high performance of athletes depends on neuro-functional intrinsic factors. Recent studies have been exploring the process of attention to stimuli, through external and internal attentional focus tasks and its role in the performance of athletes. In this review, we explore a wider perspective of the influence of attentional focus on improving the performance of athletes. The study is based on the PRISMA guidelines, with search in databases: Pubmed, PEDro, Medline and Cochrane of studies published in the last 10 years. Articles were grouped according to the type of study, objective, a method of evaluation, intervention and main results. Methodological quality was evaluated with PEDro scale and survey resulted in 11 selected studies. The most used methodological model was the sample selection at random. Peter Scale demonstrated that only one study score greater than or equal to 6. Some factors have undermined the good methodological quality of selected studies, such as randomization and outcome measures, indicating that evidence about the use of external attentional focus for improved performance of athletes is not yet satisfactory.

Keywords Attention, Athletic performance, Athletes, Executive function.

INTRODUCTION

The relevance of good sports training has been a topic of discussion in recent years. The livelihoods of professional athletes depend on their ability to act at the highest level possible [1]. The load and the training plan currently require a commercial demand, in this sense the athletes experience a higher charge in their performance. In this competitive load process, the athlete is exposed to major injury risk situations, leading to increased investment in sports training aimed at preventing injury, aiming at minimizing the financial and professional impact that lesions can cause [2,3].

The sporting performance of an athlete is characterized by a multi-factorial set, which is established by means of intrinsic factors at different levels (neuro-functional adjustment of the motor act and cognitive action), as well as numerous autonomic and Homeostatic, and not just the elaboration and decision of the control of the movement. Thus, the harmony of these factors enables a high sporting performance, since there are techniques of increased performance and level attentional based on visual stimuli. This process in the perception and attention to stimuli is called focus of attention, which is a variable divided in external focus (focus on the effect of the movement) and

internal focus of attention (focus on the movements themselves), essential in learning and increase in performance during the motor act [4-7].

Studies indicate that an external focus of attention is generally more effective and can assist in improving the performance of athletes in their training [8,9]. A study was developed with less skilled and highly skilled baseball players, these participated in four dual-task conditions in a baseball simulation: two that had the attention directed towards the execution of skills (movement of hands) and skill/external (movement bat) and two that directed attention to the environment (hearing tones), in which the performance of hitters for highly skilled players was better in the environmental/external condition and worse in the ability/internal condition. Current studies do not fully address the association of the external and internal focus of attention in the process of learning motor skills and improving performance. In this sense, the present study highlights a systematic process in order to synthesize the main findings on the impact of the attentional focus on sports performance and performance improvement, supported by the following databases: PubMed, Pedro, Medline e Cochrane. The objective of this study was to carry out a revision study of the influence of the attentional focus on improving the athletes' performance.

METHODOLOGY

A systematic review was carried out on the effects of attentional focus on athletes' performance. The presentation of the revision was based on the guidelines of the Prism protocol, which included the main items to report systematic revisions and meta-analyses [10]. The search in the literature consisted of research in the databases: Pubmed, PEDro, Medline, Cochrane in the period from April 2018 to May 2018, and repeat in October 2018. This search was limited to studies that have been published in the English language for the last ten years. A search of the following keywords was employed: "focus of attention" and "players".

The publications resulting from the initial selection in the selected databases were analyzed by the authors and subsequently refined according to the following inclusion criteria: Original studies as type of clinical trials (randomized or not) or observational (transverse or longitudinal, with or without control group); Studies with at least one outcome related to attentional focus on athletes; Publications with good quality methodological. It was only possible to include complete documents available in the databases to carry out the systematization of the study.

The criteria for excluding studies with methodological errors were considered to analyze the attentional focus on a different population of athletes or sportsmen, dissertations, book reviews, Congress Annals, conferences, editorials, and articles that they were written in other languages besides English. An exploratory reading of the summaries, materials and methods and results of the articles was initially performed by the authors, excluding those who did not attend the inclusion criteria, and all studies judged according to the criteria previously independently established between the authors.

Subsequently, the articles were systematically revised, grouped according to the type of study, objective, and method of evaluation, intervention and main results, arranged in tables Table 1.

Table 1: Characteristics of the studies to repercussions of the attentional focus on the athletes' performance.

Authors	Study	Objective	Sample	Rated items	Intervention	Results
[12]	Experimental	Study the effect of familiarity and direction of attentional focus on performance.	Twenty-three female basketball players divided into two groups (16 athletes and 7 athletes in the first experiment; Fourteen Golf Beginners (8 men, 6 women) in the second experiment.	Free shooting using different focuses of attention in the first experiment; Precision of golf swing in internal and external focus conditions.	They were instructed to direct their attention to the specified aspect. In the second experiment, the participants were informed that they should direct their attention alternately to two specific aspects when performing the task	Best free shooting performance under familiar focus conditions regardless of focus direction.

[17]	Experimental	Investigate the effects of an external focus, by a visual stimulus and an internal focus, by means of a verbal stimulus during the unexpected cut of female and male athletes and how these effects remained over time.	Ninety participants divided into two groups with 45 people, one group of the male gender and the other female.	Exit and jump speed.	Visual feedback and verbal feedback	The men in the visual feedback group showed greater angles of ankle dorsiflexion in relation to the control group
[19]	Experimental	Investigate the interaction and effect on performance by using typical internal focus instructions on a Dart Launch task and examining the concentrated look and performance result.	Twenty participants (11 men and 9 women).	Attention and performance.	Internal focus of attention and external focus of attention.	The results do not replicate the benefit of an external focus of attention nor the benefit of a longer focus duration in the look.
[18]	Experimental	Examine to what extent a program based on attention reduce the number of sports injuries in a sample of football players.	Forty one men participants (n=31) and female (n=10) Junior Elite football players.	Attention	The practice of full attention.	There was no significant difference in the occurrence of injury during the study period between the intervention and the control group.
[13]	Experimental	Evaluating whether to adopt an external focus during the motor, imagery contributes to improving the performance of the tennis service.	Five girls and seven boys elite children's tennis players at the age of 11.	Speed and accuracy.	An external focus of attention	A significant difference in the speed of withdrawal during the withdrawal test while no difference was reported for the variation coefficient of the drawing speed.
[14]	Experimental	Investigating how the focus of a athletes attention affects the cinematic performance of the Rapture.	Twelve athletes trained in a competitive manner (8 men and 4 women).	Instant speed	An internal and external focus of attention.	The internal concentration increased the speed of realization of the movement of the elbow joint in relation to the external focus.
[20]	Experimental	Investigate the effects of manipulation of the perception of rhythm control in attentional focus, physiological and psychological results during the race.	Twenty experienced resistance runners	Execution speed, completion time, heart rate, post-judgment blood lactate, perceived effort	Focus Attentional	The average speed of gait was slower during the perception of exertion than during the self-controlled pace.
[21]	Experimental	Assess the Influence of attentional focus on the 10 meter sprint time and the kinetics in a group of collegiate football players and highly	Sixteen healthy and college football players with an average age of 19 years in the first experiment; Experienced	The velocity was the item evaluated in the two experiments.	Internal focus, external focus, and normal focus.	Time of 10 meters and the kinetic variables, no significant differences were observed in any of the conditions in the for both experiments.

		experienced sprinters.	sprinters (N=13; 6 Women, 7 men), with an average age of 28 years in the second experiment.			
[15]	Experimental	Investigate the focus with experienced baseball position players who recover from knee surgery and Baseball pitchers in recovery from elbow surgery.	Twenty male baseball players and participants who didn't play in both experiments.	Direction	Auditory and visual feedback	Injured Players had a diffuse focus of internal attention similar to that of beginners, resulting in worse pitching performance as compared to the expert controls
[22]	Experimental	Investigate the effects of different instructions in the punch, speed and impact forces between Intermediate and expert boxers competitive and kickboxers.	Fifteen competitive boxers and kickboxers	Forces and speed	An internal and external focus of attention.	The external focus instructions led to higher standard peak impact force compared to control instructions.
[16]	Experimental	Evaluate the effects of the focusing instructions on the production of the force during the half-height isometric traction.	Twenty-two athletes trained in various sports modalities.	Isometric force	An internal and external focus of attention	The external focus has higher peak strength compared to internal control and focus.

The methodological quality of the articles was also evaluated using the PEDro scale. The PEDro scale takes into account two aspects of the test: internal validity and sufficiency of statistical information. Although there are issues on the scale, only ten are punctuated and the final score ranges from zero to ten. The result is obtained by calculating the total of all positive responses. The studies indexed in the database that have already been evaluated by the methodological quality of the members of PEDro, were maintained, since those that were not previously classified, were evaluated independently by consensus of two evaluators.

Results

Research in databases previously obtained 402 papers with full text. Then with more detailed research from reading the study, 41 papers were identified with eligible characteristics, subsequently following the inclusion and exclusion criteria remained in the final selection of 11 studies (Figure 1).

The most used study model was the experimental with sample selection at random and non-random [11-18]. In the selected surveys were evaluated the focus attentional internal and external in various sports [basketball [12]; Javelin Throw [18]; ketball [15]; Race [19-21]; baseball [13]; football [14,20,21]; Boxing [21]; Tennis [13]; and Weight release [17].

The sample size ranged from 12 to 90 participants with a male predominance [11,15,17], and only one study conducted sample research with one genre [13]. The age range of the survey participants was between 11 and 28 years of age [11,20]. Only two studies used in the research conducted experiments with one of the focus of attention [11-14], the others used both internal focus and the external focus of attention. The research associated instruments of analysis of the concomitant speed the tasks of evaluation of the attentional focus by means of visual stimuli [11,16,17,19-21].

The studies presented in their methodological design the most different sports modalities and presented heterogeneity of the sample, which can justify the different results. However, when associated with the evaluation items, as the speed together with the attentional focus, for example, similar results were obtained. In the research developed by

Guillot A et al., [11], there was a significant difference in the speed of the looting of the athletes of volleyball in conducting the tests, followed by a regularity of variation in the speed of the server using the external focus of attention as an intervention.

The study showed that the internal concentration increased the speed of realization of the movement of the elbow joint in relation to the external focus. In another study was analyzed the average speed of the gait, Schutts KS et al., [17] demonstrated that the average speed of gait was slower during the perception of exertion (internal focus) than during the controlled pace (external focus).

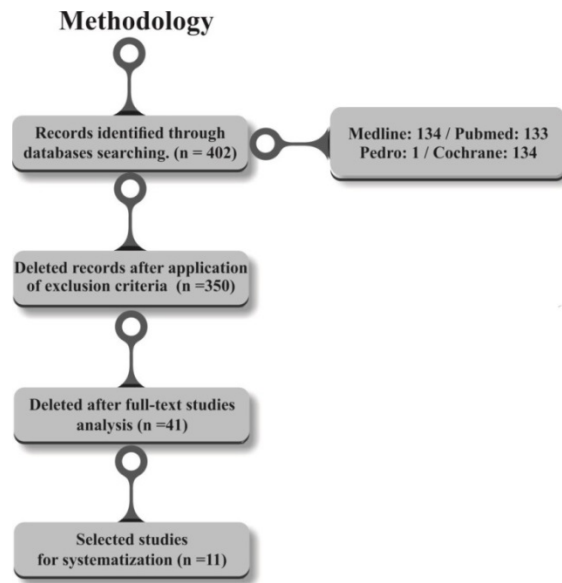


Figure 1: Diagram of the selection of paper for systematic review.

Table 2: Analysis of the methodological quality of the studies about the attentional focus on the athletes’ performance by the PEDro Scale.

	[12]	[17]	[19]	[18]	[13]	[14]	[20]	[21]	[15]	[22]	[16]
1-Eligibility criteria							Yes	Yes	Yes	Yes	Yes
2-Random allocation	Not	Yes	Not	Yes	Not	Not	Not	Not	Not	Not	Not
3-Hidden allocation	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not
4-Initial similarity between groups	Yes	Yes	Not	Not	Not	Not	Yes	Yes	Yes	Not	Not
5-Blind subjects	Not	Yes	Not	Not	Not	Not	Yes	Yes	Not	Not	Yes
6-Blind therapists	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not
7-Blind evaluators	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not
8-Closing measures at 85% of the sample	Yes	Yes	Yes	Not	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9-Analysis of the intention to treat	Not	Not	Not	Not	Not	Not	Not	Not	Yes	Not	Yes
10-Comparison among groups	Not	Yes	Not	Yes	Not	Not	Not	Yes	Yes	Not	Yes
11-Precision Measurements	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Score	10-Mar	10-Jun	10-Feb	10 Mar	10-Feb	10-Feb	10-Apr	10-May	10-May	10-Feb	10-May

The analysis of Winkelmann NC et al., [20] revealed that the interaction between the attentional focus condition and the order of condition of the athletes were not significant in the 10-metre Sprint with football players. In the experiment of [18] with the launch of darts no correlation between the duration of attention in the look, start, shift or time until javelin launch and release with the performance was significant.

In the Gray R., [13] study, the injured players had a diffuse focus of internal attention similar to that of beginners, resulting in worse pitching performance compared to the expert controls, and can indicate that the level of the athlete can influence on Attentional focus. In addition, the research of Halperin I et al., [21] observed that the instructions of the external focus led to the increase of the impact force when compared to the control group.

Halperin I et al., [16] demonstrated that the external focus of attention had a higher result than the control group and the internal focus of attention in the strength aspect. Study of Maurer H et al., [12] obtained a similar result, in which, the best performance of free shooting in basketball was in conditions of familiar or external focus, regardless of the direction of focus in which the athletes were subjected.

DISCUSSION

In this study was analyzed through a systematic review of the repercussions of the attentional focus on the performance of athletes with the application of the PEDro scale. The use of scale 6 Peter demonstrated that only one study presented satisfactory scientific evidence in clinical studies. According to the classification of the scale, the lack of concealment in the randomization of the subjects, masking of the subjects, evaluators and therapists, besides the absence of the analysis of the intention to treat and the measures of satisfactory outcome in most methodologies Applied, led to the fall in the methodological quality of the studies, consequently of its scientific evidence.

Were included in this study, research that associate the external attentional focus, internal, or analysis of both through cognitive tasks, and thus have an improvement of the sports performance. In recent years, countless studies have demonstrated that directing attention while performing skills is a crucial factor in quality performance [22-24]. Attentional focus, is nothing more than an important variable in the motor learning of the human being, this focus is divided into internal attentional focus which is when the individual performs a maneuver focusing on the movement of his own body and external attentional focus which is when the individual directs his attention to external factors such as the environment [6]. In athletes the implementation of feedback with an external and internal focus of attention, especially with the visual feedback component is promising in terms of reducing the risk of injury, contributing to the performance of the individual [15].

Among the studies selected for this systematization, six obtained in their results an improvement of the performance of the athletes with the use of the external attentional focus as an intervention [11,15,16,19,21]. Previous studies point out that the external focus of attention promotes a better motor response when compared to the internal attentional focus because the internal focus of attention orients the individual to be aware of his movements, which disturbs the automatic control of the engine systems involved [9,22,23]. Additionally, the external focus is associated with greater variability in articular kinematics [22].

Changing the control and adjusting in rhythm influence the attentional focus of the athlete itself. External control increases stimulation and this facilitates performance, particularly when runners create attention strategies conducive to improving efficiency in the race [19]. The attentional focus and impact on performance can offer an excellent knowledge base for coaches who work in the area of strength and fitness, similar to what coaches use in physiology and biomechanics to guide the programming choices, coaches can still plan strategies to ensure they are teaching athletes to focus their attention to improve performance.

Research points out that focusing on the effect of movement (external focus of attention) is obtained positive results for performance and motor learning by comparing them with the concentration in the movements of a person (internal focus of attention), but these studies are almost exclusively from studies used with performance result measures [25-27].

The findings of the study of Guillot A et al., [11], indicate that the adoption of an external attentional focus during the motor imagery, which means a mental representation of an action without engaging in its actual execution, resulted in a significant increase in the accuracy and speed during the practice of tennis, as well as an improvement in the first successful withdrawals and points earned during a real match. The well-performed performances aren't affected by the runtime, this time offers them the opportunity to meet and monitor the automated execution of the movements, which provides a greater demand for attention to the execution of the task properly DITA [22].

In the experiment of Winkelman NC et al., [20], where two experiments were carried out that evaluated the influence of the attentional focus on the 10 meters running time in a group of college football players and experienced sprinters, the results showed that both the external focus and control conditions resulted in race times significantly faster than the internal focus condition, but there were no significant differences observed between the external focus and the control conditions. In experiment 2, experienced sprinters performed the same 10-meter running task using the same instructional conditions as experiment 1. For the time of 10 meters and the kinetic variables, no significant differences were observed in any of the conditions. These results provide new evidence that the level of experience mediates the influence of the attentional focus on the performance of the race, another point that has been discussed.

On the other hand, some studies have obtained good results in their investigation with the use of internal attentional focus [14,17,18]. It has been demonstrated, however, that instructions that direct the athlete's attention to body-related characteristics involved in an action (the internal focus of attention) can have a detrimental effect on performance and learning, particularly in compared with a focus of externally directed attention [28]. Internal attention focus tends to be associated with damage to performance, although this effect may depend on the complexity of the task. Little complex tasks and where the context appeals in a reduced way to decision making, induces a greater internal focus, a greater concentration on the aspects inherent in the realization of the movements [29].

In this sense, instructions that induce a focus of attention on performance characteristics involved in a skill interfere with the subsequent performance of this ability. This interference occurs regardless of whether these characteristics are directly or indirectly related to the ability. In addition, the nature of the instruction provided or the level of skill of the participants can influence the results of the experiments using the internal focus of attention [30].

The attentional control, whether targeted by objectives or stimulus, selective or divided, of internal or external focus, is responsible for enhancing or inhibiting the attainment of high performances. By targeting the relevant indicators, athletes can use the information collected, allowing the anticipation of the development of the scenarios, which consequently is reflected in a performance more adjusted to the constraints of the task and involvement [29].

The study presented some limitations, such as few studies in the last 10 years, in addition, only articles in English with heterogeneous population corresponded to the inclusion criteria. Another point was the non-presence of longitudinal studies, which point to greater evidence of association of attentional focus on motor performance.

CONCLUSION

The systematic review shows that the external attentional focus presents greater benefits in improving the performance of the athletes, since it is recommended to coaches who use instructions that direct the attention of the athlete out (external focus of attention), toward the result of the movement, instead of the action itself (internal focus of attention). However, there are some factors that have damaged the good quality of methodological outcome in most selected surveys, in relation to the randomization of subjects, masking of subjects, evaluators and therapists, analysis of the intention to treat and outcome measures, indicating that the evidence about the use of the attentional focus to improve the performance of athletes is not yet satisfactory, which guides the need for further studies with this approach, which use athletes with the same level of skill in a certain sport mode.

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