Effects of mindfulness- and acceptance-based interventions on performance and psychological variables in chess: A systematic review

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Abstract

Background: There is a growing interest in mindfulness- and acceptance-based interventions in sport, with empirical results that support improvements in athletes' performance and well-being. Chess is a sport in which the demand is maximum and where mental preparation can have an important impact on the results. The objective of this work is to identify the mindfulness- and acceptance-based interventions implemented in the context of chess and to examine their effects on performance and on the psychological variables potentially relevant to performance, by conducting a systematic literature review.

Method: A bibliographic search was carried out in the PubMed, SCOPUS and Web of Science databases and studies incorporating interventions based on mindfulness (MBIs) or acceptance and commitment therapy (ACTs) applied to chess were selected.

Results: No MBI applied to chess and only four short ACT interventions were found. The main objective in all of them was to improve athletic performance and all but two players significantly improved their performance. Improvements were also made in the psychological variables considered, although they were not generalized.

Conclusions: Chess is shown to be a virgin field of research to explore for MBIs. The brief ACT interventions had a positive effect on improving chess players' performance and, with less evidence, on reducing problematic reactions to private events during competition. Further studies of higher methodological quality are needed to corroborate the results obtained.

Keywords: Mindfulness; ACT; Chess; Systematic review; Sport

Highlights

- Chess is a sport in which the demand is maximum: a single error can lead to defeat.
- Chess is considered the sport with the highest intellectual content.
- Mental preparation can have an important impact on the results in chess.
- There is a growing interest in mindfulness- and acceptance-based interventions in sport.
- Chess is shown to be a virgin field of research to explore for MBIs.

Contents

1. Introduction

In the sporting context, improving performance and managing the psychological variables involved in the pressure to obtain results such as anxiety or stress are athletes' priority objectives, and especially elite athletes due to the ever-present demands of high-level sporting competition. Therefore, athletes who want to obtain good results must not only be technically proficient in their sport, but they must also be well prepared mentally.

Demand is maximum in the sport of chess since games must be played in a limited time, a single error can lead to defeat, and moves once made cannot be rectified (Ruiz, 2006; Ruiz & Luciano, 2012). Based on Ruiz & Luciano (2012), we consider that the relevant behaviors of chess players to achieve good performance during a game can be summarized as: (a) managing the limited time available; (b) deciding each movement based on assessing their position as the main criterion; and (c) focusing on their position on the board and not on private events. To this effect, it is not surprising that chess is considered to be the sport with the highest intellectual content[2], where mental preparation can have a significant impact on the results.

Regarding mental preparation, there are two main approaches. First, there is the traditional Psychological Skills Training (PST) based on cognitive behavioral techniques; and second, there is mindfulness- and acceptance-based training.

PST techniques focus on controlling the content of internal experiences including thoughts, emotions, and body sensations, the objective of which is to change internal states to create an ideal performance-enhancing state. Among them, the most commonly used techniques are goal-setting, imagery/mental rehearsal, arousal control, self-talk modification, precompetitive routines, or a combinations of these (Gardner & Moore, 2007, 21). While there is no agreement as to their effectiveness in improving performance, there is a set of meta-analyses that show important effect sizes on performance for some of these interventions (Hatzigeorgiadis *et al.*, 2011: self-talk; Kyllo & Landers, 1995: goal-setting; Driskell, Copper & Moran, 1994: precompetitive routines)*,* which seem to be more centered on focusing attention on useful signals for performance than on controlling internal states. Moreover, although the meta-analyses did not pay much attention to the methodological rigor of the studies included, they do present results supporting the use of these interventions in sport (Noetel et al., 2019).

Birrer, Ruthlin & Morgan (2012) point out the existence of two explanatory theories as to why athletes cannot successfully control their cognitive processes, despite the effort they make to do so. The theory of ironic mental processes explains how wanting to control internal states can have the opposite effect, and that rather than suppressing them their presence can be increased and, contrary

to what is sought, they are also given more attention. Consequently, it is hypothesized that the athlete focuses on signals that are not relevant to performance, resulting in a decrease rather than an improvement in their performance. Furthermore, when the performance achieved does not match the expected performance, the theory of reinvestment comes into play, which states that athletes perform less well under pressure when they try to execute the skill consciously rather than allowing it to be performed automatically (Noetel et al., 2019).

As an alternative to techniques that promote controlling internal experiences, there are a number of interventions based on mindfulness and acceptance whose interest lies in recognizing and accepting these experiences, focusing on the present moment without judgment and on the cues relevant to the task (Birrer, Ruthlin & Morgan, 2012). Noetel et al., 2019 argue that mindfulness- and acceptance-based interventions reduce the negative effects of ironic rebound and reinvestment on athletic performance based on a combination of: (a) the fact that by promoting focus on the present moment with acceptance, these interventions facilitate the automatic execution of performance (Gardner & Moore, 2006, 2007, 2012); and (b) Birrer, Röthlin & Morgan (2012)'s proposal concerning athletes performing at their highest level when they execute skills automatically without conscious control and with an open awareness that enables the required adjustments to be made to better meet the objectives.

With specific reference to mindfulness-based interventions (MBIs), or the interventions whose main component is mindfulness meditation, two protocols can be highlighted in the clinical field, *Mindfulness-Based Stress Reduction* (MBSR; Kabat-Zinn, 1982, 2003), which was the first and is the best known and used, and *Mindfulness-Based Cognitive Therapy* (MBCT; Segal, Williams & Teasdale, 2002, 2013), developed from MBSR and combined with cognitive therapy, and the only mindfulness-based protocol to be included in third generation therapies by common agreement (Dimidjian et al., 2016). Another prominent protocol in the clinical setting is *Acceptance-Commitment Therapy* (ACT; Hayes, Strosahl & Wilson, 1999), also considered third-generation therapy (Dimidjian *et al.*, 2016; García Campayo & Demarzo, 2018b, 47). However, despite including mindfulness as one of its therapeutic elements, it does not incorporate meditation practice. In the sporting context, the fundamentals of these models have been integrated into the *Mindfulness-Acceptance-Commitment* approach (MAC; Gardner & Moore, 2007), which combine MBCT and ACT and incorporate brief meditations, and into the *Mindful Sport Performance Enhancement* approach (MSPE; Kaufman, Glass & Arnkoff, 2009), which is mainly based on MBSR combined with MBCT and meditative practices. There is a third prominent protocol, *Mindfulness Meditation Training for Sport* (MMTS; Baltzell & Akhtar, 2014), which emerged as an alternative to the previous two protocols and was intended as a shorter intervention to facilitate adapting the daily program to

5

the already tight schedules of elite university athletes. Mindfulness meditation is at the core of the intervention program of this protocol, which incorporates PST techniques and, in its version 2.0 (Baltzell & Summers, 2017), integrates the concept of self-compassion throughout to offer an appropriate level of kindness, which is deemed to be essential to dislodge the anxiety involved in achieving high performance and the harsh self-criticism present in athletes.

There is a growing interest in mindfulness- and acceptance-based interventions in sport especially, as we have seen, with the development of specific protocols, and with empirical results that support improvements in athletes' performance and well-being, despite the reviews carried out so far calling for more and better quality research. We have so far linked just three systematic reviews on mindfulness and acceptance in sport (Sappington & Longshore, 2015; Noetel et al., 2019; Corbally *et al.*, 2020) and a single meta-analysis (Bühlmayer et al., 2017), in addition to six bibliographic reviews (Gardner & Moore, 2012; Gardner, 2016; Palmi & Solé, 2016; Petterson & Olson, 2017; Carraça et al., 2018; XXXXXXX, 2020). Of these, just one of them (Corbally et al., 2020) focuses on a single sport (long-distance runners) and three of them (Gardner, 2016; Carraça et al., 2018; Noetel et al., 2019) incorporate the same intervention applied to chess players.

In view of all the above factors, the objective of this systematic review is to identify the mindfulness- and acceptance-based interventions implemented in the context of chess and to examine their effects on performance and psychological variables potentially relevant to performance.

2. Methodology

The present review follows the PRISMA *(Preferred Reporting Items for Systematic reviews and Meta-analyses)* structure and guidelines for publishing systematic reviews (Liberati et al., 2009; Urrútia & Bonfill, 2010; Hutton et al., 2015).

2.1. Eligibility criteria

Following the structure of the PICOS approach *(Participants, Interventions, Comparisons, Outcomes, Study design)*, the literature review covers all types of designs (S) of MBIs and ACTs (I) intended for chess players (P), with or without control groups (C), the objective of which is to obtain results related to performance improvement and / or psychological variables potentially relevant to this (O). Since our interest lies is in identifying all the mindfulness- and acceptance-based interventions carried out in the context of chess and assessing the interest this field has generated for these interventions, we

adopt a broad focus in terms of selecting the interventions, including both published and unpublished studies and all study designs.

2.2. Information sources

The bibliographical review was carried out in the following databases, gray literature in thesis databases and in the references of published articles was also reviewed:

-PubMed (1871-present), dated July 15, 2020 and search in *Title and Abstract.*

-SCOPUS (1788-present), dated July 15, 2020 and search *in Title, Abstract and Keywords.*

-Web of Science, dated July 15, 2020, in its *All Databases* version, which includes the Web of Science Core Collection databases (1900-present); Current Contents Connect (1998-2009); the Derwent Innovations Index (1980-2009), which combines unique value-added patent information indexed from over 50 patent-issuing authorities in the Derwent World Patent Index (1963-present) with patent citations indexed from the Derwent Patents Citation Index (1973-present); the KCI-Korean Journal Database (1980-present); MEDLINE® (1950-present); the Russian Science Citation Index (2005-present); and the SciELO Citation Index (2002-present). Website of the Spanish Foundation for Science and Technology FECyT: https://0-apps-webofknowledge-com.cataleg.udg.edu/summary.do?product=UA&parentProduct=UA&search_mode=AdvancedSearch&parentQid=&qid=1&SID=D2J8Ba2cCVCHQ62dZz1&&update_back2search_link_param=yes&page=1. The search was performed in *All documents type* and *All languages*.

2.3. Search strategy

The following Boolean keywords and operators were used in all the searches and databases: *Mindfulness* OR *ACT* AND *Chess*.

2.4. Study selection

Two independent reviewers (J.BiC. and A.B.S.) eliminated the duplicates, examined the titles and / or summaries, and selected the studies for full-text examination following eligibility criteria. There were no discrepancies in the selection. Both reviewers came across an unreleased study cited in one of the selected studies and decided by mutual agreement and likewise without discrepancies to include it in the review, following the objective of conducting as broad a review as possible.

2.5. Data items

For the data extraction, we follow the PICOS eligibility criteria, specifying the description and size of the sample group, their gender and age, and also adding the objectives of each study, the composition and characteristics of the experimental and control groups, and the effect size, where relevant. When one item of data was not available, the reason for this was specified in the results table itself.

2.6. Risk of bias in individual studies

We take as a reference the risk assessment of bias carried out in the systematic review conducted by Noetel et al. (2019), who perform the Cochrane risk of bias assessment because they consider it to be more valid, sensitive, and specific than the scales and checklists that measure bias (Higgins & Altman, 2008; cited in Noetel et al., 2019).

3. Results

3.1. Study selection

A total of 233 records, 232 from searches (139 on Web of Science, 13 on PubMed, and 80 on SCOPUS) plus one other study referenced in one of the records obtained in the search were identified. A total of 60 duplicates were eliminated, leaving 173 records screened for eligibility according to the inclusion criteria. A total of 37 records were excluded immediately because they were patents and, following a review of the titles and / or abstracts, a further 132 were excluded as they were not mindfulness-based or ACT interventions applied to the context of chess. Eventually, 4 studies were included in the qualitative synthesis of this systematic review. See Fig 1 for the breakdown of the selection.

Fig 1. Flow diagram of the study selection process here

3.2. Study characteristics

A total of 35 chess players, most of which were men aged between approximately 14 and 50 years, participated in the set of four studies included in the review. The full characteristics of the studies are provided in Table 1.

Table 1. Summary of included studies here

Three of the four studies were non-randomized controlled trials and one was a case study. In the first three, the same type of intervention was performed, a brief 4-hour ACT protocol, albeit with differences in the number of sessions, their duration, the context, and the period of time during which the protocol was taught and applied either individually or in a group format. In the case study, a brief 6-hour ACT protocol was applied over a two-month period in sessions of approximately one-and-a-half hours duration. A comparison group (CG) without treatment and without contact with the participants was included in all the studies apart from the case study. In all the studies, after the program was completed there was a follow-up at between six and nine months.

The main objective of all the studies was the improvement of chess performance, as measured by the Elo rating or the Elo performance rating, the two scores used by the International Chess Federation (FIDE, *Fédération Internationale des Échecs)* as objective measures of the playing strength (level) of chess players. Process measures related to improving psychological variables were also added, depending on the study. These include generic experiential avoidance, as measured by the *Acceptance and Action Questionnaire* in its initial (AAQ) and later versions of 10 (AAQ-II$_{10}$) or 7 items (AAQ-II$_7$); problematic reactions to private events as a measure of specific experiential avoidance in chess, as measured by the *Chess Counterproductive Reactions Questionnaire* (CCRQ) prepared by the authors themselves; and / or specific questions relating to interference, believability, and control of private events in normal and difficult competition situations.

3.3. Risk of bias within the studies

In line with the evaluation of Noetel et al. (2019), the three non-randomized controlled trials are categorized as high risk of bias because in two of them (Ruiz & Luciano, 2009, 2012) the researchers have no contact with the comparison groups, the members of which are selected from the FIDE online database, while for the third one (Ruiz & Luciano, 2006), we only have the incomplete data provided in Ruiz & Luciano (2009), which does not include the selection criteria of the control group, the results measures, or the quantitative results.

3.4. Results of individual studies

Ruiz (2006). Professional chess player subject to the brief ACT intervention of four 6-hour sessions conducted over a period of two months significantly improved their chess performance in the six months following the intervention, as measured by Elo FIDE, an objective FIDE rating which varies depending on the results obtained in the competitions. The player also showed a significant decrease

in experiential avoidance, as measured with AAQ, and a considerable decrease in interference, believability and control of private events in both normal and difficult competition situations one month after the intervention.

Ruiz & Luciano (2006). For this intervention, we only have the data presented by the authors in their work published in 2009, so we are very limited in terms of the details of its characteristics and results. In this study, a brief ACT intervention with an individual protocol lasting just 4 hours was carried out with 5 professional chess players and a CG with similar characteristics. In a follow-up at 7 months, the members of the experimental group (EG) had notably improved their sports results in comparison to the CG, which was strongly correlated with the decrease in the frequency of problematic reactions to certain thoughts that were also the subject of the intervention.

Ruiz & Luciano (2009). This intervention aims to replicate the previous two, and was this time applied in a group format to 7 promising young chess players, boys and girls aged between 14 and 20 years, in the form of a brief ACT intervention lasting 4 hours and conducted over 5 consecutive days in a Spanish Chess Federation (FEDA, *Federación Española de Ajedrez*) training camp. The CG was selected from the FIDE online database, with each participant paired with an EG of the same sex, with an age difference of less than one year and a difference in the Elo FIDE rating of less than 40 points. In a follow-up at an average of 9 months, it was found that of the 9 first tournaments in which each player took part after the intervention, compared to the 9 previous tournaments, there was a significant increase in performance as measured by the average Elo performance rating they obtained. The Elo performance system is a theoretical measure used by the FIDE to assess the level of play by a player in a tournament. Of the 7 players in the experimental group, 5 scored above the change criterion established for the result (increased by an average of 40 Elo performance points), with a moderate effect size difference between this group and the control group (d = 0.52). This criterion was not met by any of the players in the control group. Six months after the intervention, only 3 of the participants showed a significantly lower score than the established change criterion (15% decrease) in generic experiential avoidance (AAQ-II$_{10}$), and 3 others showed a drop above the established change criterion (15% decrease) for problematic reactions to private events during competition (CCRQ), which is a measure of experiential avoidance in chess developed by the authors of this research. No correlation was found between drop in AAQ-II$_{10}$ and performance improvement, but a correlation was found between drop in CCRQ and performance improvement.

Ruiz & Luciano (2012). The protocol of this brief 4-hour ACT intervention is similar to that used in Ruiz & Luciano (2009), this time applying it in an individual format in two or three daily sessions of between 75 minutes and 2 hours during a tournament, depending on the characteristics of the tournament, to 5 adult male chess players aged between 23 and 50 years with an international title (International Master (IM) or International Grandmaster (GM)). The CG was similarly selected from the FIDE online database, matching each participant with an EG participant with an age difference of no more than 2 years, the same international title, and an Elo rating difference of no more than 30 points. In a follow-up at 7 months after the intervention, all the EG chess players had achieved significant performance improvements in that time compared with the previous 7 months, as measured by the Elo performance average rating and over and above the expected change criterion (improvement of an average of 40 points in Elo performance), with a large effect size in the EG $(d = 1.42)$ and a moderate-large differential relative to the CG $(d = 0.79)$, no participants in which presented significant improvements in their performance. With regard to psychological variables, in a follow-up at 6 months after the intervention, we found that only the participant with a higher score previous to the EG reduced this score above the established criterion (reduction of 15%) in generic experiential avoidance (AAQ-II$_7$), while all of them presented significant reductions above the established criterion (25% reduction) in the frequency of problematic reactions to private events (CCRQ), which measures experiential avoidance in chess. Similarly, in a follow-up at 6 months, the reduction criteria (25%) were met in interference and believability of private events for 3 and 4 of the participants in the EG, respectively.

3.5. Synthesis of results

No MBI applied to chess was found, so we only have the results of ACT interventions in this sporting filed. The main objective of the four studies is the improvement of athletic performance through applying a brief ACT intervention. All the participating players included in the EGs apart from two showed a significant increase in their performance between the period prior to the intervention and the follow-up in terms of the Elo rating or the average score of the Elo performance achieved, thus highlighting the effectiveness of such interventions in improving athletic performance. Despite favorable performance outcomes for virtually all the EG members, the existence of a high bias risk due to the lack of data in some of the studies, together with the online choice system of the members of the CG in the two studies reporting this item, should not be overlooked.

Regarding psychological variables, noteworthy are the improvements in generic experiential avoidance (AAQ, AAQ-II$_{10}$, AAQ-II$_7$) in all the studies where the use of this measure is known, although only for some players. The same is true of experiential avoidance applied to chess (CCRQ),

11

but with a greater effect. There were also reductions in interference, believability, and control of private events at normal and difficult times during competition in the studies in which these instruments are used, although not in all the chess players.

See Table 2 for a summary of the results of all the studies.

Table 2. Effects of brief ACT protocols on results here

4. Discussion

First, and notably, it is surprising that no MBI was found among the mindfulness- and acceptance-based interventions in chess players. ACT interventions place explicit and implicit importance on being aware of the contents of the mind at all times in order to respond to it rather than react to it, which is an essential component of the conceptualization of mindfulness in the sporting field of Gardner and Moore, creators of the MAC protocol. This protocol combining MBCT and ACT is the one most widely used in sport and has accumulated empirical evidence as to its effectiveness in terms of interventions in this field, with recent RCTs supporting it in different sports and results (Ivarsson et al., 2015: sports injury in soccer; Gross et al., 2016: performance and psychological variables in basketball; Zhang *et al*., 2016: performance and psychological variables in darts; Josefsson *et. al*., 2019: performance and psychological variables in mainly floorball and golf).

The brief ACT interventions applied to the field of chess in this review, all of which have been carried out by the same authors, have lead to significant increases in performance, supported by moderate or large effect sizes when they have been demonstrated, since it has been hypothesized that an effect size of 0.3 may increase the chances of obtaining an Olympic medal by 10% (Hopkins, Hawley & Burke, 1999; cited in Noetel et al., 2019). However, these interventions provide no conclusive results regarding generic and applied experiential avoidance in chess.

Notwithstanding the good results obtained, especially in terms of improving performance, it should be noted that the sample is very limited, that there is no RCT among these studies and, as we have seen, they are not exempt from the risk of bias. Therefore, concurring with all the reviews cited above, new studies with a more robust design are needed to be able to confirm the effect of brief ACT interventions on performance and on psychological variables potentially relevant to it.

4.1. Strengths and limitations of included studies

Few studies were available for inclusion in this review, none of which was an MBI, so the interventions studied are limited to brief ACT protocols. The risk of bias in the interventions included was high, since none of them was an RCT. Detailed information on one of them was lacking and, when this was detailed, the members of the CG were selected without having any contact with them and via an online database.

At the level of results, we consider that while the fact that all the interventions found have the same authors means more consistent results and leads to greater homogeneity in terms of comparing the data, it also increases the risk of allegiance bias due to the lack of the replicability required in research (Munder et al., 2011). The fact that the population groups are close regarding playing strength, and the measuring instruments being certainly similar although not identical, facilitate the comparison of the results among studies. Always taking the high risk of bias presented into account, the conclusion drawn is that the size of the effect in terms of the performance improvements found in all the interventions, where this was available, is moderate-large, and thus that the interventions lead to improvements in chess players' competitiveness. However, there is a need to conduct more and higher quality studies based on a much broader sample of participants before these can be considered generalizable. Another positive element found in the studies is the very existence and duration of the follow-ups which, in relation to performance, was between 6 and 9 months.

4.2. Strengths and limitations of this review

At the review level, we consider that taking all the studies found in the search of the existing literature into account facilitates having an overview of the breadth of the research done so far on mindfulness and acceptance in the context of chess, although it is true that what can be considered a strength can also be a limitation, and the review does not discriminate on the basis of the quality of the studies found or the information available in them.

We did not limit ourselves to studies in English, taking research in all the languages into account and finding works in English and Spanish.

In our search, we limited ourselves to interventions in mindfulness and ACT and we did not consider the other interventions considered by Noetel et al. (2019) to also form part of the range of interventions, such as self-compassion and different types of meditation, which would have expanded the scope of the review.

5. Conclusions

From the results obtained in the studies included in the review, we can conclude that brief ACT interventions have a positive effect on improving chess players' performance and, although with less evidence, on reducing problematic reactions to private events during competition, in a context where experiential avoidance plays a relevant role.

Among the studies included in the review there is no MBI applied to the context of chess, since the four studies reported are based on the ACT protocol. Notably, ACT is a third-generation therapy aimed at promoting psychological flexibility and, consequently, combating psychological rigidity. To this end, it uses six therapeutic processes: acceptance, cognitive defusion, awareness of the present moment, self as perspective, direction by values, and committed action (García Campayo & Demarzo, 2018b, 48-49; Miró, 2018, 112-114). From this approach, following Szabo et al. (2015) and cited in Miró (2018, 113), it is considered that mindfulness involves four of these six processes (acceptance, cognitive defusion, awareness of the present moment, and the self as perspective) and that it plays a fundamental role in ACT. However, although ACT uses awareness-raising and informal mindfulness exercises, it does not incorporate the practice of meditation (Birrer, Röthlin & Morgan, 2012; Cebolla & Demarzo, 2014, 38-39) and is therefore not considered to be an MBI (Cebolla & Demarzo, 2014, 38; Demarzo et al., 2015; García Campayo & Demarzo, 2018b, 47-48, 63; Hervás, Cebolla & Soler, 2016). Thus, despite the relationships between mindfulness and the ACT protocol, we can conclude that we did not find any MBI applied to chess.

Regarding future research, and as specified by the authors themselves (Ruiz & Luciano, 2009), the fact that the utmost importance is given in at least one of the ACT interventions to the practice of the ability to be present with cognitive content in order to select the chosen response, leaves a door open to the use of MBIs to improve both performance and the psychological variables potentially relevant to it, and the well-being of chess players, meaning that there is a long way to go to ascertain the suitability of implementing MBIs in the context of chess.

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17

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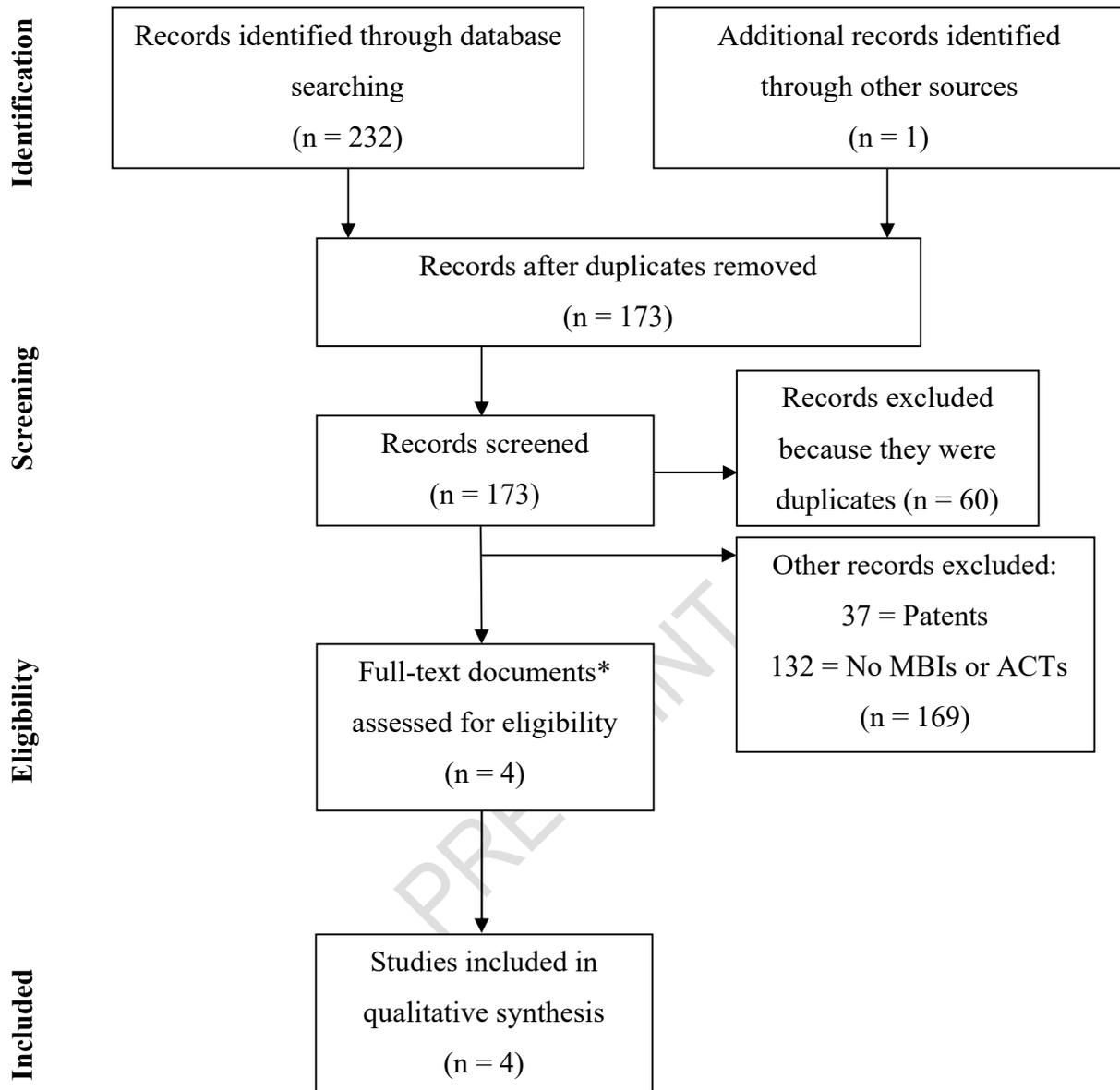
Fig 1. Flow diagram of the study selection process

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*One of them is a conference presentation, for which we only have the data cited in the paper that makes reference to it.

Table 1. Summary of included studies

Reference	Study design	Participants (target, sample size: n)	Comparison (EG: experimental group, CG: control group)	Intervention	Objectives	Outcome measures	Results	Follow-up $(d)^a$
Ruiz (2006)	Case study	27-year-old professional chess player (n = 1)	-	Brief ≈90-minute 4-session ACT protocol in 2 months	Improved chess performance	Elo FIDE[b] AAQ PEI PEB PEC	Δ^c significant performance ∇^c AAQ (Pre-post) ∇ considerable PEI ∇ considerable PEB ∇ considerable PEC	6 months 1 month 1 month 1 month
Ruiz & Luciano (2006)[d]	Non-randomized controlled trial	Professional chess players (n = 10)	EG = 5 CG = 5	Brief 4-hour individual ACT protocol	NA[e]	NA	Δ noteworthy performance in the 5 EG chess players, with significantly better results than in the CG, highly correlated with the ∇ frequency of problematic reactions to thoughts also subject to intervention	7 months
Ruiz & Luciano (2009)	Non-randomized controlled trial	Promising young chess-players (n = 14)	EG = 7: 8 members (4♂, 4♀), one did not answer the questionnaires Age range: 14-20 years (average = 16, SD = 2.32) CG = 7: No-contact participants Each paired with a same-sex EG participant, with an age difference of less than one year and an ELO ranking of less than 40 points	Brief 4-hour group ACT protocol for 5 consecutive days at a training camp	Improved chess performance	Average Elo Performance rating[f] AAQ-II$_{10}$ CCRQ	Δ significant performance in 5 of the 7 EG chess players, above the established change criterion (Δ 40 points), a criterion not reached by any of the CG players ∇ AAQ-II$_{10}$: only in 3 EG participants, significantly above the established change criterion (15% reduction) No correlation was found between AAQ-II∇_{10} and Δ performance ∇ CCRQ: only in 3 EG chess players, higher than the established change criterion (15% reduction) Correlation was found between ∇ CCRQ and Δ performance	≈9 months (ND) [0,52] 6 months 6 months
Ruiz & Luciano (2012)	Non-randomized controlled trial	Adult international-level chess players, with the title of International Master (IM) or International Grandmaster (GM) (n = 10)	EG = 5: 100%♂ Age range: 23-50 years CG = 5: 100%♂ No-contact participants Each paired with an EG participant with an age difference of no more than 2 years, with the same international title and an ELO Ranking difference of no more than 30 points	Brief intensive 4-hour individual ACT protocol implemented during a tournament in two or three sessions, one session per day, ≈75 minutes or 2 hours respectively, depending on the tournament characteristics	Improved chess performance	Average Elo Performance rating AAQ-II$_7$ CCRQ PEI PEB	Δ significant performance on all EG chess players, above the expected change criterion (Δ 40 points). None of the CG participants improved their chess performance ∇ AAQ-II$_7$: only the participant with the highest previous EG score above the established change criterion (15% reduction) ∇ CCRQ: all EG participants meeting the established change criterion (25% reduction) ∇PEI: 3 of the 5 participants in the EG reached the criterion for pre-post change (25% reduction) ∇ PEB: 4 of the 5 participants in the GE showed the criterion for pre-post change (25% reduction)	7 months (1,42) [0,79] 6 months 6 months 6 months 6 months

Notes: [a]*d*: Cohen's *d* = Cohen's *d* statistic, which measures the effect size, that is, the intensity of the change produced by the intervention studied. 0.2 to 0.5 is considered to be a "small" effect size, 0.5 to 0.8 a "moderate" effect size, and above 0.8 a "large" effect size (García Campayo & Demarzo, 2018a, 131). The value in brackets refers to the EG with respect to itself, and the value in square brackets to the differential with the CG. [b]Elo FIDE: ranking of a player's level of play, used by FIDE, and variable depending on the strength of the opponents and the results obtained in the competitions. [c]Δ/∇: Increase/reduction of the value of the corresponding variable. [d]Conference presentation, cited in Ruiz & Luciano (2009). From this study, we have only the data cited about it in the article in which it is referenced. [e]NA: Not available. [f]Average Elo Performance rating: average of the score used by FIDE to assess the playing strength developed by a player in a tournament.

Legend:
AAQ: Acceptance and Action Questionnaire
AAQ-II$_{10}$: Acceptance and Action Questionnaire II - 10 items version
AAQ-II$_7$: Acceptance and Action Questionnaire II - 7 items version

ACT: Acceptance and Commitment Therapy
CCRQ: Chess Counterproductive Reactions Questionnaire

PEB: Private events' believability during normal and difficult moments of competition
PEC: Private events' control during normal and difficult moments of competition
PEI: Private events' interference during normal and difficult moments of competition

Table 2. Effects of brief ACT protocols on results

Reference	Study design	Outcomes EG			
		Performance	Experiential avoidance (AAQ / AAQ-II$_{10/7}$)	Chess counterproductive reactions to private events (CCRQ)	Private events' interference, believability, and control for normal and difficult moments of competition (PEB / PEC / PEI)
Ruiz (2006)	Case study	Δ^a Elo FIDE	∇^a AAQ	-	∇ PEI ∇ PEB ∇ PEC
Ruiz & Luciano (2006)[b]	Non-randomized controlled trial	Δ in all	NA[c]	∇ in all	NA
Ruiz & Luciano (2009)	Non-randomized controlled trial	Δ Elo performance in 5 out of 7	∇ AAQ-II$_{10}$ 3 out of 7 No correlation with performance	∇ CCRQ 3 out of 7 Positive correlation with performance	-
Ruiz & Luciano, (2012)	Non-randomized controlled trial	Δ Elo performance at all	∇ AAQ-II$_7$ 1 out of 5	∇ CCRQ in all	∇ PEI at 3 out of 5 ∇ PEB at 4 out of 5

Notes:
(a) Δ/∇: Increase/reduction of the value of the corresponding variable, between the period prior to the intervention and the follow-up, above the change criterion established for it, except for Ruiz (2006), where it directly represents an increase/reduction of the variable. [b]Conference presentation, cited in Ruiz & Luciano (2009). We only have the data cited about this study in the paper in which it is referenced. [c]NA: Not available.

Legend:
AAQ: Acceptance and Action Questionnaire
AAQ-II$_{10}$: Acceptance and Action Questionnaire II - 10 items version
AAQ-II$_7$: Acceptance and Action Questionnaire II - 7 items version

ACT: Acceptance and Commitment Therapy
CCRQ: Chess Counterproductive Reactions Questionnaire
PEB: Private events' believability during normal and difficult moments of competition
PEC: Private events' control during normal and difficult moments of competition
PEI: Private events' interference during normal and difficult moments of competition