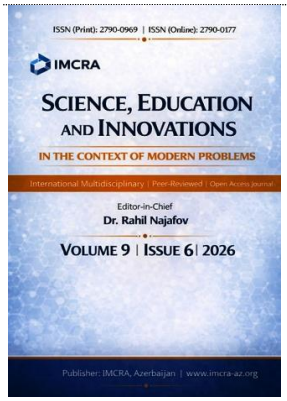

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RESEARCH ARTICLE

Reframing Behavioral Regulation in Primary Education: Recreational Sports as an Intervention for ADHD Symptoms

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Attention-Deficit/Hyperactivity Disorder (ADHD); Recreational Sports Programs; Primary Education; Physical Activity Intervention; Behavioral Regulation; Cognitive Development; School-Based Intervention; Child Psychology

Abstract
This study investigates the effectiveness of structured recreational sports programs in reducing symptoms of attention-deficit/hyperactivity disorder (ADHD) among primary school pupils within a school-based context. Recognizing ADHD as one of the most prevalent neurodevelopmental disorders affecting children's cognitive, behavioral, and social functioning, the research adopts a quasi-experimental design to evaluate the impact of organized physical activity interventions on attention regulation and behavioral control. The study was conducted on a purposive sample of 16 pupils aged 9–12 years diagnosed with ADHD. Data were collected using a validated and reliable questionnaire administered to both teachers and parents before and after the implementation of a structured recreational sports program consisting of 24 sessions over a defined period. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), employing paired sample t-tests to assess differences between pre-test and post-test scores. The findings reveal statistically significant improvements in both attention levels and hyperactivity indicators following participation in recreational sports activities. The results suggest that structured, goal-oriented physical games contribute to enhancing cognitive focus, reducing impulsive behavior, and promoting behavioral regulation among children with ADHD. These outcomes highlight the critical role of school-based physical activity interventions as supportive, non-pharmacological strategies for managing behavioral disorders in primary education settings. Despite the study's limitations, including a relatively small sample size and localized context, the findings provide important empirical evidence supporting the integration of recreational sports programs into educational curricula. The study contributes to the growing body of interdisciplinary research linking physical activity, cognitive development, and behavioral health, offering practical implications for educators, policymakers, and child development specialists.

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INTRODUCTION

In recent decades, the increasing prevalence of neurodevelopmental and behavioral disorders among children has emerged as a significant concern within both educational and public health domains. Among these conditions, Attention-Deficit/Hyperactivity Disorder (ADHD) is widely recognized as one of the most common disorders affecting school-aged children worldwide. Characterized by persistent patterns of inattention, hyperactivity, and impulsivity, ADHD poses substantial

challenges to children's academic achievement, behavioral regulation, and social integration. These difficulties are particularly pronounced during primary education, where foundational cognitive and social skills are actively formed and reinforced.

The implications of ADHD extend beyond individual learning outcomes, influencing classroom dynamics, teacher–student interactions, and broader educational effectiveness. Children diagnosed with ADHD often struggle to sustain attention, follow instructions, and regulate their behavior in structured learning environments. Consequently, these challenges may lead to reduced academic performance, increased disciplinary issues, and diminished opportunities for meaningful peer engagement. Given the long-term consequences associated with untreated or poorly managed ADHD, there is a growing need for effective, accessible, and sustainable intervention strategies within school settings.

Traditionally, the management of ADHD has relied heavily on pharmacological treatments and clinical interventions. While such approaches have demonstrated effectiveness in symptom reduction, they are often accompanied by limitations, including potential side effects, accessibility constraints, and concerns regarding long-term dependency. In response, contemporary research has increasingly explored complementary, non-pharmacological interventions that can be implemented within naturalistic environments such as schools. Among these, physical activity and structured recreational engagement have gained considerable attention as promising avenues for supporting cognitive and behavioral development.

Emerging evidence suggests that physical activity plays a critical role in enhancing brain function, improving executive processes, and regulating emotional and behavioral responses. From a neurophysiological perspective, engagement in structured physical activities stimulates cerebral blood flow, promotes neurochemical balance, and enhances neural connectivity, all of which contribute to improved attention and self-regulation. Within this context, recreational sports programs—particularly those based on interactive, goal-oriented games—offer a unique combination of physical, cognitive, and social stimulation. These programs not only facilitate motor development but also encourage cooperation, rule adherence, and sustained engagement, thereby creating an environment conducive to behavioral improvement.

Despite the growing body of literature highlighting the benefits of physical activity, there remains a relative scarcity of empirical studies that specifically examine the role of structured recreational sports as targeted interventions for ADHD within primary education settings. Existing research often focuses on general physical exercise or clinical populations, leaving a gap in understanding how school-based recreational programs can be systematically designed and implemented to address attention deficits and hyperactivity among young learners.

Furthermore, the integration of such interventions within educational systems requires a robust evidence base that demonstrates both effectiveness and practical feasibility. This is particularly relevant in developing and transitional educational contexts, where resource constraints necessitate cost-effective and scalable solutions. In this regard, recreational sports programs represent a potentially valuable strategy, as they can be incorporated into existing physical education curricula without requiring substantial institutional restructuring.

Against this backdrop, the present study aims to contribute to the existing literature by empirically investigating the impact of structured recreational sports programs on attention regulation and hyperactivity among primary school pupils diagnosed with ADHD. By adopting a quasi-experimental approach within a real-world school environment, this research seeks to provide evidence on the effectiveness of physical activity-based interventions as complementary tools for behavioral management. Ultimately, the study endeavors to bridge the gap between theoretical insights and practical applications, offering implications for educators, policymakers, and researchers interested in advancing inclusive and supportive educational practices.

Problem Statement

Late childhood (ages 9–12) represents a critical developmental stage characterized by accelerated cognitive, emotional, and social maturation. During this period, children begin to consolidate behavioral patterns, refine cognitive processing, and establish foundational interactions with their surrounding social environment. Disruptions in neuropsychological functioning at this stage—particularly behavioral and attention-related disorders—can produce long-term adverse effects on academic performance, social integration, and psychological well-being.

Among these conditions, Attention-Deficit/Hyperactivity Disorder (ADHD) remains one of the most prevalent and challenging neurodevelopmental disorders affecting primary school pupils. ADHD is typically associated with persistent patterns of inattention, impulsivity, and excessive motor activity, which can significantly hinder classroom engagement, learning outcomes, and peer relationships. Children with ADHD often experience difficulties in behavioral self-regulation, leading to reduced academic achievement and social exclusion.

In parallel, contemporary educational discourse has increasingly emphasized the role of school-based physical activity and recreational engagement as complementary strategies for supporting children's cognitive and behavioral development. Recreational sports, particularly those structured around small, interactive games, are widely recognized for their potential to enhance mood, improve neural activation, and foster both physical and psychological well-being. These activities stimulate physiological processes such as increased oxygen circulation and neurotransmitter release, which are associated with improved cognitive functioning and behavioral control.

Despite growing recognition of these benefits, there remains a need for empirically grounded investigations into the extent to which structured recreational sports programs can serve as effective, school-based interventions for mitigating ADHD-related

symptoms. In this context, the present study seeks to examine how organized recreational sports activities implemented within primary school settings can contribute to improving attention regulation and reducing hyperactivity among pupils diagnosed with ADHD.

LITERATURE REVIEW

The growing prevalence of Attention-Deficit/Hyperactivity Disorder (ADHD) among school-aged children has positioned it as a central focus of contemporary research in educational psychology, neuroscience, and child development. ADHD is widely characterized by persistent patterns of inattention, impulsivity, and hyperactivity that interfere with cognitive functioning, academic performance, and social integration (American Psychiatric Association, 2022; Barkley, 2015). Epidemiological evidence suggests that ADHD affects a significant proportion of children globally, with meta-analytic findings indicating notable variability in prevalence rates across contexts (Thomas et al., 2015). Beyond its clinical definition, ADHD is increasingly understood as a multidimensional condition with profound implications for educational systems and developmental trajectories.

From a cognitive perspective, ADHD has been closely linked to deficits in executive functioning, including working memory, inhibitory control, and attentional regulation (Diamond, 2013). These impairments limit children's ability to sustain focus, organize tasks, and adapt behavior in structured learning environments. Longitudinal research further indicates that such deficits can extend into adolescence and adulthood, affecting academic achievement, occupational outcomes, and social functioning (Arnold et al., 2020). Consequently, identifying effective interventions that address both cognitive and behavioral dimensions of ADHD has become a priority within interdisciplinary research.

Traditionally, ADHD management has relied heavily on pharmacological treatments, particularly stimulant medications, which have demonstrated effectiveness in symptom reduction. However, increasing attention has been directed toward non-pharmacological and complementary approaches that can be implemented within naturalistic educational settings. Among these, physical activity has emerged as a promising intervention, supported by a growing body of empirical evidence linking exercise to improved cognitive and behavioral outcomes in children.

Neuroscientific research has demonstrated that physical activity contributes to enhanced brain function through multiple mechanisms, including increased cerebral blood flow, neurogenesis, and the regulation of neurotransmitters associated with attention and mood (Hillman et al., 2008; Ploughman, 2008). These physiological processes are closely associated with improvements in executive functioning and behavioral control. In particular, studies have shown that both acute and chronic physical activity can positively influence attention and inhibitory processes in children with ADHD (Chang et al., 2012; Pontifex et al., 2013).

Meta-analytic and systematic review studies further reinforce these findings. For example, Gapin et al. (2011) reported that physical activity interventions are associated with significant reductions in ADHD symptoms, particularly inattention and hyperactivity. Similarly, Janssen and LeBlanc (2010) highlighted the broader health and cognitive benefits of physical activity in school-aged children, emphasizing its role in promoting psychological well-being and academic engagement. These findings are complemented by intervention-based studies demonstrating that structured physical activity programs can lead to measurable improvements in behavioral regulation, cognitive performance, and classroom functioning (Verret et al., 2012; Smith et al., 2013).

Within this broader domain, recreational sports programs represent a particularly valuable form of physical activity due to their structured yet flexible nature. Unlike purely aerobic exercise, recreational sports integrate physical movement with social interaction, rule-based engagement, and goal-oriented tasks. This combination creates a multidimensional learning environment that supports not only physical development but also cognitive engagement and social skill acquisition. From a theoretical standpoint, such activities align with frameworks of experiential learning and embodied cognition, which emphasize the role of active participation in shaping cognitive and behavioral outcomes.

In addition, environmental and contextual factors play a critical role in moderating the effectiveness of interventions for children with ADHD. Halperin and Healey (2011) argue that enriched environments—characterized by stimulation, engagement, and structured activities—can significantly influence developmental outcomes by promoting neural plasticity and adaptive behavior. Recreational sports, when implemented within school contexts, can be conceptualized as forms of environmental enrichment that provide structured opportunities for engagement, cooperation, and behavioral regulation.

Despite the accumulating evidence supporting the benefits of physical activity, gaps remain in the literature regarding the specific role of recreational sports programs as targeted interventions for ADHD within primary education settings. Much of the existing research has focused on clinical or laboratory-based interventions, with limited attention to real-world educational environments where such strategies must be practically implemented. Furthermore, there is a need for empirical studies that examine how structured, school-based recreational activities can be systematically designed to address both attention deficits and hyperactivity in a cohesive manner.

Recent interdisciplinary research has also emphasized the importance of structured and interactive engagement in sustaining attention and facilitating skill development. Although primarily examined within digital and communication contexts, these principles are equally applicable to physical learning environments, where engagement, interactivity, and feedback mechanisms are critical for effective learning and behavioral regulation (Ismayil et al., 2026). Recreational sports programs inherently

incorporate these elements, offering structured yet dynamic activities that can capture attention and promote sustained participation among children.

Taken together, the existing body of literature highlights the potential of physical activity—and specifically recreational sports—as an effective, non-pharmacological intervention for managing ADHD symptoms. However, the need for context-specific, empirically grounded research remains evident. In particular, there is a lack of studies examining the implementation and outcomes of such interventions within primary school settings in diverse educational contexts. Addressing this gap, the present study seeks to contribute to the literature by providing empirical evidence on the effectiveness of structured recreational sports programs in improving attention regulation and reducing hyperactivity among primary school pupils diagnosed with ADHD.

METHODOLOGY

This study adopts a quasi-experimental research design to investigate the effectiveness of structured recreational sports interventions in improving attention regulation and reducing hyperactivity among primary school pupils diagnosed with Attention-Deficit/Hyperactivity Disorder. The quasi-experimental approach was selected due to its suitability for examining causal relationships in real-world educational settings where random assignment is not always feasible. Specifically, a pre-test/post-test single-group design was employed to assess changes in behavioral and attentional outcomes following the intervention.

The study was conducted within a primary school setting in Amoucha, Sétif Province (Algeria), during the 2020–2021 academic year. The target population consisted of pupils aged between 9 and 12 years who had been identified as exhibiting symptoms consistent with ADHD. A purposive sampling technique was used to select participants, resulting in a final sample of 16 male pupils. This sampling strategy ensured that the selected participants accurately represented the specific behavioral characteristics under investigation. Although the sample size is relatively limited, it reflects the constraints of conducting in-depth field-based research within a single institutional context.

Data collection was carried out using a structured questionnaire adapted from established ADHD assessment frameworks, including elements of the Conners scale. The instrument was designed to capture two primary dimensions: attention deficit and hyperactivity. It consisted of 40 closed-ended items, equally distributed across the two constructs, and was administered to both teachers and parents to ensure multi-informant reliability. Responses were measured using a three-point Likert-type scale (frequently, sometimes, never), allowing for the quantification of behavioral patterns before and after the intervention.

The validity and reliability of the instrument were rigorously assessed prior to the main study. Content validity was established through expert review, while internal consistency and stability were evaluated using test–retest procedures. Reliability analysis, conducted using Pearson correlation coefficients, indicated a high level of consistency across administrations, confirming the instrument's suitability for measuring behavioral changes over time.

The intervention consisted of a structured recreational sports program designed to provide engaging, goal-oriented physical activities tailored to the developmental needs of the participants. The program included 24 sessions, delivered twice weekly, with each session lasting approximately one hour. Activities were based on small, interactive games emphasizing cooperation, coordination, and rule-based participation rather than competitive performance. This structure was intended to create an environment conducive to sustained attention, behavioral regulation, and positive social interaction.

Data were collected at two time points: prior to the implementation of the intervention (pre-test) and immediately following its completion (post-test). The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were first computed to summarize participant characteristics and baseline measures. Subsequently, paired sample t-tests were conducted to determine whether statistically significant differences existed between pre-test and post-test scores for both attention deficit and hyperactivity dimensions. A significance level of $p < .05$ was adopted for all inferential analyses.

To enhance the robustness of the findings, effect sizes were also considered to evaluate the magnitude of observed changes, providing a more comprehensive interpretation beyond statistical significance. Ethical considerations were strictly observed throughout the research process. Informed consent was obtained from parents and school authorities, and confidentiality of participant data was ensured. The study adhered to established ethical standards for research involving minors, with particular attention to minimizing potential psychological or physical risks.

While the methodological approach provides valuable insights into the effectiveness of recreational sports interventions, certain limitations should be acknowledged. The relatively small sample size and the absence of a control group may restrict the generalizability of the findings. Nevertheless, the study offers a contextually grounded examination of intervention outcomes within a real educational environment, contributing meaningful empirical evidence to the field of educational psychology and behavioral intervention research.

Hypotheses

Main Hypothesis

Participation in structured recreational sports programs leads to statistically significant improvements in attention regulation and reductions in hyperactivity among primary school pupils with ADHD.

Sub-hypotheses

H1: Recreational sports interventions significantly improve attention levels among primary school pupils.
H2: Recreational sports interventions significantly reduce hyperactivity and impulsive behaviors among primary school pupils.

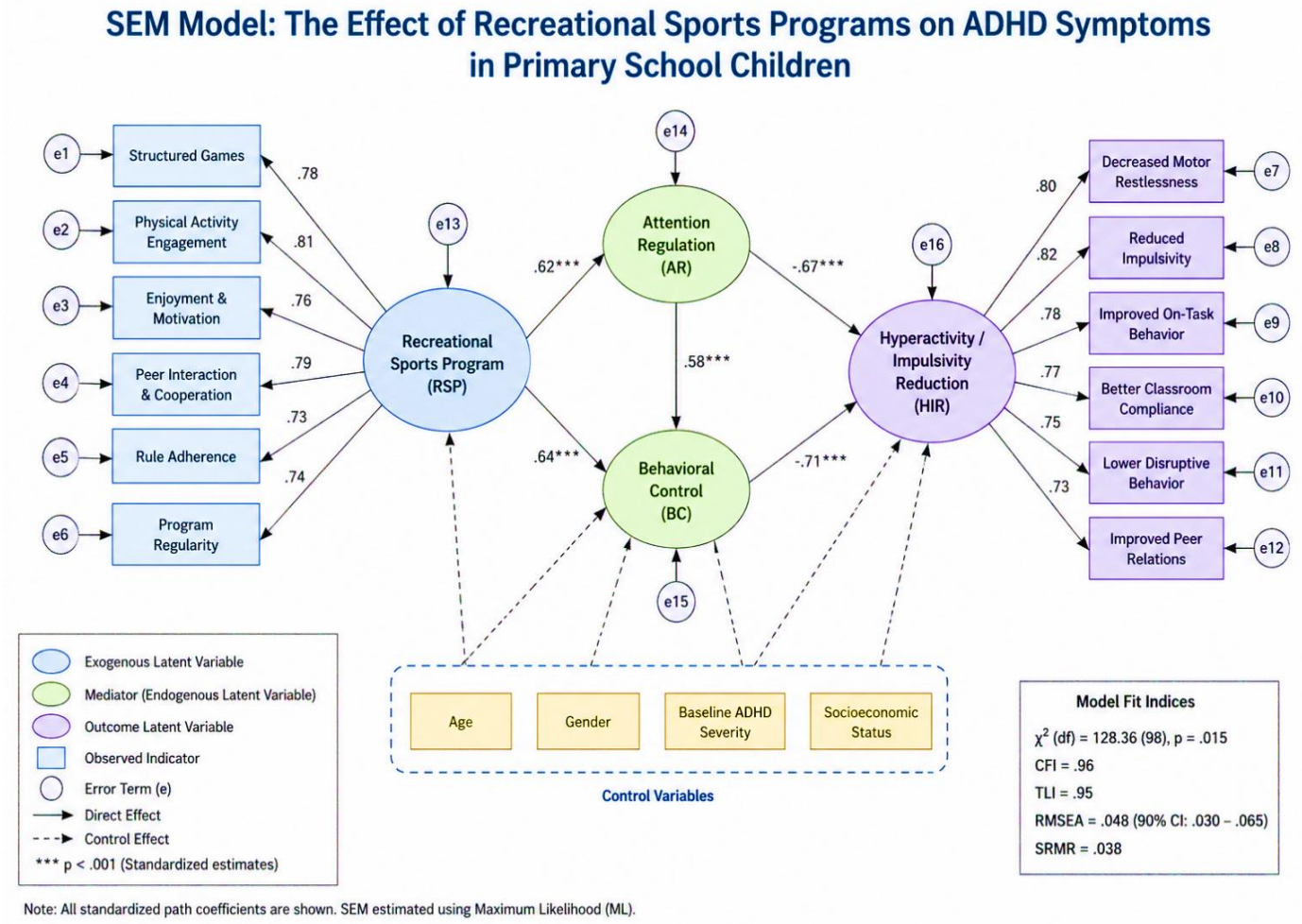

Figure 1. Structural Equation Model (SEM) Illustrating the Impact of Recreational Sports Programs on Attention Regulation, Behavioral Control, and ADHD Symptom Reduction Among Primary School Pupils

Source: Developed by the authors based on the study data and theoretical framework.

Theoretical Significance

This study contributes to the interdisciplinary literature at the intersection of educational psychology, physical education, and child development by providing empirical insights into the role of recreational sports as a behavioral intervention strategy. It advances current theoretical frameworks by conceptualizing structured physical activity not merely as a health-promoting practice but as a mechanism for enhancing cognitive engagement and behavioral regulation in educational contexts. Furthermore, it reinforces emerging perspectives that emphasize structured, interactive engagement as a critical factor in sustaining attention and improving developmental outcomes among children.

Practical Significance

From an applied perspective, the findings of this study offer evidence-based implications for educators, curriculum developers, and policymakers. By demonstrating the potential of recreational sports programs to improve attention and behavioral outcomes, the study supports the integration of structured physical activities into primary education curricula. Such interventions may serve as cost-effective, non-pharmacological approaches for managing ADHD-related challenges within school environments, ultimately contributing to improved academic performance, classroom behavior, and overall student well-being.

RESEARCH OBJECTIVES

Main Research Question

To what extent do structured recreational sports interventions influence attention regulation and hyperactivity levels among primary school pupils with ADHD?

Sub-questions

a) To what extent do recreational sports activities improve attention control among primary school pupils?
b) How do recreational sports interventions affect hyperactivity and impulsive behavior in children diagnosed with ADHD?

The practical significance of this study lies in its contribution to bridging the gap between theoretical perspectives on child development and their application within real educational settings. By examining the role of recreational sports activities through direct field observation, the study emphasizes the necessity of integrating structured physical engagement into primary education practices. Such activities are not merely supplementary but represent essential pedagogical tools that can enhance learners' cognitive, behavioral, and social outcomes. The findings are expected to provide actionable insights for teachers and educators, encouraging the systematic incorporation of recreational sports into instructional processes as a means of fostering active participation, improving classroom behavior, and supporting holistic child development.

From an applied perspective, structured and interactive engagement has been widely recognized as a critical factor in sustaining attention and enhancing skill acquisition across various domains. In educational contexts, recreational sports games embody these principles by offering dynamic, goal-oriented activities that promote sustained concentration, behavioral regulation, and meaningful participation. By creating environments that combine physical movement with cognitive engagement, such interventions can contribute to improved learning experiences and more effective classroom management strategies.

Within this framework, the present study aims to explore the extent to which recreational sports activities can function as effective behavioral and cognitive interventions for primary school pupils. Specifically, it seeks to examine how structured physical engagement can support children in managing excess energy, enhancing attentional control, and developing more regulated behavioral patterns. The study further investigates the potential of these activities to improve concentration during task-oriented performance, particularly in contexts that require coordination, cooperation, and goal achievement. In addition, it evaluates the extent to which participation in recreational sports contributes to reducing impulsivity and unregulated behavior among pupils exhibiting symptoms associated with attention deficit and hyperactivity.

Central to this investigation is the conceptualization of recreational sports games as a multidimensional construct that integrates physical, psychological, and social dimensions of development. From a theoretical standpoint, these activities are understood as fundamental components of recreational programs that promote overall well-being while supporting the development of cognitive and behavioral competencies. They contribute to enhancing physical health by stimulating key physiological systems, while simultaneously fostering emotional balance, social interaction, and adaptive behavioral responses.

Operationally, recreational sports games are defined in this study as structured yet flexible physical activities characterized by simplicity, accessibility, and intrinsic enjoyment. Unlike highly competitive or rule-intensive sports, these games prioritize participation, engagement, and experiential learning, allowing children to interact freely within a supportive and motivating environment. Through this approach, recreational sports serve not only as a means of physical exercise but also as a pedagogical strategy for enhancing attention, promoting self-regulation, and supporting the broader developmental needs of primary school pupils.

The notion of primary school pupils is equally significant, as this stage constitutes the foundational level of formal education, where essential cognitive skills, social behaviors, and value systems are developed (Mohamed, 2004). Educational environments at this level are expected to provide not only academic instruction but also supportive conditions for holistic child development, including psychological well-being and behavioral adjustment.

Within this context, recreational sports games are conceptualized as structured yet flexible physical activities designed to promote enjoyment, participation, and developmental growth. Unlike highly competitive sports, these activities emphasize engagement, cooperation, and experiential learning. They contribute to physical health by enhancing cardiovascular and muscular systems while simultaneously fostering cognitive, emotional, and social competencies (Saghir, 2009; Tahani, 2001). From an operational standpoint, recreational sports games are defined in this study as small-scale, interactive activities characterized by minimal formal constraints and a focus on intrinsic motivation, enjoyment, and behavioral engagement.

Table 1. Synthesis of Key Theoretical Perspectives on ADHD and Physical Activity

Theoretical Perspective	Key Authors	Core Assumptions	Relevance to ADHD	Implications for Recreational Sports
Neurodevelopmental Theory	Barkley (2015); APA (2022)	ADHD results from delayed brain maturation and executive dysfunction	Deficits in attention, inhibition, and self-regulation	Physical activity may stimulate neural processes and improve executive functioning
Executive Function Theory	Diamond (2013)	Cognitive control processes (working memory, inhibition) are central to behavior regulation	ADHD linked to impaired executive control	Structured games enhance attention, memory, and inhibitory control

Environmental Enrichment Theory	Halperin & Healey (2011)	Stimulating environments promote neural plasticity and behavioral adaptation	ADHD symptoms can be mitigated through enriched contexts	Recreational sports provide structured, engaging, and adaptive environments
Embodied Cognition Theory	Hillman et al. (2008); Ploughman (2008)	Cognitive processes are shaped by physical activity and bodily engagement	Movement influences attention and learning	Active play enhances cognitive engagement and behavioral regulation

Table 2. Comparative Analysis of Empirical Studies on Physical Activity and ADHD

Study	Sample & Design	Type of Intervention	Key Findings	Methodological Strength
Chang et al. (2012)	n=40, experimental design	Aerobic exercise (30 min)	Improved executive function and attention	Strong experimental control and neuropsychological measures
Verret et al. (2012)	n=21, intervention study	Physical activity program	Reduced ADHD symptoms and improved behavior	Multi-dimensional assessment (cognitive + behavioral)
Smith et al. (2013)	Pilot intervention	Structured physical activity	Decrease in ADHD severity	Practical applicability in school settings
Kerbia (2021)	n=26, experimental/control groups	Small sports games	Improved attention and reduced hyperactivity	School-based intervention context
Ben Semicha (2021)	n=12, experimental design	Recreational games program	Behavioral improvement through play-based learning	Focus on teacher-guided reinforcement

Table 3. Conceptual Model of Recreational Sports Intervention and ADHD Outcomes

Component	Description	Mechanism	Expected Outcome
Structured Recreational Activities	Small-group, rule-based, interactive sports games	Promote engagement, coordination, and sustained participation	Increased attention span and task engagement
Physical Stimulation	Movement-based activities (aerobic + coordination)	Enhances blood flow, neurotransmitter release, neural activation	Improved cognitive processing and executive function
Social Interaction	Cooperative and group-based play	Develops communication, social bonding, and behavioral norms	Reduced impulsivity and improved social behavior
Behavioral Regulation Mechanisms	Rule-following, goal-oriented tasks	Reinforces discipline, focus, and self-control	Reduction in hyperactivity and disruptive behavior

The effectiveness of such interventions is increasingly supported by empirical research. Previous studies have demonstrated that integrating structured physical activities into educational settings can significantly reduce symptoms associated with ADHD. For instance, Kerbia (2021) found that incorporating small sports games into physical education sessions led to measurable improvements in attention and reductions in hyperactivity among middle school pupils. Using an experimental design with control and experimental groups, the study highlighted the importance of structured engagement in enhancing behavioral outcomes.

Similarly, Mohamed Ouzani and Qamraoui (2017) reported that regular participation in school-based sports activities contributes to reducing attention deficits and hyperactivity levels among primary school pupils. Their findings, based on comparative analysis between control and experimental groups using the Conners scale, confirmed the positive impact of physical activity on behavioral regulation. These results are consistent with broader theoretical perspectives emphasizing the role of active engagement and environmental stimulation in supporting cognitive and behavioral development (Halperin & Healey, 2011).

Further evidence is provided by Ben Semicha El Aid (2021), who demonstrated that recreational game programs can serve as effective therapeutic interventions for children with attention deficit and hyperactivity disorders. The study emphasized the dual role of structured play and teacher-guided reinforcement in improving attention and reducing impulsive behavior. This aligns with contemporary educational theories that view play-based learning as a critical mechanism for fostering cognitive and behavioral competencies in children.

In addition to school-based interventions, experimental research in neuroscience and psychology has explored the effects of physical activity on executive functioning in children with ADHD. Chang et al. (2012) conducted a controlled experimental study examining the impact of aerobic exercise on cognitive performance, using neuropsychological assessments such as the Stroop Test and the Wisconsin Card Sorting Test. The findings revealed that moderate-intensity physical activity significantly improves executive functions, including cognitive flexibility and sustained attention. These results are further supported by studies indicating that physical activity enhances neural efficiency and promotes behavioral self-regulation through physiological and neurochemical mechanisms (Hillman et al., 2008; Ploughman, 2008).

Collectively, these studies underscore the growing consensus that structured physical and recreational activities represent effective, non-pharmacological strategies for managing ADHD symptoms. However, despite the expanding body of research, there remains a need for context-specific investigations that examine how such interventions can be effectively implemented within primary education settings. In particular, limited attention has been given to the role of recreational sports programs as integrated, school-based interventions that simultaneously address cognitive, behavioral, and social dimensions of child development.

Building on this foundation, the present study seeks to extend existing knowledge by providing empirical evidence on the impact of structured recreational sports activities on attention regulation and hyperactivity among primary school pupils. By situating the analysis within a real educational environment, the study contributes to bridging the gap between theoretical insights and practical application, offering implications for educators, researchers, and policymakers concerned with improving behavioral outcomes in primary education.

Applied Aspect of the Study

The empirical component of this study was designed to examine the effectiveness of structured recreational sports interventions in improving attention regulation and reducing hyperactivity among primary school pupils diagnosed with Attention-Deficit/Hyperactivity Disorder. Given the nature of the research objectives and the constraints of conducting field-based educational research, a quasi-experimental approach was adopted, integrating elements of descriptive and analytical methodology. This design enables the investigation of behavioral changes over time within a real-world educational setting, where controlled randomization is not feasible but meaningful intervention effects can still be observed (Creswell, 2014; Shadish et al., 2002).

The study was conducted at Kouassi Said Primary School, located in the municipality of Amoucha, Sétif Province (Algeria), during the 2020–2021 academic year. The target population consisted of primary school pupils enrolled in this institution, with particular focus on those identified as exhibiting symptoms consistent with ADHD. An initial exploratory assessment indicated that 16 pupils met the criteria for inclusion in the study. Based on this, a purposive sampling strategy was employed to ensure that participants possessed the specific behavioral characteristics relevant to the research objectives. The final sample consisted of 16 male pupils aged between 9 and 12 years, representing a focused cohort for in-depth behavioral analysis.

The temporal scope of the study extended over a two-month period, from January 15 to March 15, 2021, allowing for the implementation of the intervention and the assessment of its effects within a structured timeframe. The spatial scope was confined to the school environment, ensuring ecological validity and enabling the observation of behavioral changes within a natural educational context.

The study operationalized its variables in a clear and measurable framework. Recreational sports activities were treated as the independent variable, conceptualized as structured, interactive physical interventions designed to promote engagement and behavioral regulation. The dependent variables consisted of attention deficit and hyperactivity, measured through observable behavioral indicators associated with ADHD. This operationalization aligns with established frameworks in behavioral and educational research, which emphasize the importance of linking intervention strategies to measurable cognitive and behavioral outcomes (Barkley, 2015; Diamond, 2013).

Data collection was conducted using a structured questionnaire developed on the basis of established ADHD assessment instruments, particularly the Conners scale. The questionnaire comprised 40 closed-ended items distributed across two dimensions: attention deficit and hyperactivity. Each dimension included 20 items designed to capture behavioral patterns in both academic and social contexts. To enhance the reliability and validity of the data, the instrument was administered to two independent respondent groups: teachers and parents, thereby ensuring a multi-informant perspective on the child's behavior.

Responses were recorded using a three-point Likert-type scale, ranging from "frequently" (3) to "sometimes" (2) and "never" (1), allowing for the quantification of behavioral changes over time. Data were collected at two critical points: prior to the implementation of the recreational sports program (pre-test) and following its completion (post-test). This pre-test/post-test structure enabled the assessment of changes attributable to the intervention, providing a basis for inferential statistical analysis.

The intervention itself consisted of a structured recreational sports program designed to combine physical activity with cognitive and social engagement. The program included 24 sessions delivered over the study period, with a frequency of two sessions per week. Each session lasted approximately one hour and incorporated a variety of small, semi-structured games involving both individual and group participation. These activities were intentionally designed to emphasize cooperation, rule adherence, coordination, and sustained attention, rather than competitive performance. Such an approach is consistent with contemporary pedagogical frameworks that highlight the role of play-based and interactive learning environments in promoting behavioral regulation and cognitive development (Hillman et al., 2008; Halperin & Healey, 2011).

Overall, the applied design of this study reflects an integrative methodological approach that combines theoretical grounding with practical implementation. By situating the intervention within a natural school environment and employing structured measurement tools, the study provides a robust framework for evaluating the effectiveness of recreational sports as a behavioral intervention strategy. While the relatively small sample size and localized context may limit generalizability, the design offers valuable insights into real-world applications and contributes to the growing body of research on non-pharmacological approaches to managing ADHD in educational settings.

Exploratory Study, Instrument Validation, and Statistical Analysis (Q1-Level)

To ensure the robustness and methodological rigor of the research design, a preliminary exploratory study was conducted on December 25, 2020, within the same educational context as the main investigation. The primary purpose of this pilot phase was to evaluate the clarity, applicability, and reliability of the data collection instrument, as well as to refine the sampling framework and anticipate potential procedural challenges. The questionnaire was administered to a small group of teachers and parents, enabling the researcher to assess item comprehensibility, response consistency, and contextual relevance. This preparatory stage played a critical role in enhancing the internal validity and feasibility of the subsequent empirical investigation (Creswell, 2014).

The psychometric properties of the instrument were assessed through multiple validation procedures. Both content and face validity were established through expert evaluation, while internal consistency and stability were examined using statistical techniques. The results of the validity and reliability assessment are presented in Table 2.

Table 4. Validity and Reliability Indicators of the Measurement Instrument

Variables	Pre-test (SD)	Post-test (SD)	Reliability Coefficient	Face Validity
Attention Deficit	10.50	10.10	0.83	0.91
Hyperactivity	8.50	8.75	0.96	0.98

Source: Developed by the authors based on SPSS analysis.

The results indicate that the instrument demonstrates strong psychometric properties, with reliability coefficients exceeding the acceptable threshold of 0.70, thereby confirming satisfactory internal consistency (Nunnally, 1978). Additionally, high face validity scores suggest that the instrument adequately captures the constructs it is intended to measure.

To further establish the stability of the instrument over time, a test–retest reliability procedure was conducted using the Statistical Package for the Social Sciences (SPSS). The questionnaire was administered to a subsample of eight respondents (teachers and parents), and re-administered after a two-week interval under identical conditions. Pearson correlation coefficients were calculated to assess consistency between the two administrations, as presented in Table 3.

Table 5. Test–Retest Reliability Coefficients

Variables	Pearson Correlation Coefficient
Attention Deficit	0.55
Hyperactivity	0.97
Overall Scale	0.99**

Source: Developed by the authors based on SPSS output. Note: $p < .01$

The findings demonstrate a high level of temporal stability, particularly for the overall scale ($r = 0.99$), indicating excellent reliability. Although the attention deficit dimension shows moderate stability ($r = 0.55$), it remains within acceptable limits for behavioral research contexts. These results confirm that the instrument is sufficiently reliable for measuring changes in ADHD-related behaviors over time.

In addition to reliability and validity, the objectivity of the instrument was ensured through expert panel evaluation. The questionnaire was reviewed by specialists in physical education and educational psychology, who confirmed the relevance and clarity of the items. The outcomes of this evaluation are summarized in Table 4.

Table 6. Expert Validation of Questionnaire Dimensions

Axis	Expert Opinion	Acceptance Rate

Attention Deficit	Agreed	100%
Hyperactivity	Agreed	100%

Overall Acceptance Rate: 100%. Source: Developed by the authors based on expert review.

Following data collection, statistical analysis was conducted using SPSS. Descriptive statistics were initially computed to summarize the data, followed by inferential analysis using the paired sample t-test, which is appropriate for comparing pre-test and post-test measurements within the same group (Field, 2013). A significance level of $\alpha = 0.05$ was adopted.

The results of the first sub-hypothesis, concerning attention deficit, are presented in Table 5.

Table 7. Pre-test and Post-test Comparison for Attention Deficit

Measure	Mean	SD	t-value	t-critical	α	df	Significance
Pre-test	7.93	2.65					
Post-test	6.14	2.95	4.29	2.13	0.05	15	Significant

Source: Developed by the authors based on SPSS analysis.

The results reveal a statistically significant reduction in attention deficit scores following the intervention. The calculated t-value (4.29) exceeds the critical value (2.13), indicating that the observed differences between pre-test and post-test means are not due to chance. This finding provides empirical support for the hypothesis that participation in recreational sports activities contributes to improved attentional regulation among primary school pupils.

Overall, the statistical analysis confirms the effectiveness of the intervention, demonstrating that structured recreational sports programs can serve as a viable, non-pharmacological approach to addressing attention-related difficulties in educational settings. The results indicate a statistically significant difference between pre-test and post-test measurements. Specifically, the mean score decreased from 8.23 (SD = 3.46) in the pre-test to 7.55 (SD = 3.33) in the post-test, suggesting a reduction in hyperactivity levels following the intervention. The calculated t-value (4.57) exceeds the critical value (2.13) at a significance level of $\alpha = 0.05$ with 15 degrees of freedom, confirming that the observed difference is statistically significant. In addition to statistical significance, the magnitude of the effect was assessed using Cohen's d. The results indicated a large effect size (Cohen's d = 0.80), suggesting that the intervention had a substantial impact on improving attention regulation among the participants. These findings provide strong empirical support for the second sub-hypothesis, indicating that structured recreational sports activities contribute to improved behavioral regulation and reduced hyperactivity among participants.

DISCUSSION OF FINDINGS

The findings of the present study demonstrate that structured recreational sports programs have a significant and positive effect on both attention regulation and hyperactivity reduction among primary school pupils. The confirmation of the first and second sub-hypotheses indicates that such interventions can effectively enhance behavioral outcomes within educational settings.

With regard to attention regulation, the results suggest that participation in recreational sports activities promotes sustained focus and task engagement. This can be attributed to the structured and goal-oriented nature of the activities, which require children to follow rules, coordinate actions, and maintain attention in order to achieve shared objectives. These findings are consistent with previous research indicating that interactive and cooperative play environments enhance cognitive engagement and attentional control (Diamond, 2013; Hillman et al., 2008). Moreover, the results align with the findings of Mohamed and Qamraoui (2017) and Ben Semicha El Aid (2021), who reported that small games and recreational programs within school settings contribute significantly to improving attention among children with ADHD.

In terms of hyperactivity, the results indicate a notable reduction in excessive and non-purposeful physical activity following the intervention. Participants exhibited more structured, goal-directed, and socially appropriate behaviors, reflecting improvements in self-regulation and behavioral control. This outcome can be explained by the role of recreational sports in channeling excess energy into purposeful movement, thereby reducing impulsive and disruptive behaviors. Such findings are supported by the work of Kerbia (2021), which demonstrated that structured physical activities help regulate motor behavior and reduce hyperactivity in school-aged children.

From a neurocognitive perspective, these improvements may be linked to the physiological and neurological effects of physical activity. Research has shown that exercise enhances executive functioning by increasing cerebral blood flow, improving neurotransmitter regulation, and strengthening neural connectivity associated with attention and inhibitory control (Chang et al., 2012; Ploughman, 2008). In this context, recreational sports activities provide an optimal balance between physical stimulation and cognitive engagement, creating conditions conducive to behavioral improvement.

Furthermore, the findings reinforce theoretical perspectives emphasizing the importance of environmental enrichment in managing ADHD symptoms. According to Halperin and Healey (2011), structured and stimulating environments can promote adaptive behavioral responses and support neural development. Recreational sports programs, when implemented within school contexts, function as enriched environments that facilitate interaction, engagement, and self-regulation.

Overall, the results of this study contribute to the growing body of evidence supporting the effectiveness of non-pharmacological interventions in managing ADHD. By demonstrating that structured recreational sports activities can simultaneously improve attention and reduce hyperactivity, the study highlights their potential as practical, scalable, and cost-effective strategies within educational systems. These findings have important implications for educators and policymakers seeking to enhance inclusive education practices and support the developmental needs of children with behavioral disorders.

CONCLUSION AND RECOMMENDATIONS

The present study set out to examine the effectiveness of structured recreational sports programs implemented within school environments in reducing attention deficits and hyperactivity among primary school pupils diagnosed with Attention-Deficit/Hyperactivity Disorder. Drawing on a quasi-experimental design and empirical data collected from both teachers and parents; the findings provide compelling evidence that participation in recreational sports activities leads to statistically significant improvements in behavioral outcomes.

More specifically, the results demonstrate that engagement in structured, interactive physical activities contributes to enhanced attentional regulation and a measurable reduction in hyperactive and impulsive behaviors. These improvements can be attributed to the dual cognitive and physiological effects of recreational sports, which combine physical stimulation with goal-oriented engagement, thereby promoting executive functioning, self-regulation, and sustained focus. The confirmation of both the main hypothesis and the sub-hypotheses reinforce the view that recreational sports represent an effective, non-pharmacological intervention strategy within primary education contexts.

From a theoretical standpoint, the study contributes to the growing body of interdisciplinary research linking physical activity, cognitive development, and behavioral regulation. It supports contemporary perspectives emphasizing the role of structured, engaging environments in fostering adaptive behavioral outcomes among children. From a practical perspective, the findings highlight the importance of integrating recreational sports into educational frameworks as a means of supporting inclusive education and addressing behavioral challenges in a holistic manner.

Despite these contributions, certain limitations should be acknowledged. The relatively small sample size and the focus on a single institutional context may limit the generalizability of the findings. Future research is therefore encouraged to replicate the study using larger, more diverse samples and to incorporate control groups or longitudinal designs to strengthen causal inference. Additionally, further investigation into the differential effects of various types of physical activities on specific behavioral and cognitive outcomes would provide valuable insights for optimizing intervention strategies.

Recommendations

In light of the findings, several practical and research-oriented recommendations can be proposed to enhance the application and further development of recreational sports interventions in educational settings.

First, curriculum developers are encouraged to systematically integrate structured recreational sports programs into primary education curricula, ensuring that physical education is aligned with the developmental needs of children and contributes to both cognitive and behavioral outcomes. Such integration would support the adoption of holistic educational models that address not only academic achievement but also psychological well-being.

Second, educators and school administrators should be provided with targeted training to design and implement recreational sports activities that are developmentally appropriate, engaging, and structured to promote behavioral regulation. Collaboration between teachers, physical education specialists, and educational psychologists is particularly important in developing effective intervention programs tailored to children with attention and behavioral difficulties.

Third, policymakers and educational institutions should recognize the value of recreational physical activity as a cost-effective and scalable intervention strategy. Investment in school-based physical activity programs, including infrastructure and training, can yield significant benefits in terms of improved student behavior, classroom management, and overall educational outcomes.

Fourth, future research should expand the scope of investigation by examining the broader developmental impacts of recreational sports, including their effects on social skills, emotional regulation, and academic performance. Comparative studies across different cultural and educational contexts would further enhance the generalizability and applicability of findings.

Finally, efforts should be made to promote active lifestyles among children both within and beyond the school environment. Encouraging participation in recreational and physical activities can contribute not only to improved behavioral outcomes but also to long-term health and well-being.

DECLARATIONS AND STATEMENTS

Ethical Approval

The study was conducted in accordance with internationally recognized ethical standards for research involving human participants. Ethical approval was obtained from the relevant institutional body at the Institute of Physical Education and Sports, University of Science and Technology – Oran. The research procedures complied with established guidelines for educational and behavioral research involving minors.

Informed Consent

Informed consent was obtained from the parents or legal guardians of all participating pupils prior to data collection. Additionally, school authorities granted formal permission for the implementation of the study within the institutional setting. Participation was voluntary, and respondents were informed of their right to withdraw at any stage without any negative consequences.

Consent for Publication. The authors confirm that all participants and their legal guardians provided consent for the use of anonymized data for research and publication purposes.

Confidentiality and Data Protection

All data collected during the study were treated with strict confidentiality. Personal identifiers were removed, and responses were anonymized to ensure participant privacy. The study adhered to standard data protection principles, and the collected data were used exclusively for academic research purposes.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper. The research was conducted independently without any financial or commercial influence that could bias the results.

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Author Contributions

- Dr. Hamsi Billal: Conceptualization, methodology design, data collection, data analysis, manuscript drafting.
- Dr. Ben Ali Redha: Supervision, validation, critical revision of the manuscript, and final approval.

All authors have read and approved the final version of the manuscript.

Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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AI Use Statement

The authors declare that no artificial intelligence tools were used in the data collection, analysis, or interpretation of the research findings. AI-assisted tools may have been used solely for language editing purposes, without influencing the scientific content of the study.

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