

BEST PRACTICE APPROACHES TO THE STUDY OF COGNITIVE FUNCTIONING AND PHYSICAL ACTIVITY/SPORTS

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BEST PRACTICE APPROACHES TO THE STUDY OF COGNITIVE FUNCTIONING AND PHYSICAL ACTIVITY/SPORTS

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The Development of Motor and Pre-literacy Skills by a Physical Education Program in Preschool Children: A Non-randomized Pilot Trial

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It is known in the literature that fundamental motor skill acquisition is strongly associated with the development of neuromotor, cognitive, social, and emotional aspects in childhood. Unfortunately, in Italy, the physical education teacher is not included in the school's core personnel, and it is very hard to find a specific physical education program (PEP) that could improve preschool children's motor and cognitive status. The aim of this study was to investigate whether the quotient of gross motor development (QGMD) and pre-literacy skills concerning visual analysis and spatial orientation abilities changed after 16 weeks of PEP (2 h/week) in preschool children. We conducted a school-based non-randomized pilot trial. It involved 119 preschool children, clustered in a control group [CG, $n = 29$, body mass index (BMI): $16.90 \pm 3.16 \text{ Kg/m}^2$] and an intervention group (IG, $n = 90$, BMI: $16.00 \pm 1.75 \text{ kg/m}^2$). Participants were assessed for literacy readiness, locomotor and object control skills before and after the experimental period. IG increased the locomotor, object-control skills and QGMD in response to PEP. As concerns the pre-literacy domain, no significant difference was found in visual analysis and spatial orientation skills between IG and CG groups. However, we detected improvements from baseline to post-test in IG children. In conclusion, this study contributes additional evidence suggesting how a PEP could affect not only motor skills, but also cognitive ones. Consistently with the growing research, interventions based on structured ludic-motor activities ensure health benefits for preschool children.

Clinical Trial Registration: www.ClinicalTrials.gov, identifier NCT01274117.

Keywords: physical activity, education, fundamental motor skills, pre-literacy skills, childhood, exercise, health

INTRODUCTION

Motor skill development influences the entirety of a child's growth (Barnett et al., 2008). Numerous studies have reported that fundamental motor skill acquisition is clearly associated with the development of neuromotor, cognitive, social, and emotional skills in childhood (Gallahue et al., 2003; Lubans et al., 2010; Cameron et al., 2012; Logan et al., 2012; Lloyd et al., 2014; Diamond, 2015;



Football Players Do Not Show “Neural Efficiency” in Cortical Activity Related to Visuospatial Information Processing During Football Scenes: An EEG Mapping Study

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This study tested the hypothesis of cortical neural efficiency (i.e., reduced brain activation in experts) in the visuospatial information processing related to football (soccer) scenes in football players. Electroencephalographic data were recorded from 56 scalp electrodes in 13 football players and eight matched non-players during the observation of 70 videos with football actions lasting 2.5 s each. During these videos, the central fixation target changed color from red to blue or vice versa. The videos were watched two times. One time, the subjects were asked to estimate the distance between players during each action (FOOTBALL condition, visuospatial). Another time, they had to estimate if the fixation target was colored for a longer time in red or blue color (CONTROL condition, non-visuospatial). The order of the two conditions was pseudo-randomized across the subjects. Cortical activity was estimated as the percent reduction in power of scalp alpha rhythms (about 8–12 Hz) during the videos compared with a pre-video baseline (event-related desynchronization, ERD). In the FOOTBALL condition, a prominent and bilateral parietal alpha ERD (i.e., cortical activation) was greater in the football players than non-players ($p < 0.05$) in contrast with the neural efficiency hypothesis. In the CONTROL condition, no significant alpha ERD difference was observed. No difference in behavioral response time and accuracy was found between the two groups in any condition. In conclusion, a prominent parietal cortical activity related to visuospatial processes during football scenes was greater in the football players over controls in contrast with the neural efficiency hypothesis.

Keywords: football (soccer) players, electroencephalography, alpha rhythms, visuospatial information processing, parietal cortex, neural efficiency, situational awareness



Corrigendum: Football Players Do Not Show “Neural Efficiency” in Cortical Activity Related to Visuospatial Information Processing During Football Scenes: An EEG Mapping Study

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In the published article, there were errors regarding the affiliations for Dr. Roberta Lizio and Prof. Cristina Limatola. The correct affiliation for Dr. Roberta Lizio is ²IRCCS SDN, Naples, Italy. Furthermore, as well as having affiliation ¹Department of Physiology and Pharmacology “Vittorio Erspamer”, Sapienza University of Rome, Rome, Italy, Prof. Cristina Limatola should also have ⁷IRCCS Neuromed, Pozzilli, Italy.

The authors apologize for these errors and state that these do not change the scientific conclusions of the article in any way. The original article has been updated.

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The Positive Effect of Moderate-Intensity Exercise on the Mirror Neuron System: An fNIRS Study

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A growing number of studies have reported the beneficial effect of exercise on human social behavior. The mirror neuron system (MNS) plays a critical role in a variety of social behaviors from imitation to empathy. However, neuroimaging investigations into the effects of exercise on the MNS remain unexplored. To address this question, our study determined the effect of moderate-intensity exercise on the MNS using functional near-infrared spectroscopy (fNIRS). Specifically, 23 right-handed young individuals were asked to perform a table-setting task that included action execution and action observation before and after a 25-min exercise session on a cycle ergometer at moderate intensity (65% VO_{2peak}). The control condition was the same task performed without exercise. Cortical hemodynamic changes in the four primary brain regions of the MNS were monitored with fNIRS, using a modified probe configuration that covered all four MNS regions in the left hemisphere. We used a region of interest (ROI)-based group analysis to determine which regions were activated during action execution and action observation. Following a session of moderate-intensity exercise, we found a significant increase in activation in all four MNS regions, namely the inferior frontal gyrus (IFG), premotor cortex (PMC), superior parietal lobule (SPL), and rostral inferior parietal lobule (IPL). This result indicated a positive effect of exercise on the MNS, specifically that moderate-intensity exercise could activate the MNS.

Keywords: mirror neuron system, social interaction, motor cognition, moderate-intensity exercise, fNIRS

INTRODUCTION

In the past decade, there have been many studies investigating the effect of exercise on the brain. There is increasing evidence showing that exercise is beneficial for cognitive performance (Hillman et al., 2003; Yanagisawa et al., 2010), improves memory acquisition (Winter et al., 2007), prevents cognitive dysfunction in Parkinson's disease (David et al., 2015), and improves social behavior in adolescents with Attention-Deficit/Hyperactivity Disorder (ADHD) (Kamp et al., 2014) and in children with autism (Pan, 2010). Social cognition is a complex process, and understanding its neural basis to improve its performance is essential for our survival. Human social behaviors in the brain are mainly controlled by the amygdala, orbitofrontal cortex (OFC), and the mirror neuron system (MNS) regions (Rizzolatti et al., 2001; Adolphs, 2003). Van Rensburg et al. (2009) proposed that exercise can have a positive effect on the OFC. However, the effect of exercise on the MNS remains in question.



Effect of a Combined Exercise and Dietary Intervention on Self-Control in Obese Adolescents

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Objective: The aim of this study was to determine whether a combined exercise and dietary intervention improved cognitive and physical self-control and whether pre-to-post interventional changes in self-control were mediated by changes in body mass index (BMI) and maximal grip strength (MGS), in a sample of obese adolescents.

Methods: Forty-four obese adolescents were randomly assigned to a combined exercise and dietary program or to a waitlist control group; the data from 36 participants ($n = 18$ for each group) were analyzed. The combined exercise and dietary program was performed over 6 weeks and was supervised by qualified trainers in a closed boot camp. The exercise consisted primarily of typical aerobic training, sports, outdoor training, yoga, and resistance training. Participants were placed on moderate dietary restriction according to individual target body weight (30 kcal/kg \times target weight). The primary outcomes of this study were metrics based on cognitive and physical self-control, assessed by the Stroop task and a handgrip task, respectively. Secondary outcomes included BMI and MGS.

Results: The combined exercise and dietary intervention significantly improved both cognitive and physical self-control. Similar positive effects were also found for reduced BMI and enhanced MGS. Correlation analyses showed that the reduced BMI and enhanced MGS were significantly closely associated with improved cognitive and physical self-control. The mediation analyses revealed that the pre-to-post intervention changes in BMI and MGS significantly mediated physical self-control, but did not mediate cognitive self-control.

Conclusion: Our combined exercise and dietary intervention is an effective approach to improve multiple aspects of self-control, reduce BMI, and strengthen MGS among obese adolescents. These findings also suggest that reduced BMI and enhanced MGS mediate specific aspects of self-control.

Keywords: combined exercise and dietary intervention, obese adolescents, cognitive self-control, physical self-control, body mass index



Perceptions of Parenting Practices and Psychological Variables of Elite and Sub-Elite Youth Athletes

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Drawing from the model of parental involvement in sport, the overall purpose was to examine the associations of perceptions of parenting practices (encouragement, reinforcement, instruction, and role modeling) and athletes' psychological variables (self-efficacy, social self-efficacy, self-regulation, and intrinsic motivation) of elite and sub-elite youth athletes. Participants were elite ($n = 210$) and sub-elite ($n = 635$) athletes aged between 14 and 18 years ($M_{age} = 16.58$, $SD = 1.33$). Structural equation modeling analysis revealed that young elite athletes' perceptions of sport-related parenting practices are associated with their psychological skills and performance level in sport. Specifically, in comparison with their sub-elite peers, perceptions of parental encouragement had a significantly different strong effect on intrinsic motivation. Moreover, perceptions of parental modeling revealed different effects on performance level, as well as on intrinsic motivation, and self-regulation. These perceptions of parenting practices may promote a positive learning environment, resulting in an increased likelihood of achieving a high level of sport performance in comparison with their sub-elite peers.

Keywords: intrinsic motivation, parental roles, self-efficacy, self-regulation, structural equation modeling, youth sport

INTRODUCTION

Early achievement of elite in sport is influenced by the type of experiences that young athletes have throughout their development, including the psychosocial relationships they establish with their parents (Côté, 1999). Although researchers have tested the influence of parents' behaviors on young athletes' psychological variables in sport (e.g., Babkes and Weiss, 1999; Fredricks and Eccles, 2005), research has generated few empirical data demonstrating how parenting practices influence young athletes' attainment of high levels of performance in sport. In fact, theoretical frameworks that guided research on parents' influences on differential child outcomes in sport and physical activity, such as the Eccles' model of parental influence on children's motivation and achievement (e.g., Fredricks and Eccles, 2004) do not specify the characteristics of parents' involvement and support in competitive sport situations (Holt et al., 2008).



Impulsiveness and Cognitive Patterns. Understanding the Perfectionistic Responses in Spanish Competitive Junior Athletes

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Introduction: High performance sport requires that the athletes maintain a constant intensity and control of their personal resources, as well as a balance between self-regulation and performance. Likely, such requirements involve the influence of their beliefs regarding the tasks to be performed to improve the confidence in their own resources to face the competition. Theoretical arguments provide new insights for understanding multidimensional perfectionism and its relationships with other variables such as affective experiences, among others. In this study, perfectionism was conceptualized as a “stable personality disposition,” whereas the impulsiveness components were defined as “representing psychological mechanisms (or processes)” underlying the relationships between perfectionism and athletic experiences.

Aim: This study aims to establish and show profiles of perfectionist beliefs and impulsive responses according to sport modality and the relationships between all these variables. Team athletes were expected to show more functional resources than those in combat or endurance sports.

Methods: The psychological responses of 487 athletes (273 boys; 214 girls) practicing high-performance sport were examined. A non-randomized, cross-sectional design was used. Self-reports were used to measure impulsiveness, perfectionism and competence self-perceptions.

Results: Athletes with functional responses of impulsivity and perfectionism showed higher perceived self-competence. Athletes with more reflective thoughts, more careful planning and generally less sensitive to rewards and behaviors were more self-regulated and planned (functional impulsivity) and showed more moderate relationships between the most dysfunctional perfectionist beliefs and self-competence. In addition, perfectionism seems to be useful to the striver athletes that want to be the best,



Body Composition and Cognitive Functioning in a Sample of Active Elders

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The purpose of this paper was to analyze the relationship between body composition and cognitive functioning in an elderly people's sample. A total of 106 older adults between the ages of 60 and 79 were involved in physical activity ($M = 67.57$; $SD = 4.96$). About 31.10% were men ($n = 33$) and 68.90% were women ($n = 73$). The instruments used to assess cognitive capacity were the Trail Making Test (forms A and B), the Stroop Test, and the Attention Test d2. The body composition of the participants was evaluated by electrical bioimpedance. Correlation analysis, linear regression (successive steps), and cluster analysis were carried out to analyze the relationships between the different measures. The results showed significant relationships between the analyzed variables. In addition, muscle mass predicted the cognitive functioning values. These results suggest that healthy lifestyles, including physical activity, are essential for well-being and quality of life in older people. In addition, it appears from the results found that it would be necessary for these lifestyles to contribute to preserving their level of physical condition, because of the possible impact it would have on their health.

Keywords: physical activity, body composition, elderly, attention, cognitive development

INTRODUCTION

Active aging is associated with positive health effects, improved psychosocial functioning, and lower mortality risk (Haskell et al., 2007; García-Molina et al., 2010; Reigal and Hernández-Mendo, 2014). Specifically, regular physical activity is associated with improvements in the cognitive functioning of older people, as evidenced in research conducted in recent years, in which positive relationships have been found with abilities such as attention, memory or executive functioning (Bherer, 2015; Daly et al., 2015; Iuliano et al., 2015; Sánchez et al., 2018).

Specifically, attentional capacity has been studied from numerous authors (Marshall et al., 2015; Strait et al., 2015). This is a basic cognitive capacity that is related to multiple cognitive processes such as memory, executive control, language or learning, and has a great interest in educational or clinical field (Maureira and Flores, 2017). Dimensions such as selective attention is considered as an indicator of the ability to attend to specific stimuli and ignore others, being a relevant process to successfully perform a broad set of tasks that allow people to adapt correctly to their environment (Estévez-González et al., 1997; Giuliano et al., 2014).



Effects of Open Versus Closed Skill Exercise on Cognitive Function: A Systematic Review

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Background: Exercise modes can be divided into open skill exercise (OSE) and closed skill exercise (CSE). While research has shown that these two exercise modes may have different effects on cognitive function, this possibility has not been systematically reviewed.

Objective: The purpose of the present review was to objectively evaluate the research literature regarding the effects of OSE versus CSE on cognitive function.

Methods: Six electronic databases (Web of Science, EMBASE, Google Scholar, PubMed, PsycINFO, and SPORTDiscus) were searched from inception dates to December 2018 for studies examining the associations of OSE and CSE with cognitive function. The literature searches were conducted using the combinations of two groups of relevant search items related to exercise modes (i.e., OSE and CSE) and cognitive function. Articles were limited to human studies in all age groups. Both intervention and observational studies with full text published in English-language peer-reviewed journals were considered eligible. The search process, study selection, data extraction, and study quality assessment were carried out independently by two researchers.

Results: A total of 1,573 articles were identified. Fourteen observational and five intervention studies met the inclusion criteria. Twelve of the 14 observational studies found that OSE benefits cognitive function, and seven of these 14 observational studies supported superior effects of OSE compared with CSE for enhancing cognitive function. Three of the five intervention studies found that OSE (versus CSE) led to greater improvements in cognitive function in both children and older adults.

Conclusion: Although the majority of studies in this review were observational cross-sectional designs, the review tends to support that OSE is more effective for improving some aspects of cognitive function compared with CSE. More rigorous randomized control trials with long-term follow-ups are needed in order to confirm these differential cognitive effects of the two exercise modes.

Keywords: motor skill, open skill exercise, closed skill exercise, cognition, executive function



How Does Exercise Improve Implicit Emotion Regulation Ability: Preliminary Evidence of Mind-Body Exercise Intervention Combined With Aerobic Jogging and Mindfulness-Based Yoga

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Purpose: The primary aim of the present study is to examine the effect of 8-week mind-body exercise intervention combining aerobic jogging and mindfulness-based yoga on implicit emotion regulation ability. The secondary aim is to explore the specific potential pathways by which the mind-body exercise intervention fosters implicit emotion regulation. This may help us to understand how the key components of exercise intervention contribute to emotional benefits.

Methods: Sixty participants were randomly allocated to one of two parallel groups: (1) the intervention group ($n = 29$) and (2) the waitlist control group ($n = 31$). Participants were asked to fill out scales measuring mindfulness and instructed to complete an emotion regulation task to assess implicit emotion regulation ability as well as the PWC 170 Test to evaluate aerobic fitness before and after the intervention.

Results: The results of the two-way repeated ANOVA revealed that 8 weeks of intervention improved implicit emotion regulation, mindfulness, and aerobic fitness levels. Path analysis showed that only improved aerobic fitness mediated the intervention effect on implicit emotion regulation ability, controlling for change in negative affect. Notably, the relationship between the effects on implicit emotion regulation ability and aerobic fitness was moderated by improved mindfulness.

Conclusion: Eight weeks of mind-body exercise intervention improves implicit emotion regulation ability. The aerobic fitness may be an essential pathway which mediates the efficacy on implicit emotion regulation ability. Furthermore, different components, such as aerobic fitness and mindfulness, may interactively contribute to such emotional benefits.

Keywords: mind-body exercise, aerobic jogging, mindfulness-based yoga, implicit emotion regulation ability, aerobic fitness, mindfulness, potential pathway



The Effect of Traditional Chinese Mind-Body Exercise (Baduanjin) and Brisk Walking on the Dorsal Attention Network in Older Adults With Mild Cognitive Impairment

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A growing number of studies have shown that mind-body exercise is beneficial to cognitive function, especially memory, in elderly MCI patients. However, few studies have explored the effect of mind-body exercise on the attention of MCI population. We recruited 69 participants and divided them equally into Baduanjin, brisk walking (BWK) exercise or usual physical activity (UAP) control groups. The two exercise groups performed 60 min of exercise three times per week for 24 weeks. All subjects underwent whole-brain functional MRI and assessment of attentional abilities, including selective, divided, and sustained attention, and processing speed at baseline and after 24 weeks. The results show that: Baduanjin exercise significantly increased the selective attention of MCI patients, and Dorsal attention network (DAN) of Baduanjin exercise group exhibited functional connectivity decreased in right rolandic operculum (ROL. R), right middle temporal gyrus (MTG. R), right supramarginal inferior parietal, angular gyri (IPL. R), right precuneus (PCUN. R), and right fusiform gyrus (FFG. R) regions compared with the other two groups. The BWK exercise group had obviously functional connectivity increased in IPL. R and decreased in the MTG. R region compared to that in the UAP group. But no significant association between the changes of functional connectivity of DAN and the change of attentional ability test was observed. Thus, our data indicated Baduanjin exercise may be a potential beneficial intervention to improve the attention of the elderly with MCI. Further study with more samples is necessary to elucidate its imaging mechanism.

Keywords: mind-body exercise, Baduanjin, brisk walking, mild cognitive impairment, dorsal attention network

INTRODUCTION

At present, over 46 million people are living with dementia, and by 2050, this number will rise to almost 131.5 million worldwide; dementia has been identified as a global health priority due to the growing burden of the disease (Prince, 2015). Dementia is a progressive disease with a long duration. Pathological changes start taking place up to 20 years before the presentation of clinical



How to Train Your Health: Sports as a Resource to Improve Cognitive Abilities in Cancer Patients

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From a cognitive-psychological perspective, physical exercise (PE) and sports are an interesting tool for improving people's cognitive abilities. One field of application for such a tool is decision making (DM) support in chronic patients, cancer patients, and survivors in particular. On the one hand, cancer patients and survivors have to continually take important decisions about their own care (e.g., treatment choice; changes in lifestyle), in collaboration with caregivers and health providers; on the other hand, side effects of treatment may be detrimental to cognitive abilities, such as attention, which make the health DM tasks even more demanding, complex, and emotionally disruptive for patients. Since cancer patients have to engage in healthy activities both for improving their own quality of life and for sustaining the effects of medications, clinical advice to engage in sport and PE is becoming more and more widespread within interventions. However, while sports are usually seen as healthy physical activities, their impact on cognitive abilities is mostly overlooked in the literature. The hypothesis of the present work is that sports could be fully exploited in their potential as focused exercises for cognitive ability training, in the field of cognitive training for chronic patients specifically. Indeed, literature shows that different sports (e.g., individual or team-based) influence and possibly augment cognitive abilities such as focused and divided attention, working memory, and DM under time constraints. Moreover, besides providing training for cognitive abilities, the experience of sports may represent an opportunity to explore, train and sharpen DM abilities directly: we identify five ways in which sport experiences may influence DM processes, and provide indications for future research on the topic.

Keywords: decision making, sport, cognitive functions, attention, oncology, psycho-oncology

INTRODUCTION

Oncological treatments influence patients' physical and cognitive functions. Studies have provided evidence that cancer treatments, such as chemotherapy, radiotherapy, and hormone therapy, can produce adverse effects including vascular complications, convulsion, mood disorders, and cognitive dysfunction (Alvarez et al., 2007; Dietrich et al., 2008). Many patients undergoing cancer treatment complain about so-called "chemobrain" (Brezden et al., 2000; McAllister et al., 2004),



Relationships Between Reaction Time, Selective Attention, Physical Activity, and Physical Fitness in Children

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The objective of this study was to analyze the relationships between simple and complex reaction times (RTs) with the physical activity performed weekly, the physical fitness and selective attention in children of the third cycle of primary education. Participants were 119 children aged between 10 and 12 years ($M = 10.71$; $SD = 0.77$). The instruments used for data collection were the D2 attention test to analyze selective attention, various tests of the Eurofit and ALPHA-Fitness Battery to evaluate the physical condition, a bioimpedancimeter Tanita TBF 300 to evaluate the body composition, and the FITLIGHT Trainer to measure the simple and complex RTs. The group that carried out more weekly physical activity used less time in simple ($p < 0.05$, $d = -0.68$, 95% CI [-1.19, -0.17]) and complex RT tests ($p < 0.05$, $d = -0.63$, 95% CI [-1.14, -0.12]). Also, the results showed that the simple RT was related in a significant way with physical fitness, while the complex RT was related significantly to attentional capacity and physical fitness.

Keywords: reaction time, selective attention, FITLIGHT trainer, physical activity, physical fitness

INTRODUCTION

Reaction time (RT) is a relevant variable in areas such as sports, academics, and other tasks of daily life (Metin et al., 2016; Sant'Ana et al., 2016). It can be defined as the time that elapses from when a stimulus appears until a response is given and is considered a good measure to assess the capacity of the cognitive system to process information (Jensen, 2006; Kuang, 2017). From a physiological point of view, RT is a complex phenomenon whose functioning has been studied by numerous researchers (Kuang, 2017). The RT depends on the speed of the sensorimotor cycle, composed by the detection of the initial stimulus, transfer of the information through the afferent nerves, generation of the response from the central nervous system, and final response (Adleman et al., 2016; Greenhouse et al., 2017).

There are differences between simple and complex RTs. The first is defined as the interval time between when a stimulus appears, its detection, and the given response (Jayaswal, 2016). The second involves the identification and selection of a response to various stimuli (Boisgontier et al., 2014).



Effects of a Computerized Training on Attentional Capacity of Young Soccer Players

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The purpose of this work was to analyze the effects of a computerized training on attentional capacity in a group of young soccer players. Seventy-five male adolescents from two soccer clubs in the city of Malaga (Spain) and aged between 14 and 18 (15.45 ± 1.43 years) participated in the investigation. A quasi-experimental design was used, and the adolescents were divided into control ($n = 38$) and experimental ($n = 37$) groups. The experimental group underwent a computerized training (Rejilla 1.0) of their attention during 9 weeks and 27 sessions. In addition, the D2 attention test was used to analyze the evolution of participants after the intervention program. The results showed positive effects of the computerized intervention program on selective attention, observing changes both in the executions of the software used ($p < 0.001$, Cohen's $d = 1.58$, 95% CI [1.06, 2.11]) and in the main measures of the D2 test, total effectiveness ($p < 0.001$, Cohen's $d = 0.62$, 95% CI [0.15, 1.08]) and concentration ($p < 0.01$, Cohen's $d = 0.48$, 95% CI [0.02, 0.94]).

Keywords: attention, cognitive functioning, soccer, computerized training, sport

INTRODUCTION

Scientific literature has highlighted in recent years that cognitive functioning of athletes could be a determinant of their performance and predictor of their level of expertise (Romeas et al., 2016; Fink et al., 2018). Some research has indicated that athletes who show better cognitive functioning show increases in performance, especially in those disciplines that require continuous adaptation to play and a great ability to anticipate and maintain attention (Verburgh et al., 2014). For example, Huijgen et al. (2015) observed in a group of elite soccer players between 13 and 17 years old better scores in inhibitory control and cognitive flexibility than in a group of sub-elite soccer players. Verburgh et al. (2014) compared two groups of soccer players between 8 and 16 years old, indicating better scores on inhibitory control and the ability to reach and maintain alertness in the most talented group. Vestberg et al. (2017) investigated a group of soccer players between 12 and 19 years old, revealing that executive functions are cognitive abilities that predict sport success.

Specifically, some works have highlighted that aspects such as attention and concentration are significantly related to the behavior of athletes (Weinberg and Gould, 2010; Carraça et al., 2018; Love et al., 2018). Among existing research, Williams et al. (2011) revealed that visual attention training may influence performance in sports modalities in which moving objects such as a ball are used. Roca et al. (2018) analyzed 44 soccer players with an average age of 20.8 years old and



Dynamics of Executive Functions, Basic Psychological Needs, Impulsivity, and Depressive Symptoms in American Football Players

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Executive functions play an important role in sports since the ability to plan, organize, and regulate behavior to reach an objective or goal depends on these functions. Some of the components of executive functions, such as inhibition of impulsive behavior and cognitive flexibility, are necessary for contact sports (e.g., American football) to carry out successful plays on the sports field. Executive functions have been studied in the sporting environment, but their relationship with the athletes' basic psychological needs (BPN), such as autonomy, competence, and relatedness, remains unexplored. Due to the importance of motivational processes over cognitive functions and in the generated adaptive results in athletes, this relationship should be taken into account. Therefore, the aim of this study was to analyze and compare executive functioning and psychological need thwarting over impulsivity and psychological distress, before and after the season (4 months) in 28 undergraduate football players. Neuropsychological and psychological tests were applied. The results showed that there was an improvement in inhibition and planning at the end of the season. There was also an increase in attention and motor impulsiveness, and a decrease in need thwarting at the end of the season. A positive association between executive function, impulsiveness, psychological needs, and affective symptoms were also found. Our findings reveal the dynamics of sport-related psychological variables throughout the sport season in American football players, the association of these for the achievement of sport success, and the importance of encouraging proper management of emotions.

Keywords: inhibition, frustration, football, impulsivity, motivational processes

INTRODUCTION

The development of maximum sporting capacities depends on different components, such as physiological, technical, cognitive, emotional, personality-related, and motivational factors. The harmonic interaction of these components results in optimal trainability (Harre, 1987) and in the attainment of sport mastery.



Physical Activity, Sports Practice, and Cognitive Functioning: The Current Research Status

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The evidence for the benefits of physical activity on cognitive functioning has increased in recent years. Although the relationship between these variables has been analyzed for decades, the development of evaluation techniques has resolved several issues and advanced this area of knowledge. Moreover, several authors have pointed out the association between the cognitive functioning of athletes and their performance in competition. These recent studies suggest that some specific cognitive abilities of athletes could help them become more effective and improve their chances of success. The objective of this paper was to identify the most relevant advances in these areas of study and to highlight more promising lines of research for the next few years. We have discussed findings from the application of different physical activity programs as well as the most significant cognitive performance variables for sports practice. The limitations of the findings were also discussed.

Keywords: cognitive functioning, physical activity, physical-sports, brain, cognitive abilities

PHYSICAL ACTIVITY, SPORTS, AND THE BRAIN

The relationship between physical exercise and cognitive functioning has received much attention in recent years (Northey et al., 2018; Moran et al., 2019). This has been an object of interest for decades, but much remains unknown. Neuroscience has advanced significantly, improving knowledge of brain functioning in response to different situations and its evolution over the course of people's lives (Cabeza et al., 2018; Dumoulin et al., 2018). Scientists studying physical activity and sports have integrated this knowledge of brain functioning, using it to explain the contribution of physical exercise and how cognitive performance may increase performance in certain facets of sport (Fink et al., 2018; Hsu et al., 2018).

Techniques such as electroencephalography (Cheron et al., 2016; Gutmann et al., 2018), functional magnetic resonance imaging (Chaddock-Heyman et al., 2013; Fontes et al., 2015; Chen et al., 2016), positron emission tomography (Boecker and Drzezga, 2016), single photon emission tomography (Shih et al., 2019), or magnetoencephalography (Huang et al., 2016) have all improved the visualization and understanding of cognitive processes generated and developed in physical activity and sport contexts. The core of their contribution is the observation of brain changes during exercise, the impact of various tasks, and improvements in physical condition, which reflects this phenomenon (Becker et al., 2016; Jonasson et al., 2017; Schwarb et al., 2017).



Teacher Autonomy Support in Physical Education Classes as a Predictor of Motivation and Concentration in Mexican Students

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There is a strong belief that physical education can affect an individual's physical activity, healthy habits, and behaviors through pleasant, positive, and significant exercise experiences, a practical knowledge base, and comprehensive teaching strategies. However, a crucial cognitive aspect for the effective and significant learning of the activities offered in the educational environment is the concentration of students. This study aims to test a hypothetical model based on self-determination theory to assess the degree of support prediction provided by the teacher for student autonomy in the various types of motivation and on student concentration in physical education classes in high schools within the Mexican context and test invariance across gender groups. This study included 859 students between 11 and 16 years from different high schools in the city of San Nicolás de los Garza, Nuevo León (México). The Learning Climate Questionnaire, the Perceived Locus of Causality, and the Concentration scale adapted to physical education and translated into Mexican Spanish were used. Results showed good internal consistency for all instruments. Both the measurement model and the structural equation modeling showed satisfactory adjustment indexes. The results revealed that the autonomy support positively predicted autonomous motivation, controlled motivation to a lesser extent, and amotivation negatively. Furthermore, the students' concentration was highly and positively predicted by autonomous motivation, by controlled motivation to a lesser extent, and by amotivation negatively. The model predicted 39% of variance of autonomous motivation with large effect size ($f^2 = 0.64$), 2% of controlled motivation with small effect size ($f^2 = 0.02$), 8% of amotivation with small effect size ($f^2 = 0.09$), and 49% of concentration with large effect size ($f^2 = 0.96$). Finally, the invariance analysis revealed that the model fit was invariant across gender groups. The results of this study emphasize how important it is for teachers to adopt an interpersonal style of autonomy support to generate a motivational climate that influences the concentration of students. This could contribute to the achievement of the purposes and educational objectives of the physical education class, which, in turn, might be conducive to students adopting healthy lifestyles in adolescence and beyond.

Keywords: self-determination theory, autonomy support, motivation, concentration, physical education, Mexico, invariance, gender



The Effects of a Multidimensional Exercise Program on Health Behavior and Biopsychological Factors in Mexican Older Adults

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Background: The population of older adults is increasing worldwide, which brings attention to the importance of healthy aging. Adoption of healthy lifestyle activities such as participating in physical activity on a daily basis is key to maintaining physical and mental health. The aim of this study was to investigate the effects of participation in a 12-week multidimensional exercise program on health behavior and biopsychological factors of older adults living in Northeastern Mexico.

Methods: A quasi-experimental study was conducted with 45 older adults (35 females and 10 males; $M = 67.24 \pm 5.73$ years). The participants were assigned to an experimental group (EG; $n = 23$) that participated in a 12-week exercise program and a control group (CG; $n = 22$). Pre- and post-analyses of the exercise intervention data were carried out to investigate the participants' health-related variables including physical activity levels, blood pressure, self-esteem, depressive symptoms, and blood lipids profiles.

Results: The results indicated that the exercise intervention contributed to significant improvements in the older adults' health-related variables for the EG when contrasted with the control group. For instance, the EG significantly improved systolic ($p < 0.001$) and diastolic ($p < 0.027$) blood pressure, blood lipids [e.g., cholesterol ($p < 0.05$)], triglycerides ($p < 0.05$), self-esteem ($p < 0.005$), and depressive symptoms ($p < 0.002$) as well as physical activity ($p < 0.001$) levels. The results also demonstrated that only those individuals in the EG diagnosed with disease benefited from improved self-esteem and physical activity levels when contrasted with their healthy counterparts.

Keywords: older adults, multidimensional exercise programs, healthy aging, physical and psychological well-being, depression



Physical Fitness Level Is Related to Attention and Concentration in Adolescents

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The main goal of this study was to analyze the relationships among physical fitness, selective attention and concentration in a group of 210 teenagers (43.81% male, 56.19% female) from the city of Málaga (Spain), aged between 11 and 15 years old ($M = 13.27$, $SD = 1.80$) that participated in the study. D2 attention test was used in order to analyze selective attention and concentration. Physical fitness was evaluated using the horizontal jump test, the Course Navette test and the 5 × 10 meters speed test. The analysis taken indicated a significant relationship among the physical fitness level, the attention and the concentration, as in the general sample as looking at gender. Linear regression tests performed showed that oxygen consumption is the best predictor of attentional parameters. Cluster analysis shows two groups characterized by a greater or lower physical fitness level. So, the highest physical fitness level group scores better in the attention (e.g., boys: $p < 0.001$, d' Cohen = 1.01, 95% CI [0.57, 1.44]; girls: $p < 0.01$, d' Cohen = 0.61, 95% CI [0.24, 0.98]) and the concentration tests (e.g., boys: $p < 0.001$, d' Cohen = 0.89, 95% CI [0.46, 1.32]; girls: $p < 0.01$, d' Cohen = 0.58, 95% CI [0.21, 0.95]). Results indicate that physical fitness analysis can be used as a tool for observing differences in the attention and concentration level of the analyzed adolescents, suggesting that a physical performance improvement could be an adequate procedure to develop some cognitive functions during adolescence.

Keywords: attention, concentration, adolescents, physical fitness, sports activity

INTRODUCTION

Brain functioning study has increased in the field of physical activity and sports sciences in recent years (Northey et al., 2018; Xue et al., 2018; Reigal et al., 2019b). There is a large number of studies analyzing the practice of physical activity and cognitive functioning in children and adolescents showing links between these variables (Donnelly et al., 2016; Chaddock et al., 2018). For example, positive relationships have been observed at early ages between regular or acute physical activity with cognitive abilities such as attention, concentration, memory, working memory, cognitive flexibility, inhibitory control or processing speed (Best, 2010; Tomporowski et al., 2011; Scudder et al., 2014; Li et al., 2017). These findings are especially relevant in stages such



Association Between Preschoolers' Specific Fine (But Not Gross) Motor Skills and Later Academic Competencies: Educational Implications

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Motor development is an inseparable component of cognitive development. So, to develop the mind, it is necessary to work the body. Therefore, Early Childhood Education curricula and the scientific literature emphasize the need to promote the development of motor skills during the 1st years of life. These skills are necessary for learning and subsequent academic performance. However, studies frequently offer only a partial view of these relationships. Few works have analyzed the specific relationships between different components of preschool gross and fine motor skills and subsequent performance on different academic competencies. Further, they present discrepant results. The aim of this study was to determinate which specific components of gross and fine motor skills assessed in Spanish students during the final year of Early Childhood Education (5 to 6-year-olds) were associated with different academic competencies assessed in the following academic year, when the students were in their 1st year of Primary Education. The final sample consisted of 38 Spanish students, aged 5. A mixed methods approach was used. It consisted of systematic observation to assess specific components of gross and fine motor skills when children were in the Early Childhood Education period, and selective methodology to evaluate their academic competencies (specifically in literacy and mathematics and overall), 1 year later, once in Primary Education. Multiple linear regression models were constructed using the computing language R to examine the association between motor skills and academic competencies. The results indicated that only the components of fine motor skills showed associations with academic competencies. The pattern of association varied when literacy and mathematics competencies were specifically and individually assessed and when overall academic competency was considered. The two assessed fine motor skills (Coordination and Integration) were associated with literacy competency ($\beta = 0.344$, $p = 0.025$; $\beta = 0.349$, $p = 0.024$, respectively) and overall academic competency ($\beta = 0.267$, $p = 0.065$; $\beta = 0.493$, $p = 0.001$, respectively). However, only



Physical Exercise and Fitness Level Are Related to Cognitive and Psychosocial Functioning in Adolescents

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The purpose of this study was to analyze the relationships among physical exercise and fitness with selective attention, concentration, processing speed, general self-efficacy, self-rated health, and satisfaction with life. 208 adolescents between 14 and 16 years, from the city of Malaga (Spain), participated in the study. A comparative and predictive design was used to carry out this research. The instruments used for the evaluation were the Tanita® BC-601 Body Composition Monitor, the Eurofit Physical Condition Test Battery, the D2 Test of Attention, the WISC-IV Symbol Search and Coding tests, the General Self-Efficacy Scale (GSE), the General Health Questionnaire (GHQ-28), and the Satisfaction with Life Scale (SWLS). Analysis of variance (ANOVA), Kruskal-Wallis test, correlation analysis and linear regression were used to contrast the research objectives. The results indicated that adolescents who practiced more hours of physical exercise per week and were in better physical fitness achieved higher scores in selective attention, concentration, processing speed, general self-efficacy, self-rated health, and satisfaction with life. In addition, cardiorespiratory fitness was the physical fitness variable most closely related to and predictive of cognitive and psychosocial functioning. Cardiorespiratory fitness was predictor of all the variables analyzed, except the factor anxiety and insomnia (self-rated health), and life satisfaction that were predicted by horizontal jump measurements and fat mass, respectively. Thus, the study findings indicate that adolescents who practiced more weekly physical exercise and had a higher level of physical fitness scored better on the cognitive functioning and psychosocial tests evaluated. The data suggest that engaging in physical exercise and fitness in adolescence may be appropriate to improve health and well-being, contributing to better development at this stage.

Keywords: physical exercise, cognitive, psychosocial, quality of life, health

INTRODUCTION

Numerous studies have pointed out the physical, psychological, and social benefits that physical exercise can bring to adolescents (Esteban-Cornejo et al., 2015; Swann et al., 2018). Among them, the relationships between the practice of physical exercise with cognitive, and psychosocial functioning at these ages are relevant (Eime et al., 2013; Lubans et al., 2016; Cooper et al., 2018;