

INTERNATIONAL SYMPOSIUM

**ACTIVE BRAINS FOR ALL:
EXERCISE, COGNITION
AND MENTAL HEALTH**

GRANADA, 12TH JUNE 2017

PROCEEDINGS BOOK



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International Symposium Active Brains for All: Exercise, Cognition and Mental Health.

Editors: Francisco B. Ortega, Irene Esteban Cornejo, Carmen María Hernández Salas and Fernando Segura Senent.

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Preface

On behalf of the Organizing Committee, the PROFITH research group and the Scientific Unit of Excellence UCEES, I am pleased to welcome you to the International Symposium “*Active Brains for All*” that will be held in Granada, Spain, on June 12th, 2017.

The understanding of brain is considered one of the key challenges of the 21st century. The brain is the most complex organ in the human body, and the cross talk between body and brain is largely unknown. The new and recent advances in neuroelectric and neuroimaging technologies provide a new era for further exploring and understanding how brain, cognition and mental health can be stimulated by environmental factors, such as physical activity or nutrition, across the lifespan. Brain structure and function determine cognitive and academic performance, but also mental health. This is the fundamental basis for building up a scientific event including all key outcomes related to mind and brain.

The International Symposium “*Active Brains for All*” aims to discuss the state-of-the-art of the role of physical activity, sedentary behavior, physical fitness, and nutrition in relation with brain, cognition, academic achievement and mental health in different age groups.

We are proud to spotlight that Charles Hillman, a world leader in exercise and brain will participate in this event as keynote speaker. In addition, our research group will present the most relevant findings from the ActiveBrains project, a randomized control trial based on the effect of an exercise program on brain, cognition, academic achievement and mental health in overweight and obese children. We are glad to count also with the participation of experienced researchers working in the field of exercise, cognition and mental health, such as Jose C. Perales, Daniel Sanabria, Antonio Luque and David Cárdenas. Furthermore, other national and international researchers working on this exciting and emerging field will be gathered in Granada for this event, which will enhance communication among researchers with common interests, allowing to explore synergies as well as current and future collaborations. It will be a great opportunity to continue advancing in this field and for networking.

In a rather short time since it was first announced, and having a very specific and focused research topic, I am glad to inform that this Symposium will have 80 participants and more than 50 abstract submitted that will be presented either as poster or oral communication. Researchers from all around the country will travel to Granada for this Symposium, including: Cataluña, Madrid, Comunidad Valenciana, Castilla la Mancha, and different cities from Andalucía, among others. The symposium will host also international researchers coming from USA, Chile, UK, The Netherlands and Portugal.

Finally, I would like to thank the University of Granada for the support in the organization of this event, the collaborating partners and specially to all the participants attending to the Symposium. I wish you all will enjoy the event, which I am confident will have a high scientific level, as well as the cultural activities that we have organized. I hope this will be a memorable experience for all of you. Welcome!

Yours sincerely,
Francisco B. Ortega

Local Organizing and Scientific Committee

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Dr. Enrique Herrera Viedma. Vice-Rector for Research, University of Granada, Spain.

Dr. Aurelio Sánchez Vinuesa. Dean of Faculty of Sport Sciences, University of Granada, Spain.

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María Elisa Merchán Ramírez. Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada, Spain

Program

Monday, 12th June 2017

08:00-9:00 **Registration**

09:00-9:30 **Official Welcome**

Dra. Pilar Aranda Ramírez. Rector of University of Granada, Spain.

Dr. Enrique Herrera Viedma. Vice-Rector for Research, University of Granada, Spain.

Dr. Aurelio Sánchez Vinuesa. Dean of Faculty of Sport Sciences, University of Granada, Spain.

Dr. Víctor Soto Hermoso, Director of Research Institute of Sport and Health (iMUDS), University of Granada, Granada, Spain.

Dr. Francisco B Ortega Porcel. Chair of the Scientific and Organizing Committees

09:30-10:00 **Presentation of the Symposium**

Dr. Francisco B Ortega Porcel. Chair of the Scientific and Organizing Committees

Dra. Irene Esteban-Cornejo. Secretary of the Scientific and Organizing Committees

10:00-11:00 **Opening lecture. Exercise, cognition and mental health.**

Chair: Dr. David Jiménez Pavón.

Dr. José Cesar Perales, Granada (Spain): *Physical activity and emotional regulation*

Drs. Daniel Sanabria and Antonio Luque, Granada (Spain): *Understanding the cognition and physical exercise relationship: Insights from the brain and the heart*

Dr. David Cárdenas, Granada (Spain): *Physical condition as a mediator of the impact of mental load experienced by military helicopter pilots.*

11:00-12:00 **Selected Oral Communications**

Chair: Dr. Diego Moliner Urdiales.

Virgina Ariadna Aparicio García, Granada (Spain): *Effects of a concurrent exercise training program during pregnancy on colostrum and mature breast milk fractalkine concentrations. The GESTAFIT Project.*

Oren Contreras Rodríguez, Barcelona (Spain): *Food addiction neural correlates across three studies.*

Mireia Felez Nobrega, Vic (Spain): *Patterns of activPAL-determined sedentary behaviour are related to working memory capacity and academic achievement in young adults.*

Flávia Machado, Porto (Portugal): *Does a multicomponent exercise program improve physical and cognitive function in older with Alzheimer's disease? A controlled trial.*

Pontus Henriksson, Granada (Spain): *Cardiorespiratory fitness and obesity in male adolescents and future all-cause and cause-specific disability: cohort study of 1*

million participants.

Hanna Henriksson, Granada (Spain): *Associations between muscular strength in adolescence and later disability pension: a cohort study of one million men.*

12:00-12:30 **HIIT, Coffee break and visit to posters**

12:30-13:30 **Keynote lecture.** Charles Hillman, Boston USA: *Role of physical exercise and fitness on brain, cognition and academic performance.*

Chair: Dr. Francisco B Ortega Porcel.

13:30-14:15 **Poster presentation session.**

14:15-15:30 **Lunch**

15:30-16:30 **Selected Oral Communications**

Chair: Dra. Oren Contreras-Rodríguez.

Mónica López Vicente, Barcelona (Spain): *Cortical structures associated with sports participation in children: a population-based study.*

Andy Daly-Smith, Leeds (United Kingdom): *Acute effects of active learning on academic performance in primary school children: a randomised control trial.*

Abel Ruiz de la Hermosa Fernández Infante, Ciudad Real (Spain): *The relationship between active commuting to school and cognitive performance in 4-7 years old Spanish children. The MOVI-KIDS study.*

Mireia Adelantado-Renau, Castellón (Spain): *Serum Leptin as a Mediator of the Relationship between Cardiorespiratory Fitness and Academic Performance in Adolescents: DADOS Study.*

Juan F. Navas, Granada (Spain): *Levels of adiposity associated with altered brain functioning during general reward processing in adolescents.*

16:30-17:00 **HIIT, Coffee break and visit to posters**

17:00-18:00 **Closing lecture.** Francisco B Ortega and collaborators, Granada (Spain): *Past, present and future of the ActiveBrains, SmarterMove and CoCa projects*

Chair: Dr. Jonatan R. Ruiz.

18:00-18:30 **Symposium summary and Awards to best oral communications**

Dr. Francisco B Ortega Porcel and Dra. Irene Esteban-Cornejo.

19:45-21:45 **Cultural running/walking**

22:00 **Tapas Dinner (not included in the registration fee)**

Main Speakers



Charles Hillman, Department of Psychology and Department of Health Sciences Northeastern University, Boston USA.

PhD, Department of Kinesiology, University of Maryland at College Park, 2000

MS, Department of Exercise and Sport Sciences, University of Florida, 1997

BA, University of Miami, 1994

Dr. **Hillman's primary research** emphasis is to better understand factors that relate to increased **cognitive health** and **effective functioning** of individuals **across the lifespan**. Specifically, his research focuses on the relationship between both acute and chronic physical activity participation and cognitive function from a neuroelectric perspective. Dr. Hillman, has been appointed to the 2018 Physical Activity Guidelines Advisory Committee.



Francisco B. Ortega, Department of Physical Education and Sport, University of Granada, Spain Granada (Spain).

PhD in Exercise Physiology (First PhD), Department of Physiology, University of Granada, 2008.

PhD in Medical Sciences (Second PhD), Department of Biosciences and Nutrition, Karolinska Institutet, 2008.

BA, University of Granada, 2002.

Dr. **Ortega** is co-director of the **PROFITH** research Group and Head of the Research Unit of Physical Activity and Health Promotion in the Research Institute of Sport and Health (iMUDS). Dr. Ortega's **main research interests** are focused on (i) assessment of physical fitness and physical activity, (ii) effects of exercise on physical and mental health outcomes, as well as on cognition and brain and (iii) exercise-based interventions using mobile technology (m-Health).



David Cárdenas Vélez, Department of Physical Education and Sport, University of Granada, Spain Granada (Spain).

Ph.D. in Physical Education and Sport Sciences, Department of Personality, Evaluation and Psychological Treatment, University of Granada, 1995.

BA, University of Granada, 1987.

Dr. Cárdenas is Senior Lecturer at the University of Granada and head of the research group "Structure and Process Involved in Interaction Sports" (HUM 844). His main **research interests** are focused on (i) the bidirectional relationship between brain function (mainly mental workload), physical exercise and sport and (ii) decision making and learning process in sports.



José Cesar Perales, Department of Experimental Psychology, University of Granada, Spain, Granada (Spain).

PhD. in Experimental Psychology, Department of Experimental Psychology, University of Granada, 2002.

BA, University of Granada, 1992.

Dr. **Perales** is Associate Professor at University of Granada and Senior Member of the Learning, Emotion and Decision Research Group (CTS-176).

His **research interests** range from human learning to judgment and decision making processes, with a special focus on self-regulation in daily life behavior, including drug use, gambling, and physical activity.



Daniel Sanabria, Department of Experimental Psychology, University of Granada, Spain Granada (Spain).

PhD. in Experimental Psychology, Department of Experimental Psychology, University of Oxford, 2005.

BA, University of Granada, 1999.

Dr. Sanabria is Associate Professor at the University of Granada and Head of the Psychology, Ergonomic and Physical Activity research group (HUM-957)

His main **research interest** is focused on the relationship between cognition (mainly attention), brain, physical exercise and sport.



Antonio Luque-Casado, Department of Experimental Psychology, University of Granada, Spain Granada (Spain).

PhD. in Biomedicine, Department of Experimental Psychology, University of Granada, Spain, 2016.

MS, Department of Physical Education and Sport, University of Granada, Spain, 2012.

BA, University of Granada, 2010.

Dr. **Luque-Casado** is Posdoctoral Research Fellow at University of Granada and Member of the Psychology, Ergonomic and Physical Activity Research Group (HUM-957).

His **main research interests** are focused on (i) exercise, sport and cognition and (ii) the role of aerobic exercise on brain-heart dynamics in attentional contexts.

Posters overview arranged by topics

Physical activity, sedentary behavior, physical fitness, nutrition and brain

- B01** *Ciria, Luis F. et al.: Influence of acute physical exercise intensity on brain rhythms: tonic and phasic electrocortical response during a single bout of aerobic exercise.*
- B02** *Perakakis, Pandelis et al.: Does interoceptive sensitivity modulate the cognitive benefits of regular physical exercise? Neurophysiological evidence from the heart-evoked brain potential.*
- B03** *Zandonai, Thomas et al.: The effects of tramadol on physical performance and brain dynamics during cycling exercise: a double blind randomized placebo-controlled clinical trial.*
- B04** *Jiménez Pavón, David et al.: Effect of supervised physical exercise training at Cerebral, COgnitive and Metabolomic level in older people with mild cognitive impairment; EFICCOM Study.*
- B05** *Cadenas-Sánchez, Cristina et al.: Could a metabolically healthy phenotype differ in gray matter volume with those who are non-healthy?*
- B06** *Esteban-Cornejo, Irene et al.: Does an agile body make an agile brain? The associations of speed-agility with brain structural volume in overweight/obese children. The ActiveBrains Project.*
- B07** *Verdejo-Román, Juan et al.: Body Mass Index is associated with an abnormal white matter maturation during adolescence.*
- B08** *Martín-Pérez, Cristina et al.: Emotional brain system: associations with insulin resistance and food craving in adolescents with excess weight.*
- B09** *Madinabeitia Cabrera, Iker et al.: Strength, affect regulation, and subcortical morphology in military pilots.*

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Physical activity, sedentary behavior, physical fitness, nutrition and cognitive performance

- CP01** *Berrios Aguayo, Beatriz et al.: Effect of an active recess program on school aptitudes in primary school age children.*
- CP02** *Sanjuán Gómez, Miriam et al.: Relationship between physical activity level before and after retirement and cognitive performance in older adults.*
- CP03** *Higueras-Fresnillo, Sara et al.: Usual gait speed and cognitive decline in older adults.*
- CP04** *de la Cámara Serrano, Miguel Ángel et al.: Relationship between objectively-measured walking at different intensities and two cognitive decline tests in the Elderly.*
- CP05** *Araque Martínez, Miguel Ángel et al.: The effects of a multicomponent physical exercise programme in adults. Physical, cognitive and emotional dimensions: "Moving the memory".*
- CP06** *Gil-Espinosa, Francisco Javier et al.: Can cognitive performance predict physical fitness and academic achievement one year later?.*
- CP07** *Martínez-Ávila, Wendy Daniela et al.: Sugar intake and cognitive performance indicators in overweight/obese children: the ActiveBrains project.*

- CP08 Mora-González, José et al.:** *Is physical fitness associated to executive function in overweight/obese children? Results from the ActiveBrains project.*
- CP09 Merchán-Ramírez, María Elisa et al.:** *Association between body composition and cognitive performance in overweight/obese children: Preliminary results from ActiveBrains Project.*

Physical activity, sedentary behavior, physical fitness, nutrition and academic achievement

- AA01 Pinto-Escalona, Tania et al.:** *Physical activity in the classroom to improve academic achievement.*
- AA02 Navarro Ardoy, Daniel et al.:** *CCP Salud: asignatura curricular adicional a la Educación Física para fomentar hábitos de vida saludables: metodología del proyecto.*
- AA03 Beltrán Valls, María Reyes et al.:** *The Association between Cardiorespiratory Fitness and Academic Performance is Mediated by Weight Status in Adolescents: DADOS Study.*
- AA04 Montosa Mirón, Isabel et al.:** *Physical Condition and Academic Achievement in Adolescents Practitioners of Rhythmic Gymnastics.*
- AA05 Redondo Tébar, Andrés et al.:** *Physical fitness as a predictor of higher health related quality of life in 4-6 years old Spanish schoolchildren. MOVI-KIDS Study.*
- AA06 Rodríguez-Ayllón, María et al.:** *Association of muscular strength with measured and perceived academic achievement in overweight/obese children: Preliminary results from the ActiveBrains project.*
- AA07 García-Hermoso, Antonio et al.:** *Fitness, fatness and academic achievement in Chilean adolescents: a mediation analysis.*
- AA08 Hidalgo Migueles, Jairo et al.:** *Combined effects of sleep behavior, sedentary time and physical activity on academic achievement in overweight/obese children: Results from the ActiveBrains project.*
- AA09 Martínez de Quel Pérez, Óscar et al.:** *Poor cardiovascular fitness in adolescents is associated with low academic achievement.*
- AA10 Martínez Nicolás, Antonio et al.:** *Chronotype influences academic performance.*
- AA11 Muñoz-Hernández, M^a Victoria et al.:** *Associations between sugar intake and academic achievement in overweight/obese children: Preliminary results from the ActiveBrains Project.*

Physical activity, sedentary behavior, physical fitness, nutrition fitness and mental health

- MH01 Esteban-Gonzalo, Laura et al.:** *Positive and negative affect and self-perceived health in Spanish Adolescents.*
- MH02 Muntaner-Mas, Adrià et al.:** *Smartphone-based exercise intervention on prevention of comorbid depression and obesity in ADHD population: a randomized-controlled trial.*

- MH03 Molina-García, Pablo et al.:** *Musculoskeletal pain is associated with current mental health in overweight/obesity children: Preliminary results from the ActiveBrains project.*
- MH04 Acosta Manzano, Francisco Miguel et al.:** *Objectively measured physical activity and mental health in sedentary young adults.*
- MH05 Acosta-Manzano, Pedro et al.:** *Association of physical fitness with emotional well-being in early pregnancy. The Gestafit Project.*
- MH06 Garrido Palomino, Inmaculada et al.:** *A Comparison of Emotional Intelligence in Elite and Expert rock climbers.*
- MH07 Morillas de Laguno, Pablo et al.:** *Lack of association of physical activity and sedentary time with arterial stiffness in women with systemic lupus erythematosus.*
- MH08 Romero Gallardo, Lidia et al.:** *The effects of a concurrent exercise training program on the quality of life of pregnant women. The GESTAFIT Project.*
- MH09 Plaza Florido, Abel Adrián et al.:** *How does objectively measured mental stress differ between different levels of obesity in children? Preliminary results from the ActiveBrains project.*
- MH10 Campos Consuegra, Daniel et al.:** *Timing of Adiposity Rebound and Behaviour problems in Early Childhood.*
- MH11 Zapata Lamana, Rafael et al.:** *Effects of polarized-based distribution training on cardiometabolic risk factors in young women with overweight and obesity: A randomized-controlled trial.*
- MH12 Ortiz-Gómez, Marta et al.:** *Teaching values as a measured of mental health in professional related with education.*

Physical activity, sedentary behavior, physical fitness, nutrition and brain

Effects of a concurrent exercise training program during pregnancy on colostrum and mature breast milk fractalkine concentrations. The GESTAFIT Project

Virginia A Aparicio¹, Javier Díaz-Castro¹, Pedro Acosta-Manzano², Irene Coll-Risco¹, Lidia Romero-Gallardo², Olga Ocón³, Milkana Borges-Cósic², Jorge Moreno-Fernández¹ and Julio J Ochoa-Herrera¹.

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Key words: CX3CL1, chemokine, synaptic scaling, microglial cells, myelination

Background: To know which lifestyle factors such as exercise are responsible for changes in breast milk immune markers is of clinical relevance. In this sense, fractalkine (CX3CL1) is a chemokine that plays a crucial role in the control of the activity of the microglia, regulates the genesis of oligodendrocytes and myelination, and may protect plasticity process of synaptic scaling. Moreover, treatment with fractalkine might diminish the overproduction of proinflammatory cytokines in the microglial cells of stressed newborns[1].

Objectives: To assess the effects of an exercise intervention during pregnancy on colostrum and mature breast milk fractalkine concentrations.

Methods: Sixty-six pregnant women were randomized to either an exercise (three 60-min sessions/week of concurrent aerobic and strength training), or usual care (control) group from the 17th gestational week until delivery. For the present study specific aims, only those women able to produce milk were analysed, resulting in 23 control and 21 exercising women. Colostrum and mature milk fractalkine was measured by Luminex xMAP technology.

Results: After adjustment for maternal age, weight and physical activity levels, colostrum from mothers that followed the exercise program showed a borderline significant but clinically meaningful 28% higher fractalkine concentrations (4310±690 vs 3112±592pg/mL for exercise and control group, respectively, standardized effect size [d]=0.44; -0.20-1.08 confident interval (CI), $p=0.172$). Mature milk from mothers in the exercise group showed the same trend, with a clinically meaningful 31% higher fractalkine concentrations (1641±205 vs 1135±205pg/mL for the exercise and control group, respectively, $d=0.57$; -0.10-1.23CI, $p=0.092$).

Conclusion: The exercise program increased both colostrum and mature breast milk fractalkine concentrations, which might promote a greater neurodevelopment and neuroprotection in the newborn. Further studies with larger sample sizes are needed to confirm or contrast the present findings.

Bibliography: 1. Slusarczyk, J. et al. Fractalkine Attenuates Microglial Cell Activation Induced by Prenatal Stress. Neural Plast 2016, 7258201.

Food addiction neural correlates across three studies

Contreras-Rodríguez O.¹, Soriano-Mas C.^{1,2}, Mata F.³, Stanwell P.⁴, Pursey K.⁴, Parkes L.⁵, Burrows T.⁴ and Verdejo-Garcia A.³

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Key words: food addiction, functional connectivity, striatum, homeostasis, visceral fat

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Introduction: Alterations in dopaminergic (DA) reward processing networks have been associated with food addiction traits¹. These traits, highly prevalent in obese subjects², promote excess weight and visceral fat³ by stimulating the consumption of hyperpalatable foods, a behavior impacted by mood and stress¹. We summarized herein the neural alterations associated with food addiction traits across three different studies as a background to discuss for effective interventions that promote healthy homeostatic eating. *Methods:* Adult participants underwent fMRI resting-state brain assessments. Studies 1 (39 lean, 42 obese) and 2 (30 lean & obese) assessed the striatal connectivity in relation to food addiction during satiation (study 1), and the change from hungry to satiated states (study 2). The study 3 (75 lean & obese) assessed the insular connectivity in relation to food addiction and visceral fat. Food addiction was measured using the Yale Food Addiction Scale (YFAS, study 2)⁴, or the subjective craving reports the palatable foods previously tasted (studies 1 and 3). *Results:* Studies 1 and 2 showed that food addiction associated with an increased connectivity of striatal habit-based networks (i.e, dorsal caudate-somatosensory cortex). Although study 1 suggested this effect to be specific of obesity, the association remained covarying for BMI levels in study 2. Studies 2 and 3 showed that food addiction traits associated with an altered connectivity in brain networks involved in reward learning behaviors (i.e, accumbens-hippocampus, VTA), and in homeostatic eating and stress processing (i.e., middle insula-hypothalamus). Remarkably, this latest alteration was also associated with body visceral fat levels. *Conclusions:* Food addiction traits associate with alterations in dorsal and ventral striatal networks, and homeostatic processing brain networks. Physical exercise induces increases in DA release, and physical inactivity is related to striatal D2R signaling alterations in obese mice⁵. Future studies should assess whether physical exercise could ameliorate food addiction traits.

Cortical structures associated with sports participation in children: a population-based study

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Key words: Physical activity, sports, magnetic resonance imaging, cerebral cortex, schoolchildren.

Objectives: The decrease of physical activity in children is a growing public health problem, not only for the consequences in cardiovascular system, but also in the central nervous system. The literature about the effects of physical activity on the child brain at a population level is scarce. This study aimed to examine whether exercise habits were related to brain maturation. We studied cortical structures related to sports participation and we explored cortical differences associated with type of sport in a large sample of healthy children.

Methods: The study included 911 6- to 10-year-old children from the Generation R cohort. Sports participation data was collected through a parent-reported questionnaire. Magnetic resonance scans were acquired, and global brain volume and cortical thickness were quantified.

Results: Global brain volumetric measures were not associated with weekly sports participation in the fully adjusted models. We observed increased cortical thickness in motor and premotor areas associated with sports participation. In a sub analysis only in boys, participation in individual sports was related to thicker cortices in prefrontal brain areas involved in the regulation of behaviors, in contrast to team sports.

Conclusions: This study is important for public health because the results suggested a relationship between sports participation and an earlier maturation of brain areas associated with motor control, highly relevant for child development. Further longitudinal studies are needed in order to

establish causality and to go in the depth into the team/individual sports associated differences in child brain.

Levels of adiposity associated with altered brain functioning during reward processing in adolescents

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Key words: Excess weight, adolescence, monetary incentive delay, brain reward system, reward.

Background and aims: The brain reward system is key to understanding adolescent obesity in the current obesogenic environment, characterized by the wide availability of highly rewarding stimuli to which adolescents are particularly sensitive. We aimed (1) to examine the association between body fat levels and brain reward system responsivity to general rewards in adolescents, and (2) to test the moderating impact of sex on such relationship.

Method: Sixty-eight adolescents (34 females; mean age [standard deviation] = 16.56 [1.35]) participated in this study. Sample size was determined by a multivariate power analyses to detect a medium sized effect of $d = 0.5$, with 80% power and $p < 0.05$. Participants were measured for body fat levels with bioelectric impedance. They also underwent a functional magnetic resonance imaging (fMRI) scan during the Monetary Incentive Delay (MID) task. This task elicits brain activations associated with two fundamental aspects of reward processing: reward anticipation and feedback. We conducted fMRI analyses while controlling for sex, age and socioeconomic status. These analyses were corrected for multiple comparisons using a combination of voxel intensity and cluster extent thresholds ($p < 0.001$; minimum cluster size = 39 contiguous voxels).

Results: Higher body fat levels were associated with lower activation of the primary somatosensory cortex during reward feedback after controlling for the sociodemographic confounders in the entire sample. There are no associations between body fat and brain activity neither during anticipation nor feedback processing.

Conclusions: In adolescents, higher adiposity is linked to blunted responsivity in brain regions that process the hedonic value of rewards. Sex did not moderate this association.

Posters

Influence of acute physical exercise intensity on brain rhythms: tonic and phasic electrocortical response during single bout of aerobic exercise

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Key words: Fitness, Cognition, Attention, Oddball task, EEG frequencies

Aerobic exercise has been associated positively with improvements in brain and cognitive functions in the last years [1,2]. However, the effects of acute aerobic exercise on brain electrocortical activity, which may play a main role in this relationship, remain still uncover [3]. The purpose of this study was to investigate tonic and phasic electrocortical activity during a single bout of exercise at two different intensities in order to better understand the neural mechanisms underlying cortical-induced changes in the brain. Twenty high-fit young males (19-32 years old) were recruited for two experimental sessions on separate days. Electroencephalography (EEG) was recorded during the counterbalanced sessions of cycling at 80% (high load) and 20% (low load) of VO₂max, while performing an oddball (cognitive) task where they had to detect infrequent targets presented among frequent non-targets. A warming up and cooling down periods of 10 min were also completed before and after both exercise periods. A cluster-based nonparametric permutation tests showed a tonic increase of all EEG frequency bands during high load exercise session with respect to the low load session. Slow frequencies also showed higher spectral power after high load exercise than low load. There were no differences between sessions during warming up. In the oddball task, phasic analysis showed higher parieto-occipital theta synchronization immediately after the target and lower alpha and low-beta desynchronization to the standard trials in the high load than in the low load session. Importantly, the present findings pinpoint a general influence of exercise on whole brain electrocortical activity and provide novel evidence of a complex interplay of multiple frequency bands which might help to understand the underlying neural mechanisms to the positive relationship between of physical exercise and cognition.

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Does interoceptive sensitivity modulate the cognitive benefits of regular physical exercise? Neurophysiological evidence from the heart-evoked brain potential

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Key words: Fitness, Interoception, Cognition, EEG, Heart evoked potential, Psychomotor vigilance task

Interoception refers to our ability to perceive internal body signals like temperature, pain, muscular and visceral sensations, hunger, thirst, etc [1]. It has been shown that individuals differ in their sensitivity to these internal stimuli and that these individual differences relate to cognitive performance in laboratory tasks [2]. Furthermore, recent evidence supports that interoceptive sensitivity can be augmented using simple biofeedback techniques [3]. Here, we explore whether regular physical exercise has a similar effect on interoceptive sensitivity that can also be related to cognitive performance. Twenty-five male athletes recruited from local triathlon clubs and twenty-five University students reporting sedentary behaviour were assigned to a high-fit and a low-fit group, respectively. All participants underwent a 60-min Psychomotor Vigilance Task (PVT) while simultaneous Electroencephalogram and Electrocardiogram were recorded. We estimated the Heartbeat evoked potential (HEP), which is the brain potential elicited by single heartbeats, in the first two cardiac cycles following the preparatory stimulus of the PVT. A cluster-based nonparametric permutation test revealed two significant clusters showing significant group differences in centro-parietal (cluster1, $p=0.021$) and parieto-occipital (cluster2, $p=0.008$) sites. We also found a positive correlation between HEP amplitude and reaction time only in the high-fit group ($r=0.33$, $p=0.007$ vs. $r=0.05$, $p=0.7$). These findings indicate that regular physical activity acts as interoceptive feedback that increases individual sensitivity to internal stimuli, in this case cardiac afferent activity, which could possibly also contribute to improved cognitive performance.

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The effects of tramadol on physical performance and brain dynamics during cycling exercise: a double blind randomized placebo-controlled clinical trial

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Key words: Analgesic, sport performance, cognitive performance, EEG, athletes

The use of tramadol, an analgesic medication, in professional cycling is generating particular interest and concern. Tramadol might enhance cycling performance at the cost of reducing the ability to stay focused. The aim of the present study was to test the hypothesis that acute oral administration of tramadol improves exercise performance during a 20-min cycling Time-Trial (TT) (Experiment 1) in a group of cyclists and whether sustained attention would be impaired during exercise (Experiment 2). This study used a placebo-controlled, double blind methodology. We administered a single oral dose of Tramadol (100 mg), or placebo 120min before starting the TT. Electroencephalography measures (EEG) were recorded throughout the cycling exercise and at rest. In *Experiment 2*, the methods were the same as in *Experiment 1* except that participants performed an Oddball (cognitive) sustained attention task during exercise.

We recruited 56 cyclists in total. In *Experiment 1*, overall power output was higher in the tramadol condition than in the placebo condition. This result was partially replicated in *Experiment 2*, as the power output during the second half of the TT was higher under tramadol, while no differences were observed in the first part of the TT. Pooled data from Experiments 1 and 2 showed significant higher power in the beta (14-40 Hz) band at baseline in the tramadol condition than in the placebo condition (100' after substance intake). The EEG analysis during exercise revealed opposite results when comparing Experiments 1 and 2. No effects of condition were shown either in the PVT or the oddball task. We conclude that tramadol may improve performance, but it may be mediated by fatigue (*Experiment 2*). Regarding brain electrocortical activity and cognitive performance, the results do not seem to support any detrimental effect of tramadol on brain and cognitive performance during exercise.

Effect of supervised physical exercise training at Cerebral, Cognitive and Metabolomic level in older people with mild cognitive impairment; EFICCOM Study

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Key words: Physical exercise, cerebral, cognition, metabolomic, older people.

Objectives: The EFICCOM project aims to examine the effect of a supervised exercise intervention on structural cerebral changes (MRI), cognitive and metabolomic dimensions in patients with mild cognitive impairment. Secondly, to assess its effects on antioxidant capacity, lipid metabolism and glucose, physical and mental health, as well as other risk factors (genetic and biological) for the development of Alzheimer.

Methodology: A total of 100 participants (65-70 years old) with mild cognitive impairment will be randomly distributed in the supervised exercise or control groups (each n=50). The design will include a 5-months intervention with measurements at baseline, post intervention and after 3 months of follow-up. The multicomponent supervised exercise will include aerobic, strength, cognitive and coordinative-agility-balance exercises. An individual periodization based on different load parameters (frequency, volume, intensity, density) will be implemented.

Results: Combining high-resolution brain imaging descriptors, cognitive parameters and metabolome profiling constitute a unique approach to provide a novel understanding and comprehensive perspective of the potential mechanisms underlying the response to exercise intervention in this population group.

Discussion: Although several cross-sectional studies have shown a positive effect of exercise on structural brain integrity and cognition (1), other trials have observed minimal or no effect (2) and there is no evidence about the role on metabolome. Moreover, the detailed characteristics of exercise interventions in terms of exercise type, frequency, volume, intensity and density remains limited (1). Hence, randomized controlled trials aimed at determining the specific dose-response effects on structural brain changes, cognitive status and metabolomic level, simultaneously, are needed. The EFICCOM project will provide a significant enhancement of our current knowledge on the role of exercise on brain health as a preventive strategy in prodromal Alzheimer's disease stages.

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Could a metabolically healthy phenotype differ in gray matter volume with those who are non-healthy?

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Key words: Metabolically healthy but obese, metabolically unhealthy but obese, cortical volume, subcortical volume, overweight, children, adolescents.

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Childhood obesity is associated with worse cognition and with detectable structural changes in the brain such as lower volumes of grey matter. Interestingly, children that are overweight/obese, yet metabolically healthy, have generally better health than metabolically unhealthy peers. However, the role of the metabolically healthy but overweight/obese phenotype for the structure of the children brain is unknown. Therefore, the aim of the study was to examine the association between metabolic healthy phenotype and brain volume in overweight/obese children. This study included cross-sectional baseline data from the ActiveBrains trial (<http://profith.ugr.es/activebrains>). A total of 97 children (10.0±1.2 years, 60 boys) participated in our study. Blood analyses and blood pressure were assessed. Metabolic phenotype was defined based on age- and sex-specific cut-offs proposed by Jolliffe and Janssen (i.e. triglycerides, glucose, high-density lipoprotein, and blood pressure). Waist circumference was not included as a metabolic risk factor. Participants were classified as metabolic healthy if they did not meet any of the 4 metabolic syndrome criteria indicated above. T1-weighted images were acquired with a 3.0 Tesla Siemens Magnetom Tim Trio System. Gray matter tissue was calculated using Diffeomorphic Anatomical Registration Through Exponentiated Lie algebra (DARTEL). All analyses were controlled for sex, peak high velocity offset, parent education, body mass index and total brain volume. Children with a metabolic healthy phenotype (n=52) showed a higher gray volume in 6 cortical regions: superior motor area (k=62), superior temporal gyrus (k=330), fusiform gyrus (k_{right}=2837 and k_{left}=2058), calcarine (k=1048), lingual gyrus (k=4206) and middle occipital gyrus (k=169, p<0.001). In conclusion, to the best of our knowledge, our contribution is the first one in the literature which analysed the influence of metabolic healthy phenotype and its brain volume in any age group. A metabolic healthy

phenotype could have a relevant role in potential increment of gray matter volume in overweight/obese children. However, further randomized controlled trials are needed in order to contrast or corroborate our findings.

Does an agile body make an agile brain? The associations of speed-agility with brain structural volume in overweight/obese children. The ActiveBrains Project

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Key words: Motor fitness, brain, magnetic resonance imaging, obesity, childhood.

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Prupose: To examine the association between speed-agility and brain structural volume in overweight/obese children.

Methods: A total of 101 overweight/obese children aged 8-11 years were recruited from Granada, Spain. Speed-agility was assessed with the 4 × 10-m shuttle-run test of speed-of-movement, agility and coordination. T1-weighted images were acquired with a 3.0 Tesla Siemens Magnetom Tim Trio system. Gray matter tissue was calculated using Diffeomorphic Anatomical Registration Through Exponentiated Lie algebra (DARTEL). All analyses were controlled for sex, peak high velocity offset, parent education, body mass index and total brain volume. The statistical threshold was calculated with AlphaSim and further Hayasaka adjusted to account for the non-isotropic smoothness of structural images.

Results: Speed-agility was related to greater gray matter volumes ($P < 0.001$, $k=59$) in 7 regions with η^2 ranging from 0.398 to 0.472; specifically, in frontal regions (i.e. orbitofrontal cortex, middle and inferior frontal gyri), temporal regions (i.e. superior temporal gyrus and fusiform gyrus) and cerebellum regions (i.e. vermis X and cerebellum VIII). No brain regions showed statistically significant negative associations between speed-agility and gray matter volume.

Conclusions: Speed-agility might be associated with greater volume of numerous cortical brain structures. These findings suggest that the development speed-agility might positively affect development of distinctive brain regions and contribute to counteract the harmful effect of overweight and obesity on brain structure during childhood.

Body Mass Index is associated with an abnormal white matter maturation during adolescence

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Key words: obesity, body mass index, adolescence, white matter, mean diffusivity

Background: Higher body mass index (BMI) during adolescence has been linked to lower cognitive function and differences in the white matter structure [1,2]. All of these studies have used fractional anisotropy (FA) measures as the index of the integrity of the white matter, but the relation between BMI and other measures of the brain structural connectivity, as the mean diffusivity (MD), has not been investigated.

Objective: This study aims to test whether BMI is linked with an abnormal development of the structural connectivity during adolescence, using both FA and MD indexes.

Methods: 112 adolescents (mean age: 15.58 ± 1.89 ; age range: 11-19, 56,3% boys, mean BMI: 25.45 ± 5.30 BMI range: 14.8-40.3) underwent a diffusion tensor imaging (DTI) session. DTI processing and FA and MD maps computation was performed using the FSL software [3]. Probabilistic fiber tractography were performed using the FSL plugin "AutoPtx" [4]. Mean FA and MD values from 15 brain tracts were extracted for each participant. We performed linear regressions in SPSS with the BMI as predicted variable and the FA and MD values as outcomes, adjusted for age and sex.

Results: We found that BMI is positively related with the MD values of the superior thalamic radiation tract ($\beta=0.423$, $p<0.001$) [FWE corrected]. We also found significant, but not Bonferroni corrected, positive relation between BMI and the MD values of the cingulate gyrus ($\beta=0.293$, $p=0.014$) and the parahippocampal parts of the cingulum ($\beta=0.273$, $p=0.016$) and the inferior ($\beta=0.198$, $p=0.047$) and superior longitudinal fasciculus tracts ($\beta=0.312$, $p=0.010$). No significant relationship was found between FA values and BMI.

Conclusions: High BMI is related with an abnormal development of the structural connectivity during adolescence. Increased MD values has been previously related with abnormal white matter maturation and axonal degeneration and demyelination.

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Emotional brain system: associations with insulin resistance and food craving in adolescents with excess weight

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Key words: obesity, food craving, functional neuroimaging, resting-state, insulin

Background: In Europe, 20% of children and adolescents have excess weight. High-fat diets have long been implicated in disruptions of appetite regulatory peptides, as insulin resistance (IR), and abnormal functioning of the areas implicated in the emotional brain system, or which is the same, the motivational and rewarding areas related to feeding (amygdala, hippocampus, hypothalamus, striatum and cerebral cortex). Both disruptions may lead to aberrant motivation to eat.

Objective: This study aims to explore the associations between the activity in the emotional brain system and body mass index (BMI), and its relation to IR and food craving (fC).

Methods: The sample comprised 42 adolescents (20 females, mean age 16.1 years; 20 overweight/obesity and 22 normal weight). Participants underwent a 6-minute resting-state fMRI session and blood tests. In addition, participants were asked to score their desire to eat high-fat foods, already tasted in a previous session. Independent Component Analysis (ICA) were carried out. A single component including areas of the emotional brain system was chosen and correlated with BMI in a one-sample t-test model. Separately, correlations were conducted in SPSS between these BMI associated regions, and IR and food craving only in excess weight group.

Results: Greater BMI was related to higher activation of dorsal caudate and left hippocampus (LH) within the ICA component. In excess weight participants, IR and fC were positively correlated ($p=0.021$; $r=0.460$). Also, greater scores in fC and IR were positively associated with higher activation of the LH ($p=0.004$; $r=0.573$; $p=0.003$; $r=0.586$). We found no significant correlations in the normal weight group.

Conclusions: Results show a triple positive correlation between activation of the hippocampus, IR and food craving in adolescents with excess weight. This data may provide an approach to understand the hormonal, neuronal and behavioral associations underlying appetite control in adolescents with excess weight.

Strength, affect regulation, and subcortical morphology in military pilots

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Key words: Emotion regulation, body composition, physical strength, combat helicopter pilots.

Introduction: Previous studies have shown links of body composition and fitness measures with brain structure, as well as with different aspects of emotional adjustment and wellbeing (Voelcker-Rehage & Niemann, 2013). However, the possible role of trait emotion-regulation success in the relationship between fitness/body composition and emotion-related subcortical structures have never been directly addressed. The present study is aimed at exploring the connection of aerobic fitness, muscle power and trait affect regulation failure with the volumes of subcortical structures known to be involved in affect processing.

Methods: 23 elite helicopter pilots were assessed in fat mass percentage, an exertion test to volitional exhaustion, bench press power output, and negative urgency (trait affect regulation failure). Their brains were scanned using MRI to estimate the size of the accumbens/amygdala complex and the thalamus. Resulting correlations were used to test the relationship between body composition/fitness measures and brain structures' size, and the role of negative urgency therein using structural equation modelling.

Results: Fat mass percentage was associated with size of the thalamus and the amygdala/accumbens complex. In the latter case negative urgency and bench press power output predicted structure size (and explained the effect of fat mass percentage away). In other words, bench press power output and emotion regulation success (but not endurance performance) were associated with a larger amygdala-accumbens size. These relationships can be explained as resulting from brain adaption to exercise-related emotional demands, or can signal individual differences in predisposition to better affect regulation and training tolerance.

Conclusion: Bench press power output and emotion regulation success are associated with a larger amygdala-accumbens size.

Reference: Voelcker-Rehage, C., & Niemann, C. (2013). Structural and functional brain changes related to different types of physical activity across the life span. *Neuroscience & Biobehavioral Reviews*, 37(9), 2268-2295.

Physical activity, sedentary behavior, physical fitness, nutrition and cognitive performance

Patterns of activPAL-determined sedentary behaviour are related to working memory capacity and academic achievement in young adults

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Key words: sitting; physical activity, activPAL, academic achievement, cognition

Objectives: To study relationships between patterns of activPAL-determined sedentary behavior (SB) and physical activity (PA) intensities with working memory capacity (WMC) and academic achievement in a sample of young adults.

Design: Undergraduate students (n=136; 21.2 age \pm 2.5) were recruited from the University of Vic- Central University of Catalonia.

Methods: WMC was assessed through a validated Spanish version of a multiple complex span task. Participants' academic achievement was measured as the grade point average obtained from all completed courses. On the same week, participants wore an activPALTM for 7 days to measure patterns of SB (total sitting and standing time, number of breaks and bouts duration) and PA intensities (light and moderate to vigorous). General linear models –adjusted by age, gender, light and moderate to vigorous PA– examined associations between SB patterns and PA with WMC and academic achievement.

Results: PA intensities, sitting time, standing time and total breaks in sedentary time were not related to academic achievement or WMC. Independent of PA, the amount of time spent in sedentary bouts of 10-20 min during weekdays was positively related to academic achievement. For WMC, negative associations were identified with sedentary bouts of 20-30min in weekend days for both active and inactive participants.

Conclusions: Frequent interruptions (i.e. every 10-20 min) of prolonged sitting time during weekdays may enhance academic achievement in young adults.

Does a multicomponent exercise program improve physical and cognitive function in older with Alzheimer's disease? A controlled trial

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Key words: exercise, dementia, functional fitness, aging, activities of daily living

Alzheimer's Disease (AD) is associated with progressive cognitive decline, along with functional impairment, and adversely affects physical conditioning. Although Multicomponent training (MT) seems to be effective at improving functional and cognitive performances in community-dwelling older healthy adults, few intervention studies have addressed older adults with dementia and neurodegenerative disorders, including AD. The aim of this study is to assess the effectiveness of MT on physical fitness, ability to perform activities of daily living (ADL), and cognitive function in people with AD. A controlled trial of 10 community-dwelling individuals diagnosed with mild to moderate AD were divided into two groups (control - GC or intervention -IG) according to their aim and availability to voluntarily participate in this study. AD subjects and their caregivers were submitted to a 6-month MT (50– 60 minutes/session), including aerobics, muscle strengthening, flexibility, balance and postural exercise. Furthermore, cognitive stimulation was promoted, enabling the interaction patient- caregiver. Before and after intervention, the following tests were used: Functional Fitness Test, Alzheimer Disease Assessment Scale – Cognitive, and Disability Assessment for Dementia Scale. Results from a repeated measures ANOVA revealed a significant time interaction on muscle strength ($F=13$, $p<0,05$) in upper and lower body. Additionally, there was a significantly better performance on cardiorespiratory fitness ($p<0,05$) in IG, and in the ability to perform ADL ($p<0.05$). The CG's performance decreased over time in cognitive function. Data suggests that a bi-weekly MT can be an important non-pharmacological intervention to delay the functional and cognitive decline of older community residents with AD.

The relationship between active commuting to school and cognitive performance in 4-7 years old Spanish children. The MOVI-KIDS study

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Key words: Active commuting, physical activity, cognitive performance, schoolchildren.

Background: Active commuting to school (ACS) can help to increase the daily amount of physical activity; however, it is unclear whether ACS (as a way to increase levels of physical activity) has the potential to improve cognitive performance. To our knowledge, only three studies have investigated the association between ACS and cognitive performance in adolescents. Nevertheless, it is questionable whether these studies can be transferred directly to schoolchildren because of the lack of research, neuronal plasticity and hormonal difference of puberty. The aim of this study was to examine the relationship between ACS and cognitive performance in 4-to-7 years old schoolchildren.

Methods: Cross-sectional observational study including 1,159 schoolchildren from 21 schools in Cuenca and Ciudad Real (Castilla-La Mancha, Spain). The mode and duration of ACS and covariates were obtained through a questionnaire fulfilled by the parents. Cognitive performance was assessed using the Battery of General and Differential Aptitudes for schoolchildren aged 3-6 (BADyG I) and 6-8 years (BADyG E1). ANCOVA models were applied.

Results: Forty-six percent of the schoolchildren used active means to travel to school. ACS was not significantly associated with cognitive performance parameters.

Conclusions: More than half Spanish schoolchildren aged 4-to-7 years did not actively commute to school. The impact of ACS in promoting a better cognitive performance for schoolchildren is not compelling. Given the short duration, distance from home to school and possible low intensity it may not be sufficient to impact upon cognitive performance. Longitudinal and intervention studies are needed to further understand our findings.

Posters

Effect of an active recess program on school aptitudes in primary school age children

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Key words: school skills, active recesses, children

Objective: the purpose of this study is to analyze the effect of 10-week active recess program on school aptitudes.

Method: A group of 114 children (57 girls and 57 boys) of 8-12 years (age=9.72±1.25years) voluntarily participated in this study. Participants were randomly assigned to one of the following groups: EG (n=56) and CG (n = 58). The EG performed three small-sided game sessions per week during the recess (e.g.; football, basketball) that required cognitive and muscle coordination. School skills were assessed by TEA test, which evaluates the intelligence. It is divided into 3 levels explores fundamental school skills: Verbal, Numerical and Reasoning.

Results: School aptitudes of the 8 to 12 year old children benefited from active recess program. The increase in physical activity during the recess increased the school aptitudes significantly of the EG: verbal aptitude (p<0.001), numerical aptitude (p<0.001) and reasoning aptitude (p<0.001) compared with the CG, which no displayed significant changes in any of the school skills.

Conclusion: 10-week of an active recess program at school improves school aptitudes. These findings carry significant implications for physical activity in schools affording a great physical and cognitive development.

Relationship between physical activity level before and after retirement and cognitive performance in older adults

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Background: The increase in the elderly population generates the need for these people to remain stable, cognitively and functionally, as long as possible. It is therefore necessary to know the variables involve in successful cognitive performance during the old age.

Objective: The objective of this research has been to analyze how physical activity and other variables related with life style before and after retirement are associated with cognitive performance during the old age.

Method: The study involved a total of 176 elderly people with a mean age of 75 years (s.d. = 8). The evaluation instruments used were the Mini-Exam-Cognitive (MEC, Lobo et al., 1979) and a structured interview of psychosocial and lifestyle variables (including physical activity) before and after retirement developed for this study by the research group.

Results: We have obtained significant associations between pre-retirement physical activity and cognitive performance in old age and between post-retirement physical activity and cognitive performance in old age. Results also show that physical activity after retirement also appears as one of the variable related to cognitive performance during the old age.

Conclusions: Physical activity has been shown to be related with cognitive performance in the sample studied. Likewise, other variables such as social relations or cultural activity have also shown equal or greater relation with cognitive performance. To summarize, the results show that physical and other lifestyle variables are related with a better cognitive performance during the old age.

Usual gait speed and cognitive decline in older adults

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Key words: accelerometry, gait speed, cognitive decline, elderly

Aim: To examine the relationship of usual gait speed measured by the 8-feet test and the Intelligent Device for Energy Expenditure and Activity (IDEEA) monitor with two cognitive decline tests in older adults.

Methods: This study comprised 200 well-functioning community-dwelling individuals (113 women), aged 65 and older (mean±SD: 71.39±5.55 years). The 8-feet test was used to assess indirect usual gait speed in clinical settings. A direct measure of usual gait speed was obtained with the IDEEA monitor, which participants wore for 48 consecutive hours, and the average usual gait speed during walking was used for the analysis. Cognitive decline was measured with (i) the Mini-Mental State Examination (MMSE, range 0-30), which has been adapted and validated for use in the Spanish population, and (ii) the Rapid Cognitive Screen (RCS, range 0-10), which is a brief screening tool (<3 min) for cognitive dysfunction that includes 3-items: recall, clock drawing, and insight.

Results: Analyses were performed with a total of 149 participants who had valid information on the 8-feet test and at least 44 hours of recording with the IDEEA monitor. Mean±SD usual gait speed was 0.96±0.28 m/s for the 8-feet test and 0.78±0.16 m/s for the IDEEA monitor. The mean±SD obtained for the MMSE and RCS cognitive decline tests were 27.98±3.00 score and 7.00±2.15 score, respectively. Although it did not reach statistical significance, usual gait speed measured by the 8-feet test ($\rho=0.125$, $p=0.128$) and IDEEA monitor ($\rho=0.083$, $p=0.314$) were positively related to the MMSE. In contrast, the RCS was significantly related to both measurements ($\rho=0.175$, $p=0.003$ for the 8-feet test, and $\rho=0.226$, $p=0.005$ for the IDEEA monitor).

Conclusions: Higher usual gait speed may protect against cognitive decline among older adults, but selected measure of both constructs could vary this relationship.

Relationships between objectively-measured walking at different intensities and two cognitive decline tests in the Elderly

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Key words: accelerometer, gait intensities, cognitive fluid tests, cognitive status, elderly

Objective: The aim of the present study was to examine the relation between total time in walking and at different intensities measured by IDEEA monitor and the scores obtained in two cognitive decline tests in older people.

Methods: A subsample of 149 participants (82 women), aged 65 to 92 years (mean \pm SD: 71.4 \pm 5.5 years), from the IMPACT65+ Study were included. The Intelligent Device for Energy Expenditure and Activity (IDEEA) device was worn for 48 consecutive hours to assess their usual gait and total walking time and at 3 different walking intensities (very light [<2.00 mph], light [2.00 to 2.49 mph], and moderate-vigorous [≥ 2.5 mph]) were estimated. To evaluate the cognitive impairment, the Rapid Cognitive Screen (RCS, 0-10 score) and the Mini-Mental State Examination (MMSE, 0-30 score) were completed for all participants. The non-parametric Spearman correlation coefficient (ρ) was calculated to examine the relationship between total walking, and walking at different intensities, and the two cognitive tests.

Results: Mean \pm SD total walking time was 127.9 \pm 52.9 min/day, and 74.2 \pm 29.7 min/day, 26.0 \pm 17.6 min/day and 27.7 \pm 16.2 min/day for very light, light and moderate-vigorous walking intensities respectively. Cognitive tests mean \pm SD were 27.9 \pm 3.0 scores for the MMSE and 7.0 \pm 2.1 scores for the RCS. Only the RCS test showed significant correlations with walking intensities. Specifically, in the total sample, a significant correlation between moderate-vigorous walking and the RCS test ($\rho=0.184$, $p=0.025$) was observed. When examining the relationships by sex and sex-specific age groups, the correlations were significant among men ($\rho=0.347$, $p=0.004$) and in older participants ($\rho=0.309$, $p=0.013$), but not in women and younger elderly participants.

Conclusion: We found a positive relation between walking at moderate-vigorous pace and the RCS test in older adults. The MMSC test was not correlated with any speed. The potential benefits of walking at lower intensities need further research.

The Effects of a Multicomponent Physical Exercise Programme in Adults. Physical, Cognitive and Emotional Dimensions: “Moving The Memory”

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Key words: Physical exercise, cognition, emotions, quality of life, adults

Introduction: Cognition, specifically the executive function, is improved as long as the physical fitness also is. Both are strictly related to each other (1). Multimodal interventions on cognitive and physical functioning have produced great benefits on adults, such as increases in Brain-derived neurotrophic factor (BDNF), a better verbal fluency or balance improvements (2).

The aim of this project is to promote the necessity of develop cognitive abilities on physical exercise programs of adult people. We would evaluate the physical fitness, cognition, emotions and health-related quality of life in adults living in Almería and province (pre-posttest of a physical exercise program).

The peculiarity of this project and the difference between this proposal and the majority of physical exercise programs/studies is the cognitive performance in every single session. The present interventional program includes different activities which develop cognitive performance combined with physical exercise. These activities would keep the participants active in both physical and cognitive dimensions.

Methodology: A total sample of 400 adults from Almería would be evaluated using the Senior Fitness Test for physical fitness, the Trail Making Test A&B and the Stroop Test for cognition, a mood value scale (EVEA), and the SF-12 for the Health-related quality of life. Before the evaluation and during the program, we would have meetings with the instructors of the physical exercise programs introducing the proposal of activities and supervising everything is developed as we would consider opportune.

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Can cognitive performance predict physical fitness and academic achievement one year later?

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Key words: Cognitive achievement, cardiorespiratory fitness, muscular strength, flexibility, academic performance

Previous studies have shown that physical activity, fitness and academic achievement might predict cognitive performance later in life. However, to the best of our knowledge, there are no studies examining the inverse relationship, that is, whether cognition may predict fitness and academic performance in adolescents one year later. Therefore, the aim of this study was to examine the associations between cognitive performance and physical fitness and academic achievement one year later. This study includes baseline and one-year follow-up longitudinal data of cognitive performance, academic achievement and fitness performance. A total of 131 adolescents (aged range: 12 to 13) from South Spain participated in our study. Cognitive performance was assessed using the Raven's Progressive Matrices test (non-verbal test). Cardiorespiratory fitness was measured by 20 m endurance shuttle-run. Lower-limbs muscular strength was assessed by the standing long jump test. Flexibility was assessed by the sit-and-reach test. Academic performance was assessed using the grades obtained in Language, Mathematics, English (foreign language) and Geography and History. Cognitive performance was collected in October 2015, while fitness and academic achievement were evaluated one year later (October 2016). Linear regression analyses were performed. Our results indicate that cognitive performance was not associated neither with cardiorespiratory fitness ($\beta=0.109$, $p=0.254$), nor muscular strength ($\beta=0.155$, $p=0.104$), or flexibility ($\beta=0.080$, $p=0.406$) one year later. Regarding academic achievement, cognitive performance was positively associated to Mathematics ($\beta=0.482$, $p<0.001$), Language ($\beta=0.407$, $p<0.001$), Geography and History ($\beta=0.454$, $p<0.001$) and English ($\beta=0.382$, $p<0.001$) achievements one year later. Overall, our results suggest that cognitive performance might predict academic achievement but not fitness one year later. Further studies with a randomized controlled design should contrast or corroborate our findings in young people.

Sugar intake and cognitive performance indicators in overweight/obese children: the ActiveBrains project

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Key words: dietary intake, nutrition, cognition, executive functions, preadolescents.

Introduction: The effects of dietary habits such as sugar intake on cognition performance and behavior are not clear.

Aim: The aim of this study was to examine the association of sugar intake with indicators of executive function such as cognitive flexibility, inhibition and planning ability.

Methods: A total of 98 overweight/obese children (10 ± 1.1 years; 40.8% girls) participated in this cross-sectional study from the ActiveBrains project. Cognitive flexibility was assessed by Design Fluency Test (DFT) and Trail Making Test (TMT), inhibition by the Stroop Color-Word Test and planning ability by the Zoo Map Test. For DFT the total correct designs of 3 conditions were registered; for the TMT an interference score was calculated (time in condition 4 minus condition 2); for the Stroop-Color-Word test an interference score was also calculated (time in condition 3 minus condition 1); and for Zoo Map Test three variables were obtained like planning time and sequence score of condition 1 and total sequence score of condition 1 and 2. The mean sugar intake was analysed within the dietetic assessment which was performed by two non-consecutive weekdays 24-h recalls and data was processed using EasyDiet® and the nutrition labeling data. We performed linear regression analyses controlling for age, sex, body mass index and parental education attainment.

Results: No significant associations were found between sugar intake score with cognitive flexibility, inhibition and planning ability (all $P > 0.05$). A borderline association was found between sugar intake and the time interference score of Stroop Color-Word Test ($\beta = -0.181$, $P = 0.059$).

Conclusion: Further research with larger sample sizes, is needed to examine the relation between cognitive domains and specific nutrients and encourage healthy diet habits.

Founding by: The ActiveBrains Project is founded by the Spanish Ministry of Economy and Competitiveness (Reference DEP2013-47540)

Disclosure of interest: None of the authors have any conflicts of interest.

Is physical fitness associated to executive function in overweight/obese children? Results from the ActiveBrains project

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Key words: cognitive flexibility, inhibition, physical exercise, youth.

Background: Overweight/obese children have worse executive function than normal-weight children. In this context, physical fitness might help to improve cognition. It is therefore important to identify if a global score of all physical fitness components (i.e. cardiorespiratory fitness, muscular strength and speed-agility) influence executive function in overweight and obese children.

Aim: The aim of the present study was to examine the association of a physical fitness score with indicators of executive function such as cognitive flexibility, inhibition and planning ability.

Methods: A total of 100 overweight/obese children (10.1 ± 1.1 years; 58% boys) participated in this cross-sectional analysis from the ActiveBrains project. The ALPHA test battery for children and adolescents was used to assess every component of physical fitness. Muscular strength (upper and lower-limb), speed-agility and cardiorespiratory fitness were tested using handgrip and standing long jump, 4x10m shuttle run and 20m shuttle run tests, respectively. The individual score of each test was standardised (Z-standardised score). A physical fitness score was calculated as mean of all Z-standardised scores. Executive function was assessed using indicators such as Design Fluency Test (DFT) and Trail Making Test (TMT) for cognitive flexibility, the Stroop Color-Word Test for inhibition and the Zoo Map Test for planning ability. We performed linear regression analyses controlling for age, sex and maternal education.

Results: A higher physical fitness score was significantly associated with higher scores in indicators of cognitive flexibility, particularly the DFT ($\beta=0.285$, $P=0.001$) and TMT ($\beta=0.245$, $P=0.015$). No significant associations were found between physical fitness score and inhibition and planning ability (all $P > 0.050$).

Conclusion: Our findings suggest that higher physical fitness may positively influence executive function and, particularly, cognitive flexibility. Future studies are needed in order to confirm these findings.

Association between body composition and cognitive performance in overweight/obese children: Preliminary results from ActiveBrains Project

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Key words: cognitive performance; childhood obesity; body composition, adiposity, fat mass.

Background: According to several studies, overweight and obese children have worse cognitive performance compared to normal-weight children. However, it is not fully investigated whether severe/morbid obesity (class II-III), as compared to overweight and mild obesity (class I), is related to even worse cognitive performance.

Therefore, we studied associations of body composition with cognitive performance in children with different overweight/obesity status.

Methods: A total of 109 overweight/obese children (64 boys), aged between 8 and 11 years, participated in this cross-sectional study from the ActiveBrains Project. Fat mass index and fat-mass in the android region were assessed by Dual-energy X-ray absorptiometry. Moreover, waist circumference was measured and Body mass index (BMI) was calculated and classified into weight status categories according to the cut-offs by Cole *et al.* Cognitive performance was assessed using the Kaufman Brief Intelligence Test, Trail Making Test for cognitive flexibility and the Stroop Color-Word Test for inhibition. Comparisons of cognitive performance in children with overweight (n=27), mild obesity (n=47) and severe/morbid obesity (n=35) were conducted using analysis of covariance (ANCOVA) adjusting for confounders (i.e. age, sex and parental educational). Also, linear regression analyses were performed adjusting for the same confounders.

Results: Overall, there were no statistically significant differences in cognitive performance between children with overweight, mild obesity and severe/morbid obesity although there was a borderline difference ($P=0.053$) indicating that overweight children performed better than children with severe/morbid obesity in the Stroop Color-Word Test. Furthermore, there were no statistical significant linear association of BMI, fat mass index, fat mass in the android region and waist circumference with cognitive performance.

Conclusion: This relatively small study found no significant associations between body composition and cognitive performance in children from 8 to 11 years of age. Further studies are needed to clarify the influence of severe/morbid obesity on cognition in children.

**Physical activity, sedentary behavior, physical
fitness, nutrition and academic achievement**

Acute effects of active learning on academic performance in primary school children: a randomised control trial

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Key words: active learning, physical activity, acute, academic performance, children

Evidence establishing the acute effects of active learning on moderate-to-vigorous physical activity (MVPA) and academic performance (AP) is limited. In addition, individual level treatment fidelity is often unconfirmed in acute school-based studies.

Purpose: To investigate the acute effects of an active lesson on MVPA and AP in primary school children.

Methods: Ninety-eight pupils from Year 2 (N=43; Mage=6.7±0.30 yrs; nGirls=23) and Year 5 (N=55; Mage=9.7±0.32 yrs; nGirls=20) were recruited. Following familiarisation, pupils were randomly allocated to a 45-minute physically-active lesson (PAL, n=50) or standard classroom lesson (SCL, n=48). One week post-familiarisation, immediately before, and 10-mins after each lesson, pupils completed the Maths Addition and Subtraction, Speed and Accuracy Test (MASSAT) and Wide Range Achievement Test (WRAT4, Year 5 only). MVPA data was measured in 15-second epochs using accelerometers and Evenson cutpoints. A two-way ANOVA with repeated measures assessed changes in academic outcomes; MASSAT processing score (PS: total correct answers – total incorrect answers), WRAT4 Total Score (TS- total correct answers).

Results: Eighty-seven participants (nPAL=42, nSCL=45) completed assessments. Significantly more MVPA was accumulated in PALs (10.09±4.09mins, range 4.75mins to 22.25mins) compared to SCL (0.97±1.00mins; p=0.001). Thirteen pupils (31%) achieved ≥12 mins MVPA in PALs. No significant interaction effects were observed in PALs compared to SCLs for either MASSAT-PS (p=0.085) or WRAT4-TS (p=0.519). Although non-significant, greater, improvements in MASSAT-PS scores were observed for PAL≥12 (2.62±4.14) compared SCL (-0.36±5.58; p=0.084, Partial Eta=0.052).

Discussion: PAL led to substantial increases in MVPA with no significant change in AP. PAL resulted in a large variation of MVPA accumulation at the individual level questioning a universal experience. Aligned with previous literature, higher levels of MVPA in the PALs may lead to higher AP. Appropriately powered studies enabling sub-analyses are required to confirm this effect.

Serum Leptin as a Mediator of the Relationship between Cardiorespiratory Fitness and Academic Performance in Adolescents: DADOS Study

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Key words: Academic achievement, adolescence, school outcomes, adipokines, fitness

Objectives: 1) To analyse the relationship of cardiorespiratory fitness (CRF) with academic performance (AP), taking into account potential confounders including serum leptin concentration; 2) To test the mediating effect of serum leptin concentration in the association of CRF and AP.

Methods: A sample of 263 adolescents (125 girls) aged 13.9 ± 0.3 years from the DADOS (Deporte, ADOlescencia y Salud) Study was included in the analyses. CRF was assessed by the 20-m shuttle run test and the number of completed laps was registered. AP was assessed through final school grades of Math, Spanish, core subjects (math and Spanish mean) and grade point average (GPA). Serum fasting leptin concentrations were measured using an enzyme-linked immunosorbent assay. Linear regression and mediation analyses were performed and p-values <0.05 were considered statistically significant.

Results: Linear regression analyses showed that CRF was associated with Math, core subjects and GPA (all $p < 0.05$) after controlling for sex, pubertal development and socioeconomic status (model 1). Further regression analysis adding serum leptin as confounder (model 2) showed no association of CRF with Math, core subjects and GPA. Mediation analysis revealed that serum leptin acted as a mediator in the relationship of CRF with core subjects (Sobel test $z = 2.08$; $p < 0.05$ %Med=74.6%) and with GPA (Sobel test $z = 2.22$; $p < 0.05$ %Med=68.6%).

Conclusions: Our results fit in line with previous research showing a positive association between CRF and AP1 and highlighting the mediation effect of leptin between CRF and AP in adolescents. The main findings of our study point towards the idea of a negative association between serum leptin levels and AP2. Further studies are needed to a better understanding about the role of leptin on cognitive processes.

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Posters

Physical activity in the classroom to improve academic achievement

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Key words: Physical Education, interdisciplinarity, secondary education, Spanish Language and Literature.

The increase in sedentary lifestyle has favoured different strategies to promote physical activity. What's more, physical exercise has been shown to improve cognitive functions. Thus, the aim of our study was to know the effects of an interdisciplinary intervention between Physical Education and a classroom subject.

116 students took part ($13,6 \pm 0,7$ years, 50 girls): one group carried out 10 minutes of study-review theory of a Spanish Language and Literature subject while the other group did 10 minutes of physical exercise related with the same teaching unit.

Before and after the intervention they completed a test with multiple choice responses, *The Strengths and Difficulties Questionnaire (SDQ)* and the *questionnaire for assessing physical activity in school adolescents*.

It has been shown that doing ten minutes of physical activity, related to the contents of a curricular area, improves academic performance ($p < 0,05$), attention ($p < 0,01$) and it increases the weekly frequency of physical activity ($p < 0,01$). Thus, an increase of physical activity in high schools is recommended to improve academic performance.

CCP Salud: asignatura curricular adicional a la Educación Física para fomentar hábitos de vida saludables: metodología del proyecto

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Key words: asignatura, currículo, salud, rendimiento cognitivo, rendimiento académico

Con la implantación de la Ley Orgánica 8/2013, de 9 de diciembre, para la Mejora de la Calidad Educativa (LOMCE), existe la autonomía de centros para la creación de una nueva materia dentro del bloque de asignaturas de libre configuración autonómica. Se ha creado la asignatura “Calidad de vida, creación de hábitos y práctica de actividad física saludable” (CCP Salud) para el nivel educativo de 2º de ESO, con una carga lectiva de 3 periodos semanales. Hacer actividad física (AF) regular y llevar estilos de vida saludables, puede mejorar el rendimiento cognitivo (Xu, 2013)¹ y académico (Ardoy et al. 2014)².

Objetivo: Examinar el efecto de una materia curricular adicional a la Educación Física (CCP Salud) durante un curso escolar, sobre la forma física y rendimiento escolar en niños de 13 a 14 años.

Método: Alumnos matriculados en 2º de ESO en un mismo centro (n=150), divididos en grupo experimental (n=50, cinco sesiones de AF curricular; dos de Educación Física y tres de CCP Salud) y grupo control (n=100, dos sesiones de AF curricular, solo Educación Física), según elección de las familias. Se analizará el efecto de la materia CCP Salud durante un curso escolar sobre la condición física, perímetro de cadera, rendimiento académico (calificaciones), cognitivo (BADYG) y procesos atencionales (d2t).

Resultados: La materia CCP Salud podría mejorar la forma física y reducir el tejido adiposo en los estudiantes que elijan esta asignatura. También podría mejorar, o no empeorar, el rendimiento académico y procesos atencionales a pesar de tener menos periodos lectivos de refuerzo curricular en otras materias troncales.

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The Association between Cardiorespiratory Fitness and Academic Performance is Mediated by Weight Status in Adolescents: DADOS Study

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Key words: academic performance, fitness, body mass index, adolescence.

Objectives: 1) To investigate the relationship between cardiorespiratory fitness (CRF), weight status and academic performance (AP) in adolescents; 2) to examine whether the association between CRF and AP is mediated by weight status.

Methods: 269 adolescents (129 girls) aged 13y.o. from the DADOS (Deporte, ADOlescencia y Salud) study were included in the analysis. CRF was assessed by the 20-m shuttle run test and the number of completed laps was registered. AP was assessed through final school grades of Maths, Spanish, and grade point average (GPA). Weight status was indicated through BMI and expressed as kg/m². Linear regression and mediation analyses were performed and a p-value <0.05 was considered statistically significant.

Results: Linear regression analyses showed that CRF was associated with Maths and GPA (p=0.01) after adjusting for sex, pubertal development and socioeconomic status (model 1). Further regression analysis adding BMI as confounder (model 2) showed no association of CRF with Maths and GPA. Mediation analysis revealed that BMI acted as a mediator of the relationship between CRF and AP. The estimated percentage of total influence for Maths was 66.9% (Sobel test z=2.18; p<0.05) and 91.8% for GPA (Sobel test z=2.55; p<0.05).

Conclusions: Our data are consistent with previous studies showing a positive association between CRF and AP and a negative association between BMI and AP in adolescents^{1,2}. The main findings of our study suggest that the association between CRF and AP is mediated by weight status. School-based programs aimed to improve AP in adolescents, should take into account CRF levels and weight status in order to achieve better results.

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Physical Condition and Academic Achievement in Adolescents Practitioners of Rhythmic Gymnastic

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Key Words: Rhythmic gymnastic, adolescents, physical fitness, academic achievement.

Objective: The main objective was to analyze the Physical Fitness (PF) and Academic Achievement (AA) in adolescents practitioners of Rhythmic Gymnastic.

Method: A descriptive-transversal study was carried out in which 35 adolescents (age = 14.2 ± 0.86 years) participated. The PF was assessed using the ALPHA-Fitness battery. The AA was estimated through the final grades of the previous academic year. The average score of Language and Literature, Mathematics, Geography and History and English was obtained. The AA is classified as low <5; normal from 5 to 7; medium - high 7 to 9 and very high > 9.

Results: The gymnasts show high results of PF and the average of BMI is 17,74 Kg/m² ($\pm 1,33$) maintaining in a low percentile. Regarding to AA, most get averages scores high and very high, remarkable (48%) and outstanding (32%). The subjects with the best qualifications were Geography and History and Language and Literature (36% Outstanding in both), while the worst were Mathematics and English (12% and 8% approved, respectively). Of these gymnasts, with medium-high and very high values in the AA 80% also acquired medium, high and very high scores in the tests of agility and standing broad jump, and 68% in 20m shuttle run test. Specifically in mathematics, gymnasts who obtained medium, high and very high marks, the 80% showed higher values in standing broad jump, the 76% in the agility test and only 48% in aerobic capacity. The study found no significant association between the general PF and AA nor any association between each of the tests performed.

Conclusions: The gymnasts have a good general PF, showing very high, high and medium scores in standing broad jump and speed / agility. The BMI was below average, which shows in these gymnasts a favorable of morphological efficiency for this sport. Besides that, all gymnasts have scores medium, high and very high in AA. The study found no significant association between the general PF and AA. We suggest that the sample is expanded to verify the result, as well as, longitudinal cut work to establish with propriety a possible causal relation between both variables.

Physical fitness as a predictor of higher health related quality of life in 4-6 years old Spanish schoolchildren. MOVI-KIDS Study

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Key words: Calidad de vida relacionada con la salud, Escolares, Capacidad cardiorrespiratoria, Fuerza muscular, Velocidad/agilidad, Rendimiento académico.

Introducción: La calidad de vida relacionada con la salud (CVRS) en la infancia es un constructo multidimensional que incluye aspectos físicos, psicológicos y sociales, contemplando además la capacidad para realizar actividades apropiadas según la edad del individuo. El objetivo de este estudio fue conocer cuáles de los componentes de la condición física (CF) [capacidad cardiorrespiratoria (CCR), fuerza muscular (FM) y/o velocidad/agilidad (V/A)] era el mejor predictor de CVRS en escolares de 4-6 años de Castilla-La Mancha.

Metodología: Estudio observacional-transversal con una muestra de 1.413 escolares de 4-6 años de 21 colegios de Cuenca y Ciudad Real, España. La CVRS se evaluó usando el cuestionario Kiddy-Kindl, que analiza seis dimensiones: bienestar físico, bienestar emocional, autoestima, familia, amigos y colegio. Se analizó mediante regresión lineal múltiple la relación independiente entre la CCR, FM, V/A con la CVRS y cada una de sus dimensiones.

Resultados: La FM en los niños y la V/A en las niñas se asoció con la CVRS (puntuación total KiddyKindl). Por dimensiones, el bienestar físico se asoció con la FM ($\beta=0,147$) y el rendimiento académico (colegio) con la CCR ($\beta=0,112$) en los niños. En las niñas, el bienestar físico se asoció con la V/A ($\beta=-0,154$), y el colegio con la FM ($\beta=0,128$) y la V/A ($\beta=-0,123$).

Conclusión: El presente estudio es, hasta donde conocemos, el primero que analiza la asociación independiente de los tres componentes de CF con la CVRS en escolares para conocer cuál es mejor predictor de CVRS. Estos resultados sugieren que el mejor predictor de rendimiento académico en niños es la CCR. Sin embargo, en niñas, el mejor predictor fue la FM seguido de la V/A. Estos resultados ponen de manifiesto que los programas de actividad física deberían incluir ejercicios que desarrollen la CCR y que incluyan la FM y la V/A para mejorar el rendimiento académico de los escolares.

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Association of muscular strength with measured and perceived academic achievement in overweight/obese children: Preliminary results from the ActiveBrains project

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Key words: Academic self-concept, Woodcock-Johnson III, handgrip strength, writing, mathematic.

Objective: Handgrip strength is a general muscular strength indicator in children. Previous studies showed that muscular strength is associated with higher academic achievement in normal weight children. Since, overweight/obese children showed lower levels of academic achievement than their normal weight peers, the aim of the present study was to analyse the association of muscular strength with measured/perceived academic achievement in overweight/obese children.

Methods: A total of 106 overweight/obese children (10.0±1.1 years, 61 boys) under the umbrella of the ActiveBrains project (<http://profith.ugr.es/activebrains>) participated in this cross-sectional study. Muscular strength was evaluated by the handgrip test. The measured academic achievement was evaluated by the standardised Woodcock-Muñoz test (Spanish adaptation version from the original Woodcock-Johnson III®). The measured academic achievement components used were: writing, oral expression, mathematic and mathematical calculation. The perceived academic achievement was evaluated by the Self-concept form 5 (AF5) and an average indicator of perceived academic achievement were calculated. Lineal regression analyses adjusted for age, sex and, body mass index and mother education level were used performed.

Results: Muscular strength was positively associated with perceived academic achievement (Standardized Beta [β] =0.315, p=0.009). Muscular strength was positively associated with writing and oral expression scores (β =0.305, p=0.007; β =0.235, p=0.049, respectively). Muscular strength was positively associated with mathematic score (β =0.270, p=0.012) and borderline associated with mathematical calculation (β =0.203, p=0.061).

Conclusion: Muscular strength could positively influence measured/perceived academic achievement in overweight/obese children. However, future randomized control trials are warranted to ascertain a cause-effect relationship.

Fitness, fatness and academic achievement in 36,870 Chilean adolescents: a mediation analysis

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Key words: academic performance, obesity, body mass index, physical fitness

Objective: The purpose of this study was twofold: to examine the combined association of fatness and physical fitness components (cardiorespiratory fitness and muscular strength) with academic achievement, and to determine whether cardiorespiratory fitness and muscular strength are mediators on the association between body mass index and academic achievement in a national representative sample of adolescents from Chile.

Study design: Data were obtained from the Chilean System for the Assessment of Educational Quality test for eighth grade in 2011, 2013 and 2014 and includes a sample of 36,870 adolescents (mean age 13.8 years, 55.2% boys). Physical fitness tests included cardiorespiratory fitness (20 m shuttle run) and muscular strength (standing long-jump). Weight and height were assessed, and body mass index was calculated. Academic achievement in language and mathematics was assessed using the standardized tests. The PROCESS script developed by Hayes was used for mediation analysis.

Results: Fit and low-fat adolescents, compared with unfit and high-fat adolescents, had significantly higher odds for attaining high academic achievement in language and mathematics. However, in language, unfit and low-fat students did not have significantly higher odds for obtaining high academic achievement. Those with high fat had higher academic achievement (both language and mathematics) if they were fit. Linear regression models suggest a partial or full mediation of physical fitness in the association of body mass index with academic achievement.

Conclusions: Cardiorespiratory fitness and muscular strength may attenuate or even counteract the adverse influence of body mass index on academic achievement in adolescents.

Combined effects of sleep behavior, sedentary time and physical activity on academic achievement in overweight/obese children: Results from the ActiveBrains project

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Key words: sleep time, sedentary behavior, moderate-to-vigorous physical activity, academic performance, adolescents.

Overweight/obese children have shown worse academic achievement than their normal-weight peers, and its physical activity level might explain such differences. Time spent in sleep, sedentary behavior and physical activity is constrained to the 24h of a day, which makes these behaviors highly codependent. Hence, individual analyses of these behaviors may lead to biased findings and novel strategies such as compositional data analysis could be a good strategy. Therefore, the aim of this study was to explore the combined effects of sleep, sedentary time and physical activity on academic achievement in overweight/obese children with a compositional data approach. A total of 102 overweight/obese children (10.04±1.12 years, 60% boys) from the ActiveBrains project (<http://profith.ugr.es/activebrains>) were included in this study. Self-reported sleep time was combined with accelerometer-based measures of sedentary time and physical activity to obtain the 24h time budget composition (GT3X+, ActiGraph, Pensacola, FL). Academic achievement was assessed using the Spanish adaptation of the Woodcock-Johnson III® (WJ III®). Compositional data approach was used to conduct linear regressions controlling for age, sex and maternal education. A variation analysis showed high co-dependences between the time spent in sleep, sedentary behaviors and physical activity (all pair-wise log ratios < 0.3). We did not find any significant association of sleep, sedentary time or physical activity to academic achievement (all p>0.05). These findings suggest that the distribution of time spent in sleep, sedentary behaviors and physical activity is not associated to academic achievement in overweight/obese children. Further research with higher sample sizes and including normal-weight children could improve the understanding of the relationship between sleep, sedentary time and physical activity and academic achievement.

Poor cardiovascular fitness in adolescents is associated with low academic achievement

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Key words: Academic achievement, cognition, fitness, physical exercise, adolescence.

Poor cardiovascular fitness is associated with cardiovascular disease risk factors. Recently, the cut points where a red flag should be raised in children and adolescents have been defined (Ruiz et al., 2016). Aerobic fitness has also been associated with academic achievement (Raine et al., 2017). The aim of this study was to know if adolescents with cardiovascular fitness below cut point have a lower academic performance.

The participants of this study were 188 secondary school students (105 girls and 83 boys) aged 12-18 years. Poor cardiovascular fitness was defined as being under the maximal oxygen uptake (VO₂max) cut points for boys (42 mL/kg/min) and girls (35 mL/kg/min) (Ruiz et al., 2016). VO₂max was calculated using the equation from Ruiz et al. (2008) which use results from a 20m shuttle run test, sex, age, weight and height. This resulted in 57 girls and 14 boys with poor cardiovascular fitness. Academic achievement was defined by the average of grades in all subjects from the last quarterly evaluation before the study. Additional analysis was performed using the grades obtained from each student in the following subjects: Maths, Spanish Language and Literature, English and Physical Education.

Results showed that boys with poor cardiovascular fitness achieved similar results than their schoolmates in the average grade ($t=0,425$, $p>0,05$), Maths ($t=1,88$, $p>0,05$), Spanish Language and Literature ($t=,737$, $p>0,05$), English ($t=-0,336$, $p>0,05$) and Physical Education ($t=-0,757$, $p>0,05$). Contrarily, girls with their cardiovascular fitness below the cut point achieved lower marks than girls above the cut point in the average grade ($t=3,454$, $p<0,01$), Maths ($t=2,841$, $p<0,01$), Spanish Language and Literature ($t=2,088$, $p<0,05$), English ($t=-2,448$, $p<0,05$) and Physical Education ($t=-4,812$, $p<0,01$).

In conclusion, girls with poor cardiovascular fitness achieved low academic results.

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Chronotype influences academic performance

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Key words: Chronotype, Sleep, Activity, Academic performance

Introduction: Sleep timing is determined by homeostatic factors and the circadian clock, whereas social constraints impose schedules that modify this endogenous preference. Sleep habits and sleep quality have demonstrated to produce an impact on memory and academic performance.

Objectives: Our aim was to assess whether a population of preadolescents' sleep habits affect their academic performance in general.

Material and methods: To this, 102 preadolescents (10.0±0.1 years old; 40.2% women) were recruited. Sleep habits were quantified subjectively by Munich ChronoType Questionnaire (MCTQ) and objectively by actigraphy (Actigraph®). MCTQ yielded sleep onset, sleep offset, sleep duration, sleep midpoint and chronotype, whereas actigraphy variables were stability, fragmentation, amplitude, robustness, night and day mean values. The participants also reported their academic grades (Mathematics, Language, English, Sciences and total grade) and completed the Woodcock-Johnson Tests of Cognitive Abilities. Finally, parents' educational level, demographic variables (age, sex, body mass index) and fitness and fatness indicators (maximal oxygen consumption and fat mass index) were also recorded as possible cofounders. In order to address the relationship between sleep habits and academic grades Pearson's correlations with Bonferroni correction were performed controlling for parents' educational level and demographic, fitness and fatness variables.

Results: Late chronotypes were related with worse scores in the Woodcock-Johnson test and academic grades. In fact, statistically significant relationships were achieved for Sleep End and Midsleep with total score and mathematics and academic components of the Woodcock-Johnson test. In addition, fragmentation, stability and robustness of the activity pattern were related with mathematics and academic components of the Woodcock-Johnson test

Conclusions: Late chronotypes were related with lower cognitive results and lower grade marks. This highlights the importance of students' sleep schedules in academic performance.

Associations between sugar intake and academic achievement in overweight/obese children: Preliminary results from the ActiveBrains Project

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Key words: sugar intake, academic performance, adolescents, obesity, overweight.

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Background: In general, overweight and obese children have worse academic achievement compared to normal-weight children. It is therefore important to identify modifiable health determinants, such as dietary habits, that may influence academic achievement in overweight and obese children.

Aim: This study was aimed to study associations between sugar intake and academic achievement in overweight/obese children.

Methods: A total of 110 overweight and obese children (10.0 ± 1.2 years, body mass index 26.6 ± 3.4 kg/m², 44 girls and 66 boys) participated in the present cross-sectional study. Academic achievement was assessed using the Spanish adaptation/translation of the Woodcock-Johnson III® (WJ III®). Sugar intake was calculated based on one or two non-consecutive 24h recalls performed by nutritionists face to face, with both parents and children being present. Total energy intake and sugar intake was examined by Easydiet. Multiple linear regression analyses were performed adjusting for potential confounders (i.e. age, sex, energy intake, maternal education and total energy intake).

Results: There were no statistically significant associations between sugar intake and total academic achievement ($r=0.016$, $p=0.87$) reading ($r=0.067$, $p=0.50$), writing ($r= -0.035$, $p=0.72$) and mathematics ($r= -0.009$, $p=0.93$). Sensibility analyses, with additionally adjustment for children's body mass index shown very little influence on the estimates.

Conclusion: We did not identify any statistically significant associations of sugar intake with academic achievement. Our sample size was relatively limited, and hence, further studies using larger sample sizes are needed to expand the knowledge about sugar intake and academic achievement.

Physical activity, sedentary behavior, physical fitness, nutrition fitness and mental health

Cardiorespiratory fitness and obesity in male adolescents and future all-cause and cause-specific disability: cohort study of 1 million participants

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Key words: cardiorespiratory fitness; obesity; disability; morbidity

Background: Diseases and injuries are global public health issues leading to disability. Thus is the identification of early risk factors for later disability of great public health importance. The aim of the study was therefore to study associations of cardiorespiratory fitness and obesity status in male adolescents with later disability pension.

Methods: This prospective cohort study utilized data from the Military Service Conscription Registry. The male adolescents (16-19 years) in the study underwent military conscription between the years 1972 to 1994 and were follow-up until the 31 of December, 2012. A total of 1 079 128 adolescents had complete data of cardiorespiratory fitness (cycle test), body mass index (BMI) and outcomes and covariates. Hazard ratios (HR) with their 95% confidence intervals (95% CI) was derived using cox regression adjusting for conscription year and age, conscription center, childhood socioeconomic position, mental hospitalization/ psychiatric diagnosis before or at conscription (only for all-cause and psychiatric disability pension) and mutually adjusting for cardiorespiratory fitness and BMI.

Results: Male adolescents in the lowest decile (i.e. 10 %) of cardiorespiratory fitness had a greater risk of disability pension due to all (HR, 3.74; 95% CI, 3.55-3.95), psychiatric (HR, 4.01) and musculoskeletal causes (HR, 3.72) than adolescents in the highest decile of cardiorespiratory fitness. Furthermore, adolescents with morbid obesity (≥ 40 kg/m²), as compared to normal-weight, had higher risk of disability pension due to all (HR, 3.21; 95% CI, 2.49-4.15), psychiatric (HR, 1.63) and musculoskeletal causes (HR, 4.11).

Conclusion: Both low cardiorespiratory and obesity class III in male adolescents are great risk factors for later disability pension. Importantly, low cardiorespiratory fitness appeared to be a greater risk factor than morbid obesity for disability pension due to all and psychiatric causes.

Our study provides strong evidence for the promotion of cardiorespiratory fitness and healthy body weight in adolescence.

Associations between muscular strength in adolescence and later disability pension: a cohort study of one million men

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Key words: Muscular strength, aerobic fitness, disability pension, obesity

Background: Disability pension is a consequence of severe chronic disease or injury. Low muscular strength at a young age is an emerging risk factor for morbidity but little is known about the association between muscular strength and disability pension risk.

Objective: To investigate the associations of muscular strength with disability pension, also for specific causes of disability pension and in different body mass index categories. Also combined effects of muscular strength and aerobic fitness were investigated.

Participants: Data from 1 212 503 male adolescents was utilized from the Swedish military conscription register.

Measurements: Knee extension, handgrip and elbow flexion strength and aerobic fitness were measured during conscription. Cause of disability pension was retrieved from the Social Insurance Office.

Results: Muscular knee extension strength in young adulthood was inversely associated with men's risk of obtaining disability pension due to all-causes (HR for lowest vs. highest quintile, 1.40, 95% CI, 1.36-1.43). The risk associated with low muscular strength differed greatly between specific causes of disability pension and the strongest associations were found for psychiatric, nervous system and other causes. Being strong was associated with lower risk of disability pension in all BMI categories. Furthermore, being mutually unfit and not strong was associated with the highest disability pension risk (HR 1.80, 95% CI, 1.75-1.84) as compared to being fit and strong.

Conclusion: This study provides strong evidence for an association between low muscular strength and risk of disability pension. A combination of low muscular strength and low

aerobic fitness was an especially important risk factor for disability pension. Preventive actions should begin at young ages and combine muscular strength and fitness enhancing exercise.

Posters

Positive and negative affect and self-perceived health in Spanish Adolescents

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Key words: hedonic wellbeing, affect, self-perceived health, adolescents, Spain

Objectives: To analyze the relationship between hedonic wellbeing (positive and negative affect) and self-perceived general heath in a sample of Spanish adolescents.

Methods: A cross-sectional analysis was carried out with a sample of 823 secondary school adolescents (398 girls) aged 14-18, performed under the umbrella of the UP&DOWN study (designed to value the impact over time of physical activity and sedentary behaviors on health indicators, including subjective wellbeing). Hedonic wellbeing was assessed using the Spanish version of the Positive and Negative Affect Schedule for children and adolescents. This validated tool is composed of two separate scales, providing two independent measures of positive and negative affect (linked with positive and negative feelings) (1). Self-perceived health was employed to measure health status of adolescents, which has been considered a relevant indicator of health outcomes (2). A logistic regression model was constructed to evaluate relationships between positive and negative affect scores and self-perceived health in secondary school adolescent girls and boys separately.

Results: Increased positive affect scores were associated with a lower risk of reporting poor health in secondary school adolescent boys (OR=0.69; 95%CI 0.56-0.85; $p=0.001$; OR=0.89), while this relationship was at the limit of significance in adolescent girls (95%CI 0.79-1.00; $p=0.054$). In addition, increased negative affect scores were associated with a higher risk of reporting a poor health in both, boys and girls (OR=1.30; 95%CI 1.10-1.54; $p=0.002$; OR=1.10; 95%CI 1.00-1.21; $p=0.0037$, respectively).

Conclusions: Increased levels of hedonic wellbeing could behave as a protective factor of poor health in adolescent populations.

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Smartphone-based exercise intervention on prevention of comorbid depression and obesity in ADHD population: a randomized-controlled trial

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Key words: motor activity, mobile apps, mHealth, mental disorder.

Background: The therapeutic effects of exercise for mental disorders have been described extensively in observational studies and clinical trials. However the knowledge about the exercise effects on neurocognitive functions associated with ADHD are scarce. In addition, scientific studies using m-Health applications as a tool to treat ADHD symptoms are also lacking. **Objectives:** The present pilot randomized controlled (RCT), under the umbrella of the CoCA project, aims to examine the effects of an exercise intervention in combination with m-Health based monitoring and reinforcement, targeting the prevention of obesity and depression symptoms.

Methods: A total of 219 adolescents and young adults aged 14 to 30 years old with ADHD are randomized into an exercise or a light therapy group. The physical exercise intervention consists in training three days a week during 10 weeks. Participants perform three days of aerobic activities proposed and in two of these days also do muscle-strengthening exercise. Exercise sessions are presented through different videos which are stored on the mobile phones that the participants borrow during the intervention.

Results: The m-Health system comprises of a smartphone and an activity sensor on the wrist connected via bluetooth low energy. A commercial software (movisensXS) prepares customized e-diaries and intervention tools like exercise videos provided by an app. Furthermore, feedback on performed therapy parameters is processed in real time, generated automatically and sent back to the participant's smartphone to improve motivation and compliance.

Conclusions: Under the umbrella of the CoCA project, this pilot clinical trial based on an exercise m-health approach in ADHD young patients will provide new insights about the potential of smartphones to improve ADHD symptomatology and its comorbidities, such as obesity and depression.

Musculoskeletal pain is associated with current mental health in overweight/obesity children: Preliminary results from the ActiveBrains project

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Key words: Musculoskeletal pain, pediatric pain, depression, self-esteem, childhood

Overweight and obesity at childhood has been associated with a higher prevalence of musculoskeletal pain. Likewise, a recent cohort study has showed that adolescents with multisite musculoskeletal pain have an increased risk of mental health disorders later in life. Yet, little is known about the association of musculoskeletal pain with current mental health in children. Thus, the aim of this study was to investigate associations between self-reported musculoskeletal pain and mental health in overweight/obese children. A total of 64 overweight/obese children (10.86±1.25 years; 38 girls) from the ActiveBrains project (<http://profith.ugr.es/activebrains>) participated in this study. Self-reported musculoskeletal pain was measured by Vami/ Thompson Pediatric Pain Questionnaire (PPQ). The location and intensity of pain was clusterized into total pain, lower limbs pain (foot, calf, knee, thigh and hip complex pain) and upper body pain (low back, thoracic spine, neck, shoulder and elbow pain). Depression was assessed by the Children Depression Inventory (CDI) which include scales about negative mood, ineffectiveness, anhedonia, negative self-esteem and interpersonal problems. Rosenberg Self-Esteem scale was used to evaluate children's self-esteem. Linear regression analyses were performed controlling by age, sex, body mass index and parental education. Our results showed a higher perception of total pain, lower-and upper-limbs pain were associated to a worse self-esteem ($\beta = -0.439$, $p < 0.001$ and $\beta = -0.360$, $p = 0.004$; $\beta = -0.315$, $p = 0.016$; respectively). Furthermore, a higher perception of total pain and upper-body pain were strongly associated with higher depression scores ($\beta = 0.333$, $p = 0.005$; $\beta = 0.340$, $p < 0.005$). Overall, our findings suggest that the relationship between musculoskeletal pain and mental health problems might exist not only prospectively but also in a current moment in overweight/obese children. Further randomized clinical trials that study the causal relationship between these variables in overweight/obese children are needed.

Objectively measured physical activity and mental health in sedentary young adults

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Key words: leisure-time physical activity, psychological health, positive affect, negative affect, hope.

Technologies, labor saving devices, and the prone-to-obesity environment in which we live have led to the reduction of leisure-time physical activity and the drastic increase of sedentary behavior. This fact has affected not only physical but also mental health. Regular physical activity seems to positively contribute to mental health in the general population. However, if these positive changes also occur in sedentary people is not well known. We examined the association between objectively measured physical activity and mental health in sedentary young adults. A total of 91 adults (69% female, age: 21±2 years, BMI: 25 ± 5 kg/m²) participated in this study. Participants reported not to be engaged in regular physical activity > 20 min/day on > 3 days/week. Physical activity was objectively measured with hip-worn accelerometers (GT3X+, Actigraph, Pensacola, FL) for 7 complete days. Mental health indicators included hope (AHS, adult hope scale), positive and negative affect (PANAS, positive affect and negative affect scale) and optimism (LOT-R, life orientation test-revised). Sedentary behaviour and light intensity physical activity were not associated with any mental health indicator (all $P > 0.05$), yet time spent in moderate-vigorous physical activity and the number of steps per day were inversely associated with hope (standardized $\beta = -0.27$, $P \leq 0.01$; $\beta = -0.31$, $P < 0.01$, respectively) and positively associated with negative affect ($\beta = 0.30$, $P < 0.01$; $\beta = 0.29$, $P < 0.01$, respectively). Paradoxically, our results suggest that in sedentary young adults, higher levels of moderate-vigorous physical activity are associated with worse mental health. Randomized controlled trials are needed to contrast these findings.

Association of physical fitness with emotional well-being in early pregnancy. The Gestafit Project

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Key words: gestation, flexibility, positive affect, emotional clarity, emotional repair

Objective: Early pregnancy is a relevant period within gestation in which pregnant women experience emotional changes that could be caused by hormonal disruptions. These psychological and physiological changes during pregnancy may contribute to reduced physical activity levels and consequently impaired physical fitness. Paradoxically, studies in general population have shown that regular exercise may improve emotional well-being. Thus, there is a need to better understand the relationships between physical fitness and emotional state during pregnancy. The main aim of the present study was to analyze the independent association of flexibility, cardiorespiratory fitness and muscular strength with positive affect (PA), negative affect (NA) and emotional attention, clarity and repair during early pregnancy.

Methods: This cross-sectional study was composed of 66 pregnant women (age 32.9±4.9years, body mass index 24.6±4.5kg/m²) from Granada. Flexibility, cardiorespiratory fitness and muscular strength were assessed with the back scratch, 6 minute walk and hand-grip strength tests, respectively. Emotional well-being was assessed with the Positive and Negative Affect Schedule (PANAS) and with the Trait Meta-Mood Scale (TMMS). The PANAS was used to measure PA and NA and the TMMS to measure emotional attention, clarity and repair.

Results: After adjusting for age, number of abortions and low back pain intensity, the back scratch test was positively and independently associated with PA (Standardized Beta [β]=0.30, p=0.017), emotional clarity (β=0.31, p=0.014) and emotional repair dimensions (β=0.43, p<0.001). Any significant association was found between the hand-grip and 6 minute walk tests with the rest of emotional well-being indicators (all, p>0.05).

Conclusion: Increased levels of flexibility during early pregnancy are associated with higher positive affect, emotional clarity and emotional repair during early pregnancy. Moreover, emotional well-being may improve overall psychological well-being and reduce the risk of depression during pregnancy. However, future randomized control trials are warranted to ascertain a cause-effect relationship.

A Comparison of Emotional Intelligence in Elite and Expert rock climbers

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Key words: Rock climbers, Redpoint climbing ability, Fitness level, MSCEIT, Emotional intelligence.

Background: Emotional intelligence (EI) is the ability of athletes to control their emotions during sport. The literature recognizes that EI may vary from situation to situation, which means it could be a trainable cognitive demand. EI has not been analyzed in rock climbing yet.

Objectives: To compare EI in 27 expert and 15 elite rock climbers aged 18 to 44 years. The project is part of the larger C-HIPPER study (The high-performance international rock-climbing study).

Methodology: EI was measured by using a Spanish translation of the 141 item theoretical model proposed by Mayer-Salovey-Caruso (MSCEIT) (1). The MSCEIT considers ability whilst using two sub set (Experimental and Strategic EI) to assess each of the four branches of EI (Perceiving and Identifying, Facilitating, Understanding, and Managing Emotions). The sex-specific 75th percentile of redpoint climbing ability was used to divide the sample into expert (≥ 75 th) and elite (< 75 th) climbers. Additionally, aerobic capacity from treadmill was used to divide the sample into unfit and fit climbers, following idea from Blair' studies (2, 3).

Results: When considering all EI parameters, those climbers in the elite and fit climbers were negatively associated with a significantly greater reduction in facilitating emotions after adjusting for age and years climbing for climbing ability [Odds ratios (OR) with 95% confidence intervals (CI); HR (95% CI): -7.4 (-14.6, -0.2)] and fitness level [-9.8 (-18.5, -1.1)], respectively. There were no significant differences in any other EI parameters.

Conclusion: Elite climbers with a high fitness level are associated with a lower facilitation of emotions after controlling for age or climbing experience. Therefore, it is possible that emotional skill development may enhance climbers during the earlier career as climber, however other aspects may be more important at high level performance.

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Lack of association of physical activity and sedentary time with arterial stiffness in women with systemic lupus erythematosus

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Key words. Physical activity levels, sedentary time, pulse wave velocity, systemic lupus erythematosus, accelerometry

Objective: To examine the association of objectively measured physical activity (PA) intensity levels and sedentary time with arterial stiffness in women with Systemic Lupus Erythematosus (SLE) and whether participants with higher levels of PA have lower arterial stiffness than those with lower levels of PA.

Methods: The study comprised 47 participants (41.2±13.9 years) with clinical and treatment stability of SLE during the previous 6 months of the study. Sedentary time and PA levels was objectively measured by accelerometry, using triaxial accelerometer GT3X+ (Actigraph, Pensacola, Florida, USA). Arterial stiffness was assessed through pulse wave velocity (PWV) measurement, evaluated by Mobil-O-Graph® 24h pulse wave monitor (IEM GmbH, Stolberg, Germany).

Results: The mean time of the variable bouts moderate to vigorous physical activity (MVPA) of the sample studied was 135.1±151.8 minutes/week (mean ± standard deviation). There was no association of PA (regardless of the intensity level) and sedentary time with PWV, either in crude analyses or after applying consecutive adjustment models. Participants meeting the international PA guidelines did not show lower PWV than those not meeting them (b= -0.171; p=0.273). There was no interaction between bouts MVPA and age on PWV (b= -0.057; p=0.263).

Conclusion: Our results suggest that PA levels and sedentary time are not associated with PWV. The relatively low sample size and high PA levels of the sample, along with the SLE stability of the participants during the previous 6 months of the study, compared with previous studies, limits generalizability.

Future prospective studies are warranted to better understand the association of PA and physical fitness with arterial stiffness in patients with SLE.

The effects of a concurrent exercise training program on the quality of life of pregnant women. The GESTAFIT Project

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Key words: exercise, pregnancy, mental role, SF-36, physical role

Objective: An optimal quality of life (QoL) during pregnancy is essential for a healthy gestation. The aim of the present communication was to assess the effects of a concurrent exercise program on the QoL of pregnant women.

Methods: Fifty-six pregnant women (32.9±5.0 years) were recruited in week 12±2 of gestation and divided into exercise (n=25) or usual care (control) group (n=31). The exercise group followed a concurrent (exercise combined: aerobic plus strength) training program (3 sessions per week, 60 minutes per session) from the 16±2 gestation week until delivery. Quality of life of the sample was evaluated two times at 16±2 gestation week, prior to the training program, and at 34±2 gestation week, with the Short-Form Health Survey 36 (SF-36), which establishes 8 dimensions of physical and mental health (physical functioning, physical role, body pain, general health, vitality, social function, emotional role and mental health).

Results: Overall, QoL worsened as pregnancy progressed for both groups. The trained group improved compared to control group in the dimensions of Physical Function (18% vs 3% respectively. P=0.002) and General Health (4% vs 2% respectively; P=0.037). In the dimensions of Social Function (SF) and Summary Physical Component (SPC) was a detriment, but the decrease was significantly minor in intervention group than control group. (SF: 0% vs -6%; P=0.004; respectively and SPC: -4% vs -8% respectively)

Conclusion: Pregnant women that followed the concurrent exercise program clearly improved the quality of life dimensions physical function and general health, and ameliorated the detriment on the dimension social function. Therefore, the designed exercise protocol

developed in the GESTAFIT project is a useful way to improve quality of life during gestation which may induce a better maternal and fetal health status.

How does objectively measured mental stress differ between different levels of obesity in children? Preliminary results from the ActiveBrains project

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Key words: Parasympathetic system, body mass index, fat mass, youth.

Introduction: Heart rate variability (HRV) has been validated as an objective measure of stress in different populations. This study was aimed to explore associations between time- and frequency-domain parameters of HRV with body composition in overweight and obese children.

Method: 107 overweight/obese children (10.01 ± 1.12 years) from the baseline data of the ActiveBrains project (<http://profith.ugr.es/activebrains>) were included for the present analysis. HRV was measured with the polar RS800CX®. High frequency and low frequency relative power using Fast Fourier Transform algorithm (HFnu, LFnu), Percentage of consecutive normal RRI differing more than 50 ms (pNN50), square root of the mean of the sum of the squares of differences between adjacent NN intervals (RMSSD) and the ratio between LF and HF were calculated. HF, pNN50 and RMSSD are indicators of the vagal innervation, LF is innervated by both parasympathetic and sympathetic systems, and the LF/HF ratio is representative of the sympathovagal balance. Analyses of the covariance and Bonferroni adjustment were performed controlled by age, sex and parental education, $p < 0.05$ (two-tailed) was considered statistically significant.

Results: Of the children, 27 (25%) were overweight, 46 (43%) were mild obese, and 34 (32%) were severe or morbid obese. Severe/morbid obese children showed lower levels of HFnu and a higher LF/HF ratio (all comparisons $p < 0.020$). Furthermore, pNN50 was decreased in severe/morbid obese children with a borderline significant difference from their overweight and mild obese peers ($p = 0.057$). Otherwise, RMSSD did not show significant differences between groups ($p = 0.101$).

Conclusion: Severe/morbid obesity might be associated to a lower HRV in different parameters representative of vagal tone (RMSSD, pNN50, HFnu) and a higher HRV in those related to sympathetic activity (LF/HF). This reduced vagal tone and augmented sympathetic activity might be a marker of mental stress.

Timing of Adiposity Rebound and Behaviour problems in Early Childhood

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Key words: Adiposity rebound, childhood behaviour, fatness, programming, NUHEAL.

Background: Age that the lowest point of BMI is reached is the start point of Adiposity Rebound (AR).¹ Earlier Adiposity Rebound (EAR <5 years), may increase fatness in later life. In addition, there is so much evidences about the association between EAR and the risk increased of non-communicable diseases in later life^{2,3} however the behaviour problems involved in these points have not been enough investigated².

Objective: The objective of this study was to assess the association between timing of AR and the onset of behavior problems in children at age 7.5 years, evaluating the potential role of the adiposity and skeletal grown, development and maturation, in order to demonstrate that EAR is strongly associated with increased fatness and behaviors problems at later life.

Methods: Timing of AR was estimated according to inflection point in the trajectories of the Body mass index (BMI), measured at 4.5 to 7.5 years old in 105 children of NUHEAL study. The children behaviour was evaluated according to Child Behavior Checklist (CBCL) for ages 6-18 years.⁴ Additionally, was measured children's adiposity by antropometry, the adiposity was estimated as skinfold summatory. Also were used the potential confounder parameters .

RESULTS: Outcomes highlight a clear association between EAR and adiposity in later life (β coefficient = 11.895; $p < 0.01$). In addition, the EAR was strongly associated to social problems (β coefficient = 1.9414; $p < 0.001$) and total behaviors problems (β coefficient 2.3045; $p < 0.05$). Finally, an higher adiposity at later life, was risk factor of higher level of internalizing problems (OR=1.013; CI:1.008-1.025; $p < 0.05$), externalizing problems (OR=1.011; 0.9996-1.0239; $p < 0.061$), and total problems (OR=1.0134; CI: 1.0015-1.0261; $p < 0.05$), specifically in social problems (OR=1.023; CI:1.009-1.038; $p < 0.01$).

Conclusion: The risk of behaviour problems in later life is associated to adiposity programming. Thus, EAR in early childhood is associated with increased adiposity and BMI at 7.5 years. It could be increasing the level of behaviour problems, related to internalizing and externalizing and total problems in later life, specifically in social problems.

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Effects of polarized-based distribution training on cardiometabolic risk factors in young women with overweight and obesity: A randomized-controlled trial

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Key words: Exercise, Obesity, Cardiorespiratory Fitness, Metabolism.

Intensity is a major variable in the physiological effects of exercise training in different populations. Although polarized endurance training optimizes and maximizes physiological gains in highly trained individuals, its cardiometabolic protective-effects are not established. The purpose of the present single site, randomized-controlled trial was to compare the effects of 12-weeks of high-intensity interval training (HIIT), moderate-intensity continuous endurance training (END), and polarized training (POL) programs on cardiometabolic risk factors in overweight and obese young women. The cardiorespiratory capacity, whole body substrate utilization, glucose and lipid homeostasis, and body composition were assessed. A total of 52 overweight/obese young women (age 23.3 ± 3.8 y, body mass index 33.8 ± 3.8 kg/m²) were randomly assigned to four groups: control group (CTRL, n=10), END group (n=14), HIIT group (n=14), and POL group (n=14). Results showed that POL induced greater improvements in cardiorespiratory capacity, whole body substrate utilization, and glucose homeostasis and lipids in obese and overweight young women subjects. These data suggest that POL training is a more effective non pharmacological treatment strategy for cardiovascular disease risk factors in overweight and obese young women.

Teaching values as a measured of mental health in professional related with education

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Key words: personal values, years of experience, teachers, school

Nowadays, we can observe how the values of society have changed in the last years. For this reason, we must analyse the direction of this change because values are the guide of the behaviours of any person. Values, specifically those who allow us to live as a society, are crucial for correct levels of health. To be mentally healthy, you must be able to meet and build relationship with the people around you. The school is the best place to work in values since the teachers are essential. Therefore, the aim of this study was to examine the values of the teachers and determine whether difference exists in gender, years of experience and age groups.

A total of 80 teachers of different schools of Granada participated in our study. Teachers' values were assessed by the "Portrait Values Questionnaire (PVQ)" of Schwartz. Analyses were done using ANOVA test.

Benevolence, universalism, self-direction, security, personal achievement and power as factors of mental health were studied. Main results showed differences between gender, years of experience and groups of age. Specifically, women have slower values in power than men (mean: 3.09 vs 2.34, $p=0.01$). Those teachers who have less experience (1-10 years) have higher values in hedonism (mean: 4.70 vs 3.99, $p=0.01$), achievement (mean: 3.89 vs 3.03, $p\leq 0.01$) and power (mean: 2.86 vs 2.15, $p=0.05$). Regarding the group of age, teachers with less than 40 years old presented higher values in self-direction (mean: 5.15 vs 4.85, $p=0.03$), stimulation (mean: 4.22 vs 3.71, $p=0.02$), hedonism (mean: 4.70 vs 4.04, $p\leq 0.01$), achievement (mean: 3.89 vs 3.10, $p\leq 0.01$) and power (mean: 2.92 vs 2.21, $p\leq 0.01$) than their peers with more or equal to 40 years.

In conclusion, our results provide relevant information about how personal values and mental health of the teachers differ between gender, years of experience and group of age. This study could improve the education setting as well as implement strategies to increase the values of the teachers and thus, mental health in order to create a society mentally healthy. Further studies are needed in order to contrast or corroborate these results.

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