Proceeding

Supplementary Issue: Spring Conferences of Sports Science. International Seminar of Physical Education, Leisure and Health, 17-19 June 2019. Castelo Branco, Portugal

Proceedings of the International Seminar of Physical Education, Leisure and Health, 17-19 June 2019. Castelo Branco, Portugal

Cite this article as:
Proceedings of the International Seminar of Physical Education, Leisure and Health; Castelo Branco, Portugal. (2019). *Journal of Human Sport and Exercise, 14*(4proc), S1169-S1823. doi:https://doi.org/10.14198/jhse.2019.14.Proc4.82

Table of Contents

How well do muscular strength and endurance predict cognitive function in youth?

ANA LUÍSA CORREIA[1], ÉLVIO R. GOUVEIA[1,2], ADILSON MARQUES[4], BRUNA GOUVEIA[2,3], ANA J. RODRIGUES[1], RICARDO ALVES[1], HELDER LOPES[1], MATTHIAS KLIEGEL[5], ANDREAS ILHE[5]

[1]*Department of Physical Education and Sport, University of Madeira, Funchal, Portugal*
[2]*LARSYS/ITI, Portugal*
[3]*IASáude IP., RAM / Saint Joseph of Cluny Higher School of Nursing, Funchal, Portugal*
[4]*FMH / Centro de Investigação em Saúde Pública, Escola Nacional de Saúde Pública, Universidade Nova de Lisboa, Lisboa, Portugal*
[5]*Center for the Interdisciplinary Study of Gerontology and Vulnerability, Department of Psychology, University of Geneva, Geneva, Switzerland*

ABSTRACT

Background: Muscular strength and endurance (MSE) have been correlated to healthy physical and mental condition throughout the lifespan. Objective: The main objective of this study was to investigate how well do MSE predict cognitive function in youth, after controlling for age. Methods: The sample comprised 302 students (157 girls and 145 boys), mean age 15.7 years (SD = 2.7, range 9.9-20.6), from the 5th to the 12th year, in 5 public schools. Cognitive Telephone Screening Instrument (COGTEL) as used to access cognitive function. MSE of students were assessed using the hand grip test (static strength) and sit-ups (trunk strength) from EUROFIT battery. Bivariate correlations and hierarchical multiple regression analyses were performed on the data analysis. Results: COGTEL was positively related to static strength ($r=.282$, $p<.001$) and trunk strength tests scores ($r=.268$, $p<.001$). Age explained 5.9% of the variance in COGTEL (step 1). After entry MSE at step 2, the total variance explained by the model as a whole was 12%. In the final model, both age and MSE composite score were statistically significant, with the MSE recording a higher beta value (beta=.264, $p<.001$) than age (beta=.136, $p=.034$). Conclusion: this study reinforces that better MSE significantly correlates to higher performance in cognitive function. Moreover, MSE predict cognitive function in youth in the same proportion as age does. **Keywords**: Health-related physical fitness; Cognitive performance; Youth; Physical education.

Corresponding author. *Department of Physical Education and Sport, University of Madeira, Funchal, Portugal.*
E-mail: anacorreia@staff.uma.pt
Supplementary Issue: Spring Conferences of Sports Science. International Seminar of Physical Education, Leisure and Health, 17-19 June 2019. Castelo Branco, Portugal.
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

doi:10.14198/jhse.2019.14.Proc4.82

INTRODUCTION

Muscular strength and endurance (MSE) are considered important health-related physical fitness components, since there is a positive well-known relationship with a healthy physical and mental condition throughout the lifespan (Mintjens al., 2018). There is some evidence that MSE have been related to improvements in bone mass, glucose tolerance, musculotendinous integrity, the ability to performed the everyday activities (which is related to perceived quality of life and self-efficacy among other indicators of mental health), fat-free mass and resting metabolic rate (ACSM, 2018). Despite the fact that there is a remarkable amount of research reporting a positive relationship between muscular strength and physical health, much less consistent are the relationships between cognitive function MSE (Chu et al., 2016). The present study relaunches this question, aiming to quantifying how well MSE predict cognitive function in youth. To contribute to a deeper understanding of these relationships, the main objective of this study was to investigate how well MSE predict cognitive function in youth, after controlling for age.

MATERIAL AND METHODS

Participants

The sample comprised 302 students (157 girls and 145 boys), mean age 15.7 years (SD = 2.7, range 9.9-20.6), from the 5th to the 12th year in 5 public schools.

Measures

Cognitive Telephone Screening Instrument (COGTEL): was used to assess cognitive functioning. The COGTEL consists of 6 subtests covering prospective memory, verbal short- and long-term memory, working memory, verbal fluency, and inductive reasoning (Kliegel et al. 2007). The assessments were conducted in private rooms of each school, by trained research personnel.

MSE: were assessed using the hand grip test (static strength) and sit-ups (trunk strength) from EUROFIT battery (Research CES., 1993). The two physical fitness tests were administered during physical education classes. For analyses, we calculated a composite score.

Procedures

Participants were part of the research project entitled “Physical Education in Schools from Autonomous Region of Madeira” (EFERAM-CIT). The assessments occurred between October and November of 2017. Participants were informed about the objectives of the study and written informed consent was obtained from their legal guardians. The study received Ethical approval from the Scientific Committee of the Faculty of Physical Education and Sports at the University of Madeira (Reference: ACTA N.77 - 12.04.2016).

Analysis

First, we inspected bivariate correlations of COGTEL with age, static strength and trunk strength. Second, hierarchical multiple regression analyses were conducted to investigate the amount of variance in COGTEL that was explained by MSE, simultaneously controlling for the influence of age. All analyses were performed using SPSS (version 23.0).

RESULTS

An inspection of bivariate correlations showed that COGTEL was positively related to static strength ($r=.282$, $p<.001$) and trunk strength tests scores ($r=.268$, $p<.001$). In the hierarchical multiple regression analyses,

age was entered at step 1 explaining 5.9% of the variance in COGTEL. After entry of MSE at step 2, the total variance explained by the model as a whole was 12%, F (2, 259) =64.13, p<.001. MSE explained an additional 5,8% of the variance in COGTEL, after controlling for age, R squared change =.058 (1, 259) = 17.12, p<.001. In the final model, both age and MSE were statistically significant, with the MSE recording a higher beta value (beta=.264, p<.001) than age (beta=.136, p=.034).

DISCUSSION

This study adds some evidence about the positive association between MSE and cognitive function, even after controlling for age effect. Although there are some studies that corroborate the positive association between muscular strength and cognitive function (Chu et al., 2016), when those relationships are controlled for potential covariates such as age, the associations were weakened (Kao et al., 2017). One novel aspect of the present study is that we demonstrated, that MSE explained approximately 6% of the variance in cognitive function. Interestingly, age also explained 6% of the variance in cognitive function. Moreover, evaluating each of the independent variable, in order of importance, MSE made the strongest (26%) unique contribution, when the overlapping effect of age was statistically removed. Since MSE are important modifiable health-related fitness components, school policies aiming to increase physical activity focus on promoting MSE, independently of age, may increase cognitive function. These results offer important practical contributions that should be taken into consideration by schools' administrators and teachers. For example, the increasing of time in schools allocated to sports activities, in particular activities that promote health related fitness components, such as MSE, may be associated to increased cognitive function and as consequence, academic achievement.

CONCLUSIONS

This study reinforces that better MSE significantly correlates to higher performance in cognitive function. Moreover, MSE predict cognitive function in youth in the same proportion as age does.

REFERENCES

American College of Sports Medicine. ACSM's Guidelines for Exercise Testing and Prescription, 10th Edition, Philadelphia: Lippincott Williams & Wilkins.2018.

Chu CH, Chen FT, Pontifex MB et al. (2016). Health-related physical fitness, academic achievement, and neuroelectric measures in children and adolescents, Int J Sport Exerc Psychol. https://doi.org/10.1080/1612197x.2016.1223420

Council of Europe Committee for the Development of Sport. EUROFIT: handbook for the EUROFIT tests of physical fitness. Strasbourg: Council of Europe, 1993.

Kao SC, Westfall DR, Parks AC et al. Muscular and aerobic fitness, working memory, and academic achievement in children. Med Sci Sports Exerc 2017; 49(3):500-508. https://doi.org/10.1249/mss.0000000000001132

Kliegel M, Martin M, Jäger T. Development and validation of the Cognitive Telephone Screening Instrument (COGTEL) for the assessment of cognitive function across adulthood. J Psychol. 2007; 32:147-170. https://doi.org/10.3200/jrlp.141.2.147-172

Mintjens S, Menting MD, Daams JG et al. Cardiorespiratory Fitness in Childhood and Adolescence Affects Future Cardiovascular Risk Factors: A Systematic Review of Longitudinal Studies. Sports Med 2018; 48(11):2577-2605. https://doi.org/10.1007/s40279-018-0974-5