Evidence-Based Medicine Online First, published on July 3, 2015 as 10.1136/ebmed-2014-110119

Randomised controlled trial

Physical activity may improve measures of cognition in children

10.1136/ebmed-2014-110119

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Commentary on: Hillman CH, Pontifex MB, Castelli DM, *et al*. Effects of the FITKids randomized controlled trial on executive control and brain function. *Pediatrics* 2014;134:e1063–7.

Context

Physical inactivity has been associated with numerous chronic diseases, which in turn can have an impact on quality of life and public health issues. Many studies show positive effects of regular physical activity on mood[1] and some aspects of cognitive functioning,[2] especially in older adults. However, few studies have been conducted in children and teenagers. This randomised controlled trial (RCT) examines the behavioural and neurolectric outcomes of a fitness programme in children aged between 7 and 9 years.

Methods

Of the 475 children screened, 221 of them were randomly assigned to either the physical activity (PA) group or the wait-list (WL) control group. The PA group participated in a daily 2 h session of cardiovascular and motor-skills activities after school. They also attended educational sessions (eg, health promotion). The WL group did nothing. Major outcomes were change in aerobic fitness, attentional inhibition (ie, modified version of the Eriksen Flanker Task) and cognitive flexibility (ie, colour-shape switch task) with regards to behavioural performance (accuracy and reaction time) and neuroelectric indices associated with them, especially the P3 peak commonly used to assess brain activity. Both groups were assessed before and after the intervention.

Findings

Fitness level improved in PA ($p<0.001$) and WL ($p=0.02$) groups, yet it improved more in the PA group (group difference in pre-to-post test score 1.3 mL/kg per min, 95% CI 0.3 to 2.4). However, there were no differences in fitness level between groups at pretest or post-test ($p\geq0.07$).

For attentional inhibition, increases in response accuracy were seen in both groups (PA, $p<0.001$; WL, $p=0.001$), but the PA group showed greater improvement (difference of 3.2%, 95% CI 0.0% to 6.5%). The groups did not differ with respect to reaction time ($p\geq0.18$). An increase in P3 amplitude for incongruent trials at post-test was found for the PA group (change of 1.4 µV, 95% CI 0.3 to 2.6) compared with pre-test but not for the WL group. There were, however, no differences in P3 amplitude between groups at pretest or post-test ($p\geq0.15$). The PA group showed faster P3 latency at post-test compared with pretest in response to incongruent trials (difference 20.1 ms in pre-to-post, 95% CI 2.6 to 37.6) and showed greater change in P3 latency than the WL group from pre to post-test (32 ms, 95% CI 6.9 to 57.2 for pre-to-post group difference). However, the WL group had faster P3 latency than the PA group at pre-test (521.5 ms, 95% CI 508 to 535 vs 541.9 ms, 95% CI 529.9 to 554) and there were no significant differences in P3 latency in response to the incongruent trials between groups at post-test ($p>0.2$).

For cognitive flexibility, there was an increase in response accuracy for the heterogeneous trials at post-test relative to pre-test for both PA ($p<0.001$) and WL ($p<0.001$) groups. The PA group showed greater improvement in performance on the heterogeneous task (4.8% group difference in pre-to-post change score, 95% CI 1.1 to 8.4), yet there were no differences in response accuracy between groups at pretest or post-test ($p\geq0.09$). There were shorter RT at post-test than pre-test and no differences in P3 amplitude for heteregeneous trials between groups at pre or post-test.

Commentary

This RCT offers a better comprehension of the complex relationship between exercise and cognition in children. The study claims that participation in an after school exercise programme can induce changes in brain activation and cognition. However, it seems important to remember that these results were mainly expressed in terms of change from pre to post-test. Although they suggest that the intervention induced a change in brain activation and executive functioning, one might ask if the intervention was worth the cost as the children in both groups often did not differ at post-test on many measures. Initial group differences and methodology could explain this phenomenon. Indeed, on a few measures, the WL group was initially better than the PA group. Moreover, as underlined by the authors, the use of a WL group renders it difficult to attribute group differences entirely to the intervention since other aspects of the programme might have contributed to the results. Finally, they did not control for the changes in habit that might have taken place in the WL group during the study. In sum, this study showed interesting results yet warrants other RCTs that will (1) assure group comparability in the pre-test phase of the programme and (2) will include an active control group.

Implications for practice

This RCT showed interesting results, yet highlights the need for further research. Methodological aspects should be taken into consideration in future studies. Further studies, should consider changes in aerobic fitness with age and the suggested relationship between this factor and cognition.

Competing interests None declared.

Provenance and peer review Commissioned; internally peer reviewed.

References

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