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[Intervention Review]

Fitness training for cardiorespiratory conditioning after traumatic brain injury

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A B S T R A C T

Background

Reduced cardiorespiratory fitness (cardiorespiratory deconditioning) is a common consequence of traumatic brain injury (TBI). Fitness training may be implemented to address this impairment.

Objectives

The primary objective of this updated review was to evaluate whether fitness training improves cardiorespiratory fitness in people who have sustained a TBI. The secondary objectives were to evaluate whether fitness training improves body function and structure (physical and cognitive impairments, psychological responses resulting from the injury), activity limitations and participation restrictions in people who have sustained a TBI as well as to evaluate its safety, acceptance, feasibility and suitability.

Search methods

We searched 10 electronic databases (the Cochrane Injuries Group Trials Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Embase; PubMed (MEDLINE); CINAHL; AMED; SPORTDiscus; PsycINFO; PEDro and PsycBITE) and the International Clinical Trials Registry Platform for relevant trials. In addition we screened reference lists from systematic reviews related to the topic that we identified from our search, and from the included studies, and contacted trialists to identify further studies. The search was run in August 2017.

Selection criteria

Randomised controlled studies with TBI participants were eligible if they compared an exercise programme incorporating cardiorespiratory fitness training to usual care, a non-exercise intervention, or no intervention.

Data collection and analysis

Two authors independently screened the search results, extracted data and assessed bias. We contacted all trialists for additional information. We calculated mean difference (MD) or standardised mean difference (SMD) and 95% confidence intervals (CI) for continuous data, and odds ratio with 95% CI for dichotomous data. We pooled data when there were sufficient studies with homogeneity.

Main results

Two new studies incorporating 96 participants were identified in this update and were added to the six previously included studies. A total of eight studies incorporating 399 participants are included in the updated review. The participants were primarily men aged in their mid-thirties who had sustained a severe TBI. No studies included children. The studies were clinically diverse with regard to the interventions, time postinjury and the outcome measures used. At the end of intervention, the mean difference in peak power output was 35.47 watts (W) in favour of fitness training (MD 35.47 W, 95% CI 2.53 to 68.41 W; 3 studies, 67 participants; low-quality evidence). The CIs include both a possible clinically important effect and a possible negligible effect, and there was moderate heterogeneity among the studies.

Five of the secondary outcomes had sufficient data at the end of intervention to enable meta-analysis: body composition (SMD 0.29 standard deviations (favouring control), 95% CI -0.22 to 0.79; 2 studies, 61 participants; low-quality evidence), strength (SMD -0.02 (favouring control), 95% CI -0.86 to 0.83; 2 studies, 23 participants; very low-quality evidence), fatigue (SMD -0.32 (favouring fitness training), 95% CI -0.90 to 0.26; 3 studies, 130 participants; very low-quality evidence), depression (SMD -0.43 (favouring fitness training), 95% CI -0.92 to 0.06; 4 studies, 220 participants; very low-quality evidence), and neuromotor function (MD 0.01 m (favouring fitness training), 95% CI -0.25 to 0.27; 2 studies, 109 participants; moderate-quality evidence). It was uncertain whether fitness training was more or less effective at improving these secondary outcomes compared to the control interventions. Quality of life was assessed in three trials, but we did not pool the data because of substantial heterogeneity. Five of the eight included studies had no dropouts from their intervention group and no adverse events were reported in any study.

Authors' conclusions

There is low-quality evidence that fitness training is effective at improving cardiorespiratory deconditioning after TBI; there is insufficient evidence to draw any definitive conclusions about the other outcomes. Whilst the intervention appears to be accepted by people with TBI, and there is no evidence of harm, more adequately powered and well-designed studies are required to determine a more precise estimate of the effect on cardiorespiratory fitness, as well as the effects across a range of important outcome measures and in people with different characteristics (e.g. children). In the absence of high quality evidence, clinicians may be guided by pre-exercise screening checklists to ensure the person with traumatic brain injury is safe to exercise, and set training parameters using guidelines established by the American College of Sports Medicine for people who have suffered a brain injury.

PLAIN LANGUAGE SUMMARY

Fitness training to support recovery for people with traumatic brain injury

Background

People with traumatic brain injury often have fitness levels well below the lowest fitness levels of adults of similar age and sex. Reduced fitness causes increased tiredness, which makes everyday activities harder to do. Health professionals use fitness training to address this problem. This is an update to a review first published in 2008, which aimed to evaluate how effective fitness training is at improving fitness, other outcomes such as depression, cognition (e.g. memory, attention and problem solving) and return to everyday activities.

Study characteristics

We searched for studies in August 2017. We included eight studies, involving 399 adults with traumatic brain injuries, in this review. Most study participants were men in their mid-thirties who had severe brain injuries. We found no studies that included children. The fitness training programmes were conducted in a range of settings including hospital, community and at home. In six of the eight studies all fitness training sessions were supervised. The type of fitness training varied, and included exercising on a fixed cycling machine, in water, on gym equipment such as a treadmill, home-based exercise, and a fitness group in the military. In six of the eight studies the prescribed intensity, duration and frequency of fitness training met the guidelines set by the American College of Sports Medicine.

Key results

Three of the eight studies, with 67 participants, assessed change in fitness at the end of the treatment programme. Exercise was conducted on a fixed cycling machine in two studies, and in water in the third, and all sessions were supervised. The fitness training was compared to non-exercise interventions in two of these studies, and to no intervention in the third study. We combined the results of the three studies, which demonstrated an average (mean) improvement of 35 watts on an exercise test in the fitness training groups compared to the non-exercise intervention and no intervention groups. This improvement represents approximately a 36% improvement in fitness from the start of the study, which is a large effect. However, this estimate is uncertain and the difference is likely to be between 3 to 68 watts, which may or may not be important clinically.

More than one study reported on six other outcomes; body composition, strength, tiredness, depression, quality of life and walking. It was unclear whether fitness training was better or worse than the non-exercise interventions or no intervention at improving these outcomes. Measures of cognition, activities of daily living, and return to everyday activities were only measured in one study, and there were no studies that measured the effect of fitness training on levels of physical activity and motivation. Only three studies examined the effect of fitness training beyond the end of the programme, but these could not provide a clear answer regarding the long-term effects of fitness training.

In the five studies that provided supervision for all fitness training sessions, all participants in the fitness training groups completed the studies. Treatment attendance varied between studies, and was reported as ranging from 59% to 100%, and was not reported for two studies. There was no evidence of harm caused by fitness training in any study.

Quality of evidence

Our certainty in these findings is reduced due to the low quality of the evidence caused by small numbers of study participants, poor reporting of some study details, and possible errors in the way some of the studies were carried out.

Authors' conclusions

It is unclear whether fitness training after a traumatic brain injury improves physical fitness. There is not enough evidence to understand the effect of fitness training on other important outcomes. Whilst fitness training appears to be well attended by people with traumatic brain injury, particularly when supervised, and there is no evidence of harm, further well-designed studies are required before we can draw any definite conclusions. In the absence of high quality evidence, health professionals may be guided by pre-exercise screening checklists to ensure the person with traumatic brain injury is safe to exercise, and to set training parameters using guidelines established by the American College of Sports Medicine for people who have suffered a brain injury.