Physical fitness is low after stroke and this may cause or exacerbate some common poststroke problems, including disability. It is not known whether physical fitness training after stroke reduces death, disability, or dependency.

Objectives

The primary aims of this review were to determine whether physical fitness training (cardiorespiratory training and resistance training) after stroke reduces death, dependence, and disability at the end of intervention or end of follow-up. The secondary aims were to determine the effects of fitness training on physical fitness, mobility, physical function, health status and quality of life, mood, and the incidence of adverse events.

Methods

Search Strategy

We searched the Cochrane Stroke Group Trials Register (last searched January 2013), the Cochrane Central Register of Controlled Trials (CENTRAL: The Cochrane Library 2012, Issue 12, searched January 2013), MEDLINE (1966 to January 2013), EMBASE (1980 to January 2013), CINAHL (1982 to January 2013), SPORTDiscus (1949 to January 2013), and 5 additional databases (January 2013). We also searched registers of ongoing trials, hand-searched relevant journals and conference proceedings, screened reference lists, and contacted experts in the field.

Selection Criteria

We selected randomized trials comparing cardiorespiratory training, resistance training, or a combination of both (mixed training), with no intervention, a nonexercise intervention, or usual care in stroke survivors.

Data Collection and Analysis

Two review authors independently selected trials, assessed quality, and extracted data. We analyzed data with random-effects meta-analyses using Cochrane Review Manager software (RevMan version 5.2).

Results

We included 45 trials, involving 2188 participants, that comprised cardiorespiratory (22 trials and 995 participants), resistance (8 trials and 275 participants), and mixed training interventions (15 trials and 918 participants). There were no differences in mortality at the end of intervention (n=9) or end of follow-up (additional n=7). No dependence data were reported. Global indices of disability significantly improved after cardiorespiratory training (standardized mean difference, 0.37; 95% confidence interval, 0.10–0.64; P=0.007); marginal improvements observed after mixed training were unsafe because of study design issues. There were insufficient data to assess the effects of resistance training on primary outcomes.

A significant increase in walking speed (maximum and preferred speeds) and tolerance (6-minute walking test) was observed at the end of cardiorespiratory and mixed training interventions; some improvements persisted after the intervention had been completed (Table). Cardiorespiratory training also significantly improved balance at the end of intervention (Berg Balance Scores: mean difference, 3.14; 95% confidence interval, 0.56–5.73; P=0.02). There was no evidence of any serious adverse events.

Reviewer Conclusions

The effects of training on death and dependence after stroke are unclear. Cardiorespiratory training reduces disability after stroke. There is sufficient evidence to incorporate cardiorespiratory and mixed training, involving walking, within poststroke rehabilitation programs to improve the speed and tolerance of walking; improvement in balance may also occur. Our findings reinforce the importance of task-related training when functional benefits are sought. There is insufficient evidence to support the use of resistance training on its own. Further well-designed trials are needed to determine the optimal content of the exercise prescription and identify long-term benefits.
Acknowledgments

This article is based on a Cochrane Review published in The Cochrane Library 2013, Issue 10. Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and The Cochrane Library should be consulted for the most recent version of the review.

Sources of Funding

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Disclosures

Drs Saunders and Greig were coauthors of one included study (Mead 2007). Drs Sanderson and Saunders received National Institute for Health Research funding to complete this update. Dr Mead has received research funding for exercise after stroke. She has received honoraria from Later Life Training to develop an educational course of exercise after stroke for exercise professionals. She has also received honoraria and expenses to present work on exercise after stroke at conferences. She has led a trial of exercise after stroke that is included in the review (Mead 2007). Dr Brazzelli reports no conflicts.

Table. Random-Effects Meta-analyses of Cardiorespiratory Training, Resistance Training, and Mixed Training Interventions on Walking Performance Outcomes at the End of Intervention and at the End of Follow-Up

<table>
<thead>
<tr>
<th>Fitness Training Intervention</th>
<th>Walking Outcome</th>
<th>Mean Difference (95% Confidence Interval)</th>
<th>Significance Level</th>
<th>N (n)</th>
<th>Mean Difference (95% Confidence Interval)</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiorespiratory training</td>
<td>Maximum walking speed</td>
<td>7.37 m/min (3.70, 11.03)</td>
<td>P&lt;0.0001</td>
<td>13 (609)</td>
<td>6.71 m/min (2.40, 11.02)</td>
<td>P=0.002</td>
</tr>
<tr>
<td></td>
<td>Preferred walking speed</td>
<td>4.63 m/min (1.84, 7.43)</td>
<td>P&lt;0.001</td>
<td>8 (425)</td>
<td>0.72 m/min (-6.78, 8.22)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>6-minute walking test</td>
<td>26.99 m (9.13, 44.84)</td>
<td>P=0.003</td>
<td>10 (468)</td>
<td>33.37 m (-8.25, 74.99)</td>
<td>NS</td>
</tr>
<tr>
<td>Resistance training</td>
<td>Maximum walking speed</td>
<td>1.92 m/min (-3.50, 7.35)</td>
<td>NS</td>
<td>4 (104)</td>
<td>-19.8 m/min (-95.77, 56.17)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Preferred walking speed</td>
<td>2.34 m/min (-6.77, 11.45)</td>
<td>NS</td>
<td>3 (80)</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td>6-minute walking test</td>
<td>3.78 m (-68.56, 76.11)</td>
<td>NS</td>
<td>2 (66)</td>
<td>11.0 m (-105.9, 127.95)</td>
<td>NS</td>
</tr>
<tr>
<td>Mixed training</td>
<td>Maximum walking speed</td>
<td>…</td>
<td>…</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td>Preferred walking speed</td>
<td>4.54 m/min (0.95, 8.14)</td>
<td>P=0.01</td>
<td>9 (639)</td>
<td>1.60 m/min (-5.62, 8.82)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>6-minute walking test</td>
<td>41.60 m (25.2, 57.95)</td>
<td>P&lt;0.0001</td>
<td>7 (561)</td>
<td>51.62 m (25.2, 78.03)</td>
<td>P&lt;0.00013</td>
</tr>
</tbody>
</table>

… indicates no data; N, trial number; n, participant number; and NS, nonsignificant.

Reference


Key Words: disability evaluation | exercise | physical fitness | review, systematic | stroke
Physical Fitness Training for Patients With Stroke: An Updated Review
David H. Saunders, Mark Sanderson, Miriam Brazzelli, Carolyn A. Greig and Gillian E. Mead

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