Exercises for older cyclists to improve traffic safety

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Overview

Aim of the study

Training

Participants

Results
  - cycled distance
  - perceived effects of the training
  - performance in cycle course

Discussion
Aim

Older cyclists
  - physical problems, e.g.
    - motility reduced
    - balance reduced
=> Cycling more difficult, might prevent from using the bike
=> Higher risk of
  - single bike crashes (e.g. getting on or off the bike)
  - collisions (e.g. turning to the off-side)

Requirement analysis of tasks for cyclists from a sports perspective
  - getting off the bike
  - turning
  ...

=> Sports training to improve the required abilities
Training

<table>
<thead>
<tr>
<th>Demands in traffic</th>
<th>Skills</th>
<th>Required abilities</th>
</tr>
</thead>
</table>
| Getting off the bike | - Precise stopping  
- Movement from sitting to standing  
- Standing one-legged on one pedal  
- Lifting the foot over the frame if necessary | - Anticipation  
- Reaction  
- Balance  
- Flexibility in the joints of trunk, hip, and foot  
- Movement coupling |
| Turning | - Indicating the turn (cycling one-handed)  
- Looking over the shoulder while cycling | - Movement coupling  
- Balance  
- Trunk stability  
- Flexibility in shoulders and neck joints  
- Orientation, peripheral vision |
Methods

Participants
Contacts to sports clubs in medium sized cities in Saxony and Saxony-Anhalt
- conditions:
  - space and time for training
  - trainer
  - random assignment to intervention and control group
- costs paid by German Federal Ministry of Transport, Building and Urban Development

Determine cities with training and control groups at random
Methods

Participants
Recruited cyclists of 60 years and older in 14 cities
140 persons in intervention groups, 160 in control groups

100€ for participation in 3 test sessions for all
+ regular training for intervention group, 5 months, 2 * 1 hour / week

<table>
<thead>
<tr>
<th>Frequency of bike use, Test Session 1.</th>
<th>Intervention group (N=146)</th>
<th>Control group (N=167)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1-2 times per month</td>
<td>2.1%</td>
<td>3.6%</td>
</tr>
<tr>
<td>1-2 times per month</td>
<td>2.1%</td>
<td>3.6%</td>
</tr>
<tr>
<td>1-2 times per week</td>
<td>16.4%</td>
<td>22.2%</td>
</tr>
<tr>
<td>3-4 times per week</td>
<td>32.2%</td>
<td>22.8%</td>
</tr>
<tr>
<td>Daily or nearly daily</td>
<td>46.6%</td>
<td>51.5%</td>
</tr>
</tbody>
</table>
Methods: Training
Methods: Training
Tests

Test Sessions
1: January / February 2013
2: June / July (August) 2013
3: October / November 2013

Tests of physical fitness
Bicycle computer: **distance cycled**
Questionnaires: **physical complaints**, cycling habits, ...
Cycle course: **safety relevant skills** (Heidemann, Hufgard, Sindern, Riek & Rudinger, 2009)
Mobility diary: mobility behaviour, perceived problems
Distance cycled

Bicycle computers mounted on participants’ bikes
Cycled distance between Test Sessions 1 and 2

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention (n=122)</td>
<td>1,017 km</td>
<td>1,057 km</td>
</tr>
<tr>
<td>Control (n=127)</td>
<td>918 km</td>
<td>895 km</td>
</tr>
</tbody>
</table>

No difference between groups, t-test for independent samples: $p = .82$ => no effect of training

No difference between groups before but estimates of low validity
Effects on physical complaints: Ratings

Ratings (5-point scale)
Physical complaints (a) in general and (b) when cycling in the fields
(- Diabetes)
(- Vision)
(- Hearing)
- Motility
- Cardiovascular system
- Nerve system
- Muscle strength

Mean value of physical complaints these four fields

GLM:
Effect of training (interaction of group and test session) on
- mean value of general complaints  \( p = 0.033, \eta^2 = 0.016 \)
- muscle strength in general  \( p = 0.001, \eta^2 = 0.036 \)

No effect on physical complaints when cycling.
Effects on physical complaints: Ratings

Mean of motility, cardiovascular system, nerve system, muscle strength, general

Physical complaints

Not at all

Very much

Test Session 1
Test Session 2

Intervention group
Control group
Effects on physical complaints: Ratings

Muscle strength, general

![Graph showing muscle strength ratings over test sessions for intervention and control groups.](image-url)
## Effects on physical complaints: Perceived changes

<table>
<thead>
<tr>
<th>Motility</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>21 improved</td>
<td></td>
</tr>
<tr>
<td>3 improved somewhat</td>
<td></td>
</tr>
<tr>
<td>3 easier to get on and off the bike</td>
<td></td>
</tr>
<tr>
<td>1 turning round easier</td>
<td></td>
</tr>
<tr>
<td>1 turned round more often</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical state</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 improved in general</td>
<td></td>
</tr>
<tr>
<td>6 endurance improved</td>
<td></td>
</tr>
<tr>
<td>15 fitter</td>
<td></td>
</tr>
<tr>
<td>2 somewhat fitter</td>
<td></td>
</tr>
<tr>
<td>1 stronger muscles</td>
<td></td>
</tr>
<tr>
<td>1 stronger muscles in the neck</td>
<td></td>
</tr>
<tr>
<td>1 posture improved</td>
<td></td>
</tr>
<tr>
<td>1 body tension improved</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Balance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>15 balance better</td>
<td></td>
</tr>
<tr>
<td>2 balance not decreased</td>
<td></td>
</tr>
</tbody>
</table>
Effects on physical complaints: Perceived changes

Nothing changed: 14 nothing changed
   1 nothing or very little changed
   5 nothing changed because already cycled a lot before
   5 nothing changed because already a lot of sports before
   3 little changed because very active before
   1 attended training seldom for health reasons
   1 exercises too difficult

Cycling: 8 more than before
   1 tried to cycle more than before
   6 more fun when cycling

Safety: 13 safer
   1 somewhat safer
   1 safe enough to cycle into the town centre
   4 reactions faster
Effects on physical complaints: Perceived changes

Further reported changes

6 paid more attention or rode more carefully
3 had bought helmets: 2 used them regularly, 1 for cycle tours only
2 respected traffic rules more often than before
3 had met nice cyclists at the training sessions
Cycle course

Example of task

Turning to the off-side

Potential faults
- no turn around the shoulder
- no hand-sign
- not naming the number
- touching the line with the front wheel
Proportion of participants accomplishing task correctly

<table>
<thead>
<tr>
<th>Examples of tasks</th>
<th>Intervention group Test session 1</th>
<th>Intervention group Test session 2</th>
<th>Control group Test session 1</th>
<th>Control group Test session 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dismounting to the left into a hula hoop</td>
<td>69%</td>
<td>72%</td>
<td>67%</td>
<td>72%</td>
</tr>
<tr>
<td>Dismounting to the right into a hula hoop</td>
<td>71%</td>
<td>82%</td>
<td>74%</td>
<td>80%</td>
</tr>
<tr>
<td>Turning to the off-side</td>
<td>61%</td>
<td>69%</td>
<td>43%</td>
<td>64%</td>
</tr>
</tbody>
</table>

GLM: no interaction between test session and group: no effect of training
Discussion

Distance cycled
  Ceiling effect: participants had cycled already very much before

Physical complaints
  Small effect on ratings
  Low level of complaints before intervention
    – optimistic self-perception and description?
    – reference for „complaints“ with age?
  Effects in free answers

Safety
  No transfer from training to cycling behaviour
  Performance has reached no ceiling
Thank you for your attention!

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