The effect and importance of physical activity on behavioural and psychological symptoms in people with dementia: a systematic mixed studies review

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Abstract

**Background** People with dementia may benefit from the effect of physical activity on behavioural and psychological symptoms of dementia (BPSD). Qualitative synthesis of the importance of physical activity might complement and help clarify quantitative findings on this topic. The purpose of this systematic mixed studies review was to evaluate findings from both quantitative and qualitative methods about the effect and importance of physical activity on BPSD in people with dementia.

**Methods** The systematic literature search was conducted in EMBASE, CINAHL, PubMed, PEDro and PsycINFO. Inclusion criteria were: people with a light to moderate degree of dementia, interventions including physical activity, and outcomes focusing on BPSD or quality of life. To assess the methodological quality of the studies, the AMSTAR and GRADE checklists were applied for the quantitative studies and the CASP qualitative checklist for the qualitative studies.

**Results** A small reduction in depression level and improved mood were seen in some quantitative studies of multi-component physical activity interventions, including walking. Due to high heterogeneity in the quantitative studies, a single summary of the effect of physical activity on BPSD should be interpreted with some caution. Across the qualitative studies, the common themes about the importance of physical activity were its ‘socially rewarding’ nature, the ‘benefits of walking outdoors’ and its contribution to ‘maintaining self-hood’.

**Conclusion** For people with dementia, there was a small, quantitative effect of multi-component physical activity including walking, on depression level and mood. People with dementia reported the importance of walking outdoors, experiencing the social rewards of physical activity in groups, as well as physical activity were a means toward maintaining self-hood.
Background

In Denmark, 2.5% (35,000) of the population above the age of 60 are diagnosed with dementia, but as many as 6% (87,000) are likely to suffer from this disorder (Danish Dementia Research Centre, 2017; Flachs EM, 2015; Sundhedsstyrelsen, 2016). The risk of more people developing dementia will increase with the demographic aging of the population, and based on population projections, the prevalence of the Danish population above the age of 60 with dementia is estimated to be 8% (150,000) by 2040 (Danish Dementia Research Centre, 2017). Dementia results in cognitive, behavioural, social and physical impairments, as well as direct and indirect economic costs, that impact the individual, his/her close relatives and the broader society (WHO, 2015). As the cost burden associated with the disease will inevitably increase in the coming decades, the Danish Health Authority has launched a National Action Plan to manage the impact of dementia (Sundhedsstyrelsen, 2016). The overall aims of the National Action Plan are to strengthen the quality of interventions for people with dementia and to improve their quality of life, by implementing 23 concrete initiatives (Sundhedsstyrelsen, 2016).

One of the initiatives in the National Action Plan for dementia addresses ‘more and better opportunities for physical training and activity’, as there is evidence to support its positive, physiological effects in people with dementia, such as increased aerobic capacity, muscle strength and level of function (Klarlund Pedersen, 2011; Pedersen & Saltin, 2015). Physical activity is broadly defined as any bodily movement produced by skeletal muscles that requires energy expenditure (WHO, 2011). Besides the physiological effects of physical activity, there are several other benefits, such as behavioural and psychological improvements, that must be addressed in order to evaluate the total impact of physical activity for people with dementia (Abraha I, 2017).

Evidence to support the behavioural and psychological benefits of physical activity for people with dementia is sparse and inconclusive, mainly due to methodological concerns associated with the included studies, as seen in some systematic reviews (Forbes, Forbes, Blake, Thiessen, & Forbes, 2015; Potter, Ellard, Rees, & Thorogood, 2011). Also, in most of the studies included in these systematic reviews, only measures of quality of life and depression were included, which do not cover the complex broader life situation of everyday life for people with dementia (Forbes et al., 2015; Potter et al., 2011). Qualitative synthesis might be used advantageously to explore or enhance the findings of quantitative synthesis, by including understandings and views from people with dementia and their close relatives (Gough, 2015). Therefore, there is a need for a comprehensive study of the range of behavioural and psychological symptoms of dementia (BPSD), such as depression, anxiety, apathy, sleep problems, irritability, psychosis, wandering, elation and agitation, that could plausibly be positively affected by physical activity in people with dementia (Finkel, Costa e Silva, Cohen, Miller, & Sartorius, 1996).

In order to identify the effect and importance of physical activity on BPSD in the complex broader life situation of everyday life that follows dementia, a synthesis of primary qualitative, quantitative, and
mixed methods research studies needs to be performed. The purpose of this systematic mixed studies review is to evaluate the effect and importance of physical activity on BPSD in people with dementia.

**Methods**

**Information sources.** The systematic literature search was conducted in the following electronic databases from inception to November 2017: EMBASE, CINAHL, PubMed, PEDro and PsycINFO.

**Eligibility criteria.** Full text articles in English, Danish, Swedish and Norwegian, identified via English titles and abstracts, published in international, peer-reviewed journals were considered for inclusion in the current systematic review. Inclusion criteria were people with a light to moderate degree of dementia (Mini-Mental State Examination score 10 to 25 (Folstein, Folstein, & McHugh, 1975), an intervention including physical activity and an outcome focusing on BPSD or quality of life. Studies were excluded if they did not meet these criteria, if they were pilot studies, or if they contained full or partial focus on pharmacological interventions.

**Literature search.** The literature search was based on a search matrix that was divided into five different blocks of search terms. Each synonym in each search block was combined with “OR” and the search blocks were combined with “AND”. The quantitative search was a combination of search blocks 1, 2, 3 and 4. The qualitative search was a combination of search blocks 1, 2, 3 and 5 (Figure 1).

No filters were applied regarding language or year, and the same search strategy was used on each database, except for PEDro.

**Study selection.** Two individual authors (JA, TJ) independently reviewed all potentially relevant articles by title and abstract. The full text of an article was obtained if it was considered potentially eligible by one of the authors. The two authors then evaluated the eligibility of the study until consensus was reached.

**Methodological quality.** To assess the methodological quality of the quantitative studies, two critical appraisal tools for systematic reviews that include randomised studies of healthcare interventions; 1) the checklist called ‘A MeaSurement Tool to Assess systematic Reviews’ (AMSTAR), rating the overall confidence in the results of the review (Shea et al., 2017), and 2) the ‘Grading of Recommendations Assessment, Development and Evaluation’ (GRADE) checklist, rating the overall certainty of the quality of evidence and the magnitude of effect (Ryan, 2016). The Critical Appraisal Skills Programme (CASP) checklist was applied for the qualitative studies overall evaluating 1) Rigour: has a thorough and appropriate approach been applied to key research methods in the study? 2) Credibility: are the findings well-presented and meaningful? and 3) Relevance: how useful are the findings to you and your organisation? ("CASP ", 2017). Based on the overall assessment of the confidence of the results in the study, referred to as study quality, each study was classified as either 1) a weak-quality study, 2) a medium-quality study or 3) a high-quality study. Only studies of methodological high-quality were
included in the current review. The results of the AMSTAR, GRADE and CASP assessments are summarised in table format in the results section.

**Risk of bias.** The ‘Risk of Bias in Systematic Reviews’ tool, called ROBIS (Whiting et al., 2016), was used to assess the overall risk of bias in the interpretation of review findings in the quantitative systematic reviews. Only studies with low risk of bias were included in the current review. The result of the ROBIS assessment is summarised in table format in the results section.

The qualitative studies were evaluated using a critical approach, and included in the current review if the methodological approach was considered appropriate regarding credibility, transferability, dependability and conformability (Noyes J, 2015).

**Data extraction and synthesis.** Data extraction of the quantitative studies included author information, publication year, characteristics of the intervention and sampling procedure. The qualitative data consisted of overall themes, as well as citations from the people with dementia in the studies.

**Results**

Full texts of 33 studies were read after screening the titles and abstracts, and 1,214 irrelevant and duplicated studies were excluded. The flow diagram summarises the outcomes of the literature search (Figure 2). The inclusion criteria identified 13 potentially eligible studies, of which six studies comprising quantitative methods were excluded because of low methodological quality based on the AMSTAR, GRADE and ROBIS judgement (Table 1 and 2). Totally, three studies including quantitative research methods were included in the current review (Abraha I, 2017; Barreto Pde, Demougeot, Pillard, Lapeyre-Mestre, & Rolland, 2015; Brett, Traynor, & Stapley, 2016) (Table 3). All four studies including qualitative research methods were judged as methodological high-quality studies quality using the CASP checklist and therefore included in the current review (Cedervall, Torres, & Aberg, 2015; Martin et al., 2015; Tak, Kedia, Tongumpun, & Hong, 2015; Yu & Swartwood, 2012) (Table 4).

The diverse interventions of the included, high-quality quantitative studies that had either no effect or a significant effect on BPSD are presented in Table 1. Depression was the primary outcome across the studies, but also mood and agitation were measured, along with other BPSD, often evaluated by the Neuropsychiatric Inventory Instrument (NPI), assessing delusions, hallucinations, dysphoria, anxiety, agitation/aggression, euphoria, disinhibition, irritability/lability, apathy, and aberrant motor activity, summed to a global score (Cummings et al., 1994).

Tai Chi, group exercise or home exercises revealed no effect on depression or other BPSD. Several studies included multicomponent interventions of e.g. strength, balance, flexibility, which had no or some effect on BPSD, including depression and mood. A single RCT found a significant effect on agitation during a four-week period with music and movement compared with controls. Walking as an
intervention, either solely, or in combined interventions, showed an effect or a trend towards a consistent, positive effect on depression, mood or other BPSD. The studies assessing walking had a homogeneous intervention length and frequency (Abraha I, 2017; Barreto Pde et al., 2015; Brett et al., 2016).

A summary of the results from the qualitative studies indicates that the majority of the people with dementia had positive experiences with physical activity, described as enjoyment, improved mood, sleep and well-being, with special impact on selfhood maintenance. The overall themes across the studies were ‘socially rewarding’, encouraged ‘walking outdoors’ and promoted ‘self-hood’.

The social rewards from interaction with others in the same situation appears to be essential to people with dementia, as they experience a feeling of belonging. A participant in one of the qualitative studies said: ‘Sometimes when you have Alzheimer’s, you feel kind of alone. When you exercise with other people then you don’t feel so odd’ (Yu & Swartwood, 2012). The importance of this peer support was also stated by another participant: ‘And the camaraderie. It’s such a blessing that a person would never realize until they get involved with this’ (Yu & Swartwood, 2012). The importance of being in a group during physical activity with people in the same situation was stated many times, with another example being: ’I think a key (benefit) that has come out in the end, is just that bonding. That group identity. Being with other people in a similar situation’ (Martin et al., 2015).

The qualitative studies also demonstrate the importance of people with dementia spending time outside. One participant emphasised: ’You get a kick out of nature ... Just being outdoors and moving your body. ... That’s a source of joy’ (Cedervall et al., 2015). Another participant stated: ’When I get outdoors like that, for a bike ride or something, then it [the restlessness and the anxiety] literally drains out of me. It’s such a nice feeling’ (Cedervall et al., 2015). The combination of fresh air, nature and physical activity was described: ’Yes, I feel I want to move my legs. I feel I want to go for a walk or a bike ride. [...] My whole body feels better then. [...] I think maybe you just imagine you’ve done something really good. [...] Well, if I don’t go out at all, I get a bit worried. But going for a walk makes me bright and cheery as a lark’(Cedervall et al., 2015). Walking inside and outside on a daily basis has been reported to be an important individual activity for residents with dementia in nursing homes (Tak et al., 2015).

Across the studies, more participants felt a positive impact of physical activity on self-hood, as one participant stated: ’Get on with life, like normal. You can’t get up in the morning and say ‘Oh God. I’ve got Alzheimer’s and I can’t go out’. Give me my golf clubs and I’m off up in that field’ (Martin et al., 2015). Physical activity has the ability to become a means for people with dementia to achieve well-being and maintain selfhood as the dementia symptoms progress. This was described by one woman: ’Exercise has a new meaning now. Before, it was all about burning calories, but now there’s a sense of well-being that I realise I haven’t had before. [...] The benefits [of exercising] are greater now than they used to be. I feel proud. I think maybe that I feel capable somehow. [...] I need this kind of exercise’ (Cedervall et al., 2015). Similarly, a woman with dementia stated the importance of physical activity as a means of self-hood maintenance: ’I think that keeping going is good for my whole mental
state. I can tell. I feel so alive when I walk outside and manage on my own. So it’s, well, it feels really good, and then I don’t have the feeling that I’m ill’ (Cedervall et al., 2015).

In summary, the importance of physical activity to people with dementia was described as being socially rewarding by being with peers in a similar situation, enhancing a feeling of group identity. Outdoor recreation and physical activity appeared to also be essential for feelings of joy, happiness and well-being. It seems that physical activity has the capacity to maintain self-hood in people with dementia and to shift the focus away from the diagnosis.

Discussion

In this systematic mixed studies review, the quantitatively measurable effect of physical activity for people with dementia was, in general, inconclusive on BPSD, other than depression and mood. Multi-component interventions including walking outdoors had a small but significant, positive effect on depression and mood. Overall, the importance of walking outdoors, experiencing the social rewards of physical activity in groups, as well as maintaining self-hood, are emphasised by people with dementia in the qualitative studies.

For physical activity in general, the effect on BPSD ranged from non-significant to a small effect in the quantitative studies, similar to the findings of others (Forbes et al., 2015). Possible explanations for the non-significant effect in many studies can be caused by type 2 errors due to small sample sizes, heterogeneous populations as dementia is a wide range of symptoms individually progressing, or due to intervention periods being too short. Interventions were often combined in one study with no clear description of intensity or dose, which affects the ability to evaluate the effect of the intervention and increases the heterogeneity between studies. Also, differences between studies regarding type, frequency and duration of physical activity increases heterogeneity and confounds generalisability (Fletcher, 2007). Taking this clinical heterogeneity into consideration, there was an overall positive trend of physical activity on BPSD, especially depression, indicating the importance of being physically active in everyday life.

Walking, either on its own or included in a multi-component program, had a positive trend towards, or effect on, BPSD across the studies, the optimum dose being 20 to 30 minutes, and a frequency of 5 days a week. Despite the low heterogeneity, different outcomes were used between studies, which hampered consensus on the specific effect of walking on BPSD. In the qualitative studies, walking outdoors was considered joyful, meaningful and beneficial for the interviewed people with dementia, confirming and broadening that finding from the quantitative synthesis. As walking outdoors is a free or very low-cost activity, requiring no equipment or membership fee, it is a feasible, functional and meaningful everyday activity to implement, also in people with dementia.
Although not quantitatively measurable, people with dementia reported physical activity to be important for their general health and well-being, especially as a means to self-hood maintenance (Cedervall et al., 2015), shifting the focus away from the diagnosis and towards the individuals identity. This feeling of empowerment may be mediated or reinforced by the feeling of group identity, and often, people with dementia were surprised how socially rewarding the group experience could be (Yu & Swartwood, 2012). In several studies, the importance of participating in a group during physical activity was emphasised. Using different qualitative methods, there was consensus across studies that people with dementia were satisfied and happy when joining a group with others with the same diagnosis, experiencing similar difficulties, feeling equal and being able to share experiences with each other (Martin et al., 2015). Similarly, a positive effect on behavioural competency and psychological well-being was seen after a group intervention in people with an acquired brain injury (Ownsworth, Fleming, Shum, Kuipers, & Strong, 2008).

As only a low proportion of people with dementia are engaged in self-directed activities, relatives, volunteers, health professionals and society need to be encouraged to invite people with dementia to participate in activity planning and provide necessary assistance, resources and transportation (Tak et al., 2015). Also, limiting the group size to six participants has been suggested, as this enhances group dynamics and creates room for exchanging meaning and perspectives without being overwhelmed by too many people (Martin et al., 2015). These recommendations seem to have particular relevance when planning and implementing opportunities for physical activity for people with dementia.

In order to address ‘more and better opportunities for physical training and activity’, as in the National Action Plan for dementia in Denmark, is seems that factors such as organising group training in small groups, and walking outdoors are important and relevant to many people with dementia, both initiatives being relatively low in cost and easy to implement, taken into consideration all other aspects and factors related to dementia. Future studies need to assess different aspects, including the cost-benefit of organising and assembling groups in society to participate together in physical activity in order to enhance its positive effects.

In the current systematic mixed reviews study, there are a number of methodological limitations to be considered. First, the clinical heterogeneity across the studies made it difficult to summarise the effect of physical activity on BPSD, as combining results of different populations, different concepts and different outcomes made no clinical sense (Fletcher, 2007). Still, there were some significant effects and tendencies in effects across the studies, which were elucidated by the qualitative studies, reflecting the methodological strength of applying a mixed study review to emphasise the effect and importance of physical activity in people with dementia. Secondly, the effects of the interventions were not differentiated across subtypes of the people with dementia. The severity of dementia was light to moderate for the current review, which limits the generalisability to only this population. Also, dissimilar contexts, small sample sizes and short interventions of the included studies limits the transferability of
the results and hence the implementation of the interventions described. This stresses the need for future studies to assess the effect and importance of physical activity for people with mild to moderate dementia in longitudinal, large-scale cohort studies, using a systematic approach template for intervention description and replication.

To our knowledge, this is the first systematic mixed studies review assessing the effect and importance of physical activity on BPSD in the complex phenomenon of dementia. The findings of the current study provide quantitative and qualitative evidence that support and extend each other. The methodological quality of the reviews was assessed by GRADE and AMSTAR criteria for the quantitative studies and by CASP criteria for the qualitative studies in order to include only high-quality studies in the current review.

**Conclusion**

In this systematic mixed studies review, there was a small, quantitative effect of multi-component physical activity, including walking, on depression level and mood in people with mild to moderate dementia. People with dementia state the importance of walking outdoors, experiencing the social rewards of physical activity in groups, as well as physical activity as a means to maintain self-hood.

Walking outdoors, alone or in a multi-component intervention, seems to have a promising positive effect on depression and mood, and this easy and no-cost physical activity is favoured amongst people with mild to moderate dementia. Furthermore, joining a group for physical activity is generally preferred amongst people with dementia, indicating that future studies must assess aspects of organising and assembling groups in order to encourage the positive effects of physical activity, including maintaining self-hood.

**Declaration of Conflicting Interest**
The authors declare no conflicting interests.

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References


Fletcher, J. (2007). What is heterogeneity and is it important? BMJ, 334(7584), 94-96. doi:10.1136/bmj.39057.406644.68


Noyes J, H. K., Booth A, Harris J, Harden A, Popay J, Pearson A, Cargo M, and Pantoja T on behalf of the Cochrane Qualitative and Implementation Methods Group. (2015). Qualitative research and


Table 1: The AMSTAR score rating the overall confidence and the GRADE ratings for the overall certainty of the quality of evidence and the magnitude of effect in the studies based on quantitative methods.

<table>
<thead>
<tr>
<th>AMSTAR question number</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
<th>Q10</th>
<th>AMSTAR Total score</th>
<th>GRADE Rating</th>
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<tr>
<td>Fleiner, 2016</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>+</td>
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<tr>
<td>Barreto, 2015</td>
<td>+</td>
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<td>Abraha, 2016</td>
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<td>Potter, 2010</td>
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<tr>
<td>Opie, 1999</td>
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<td>Martini de Oliveira, 2015</td>
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<td>McClam, 2015</td>
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GRADE rating: ⊝⊝⊝⊝ High quality, ⊝⊝Ο Moderate quality, ⊝ΟΟ Low quality, ⊝ΟΟΟ Very low quality
### Table 2

*Table 2. Risk of bias*

<table>
<thead>
<tr>
<th>Study/Author</th>
<th>Study eligibility criteria</th>
<th>Identification and selection of studies</th>
<th>Data collection and study appraisal</th>
<th>Synthesis and findings</th>
<th>Risk of bias in the review</th>
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</thead>
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<tr>
<td>Fleiner, 2017</td>
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<td>✅</td>
<td>✅</td>
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<tr>
<td>Abraha, 2016</td>
<td>✅     -</td>
<td>✅</td>
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<td>Barreto, 2015</td>
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<tr>
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<td>Opie, 1999</td>
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*Note: + indicates a strength of bias (e.g., clear risk of bias), - indicates a weakness of bias (e.g., serious risk of bias).*
### Table 3

*Description of the high quality studies based on quantitative methods.*

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention type</th>
<th>Intervention length</th>
<th>Intervention frequency</th>
<th>Intervention period</th>
<th>Outcome</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Brett, 2015</em></td>
<td><strong>Music and movement</strong> <strong>(I1) Strength, flexibility, endurance, balance and walking</strong> <strong>(I2) Supervised walking</strong></td>
<td>30 min (I1): 25-30 min (I2): 15-30 min</td>
<td>2 times/weekly (I1+I2): 5 times/weekly</td>
<td>4 weeks (I1+I2): 16 weeks</td>
<td>Agitation</td>
<td>Agitation: +</td>
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<tr>
<td></td>
<td><strong>(2 studies)</strong></td>
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<tr>
<td><em>Abraha, 2016</em></td>
<td><strong>Tai chi</strong> <strong>Stretching, walking, strength, flexibility and balance</strong></td>
<td>60 min 60 min 30 min</td>
<td>3 times/weekly 2 times/weekly 7 times/weekly</td>
<td>40 weeks 40 weeks 12 weeks 23 weeks</td>
<td>Depression</td>
<td>Depression: %</td>
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<td><strong>(4 studies)</strong></td>
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<td></td>
<td><strong>Strength, balance and flexibility</strong> <strong>Aerobic, endurance, strength, balance and flexibility</strong></td>
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<td>Depression: +</td>
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<tr>
<td><em>Barreto, 2015</em></td>
<td><strong>(I1) Home-exercise</strong> <strong>(I2) Group-exercise</strong> <strong>Endurance, strength, balance and flexibility</strong></td>
<td>(I1+I2): 60 min (I1+I2): 60 min 20-30 min</td>
<td>2 times/weekly 2 times/weekly 5 times/weekly</td>
<td>(I1+I2): 52 weeks 52 weeks 12 weeks (I1+I2): 16 weeks</td>
<td>BPSD</td>
<td>BPSD: (I1+I2): %</td>
</tr>
<tr>
<td></td>
<td><strong>Walking</strong></td>
<td>(I1+I2): 20 min</td>
<td>5 times/weekly</td>
<td>(I1+I2): 16 weeks</td>
<td>Depression</td>
<td>Depression: %</td>
</tr>
<tr>
<td></td>
<td><strong>(I1) Individual exercise</strong> <strong>(I2) Walking</strong></td>
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<tr>
<td></td>
<td><strong>Strength, balance and walking</strong></td>
<td>60 min 45 min 60 min</td>
<td>2-3 times/weekly 3 times/weekly</td>
<td>17 weeks</td>
<td>Depression: %</td>
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<tr>
<td></td>
<td><strong>Tai chi</strong></td>
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<td>Depression: %</td>
</tr>
<tr>
<td>Strength, balance and endurance</td>
<td>Walking</td>
<td>30 min</td>
<td>7 times/weekly</td>
<td>Depression</td>
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<tr>
<td>I1: Intervention, I2: Intervention 2, +: Significant effect, %: Non-significant effect</td>
<td></td>
<td>5 times/weekly</td>
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</tbody>
</table>