7.1 GENERAL DISCUSSION

The aim of the studies described in this thesis was to examine differences in effect between functional tasks exercise and resistance strength exercise on the physical function and quality of life of older community-dwelling women. In this last chapter, the main conclusions of the thesis are discussed. The main results are first evaluated and compared with the results of recent studies, and the possible mechanisms underlying the exercise effects are discussed. Secondly, methodological considerations are addressed. Thirdly, the answers to the research questions presented in the foregoing chapters are critically reviewed. Finally, implications for clinical practice and recommendations for future research are considered, followed by the overall conclusions.

7.2 MAIN RESULTS

7.2.1 Assessment of Daily Activity Performance

Chapter 3 describes the development of the quantitative Assessment of Daily Activity Performance (ADAP) test. This test was based on the Continuous-scale Physical Functional Performance (CS-PFP) test and allows the participant to perform at maximal capacity by maximizing the weight carried and working at the fastest speed possible or reaching the greatest distance. Like the CS-PFP test, the ADAP includes 16 common tasks, such as transferring laundry and boarding a bus, performed at maximal effort. The Assessment of Daily Activity Performance (ADAP) proved to be a reliable and valid instrument for measuring the performance of daily activities by community-dwelling older women, provided an experienced tester administered the test (Chapter 3).

Functional tasks exercises improved the ADAP total and subscales scores of healthy, community-living older women, whereas resistance strength exercises did not. The participants of the functional tasks exercise programme increased their total ADAP score by 6.8 units (14%), with an effect size of 1.25, and this improvement was still present 6 months after completion of the exercise programme (Chapter 4). Functional tasks exercises may positively influence daily habits more than resistance training does, thereby enabling older people to sustain a higher level of physical
activity and the benefits thereof. Cress and colleagues expressed a similar change on the CS-PFP test as the capacity to carry 14% more weight, while moving 10% more quickly.\textsuperscript{1} In a recent review, Barry and Carson concluded that resistance training improved both strength and power in older adults; however, resistance training-induced adaptations were not sustained beyond the training period.\textsuperscript{2} In another review by Latham et al., resistance training alone did not have an effect on physical disability. The authors suggested that resistance training should be combined with other forms of exercise.\textsuperscript{3} The findings of the present study support the evidence to incorporate task-specific functional exercises in the intervention programmes to improve physical functional performance of older adults.

### 7.2.2 Timed Up and Go test

The Timed Up and Go (TUG) test was used to assess functional mobility. Neither functional tasks exercises nor resistance strength exercises affected the TUG scores. Nine months after baseline measurements, the control group took 0.6 seconds longer to complete the TUG test. Ceiling effects may affect these results. In a cross-sectional study of 413 community-dwelling and 78 institutionalised older women, Bischoff and colleagues\textsuperscript{4} identified completion of the TUG test within 12 seconds as the cut-off point for normal mobility. The mean baseline TUG score in our study was 5.2 ± 1.0 seconds (range, 3.2 seconds – 8.9 seconds), indicating good mobility and suggesting a ceiling effect, which may have affected the results. Recently, Latham et al. affirmed in a Cochrane review that resistance strength training had little or no effect on TUG test performance.\textsuperscript{5}

### 7.2.3. Muscle strength

Isometric knee extensor strength (IKES), isometric elbow flexor strength (IEFS), and handgrip strength (HGS) were measured, to provide information about the strength of the major muscle groups of the legs, arms and hands. Twelve weeks of resistance strength training improved IKES and IEFS in older, community-dwelling women, whereas functional tasks exercise had no effect on muscle strength. This finding is consistent with the principles of training specificity. According to this principle, the nature of the stimulus determines the nature of the physical change. Neither exercise programme had an effect on the HGS, probably because the hand muscles were not
directly trained. This might be considered as a shortcoming of the programmes, because many older people suffer from an impaired hand function. Six months after the exercise period, the gain in exercise-induced muscle strength in the resistance group was lost (Chapter 4), which is consistent with the principle of training reversibility, by which the effects of training regress after completion of the training. The increase in IKES and IEFS immediately after completion of the resistance exercise training is consistent with earlier results obtained with comparable resistance exercise programmes.3,6,7 In a recent review, Hunter et al reported that there was sufficient evidence for a beneficial effect of strength training on older adults’ muscle mass, strength and power.8 Although the authors did not find consensus about an optimal training programme, Hunter and colleagues recommended a loading intensity of about 60-80% of 1-repetition maximum (1RM), with a volume ranging from 2-4 sets of 8-15 repetitions per exercise, to improve muscle strength. Resistance strength exercise seems appropriate for improving muscle strength of older adults.

7.2.4. Muscle power
Explosive leg extension power (LEP) was measured with the Nottingham power rig.9 Functional tasks exercises as well as resistance strength exercises increased LEP directly after the 3-month exercise period. The increased LEP scores were sustained for 6 months after completion of the exercise programmes. The increase in LEP in the function group was unexpected because IKES did not change in this group. LEP seems to be affected by neuromuscular events, rather than by isometric strength. In our opinion muscle power is a better functional measure than muscle strength. This idea is supported by the findings of other researchers.10,11 Several investigators proposed power training is to be preferred to resistance strength training for improving physical function.6,10 In future research it would be of interest to compare the effects of functional tasks exercises with power training.

7.2.5. Health-related quality of life
Health-related quality of life (HRQOL) was assessed with the Dutch language version of the SF-36 Health Survey,12,13 a frequently used HRQOL instrument. At the end of the 3-month intervention, no exercise effect on HRQOL was found, except for an increase in the SF-36 Physical Functioning score in the resistance group (Chapter 5).
Several studies have reported a limited effect of exercise on HRQOL in healthy older adults.\textsuperscript{3,14} The high baseline SF-36 scores of the participants in the present study make the results more vulnerable to ceiling effects, which could explain the lack of change after completion of the 3-month intervention. This is in agreement with the findings of others, who also observed a ceiling effect in a healthy population.\textsuperscript{1,15-17} In their review, Spirduso and Cronin concluded that there was a weak evidence for an effect of exercise on well-being and quality of life.\textsuperscript{18} In a Cochrane review Latham et al found no effect of resistance strength training on HRQOL in older people.\textsuperscript{5} Remarkably, in our study, the participants of both exercise groups had lower HRQOL scores, some even lower than at baseline, 6 months after completion of the exercise programmes, whereas the control group still had a high score (Chapter 5). This suggests that participants’ internal standard and self-evaluation had changed at the end of the intervention period, as a result of their experiences during the exercise programme. This phenomenon is known as ‘response shift’.\textsuperscript{19} After completion of the exercise programmes, the participants may have missed the social and physical benefits of the programme. These findings are consistent with the idea that self-reported HRQOL is a dynamic concept and subject to changes in internal standards, values or conceptualisation, resulting in a ‘response shift’.

7.2.6. Habitual physical activity

Habitual physical activity was assessed with a questionnaire developed for older adults by Voorrips et al.\textsuperscript{20} After completion of the exercise programmes, neither group had changed their habitual physical activity (Chapter 5). These results are consistent with those of Drewnowski and colleagues,\textsuperscript{21} who explained the absence of an effect on physical activity as being due to a decrease in spontaneous physical activity to compensate for exercise training. In our study, physical activity 6 months after completion of the exercise programme was diminished in the resistance group but sustained in the function group (Chapter 5). Participants of the function group who reported high satisfaction with the exercises were more likely to have greater increases in habitual physical activity scores 6 months after completion of the exercise programme (Chapter 6). These findings indicate a positive change in daily habits after a functional tasks exercise programme, which mimics daily activities, whereas resistance training has no effect. The improvement of habitual physical activity together with the increased ADAP scores in the function group 6 months after
the exercise period suggests a change in a trigger mechanism: The increase in physical capacity at the end of the training period may have enabled people to be more physically active and triggered the mechanism to maintain this regained capacity.

7.2.7. Participant satisfaction
An 18-item questionnaire was developed to assess participants’ satisfaction with the exercise programmes. A factor analysis identified four subscales: 1) evaluation of the total programme, 2) evaluation of the core exercises of the programme, 3) evaluation of the warm-up and cool-down periods, and 4) evaluation of the exercise location (Chapter 6). The participants of both exercise groups reported a high satisfaction with the programmes. In the function group, this high satisfaction was associated with a positive change in self-reported physical functioning and habitual physical activity 6 months after completion of the programme (Chapter 6). In the feasibility study (Chapter 2), the resistance exercise programme had a higher participant acceptation than the functional tasks programme, probably because the functional tasks exercises did not meet participants’ expectations. As a consequence of the feasibility study, we changed the information on the functional tasks exercises prior to the start of the programme and during the practice phase to increase participants’ knowledge and understanding of the programme. This might explain the equally high satisfaction with the two programmes. Information about and understanding of an exercise programme are important motivational factors.22,23 Besides knowledge about the programme and the exercises, we incorporated psychosocial aspects, such as social support, interaction between participants, feedback about exercise progress and emphasis on enjoyment, which may have contributed to the high satisfaction reported by both groups. Several researchers mention that class cohesion is important for continued participation by older adults.24,25 Recently, Stiggelbout and colleagues 26 found the perceived quality of an exercise programme and the baseline attitude to be predictors of continued exercise participation. To encourage continued participation in organised exercise programmes for older adults, we suggest an active promotion of a positive attitude towards exercise at baseline and to evaluate and eventually adjust the programme, by means of a participant satisfaction questionnaire.
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7.3 POTENTIAL MECHANISM

The main finding of the present study is that functional tasks exercises are better than resistance exercises in improving the performance of daily tasks by healthy, community-living older women. Moreover, this improvement lasts longer than the gain in muscle strength achieved with resistance exercises (Chapter 4). Which mechanism is responsible for the observed differences between functional tasks exercises and resistance strength exercises? And why does resistance strength training fail to improve the functional performance of older, community-dwelling adults? To get a desired physiological effect, a training programme must be consistent with the principles of training: individuality; overload; reversibility and specificity.27

**Individuality:** A general training programme is likely to be unsuitable for some group members, because the physical abilities of these individuals may differ considerably. Ideally, a training programme should be tailored to an individual’s physical status and requirements.

**Overload:** The overload principle indicates that the intensity of exercises should be just above the ‘normal’ capacity in order to facilitate physiological adaptations to training, such as neural recruitment or muscle hypertrophy. To gain maximum benefit from training, the workload should gradually be adjusted upwards as adaptations occur.

**Reversibility:** Reversibility means the loss of adaptations after training. Some effects of training regress more rapidly than others.

**Specificity:** Specificity concerns metabolic and physiological adaptations, depending on the type of overload imposed on the system, i.e. the predominant energy system or the movement pattern and specific muscle groups exercised. Adaptations to exercise training are specific to the manner and mode of exercises used during training. Specificity indicates specific adaptations of a training programme to the physiological level required at a particular time.

Training programmes for older adults are usually consistent with the overload and reversibility principles. However, none of the studies reported in the literature described exercise programmes for community-dwelling, older adults that followed the principles of individuality and specificity. The consistency of the functional tasks exercises in our study with all the principles of training might explain why this
programme was successful in improving the functional performance, unlike the resistance strength exercises. In rehabilitation medicine and sports science, exercise training with an individual, tailored approach has proven beneficial.\textsuperscript{27-30} The work of Jette and Keysor \textsuperscript{31} supports our suggestion regarding the lack of consistency with the principle of specificity. Another reason for the lack of effect of resistance strength exercises could be a limitation of neural plasticity in older adults. Recently, Barry and Carson proposed neural adaptation to be the main mechanism to enhance muscle strength and power.\textsuperscript{2} Progressive degradation of the neuromuscular system, in particular degeneration of spinal motor neurons, loss of corticospinal fibres, and cerebellar degeneration, will influence the capacity for neural adaptation in response to resistance training in older adults. If limitations of neural adaptation restrict the response to resistance training in older adults, then there will be a restricted transfer to functional movement tasks.\textsuperscript{2}

\section*{7.4 METHODOLOGICAL CONSIDERATIONS}

Randomised controlled trials (RCTs) of non-pharmacological interventions, such as exercise studies, include several components, e.g. psychosocial, cognitive and physiological components, and are often individualised (interaction, intensity, effort of participant). As a consequence, the quality of non-pharmacological RCTs is often lower than that of pharmacological RCTs.\textsuperscript{32} Therefore, the methodological quality of non-pharmacological studies should be critically evaluated. This section addresses the internal and external validity of the RCT presented in this thesis, to determine whether the effects of the exercise interventions are accurately portrayed and whether results can be generalised.

\subsection*{7.4.1 Internal validity}

Internal validity is the degree to which a study establishes the cause-and-effect relationship between treatment and observed outcome. The central issue in demonstrating internal validity and establishing the effects of treatment is to ensure equality between the groups to be compared for all relevant variables, except the independent treatment variable. Specific threats to establishing a cause-and-effect
Chapter 7

relationship are associated with research design and how the study procedures are executed.33

7.4.1.1 Study design
The primary aim of the study, to determine differences in effect between functional tasks exercise and resistance strength exercise on the physical functional performance measures and self-reported HRQOL of older community-dwelling women, was addressed in a randomised, controlled, single-blind trial (Chapters 4 and 5). RCTs are accepted as a reliable method for determining the effectiveness of a specific intervention.32,34 The RCT uses random assignment to control and treatment groups, thereby avoiding selection bias. The participants included in our study were randomly assigned to the functional tasks exercise programme (the function group), the resistance exercise programme (the resistance group) or the control group. The exercise programmes were followed three times a week in 1-hour with sessions separated by 1 day of rest. The programmes were held at a local leisure centre in the Utrecht region for three periods of 12 weeks. The control group was run concurrently with the exercise groups.

Part of the internal validity of a study depends on the drop-out rate, which should be similar for all groups investigated. During the intervention period, 14% of the included participants withdrew from the study (resistance group 18%; function group 9%; control group 16%). Six months after completion of the intervention, 25% of the included participants had withdrawn (resistance group 29%; function group 18%; control group 26%). Although the function group seemed to have a lower attrition rate than the resistance group and the control group, the attrition did not lead to a change in group composition and baseline data of the drop-outs and the participants who completed the study were not different.

7.4.1.2 Study procedures
The lower quality of published non-pharmacological RCTs compared with pharmacological RCTs is also influenced by a poor implementation of study procedures.32 Schulz and colleagues35,36 reported that the effects of treatment are 30% greater in studies with inadequate allocation concealment than in studies with adequate concealment. Similar results have been reported in studies lacking appropriate blinding. Less bias is attributed to drop-outs.33 This paragraph addresses
the implementation of several study procedures, to determine internal validity of the study.

7.4.1.2.1 Randomisation
Randomisation is a method to set up study groups, that are equivalent with respect to known and unknown variables. The randomisation procedure should not introduce bias. In the present study, random assignment was carried out by computer, using a random numbers table.

7.4.1.2.2 Allocation
Allocation concealment is essential to prevent foreknowledge of group assignment and prevents bias during the process of determining participant eligibility and assignment. Concealment in the present study was achieved by having the randomisation process administered by someone who was not responsible for recruiting participants and was carried out by computer using a random numbers table.\textsuperscript{33-36}

7.4.1.2.3 Blinding
Ascertainment bias (systematic differences in outcome assessment) and performance bias (systematic differences in care provided apart from the intervention being evaluated) can occur when a study is not blinded.\textsuperscript{37} Blinding participants and care providers is usually problematic in exercise studies, because participants are taking part in the intervention and know what treatment they have. For this reason, it is important to try to blind outcome assessors.

In line with the revised CONSORT (Consolidated Standards Of Reporting Trials) statements, with recommendations about reporting 'how the success of blinding was evaluated', we evaluated the success of blinding of the outcome assessor of the present study (chapter 4). This is not straightforward because participants easily reveal the intervention type they followed.\textsuperscript{38} At the beginning of the assessments of the present study, we specifically instructed participants not to discuss the type of exercise programme they had followed with the person who collected the data. Although 18% of the participants did reveal which type of programme they followed, the data collector guessed the intervention correctly in only 37% of the cases, as opposed to 33% expected by chance, indicating successful blinding of the data.
collector. Moreover, the effects of exercise are often assessed with self-reported questionnaires, and if participants cannot be blinded, conscious or unconscious prejudice may influence this type of measurement. Exercise trainers are an integral part of the exercise intervention and the success of the intervention may depend on the trainers’ skills, experience, and enthusiasm. To minimise performance bias, we used the same trainers for both exercise programmes. Further, we carefully instructed the trainers to follow the exercise protocols regarding the level of attention and encouragement given to participants.

7.4.1.2.4 Control group

It is often technically difficult to make a control intervention that is indistinguishable from the exercise intervention. Several exercise studies have used as control group participants who followed a non-physical activity programme, to ensure that the participants in the control group received the same amount of attention as the participants in the exercise group. However, it is difficult to ensure that exercise and control groups receive a similar amount of attention. In the present study the control did not receive additional attention, other than the scheduled physical assessments and subsequent health screening reports, because we wanted to compare the exercise programmes with a “pragmatic right” control group that mimicked a real life situation. Control group participants were asked to maintain their normal pattern of activities during the 3-month intervention period. Recently, Latham et al observed no differences in the measured effects of resistance exercises with or without an attention control group. Also, health screening of older adults alone does not produce any effect on physical functional outcomes and health-status outcomes. Control group participants of the present study also did not change in primary outcomes at the end of the intervention period.

7.4.1.2.5 Compliance with the protocol

Compliance was defined as the number of exercise classes attended, expressed as a percentage of the total number of classes. Illness, limited mobility, and reluctance to leave home are limiting factors in the exercise compliance of older individuals. The compliance rate reported in other exercise studies with older adults ranges from poor (43%) to high (100%). The compliance rate in the present study was 90% ± 9.1 (range 66 to 100%) in the function group and 90% ± 8.1 (range
71 to 100%) in the resistance group. The exercise programmes used in the present study incorporated several psychosocial aspects, to stimulate participant attendance and satisfaction. Firstly, exercise was given in classes, which increases social support. Secondly, contact between participants was stimulated by the opportunity to have a drink after each session and by training in pairs (dyad training) with emphasis on interaction and enjoyment. Thirdly, participants were called at home if they repeatedly did not come to the session. Fourthly, participants registered their exercise performance in a personal file, to provide feedback about their progress. Exercise interventions incorporating psychosocial aspects based on behavioural theories, such as social cognitive theory (SCT), the transtheoretical model (TM), and theory of planned behaviour (TPB), have a higher compliance rate among older adults than programmes not incorporating these psychosocial aspects. The theories and findings of other researchers emphasize the importance of psychosocial factors, such as class cohesion, joint participation with friends or a partner in exercise class participation, especially in older women.

7.4.1.2.6 Drop-outs
Although participants were encouraged to arrange their own transportation to the leisure centre, free transportation was provided if needed. To keep them interested, participants were sent a monthly newsletter with updates on the study’s progress and health topics. The drop-out rate of 14% during the intervention period was comparable to that reported in other exercise studies involving older community-living individuals. Exercise interventions in older persons have a drop-out rate of 6% to 34%, with the highest number of drop-outs occurring in the first 3 months. Reasons for drop-out in the present study included illness and loss of interest. The drop-outs of the control group were more likely to withdraw because of a loss of interest. This is a common problem with intervention trials in older people in whom the control group cannot be blinded. Older persons often enrol to improve their functioning or slow its deterioration and may be disappointed if they are assigned to a control group, which may result in drop-out. Tables 1 and 2 show the composition of the groups and the baseline scores of the drop-outs. People dropping out did not affect the composition of the groups and drop-outs did not differ between the groups. It is acceptable to exclude influence of the drop-out on the results of the rest of the groups.
### Table 1. Comparison of baseline values of all participants, the participants who completed the 3-month measurements, and the participants who completed the 9-month measurements.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control group</th>
<th>Resistance group</th>
<th>Function group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>3 months</td>
<td>9 months</td>
</tr>
<tr>
<td>Age</td>
<td>73.0</td>
<td>± 3.2</td>
<td>73.0 ± 3.4</td>
</tr>
<tr>
<td>ADAP total</td>
<td>47.7</td>
<td>± 9.0</td>
<td>48.7 ± 8.3</td>
</tr>
<tr>
<td>TUG, seconds</td>
<td>5.1</td>
<td>± 0.9</td>
<td>5.1 ± 1.0</td>
</tr>
<tr>
<td>IKES, newtons</td>
<td>304.0</td>
<td>± 73.2</td>
<td>312.6 ± 73.4</td>
</tr>
<tr>
<td>Physical</td>
<td>16.5</td>
<td>± 9.4</td>
<td>16.7 ± 9.9</td>
</tr>
<tr>
<td>Activity</td>
<td>49.4</td>
<td>± 7.5</td>
<td>50.3 ± 7.4</td>
</tr>
<tr>
<td>PCS</td>
<td>49.4</td>
<td>± 7.5</td>
<td>50.3 ± 7.4</td>
</tr>
</tbody>
</table>

*Note: Values are means ± standard deviation; ADAP, assessment of daily activity performance test; TUG, timed up and go test; IKES, isometric knee extensor strength; SF-36 PCS, short form 36-item Health Survey physical component summary score.

* Within group Analyses of variance (ANOVA) between baseline values of all participants, the participants who completed the 3-month measurements, and the participants who completed the 9-month measurements; † Between group ANOVA between baseline values of all included participants; ‡ Between group ANOVA between baseline values of the participants who completed the 3-month measurements; # Between group ANOVA between baseline values of the participants who completed the 9-month measurements.
Table 2. Between group comparison of baseline values of the drop-outs

<table>
<thead>
<tr>
<th>Measure</th>
<th>Drop-outs at 3-month measures</th>
<th></th>
<th>Drop-outs at between 3 and 9-month measures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control group (n = 5)</td>
<td>Resistance group (n = 6)</td>
<td>Function group (n = 3)</td>
<td>P* Value</td>
</tr>
<tr>
<td>Age</td>
<td>73.0 ± 2.2</td>
<td>74.3 ± 4.1</td>
<td>76.7 ± 3.5</td>
<td>.27</td>
</tr>
<tr>
<td>ADAP total</td>
<td>42.1 ± 11.7</td>
<td>49.6 ± 9.7</td>
<td>41.4 ± 11.7</td>
<td>.44</td>
</tr>
<tr>
<td>TUG, seconds</td>
<td>5.3 ± 0.5</td>
<td>5.5 ± 1.5</td>
<td>5.7 ± 2.9</td>
<td>.94</td>
</tr>
<tr>
<td>IKES, newtons</td>
<td>259.6 ± 59.9</td>
<td>288.9 ± 59.9</td>
<td>275.5 ± 16.4</td>
<td>.69</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>15.0 ± 8.9</td>
<td>13.1 ± 5.0</td>
<td>14.5 ± 1.7</td>
<td>.88</td>
</tr>
<tr>
<td>SF-36 PCS</td>
<td>44.7 ± 9.2</td>
<td>52.0 ± 4.5</td>
<td>46.0 ± 13.3</td>
<td>.36</td>
</tr>
</tbody>
</table>

Note: Values are means ± standard deviation; ADAP, assessment of daily activity performance test; TUG, timed up and go test; IKES, isometric knee extensor strength; SF-36 PCS, short form 36-item Health Survey physical component summary score.

*Analyses of variance between baseline values of all participants, the participants who completed the 3-month measurements, and the participants who completed the 9-month measurements.

General discussion
7.4.1.2.7 Adverse events

Schmidt and colleagues reported that older participants who experienced an adverse event in the first 3 months of an exercise programme were nearly four times more likely to drop-out than those who did not have adverse effects. Although adverse events should be monitored, they are often not reported. In the present study, the following adverse events were reported by the exercise instructors and required adaptation of the personal training programme: in the function group; muscle pain (8), osteoarthritic joint pain (5), prosthetic joint pain (4), low back pain (4); in the resistance group, muscle pain (10), osteoarthritic joint pain (5), prosthetic joint pain (3), low back pain (4). One participant in the resistance group strained a hamstring muscle, as a result of which two exercise classes were missed and the personal training programme was adapted. Despite these reported complaints, all participants completed the exercise programmes. The reported adverse events of other exercise studies include muscle pain, stiffness, joint pain, falls, and back or leg pain.

7.4.2 External validity

External validity is addressed by delineating inclusion and exclusion criteria and assessing the generalisability of findings.

7.4.2.1 Inclusion criteria

The inclusion criteria of the present study were female sex, living in the community, medically stable health, aged 70 years or older, and being willing and able to comply with the protocol for the duration of the study period after written informed consent. During telephone interviews we determined, using a validated questionnaire, whether participants were medically fit enough to participate in the exercise programme.

7.4.2.2 Exclusion criteria

The exclusion criteria were recent fractures; unstable cardiovascular or metabolic diseases; musculoskeletal disease or other chronic illnesses that might limit training or testing; severe airflow obstruction; history of cerebrovascular disease; major systemic disease active within the previous two years (e.g. cancer, rheumatoid arthritis); on daily analgesia; recent depression or emotional distress; or loss of
mobility for more than one week in the previous two months. Furthermore, to obtain a more representative group of participants, very active respondents, respondents who exercised at a sports club more than two times a week, were also excluded.

7.4.2.3 Generalisability

We targeted community-living, medically stable women aged 70 and older because older women are the least physically active of all demographic groups\textsuperscript{23} and because older women have less physical reserve than older men.\textsuperscript{65-67} In exercise studies with healthy community-living participants, it often is difficult to randomly select participants. The participants of the present study were recruited through local newspaper advertisements. It is possible that a relatively healthy population was selected, because people who volunteer to participate in a time-consuming exercise study are likely to be healthy, to be interested in health-related topics, to be more physically active, and to be more positive about the benefits of exercise. By excluding the most active respondents, we assumed we would have a more representative group of participants. The physical functioning and HRQOL scores at baseline showed that the participants were in moderate-to-good health, which may influence the generalisability of the study results to the general population. However, the baseline characteristics in terms of marital status, height, weight, and disease status of the sample population were comparable with those of the overall Dutch population of community-living women aged 70 years or older.\textsuperscript{68} It remains a question whether functional tasks exercises and resistance exercises would have induced greater improvements among less healthy participants (Chapter 6). Functional tasks exercises may be beneficial to participants with a lower capacity and with more limitations than the participants in this study.
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7.5 QUESTIONS AND ANSWERS

Our specific questions concerning the difference in effect between functional tasks exercises and resistance strength exercises on the physical functional performance and health-related quality of life of older community-dwelling women, as formulated in Chapter 1, can be answered as follows:

1. To evaluate the feasibility of a new functional tasks exercise programme, designed to improve functional performance of community-dwelling older women, by comparing it with a resistance exercise programme (chapter 2).
   The newly developed functional tasks exercise programme is feasible and well tolerated by women older than 70 years living in the community.

2. To determine the intra-examiner reliability and construct validity of the Assessment of Daily Activity Performance (ADAP) test in a community-living older population, and to identify the importance of tester experience (chapter 3).
   The Assessment of Daily Activity Performance (ADAP) is a reliable and valid instrument for measuring physical function in community-dwelling older women; however, testers should be trained in its use to improve reliability.

3. To determine whether a functional tasks exercise programme and a resistance exercise programme have different effects on the ability of community-living older people to perform daily tasks (chapter 4).
   Functional tasks exercises are more effective than resistance exercises in improving functional task performance in community-dwelling older women, and the effects of the functional tasks exercises are preserved for longer than the gain in strength achieved with resistance exercises.

4. To determine whether a functional tasks exercise programme and a resistance exercise programme have a different effect on the health-related quality of life (HRQOL) of community-dwelling older women (chapter 5).
   Both functional tasks exercise and resistance strength exercise have a limited effect on the HRQOL of community-living, older women; the HRQOL outcomes are probably affected by ceiling effects and response shift.
5. To discuss the differences in participants’ satisfaction between a functional task exercise programme and a resistance exercise programmes, and to explore the impact of participants’ satisfaction and health-status on exercise compliance and effectiveness of the two programmes (chapter 6).

Both exercise programmes are well accepted and appreciated; functional tasks exercises may positively influence daily habits more than resistance training, especially when participants are satisfied with the exercises. This enables older people to keep physically active and to sustain the positive effects of exercise.

7.6 IMPLICATIONS FOR PUBLIC HEALTH AND CLINICAL PRACTICE

Functional tasks exercises are more effective in improving physical functional performance than resistance strength exercises and the effects last longer than the gain in strength achieved with resistance exercises. Usually, after completion of an exercise programme, effects decline and finally disappear. The results of this study suggest that functional tasks exercises, which mimic daily activities, bring about a positive change in daily habits more than does resistance training. Therefore, we recommend that task-specific functional exercises are incorporated in exercise interventions to enhance the physical functional performance and independence of older adults.

To prevent early attrition, Stiggelbout et al. recently recommended evaluating the perceived quality of exercise programmes by means of satisfaction questionnaires. Our study showed that both the functional task exercises and the resistance strength exercises were accepted and appreciated by the participants. Also, the compliance rates for both programmes were higher than those reported in many other exercise studies involving older adults. The inclusion of psychosocial aspects (such as knowledge about the exercises) and social support (such as interaction between exercisers), information on the exercises and feedback about exercise progress, may have contributed to the high satisfaction and compliance with the programmes. We therefore recommend the incorporation of psychosocial aspects when designing exercise interventions.

The Assessment of Daily Activity Performance (ADAP) test proved to be appropriate, reliable and sensitive to changes after training in older adults. Since exercise effects
are specific, the tests used to measure the effects of an exercise programme should also be specific to the mode of the exercises to reflect the pursued effects. The results of chapter 5 are consistent with the idea of regarding HRQOL as a dynamic concept, which is consistently subject to changes in internal standards, values, or conceptualisation, resulting in a response shift. To obtain a clear understanding of the effects of exercise interventions in older adults, studies should include performance-based tests in addition to self-report HRQOL measures.

7.7 CONSIDERATIONS FOR FUTURE RESEARCH

This study sought to determine the differences in effect between functional tasks exercises and resistance strength exercises on the performance of daily activities by older women. In the current literature, the diversity of exercise interventions for older adults makes it difficult to determine which type of exercise is the most effective one for daily tasks. We tested the effect of the exercise programmes in a group of older women, because women constitute the majority of the older population, they are the least physically active of all demographic groups,23 they have higher prevalence rates of disability than men of the same age,66,67 and they have a smaller physical reserve than older men.65-67 It would be of interest to determine the effects of functional tasks exercises in comparison to resistance exercises in older men. Although we anticipate older men to accept functional tasks exercises, a feasibility study would first be necessary to determine so.

The population of the present study consisted of healthy older women. The results of chapter 6 suggest that the exercise programmes may have a beneficial effect in less healthy participants. More research is needed to determine the effects of functional tasks exercises in a group of frail older adults.

Although the functional tasks exercise programme proved to be highly appreciated and effective in improving the physical functional performance of older women, the programme still needs further development. For instance, the exercises do not specifically train hand function, whereas many older people suffer from an impaired hand function.71

Lastly, more research is needed to obtain an understanding of HRQOL and the response shift phenomena in intervention studies in older adults.
7.8 MAIN CONCLUSIONS

The main conclusions of our study indicate that functional tasks exercises are more effective in improving physical functional performance than resistance strength exercises and that the effects of functional task exercises last longer than the gain in strength achieved with resistance exercises. Furthermore, functional tasks exercises cause a greater positive change in daily habits than does resistance training.
REFERENCES


Chapter 7


