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Effect of Exercise and Weight Loss in People Who Have Hip Osteoarthritis and Are Overweight or Obese: A Prospective Cohort Study

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Background. Osteoarthritis (OA) is the most common joint disorder in the world and is recognized as a substantial source of disability. For people with OA of the knee, exercise in combination with weight loss is a proven, effective, conservative treatment option, yet evidence is lacking for people with hip OA.

Objective. The aim of this study was to obtain preliminary evidence of the effect of a program of exercise in combination with weight loss on physical function in people who have hip OA and are overweight or obese.

Design. This investigation was a prospective cohort study.

Methods. Thirty-five people who were 25 years or older, had clinical and radiological evidence of hip OA, and were overweight or obese (body mass index of >25 kg/m^2) were included. They participated in an 8-month program of exercise in combination with weight loss. A body mass index of 40 kg/m^2 was used as the upper limit. The primary outcome was self-reported physical function, as measured with a subscale of the Western Ontario and McMaster Universities Osteoarthritis Index. Secondary outcome measures included pain and walking tests as quantitative measures of function.

Results. Participation in the combination program resulted in a 32.6% improvement in self-reported physical function after 8 months, a finding that could be considered clinically relevant. Significant improvements also were seen in pain and on walking tests.

Limitations. The lack of a control group was a limitation of this study.

Conclusions. This appears to be the first study investigating the effect of exercise and weight loss as a combination treatment in people with hip OA. The results provide preliminary evidence that this combination treatment is effective in people with hip OA.

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Osteoarthritis (OA) is the most common joint disorder in the world and is recognized as a substantial source of disability.[1] Osteoarthritis is a chronic musculoskeletal disease that usually affects hands and weight-bearing joints, such as knees and hips. In 2007, OA of the hip affected approximately 7% of the population 65 years of age and older in the Netherlands.[2,3] A 25% increase in hip OA has been estimated for people 65 years of age and older in the Netherlands by 2050[4]; this factor, along with an aging population, will give rise to a higher prevalence of the condition in society.[5] A similar trend is occurring worldwide.[6,7]

The higher prevalence of hip OA will be caused not only by age but also by an increasing number of people who are overweight or obese.[8] Recent research strongly indicates that being overweight or obese is a risk factor for hip OA.[9] The number of people who are overweight or obese is a serious problem worldwide. Approximately two thirds of the world's population is overweight or obese, and the incidence of obesity has increased in Europe and globally in the last decade.[10–14]

Most recent recommendations for the conservative treatment of hip OA have focused on the preservation of joint function and pain relief, and combinations of nonpharmacological and pharmacological interventions have been described.[15–19] As nonpharmacological interventions, both exercise and weight loss have been recommended for managing symptoms in people with hip OA. However, these recommendations have been based mostly on knee research.

Evidence in the literature has demonstrated the benefits of exercise for both people with hip OA and people with knee OA.[20] Furthermore, knee OA research has shown that combining exercise with weight loss produces more effects on function and pain than either alone.[20,21] The recommendations for weight loss and the combination of exercise and weight loss for hip OA have been based primarily on knee OA research because of the limited availability of evidence in people with hip OA. The main problem is that in the existing studies analyzing intervention effects for both knee OA and hip OA, the outcomes were not distinguished by joint.[22] Hence, evidence regarding the treatment of hip OA with a combination of weight loss and exercise is lacking, but the notion that this combination treatment may have a positive effect on hip OA is plausible.

Therefore, the objective of this study was to obtain preliminary evidence of the effect of a program of exercise in combination with weight loss on self-reported physical function in people who have hip OA and are overweight or obese. In addition, the effect on secondary outcomes, such as pain and walking tests as quantitative measures of function, was determined.

Method

Study Design

A prospective cohort study was conducted at the Department of Orthopedic Surgery, University Medical Center Groningen (UMCG), Groningen, the Netherlands, in collaboration with the Allied Health Care Center for Rheumatology and Rehabilitation (AHCRR), Hilberdink, and Vive Diet and Lifestyle Consultancy, both situated in Groningen, the Netherlands. The study was designed to obtain preliminary evidence of the effect of a program of exercise in combination with weight loss in people who are overweight or obese and have hip OA. A detailed description of the study design is published elsewhere.[23]

Identification and Recruitment of Study Participants

People who were 25 years of age or older, had clinical and radiological evidence of hip OA,[24,25] and were overweight (body mass index [BMI] of >25 kg/m^2) or obese (BMI of >30 kg/m^2) were included. A BMI of 40 kg/m^2 was used as an upper limit to reduce the chances of including people with multiple complications. The clinical evidence of hip OA was based on the definition described by Altman[24]: complaints of hip pain and either (1) hip medial (internal) rotation of $\geq$15 degrees, pain with medial rotation of the hip, and morning stiffness of the hip for $\leq$60 minutes or (2) hip medial rotation of $<$15 degrees and hip flexion of $\leq$115 degrees; this definition has a sensitivity of 86% and a specificity of 75%. The radiographic diagnosis of OA of the hip was established by means of the criteria of Kellgren and Lawrence,[25] including grades 1 to 3.

Exclusion was based on conditions that prevented safe participation in an exercise program (angina pectoris, peripheral vascular disease, stroke, congestive heart failure, chronic obstructive pulmonary disease, insulin-dependent diabetes, psychiatric condition, renal disease, liver disease, active cancer other than skin cancer, and anemia); problems of the foot or ankle that could interfere with an exercise program; rheumatoid arthritis; an inability to walk without a cane or other assistive device; participation in another research study; an inability to finish the study or a low likelihood of adhering to the instructions of the clinical staff because of frailty or illness; and an inability to complete a questionnaire because of language problems or dementia. People who were on waiting lists for hip replacement at enrollment also were excluded. Eligibility was determined by the orthopedic surgeon or the

general practitioner, depending on the recruitment source.

Recruitment originated from 5 sources: (1) outpatient OA clinics of the Department of Orthopedic Surgery, UMCG, and the Department of Orthopedic Surgery, Martini Hospital, Groningen, the Netherlands; (2) general practitioners in areas near the AHCRR and at the Department of General Practice, UMCG; (3) people who presented directly to the AHCRR and met the inclusion criteria, as established by their general practitioners; (4) local paper advertising; and (5) website advertising at UMCG.

Eligible people from sources 1 to 3 were identified by medical specialists, and the researcher asked for permission to contact them. If written consent was given, then an initial questionnaire was mailed to the potential participants and a first appointment was scheduled. People from sources 4 and 5 were first seen at the outpatient OA clinic of the Department of Orthopedic Surgery, UMCG, where the orthopedic surgeon determined whether the potential participants were eligible for the study.

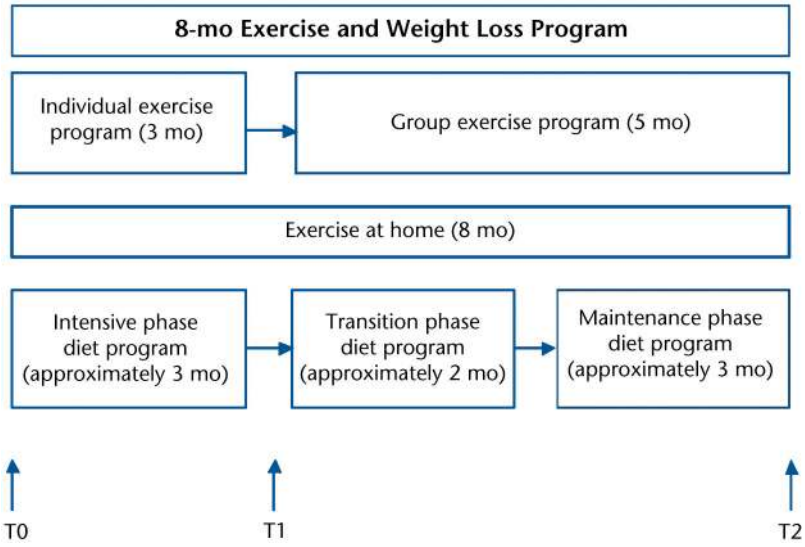

Figure 1.
Flow diagram of the intervention. T0=baseline measurements, T1=second measurements (3 months), T2=third measurements (8 months).

Intervention

The intervention, an 8-month program of exercise in combination with weight loss (Fig. 1), was introduced to the participants as a lifestyle program. The program was supervised by certified physical therapists and a certified dietitian and was hosted at the AHCRR, where both the exercise sessions and the weight loss consultations took place.

The exercise portion of the program consisted of individual and group sessions lasting 3 and 5 months, respectively. Both the individual and the group exercise sessions focused predominantly on improving aerobic capacity. In general, the structure of a session was a 10- to 15-minute warm-up; a 30-minute period of moderate to intense aerobic exercise, as monitored with the Borg scale[26]; and a 15-minute period of mobility and strength exercises. Aerobic capacity improvement was achieved with various devices, such as treadmills, free-weight benches, stationary bikes, steppers, and rowing machines. All exercises focused on personal needs, and personal preferences for aerobic equipment were taken into consideration. The weekly sessions lasted approximately 1 hour, and the exercises progressed as the participants improved.

In the group session, additional focus was placed on teaching self-management and coping, stimulating an active lifestyle, finding an optimal balance between exertion and relaxation, and decreasing limitations in activities of daily living. Also, throughout the program (8 months), participants were encouraged to perform moderate-intensity aerobic exercise at home for a minimum of 30 minutes on most or preferably all days of the week to adhere to national and international physical activity guidelines.

Along with the exercise portion of the program, participants attended the weight loss portion of the program on an individual basis. The weight loss portion of the program was based on principles of social cognitive theory[27] and was divided into 3 phases—intensive, transition, and maintenance phases—as described by Messier et al.[21] The main goal of the first phase was to heighten awareness of the importance of and the need for changing eating habits. In this phase, the ability to read and understand the diversity of labels on food products was encouraged, and the participants set goals that they believed they could achieve. This phase lasted approximately 3 months and consisted of a 1-hour intake consultation and 3 subsequent consultations every 4 weeks. The first of these subsequent consultations lasted 30 minutes, and the remaining 2 consultations lasted 15 minutes each.

In the transition phase, problems encountered by the participants were discussed, and the participants were encouraged to use insight concerning the choices that could be made when buying food to prevent relapse. This phase lasted approximately 2 months and consisted of two 15-minute sessions.

Finally, in the maintenance phase, the main objectives were to sustain the achieved weight loss and preserve the motivation to continue with healthful eating habits. This phase lasted approximately 3 months and consisted of one 15-minute session every 6 weeks.

In addition to the program of exercise in combination with weight loss, participants received a manual consisting of written information that focused on health education and OA. Throughout the program, focus was placed on teaching self-management, stimulating an active lifestyle, and eating a healthful diet. Adherence to the combination program was based on attendance of scheduled sessions and use of opportunities to catch up with any missed sessions.

Outcome Measures

At baseline (T0), information about participants' demographics (educational level, marital status, and family composition) and comorbidities was gathered.

Primary outcome measure. The primary outcome—self-reported physical function—was measured with a subscale in the Dutch version of the Western Ontario and McMaster Universities Osteoarthritis Index (Dutch-WOMAC).[28,29] The WOMAC, a disease-specific measure of health status, is widely recommended for and used in OA research. To facilitate comparison of physical function with outcomes on the subscales of the Medical Outcomes Study 36-Item Short-Form Health Survey questionnaire (SF-36), we recoded all scores into a 100-point scale, with a score of 0 indicating the worst possible health condition and a score of 100 indicating the best possible health condition.

Secondary outcome measures. Additional measurements were obtained and divided into qualitative (eg, questionnaires) and quantitative measurements.

Information about stiffness and pain was gathered by means of 2 subscales of the Dutch-WOMAC. Like the scores on the WOMAC physical function subscale, the scores on the stiffness and pain subscales were recoded into a 100-point scale. An impression of health-related quality of life was acquired by use of the physical function, role–physical, bodily pain, and general health subscales of the SF-36[30] (100-point scale, with a score of 0 being the worst possible score and a score of 100 being the best possible score). Pain also was measured with a 10-point visual analog scale (VAS) score; the average hip pain experience was determined by asking the following question[31]: "Over the last period (3 and 5 months) of the exercise and weight loss program, the level of pain in my hip was . . . ." All VAS scores were recoded, with a score of 0 indicating "the worst possible pain" and a score of 10 indicating "no pain." Physical activity behavior was measured with the Short Questionnaire to Assess Health-enhancing Physical Activity (SQUASH).[32] The SQUASH is well known and is frequently used in the Netherlands to measure physical activity behavior.[33–36] The outcome on the SQUASH was the activity score, in minutes per week, measured for 3 intensity categories based on metabolic equivalents.

All questionnaires used are reliable and valid for use in the Dutch setting and were completed at home. In this way, possible unintended influences of an unmasked researcher on the results were prevented. When returned questionnaires were incomplete, participants were contacted by telephone to complete missing items.

Measurements of functional status and gait speed were obtained with the 6-minute walk test[37] and the 20-m walk test. The 20-m walk test is a short, safe test used to measure gait speed and is comparable to the 10-m walk test.[38,39] Participants walked indoors on a 20-m-long track, and the time (in seconds) needed to complete the walk was measured. Time recording was accomplished by use of electronic timing equipment with photocell gates (HL 2-31 Photocell, Tagheuer, la Chaux-de-Fond, Switzerland).

Weight was measured in kilograms with the use of a calibrated scale, and the fat-free measurement was obtained with a handheld impedance analyzer (model BF 306 Omron Body Fat Monitor, Omron Healthcare Europe BV, Hoofddorp, the Netherlands). The Omron Body Fat Monitor yields results similar to the percentage of body fat determined by dual-energy X-ray absorptiometry[40] and is a validated tool for measuring the percentage of body fat.[41,42]

Adherence

The adherence of participants to the individual and group exercise portions of the program and the weight loss portion of the program was recorded. Attendance was assessed by dividing the number of exercise sessions that participants actually attended by the number of sessions that they were asked to attend and multiplying the result by 100%. Catch-up sessions were possible in both parts of the combination pro-

gram (exercise and diet). Adherence to the home exercise portion of the program was not registered formally, although it was discussed with the participants before the start of the next weekly session.

The first measurements (questionnaires, walking tests, and body fat and weight measurements) were obtained before the combination program started (T0). The second measurements (T1) were obtained at the beginning of the group exercise portion of the combination program 3 months later (questionnaires and weight measurement), and the third measurements (T2) were obtained at the end of the combination program 8 months later (questionnaires, walking tests, and body fat and weight measurements).

Sample Size

A priori, the sample size calculation was based on the primary outcome (self-reported physical function), as measured with the Dutch-WOMAC. To assess the magnitude of a minimal difference, we used as a reference the study of Messier et al,[21] in which a combination of exercise and weight reduction in people with OA of the knee led to a significant improvement ($\alpha<.05$) in the primary outcome (self-reported physical function). Our power calculation was based on the magnitude of improvement in the WOMAC physical function score in the treatment arm of the study of Messier et al.[21] To detect a similar improvement (~25%) in self-reported physical function from the first measurement (T0) to the last measurement (T2) in people with OA of the hip, we determined that a minimum of 20 people would be needed in our study. This number was based on a power ($1-\beta$) of .80 and a significance level of 5% (2-sided). Taking into account a dropout rate of 20%, we determined that at least 25 people would need to be included in our study.

Data Analysis

The data were analyzed with the Statistical Package for the Social Sciences (PASW Statistics version 18.03.2010, IBM Corp, Armonk, New York). Descriptive statistics were used to describe the main characteristics of the group. Generalized estimating equations (GEEs) were used to investigate whether the participants, while being exposed to the intervention, showed statistically significant changes over time in primary and secondary outcome measures. The GEEs adjusted for the correlation between repeated observations from the same participant and could be used for longitudinal data from participants with various numbers of unequally spaced observations. An exchangeable correlation structure was assumed in all analyses. For all test procedures, a probability of $<.05$ was considered to be statistically significant. For confounding and effect modification analyses, the variables of age and sex were taken into account, and a significance level of $P<.01$ was considered to be statistically significant.

Role of the Funding Source

The study was funded by the Health Care Efficiency Fund, UMCG, Groningen, the Netherlands.

Results

The total number of eligible participants recruited through 5 different sources was 35. Participants who dropped out of the program (n=5) had too much pain (n=1), major depression (n=1), or an ankle fracture (n=1) or were unable to reach the AHCRR every week (n=2). These participants did not differ in age or BMI at baseline from those who completed the final measurements. The percentage of body fat was lower in participants who were lost to follow-up (31% versus 41%). Therefore, the group whose data were analyzed consisted of 30 participants, 57% of whom were women and 57% of whom were obese (Tab. 1).

Table 1.
Characteristic of 30 Participants Who Had Hip Osteoarthritis and Were Overweight or Obese[a]

Characteristic	Value
Age, y, $\bar{X}$ (SD)	56.9 (11.9)
Women, n (%)	17 (56.7)
Level of education, n (%)	
Low	14 (46.7)
Middle	8 (26.7)
High	8 (26.7)
Length of therapy, mo, $\bar{X}$ (SD)	8.3 (1.6)
BMI, kg/m^2, $\bar{X}$ (SD)	32 (3.9)
BMI category, n (%)	
25–30 kg/m^2	13 (43.3)
>30 kg/m^2	17 (56.6)
Body fat, %, $\bar{X}$ (SD)	41 (6.4)

[a] BMI=body mass index.

Primary Outcome Measure

The primary outcome was self-reported physical function, as measured with a subscale of the WOMAC. The GEE analysis revealed that over time, participants exposed to the intervention significantly improved their physical function scores to 64.8 and 70.3 after 3 and 8 months, respectively, compared with their baseline score of 53.0 (Fig. 2, Tab. 2). These data represent an improvement of 32.6% after 8 months. The results were similar for participants who were overweight or obese; there was no significant difference between the 2 BMI categories (data not shown).

Secondary Outcome Measures

Questionnaires. There were significant decreases in WOMAC pain, VAS pain, and SF-36 pain scores after 3 months and more prominent decreases after 8 months compared with the baseline scores. During the 8-month intervention, WOMAC pain scores decreased by 25.4% (Tab. 2). The SF-36 scores for physical func-

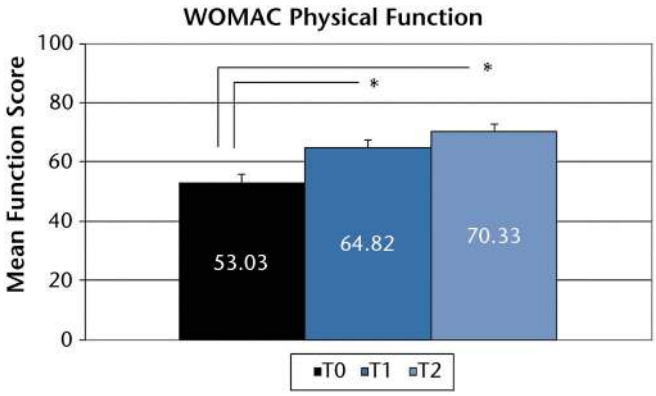

Figure 2.
Changes in physical function (as determined with generalized estimating equations). Data are presented as group mean and standard error (SE) for 90 observations at baseline (T0), after 3 months (T1), and after 8 months (T2). Asterisk indicates statistically significant change relative to the baseline.

tion and the perception of role–physical limitations also showed significant changes after 3 and 8 months (Tab. 2). The SF-36 score for the perception of general health showed a significant improvement only after 8 months. With regard to the activity scores determined with the SQUASH, only vigorous-intensity activities showed any change—an increase of 57 minutes per week (95% confidence interval [CI]=14.1 to 99.4) after 3 months ($P<.05$).

Walking tests. The results of both walking tests (6-minute walk test and 20-m walk test) showed significant improvements after 8 months (Tab. 2). Walking distance on the 6-minute walk test improved by 11.6%.

Weight and fat-free mass. After 3 and 8 months, there were significant decreases in body mass—2.8 kg (95% CI=−4.4 to −1.2, $P<.05$) and 5.6 kg (95% CI=−7.7 to −3.4, $P<.001$), respectively. The latter was a 5% reduction compared with the baseline value. Body fat, which was 41.0% at baseline, showed a significant reduction—3.3% (95% CI=−4.6 to −2.1)—after 8 months ($P=.000$).

Confounding and Effect Modification

No confounding was found for any of the outcome measurements. The GEE analysis revealed no effect modification by either sex or age at the baseline for changes in physical function or pain scores over time (data not shown).

Adherence

The level of adherence in both individual and group exercise portions of the program was 94%. The level of adherence in the diet portion was 82%.

Discussion

The results of the present study showed an improvement in self-reported physical function in participants who had hip OA and were overweight or obese after 8 months when they followed a program of exercise in combination with weight loss. The combination program resulted in a 32.6% improvement in self-reported physical function compared with that at baseline. This improvement exceeded the *a priori* desired improvement of 25%, as well as the minimal improvement of 12% that is considered clinically relevant by others.[43,44] The improvement reported in pain (25.4%) exceeded the minimal clinically important difference suggested by Tubach et al.[44] An improvement in quantitative measurements (eg, walking abilities) also was seen. To our knowledge, the effect of a program of exercise in combination with weight loss has not been studied before in people with hip OA.

Physical Function

To study the effects of a combination program on physical function in people with knee OA, Messier et al[21] conducted a randomized controlled trial and found a 24% improvement in the WOMAC physical function score after a 6-month combination program. We found slightly greater improvement for people with hip OA; this finding might be explained partly by the fact that our participants were, on average, 12 years younger and by the personal guidance in the exercise intervention. In the study of Messier et al,[21] the participants had to exercise 3 days per week at the facility for at least 4 months, after which they could opt for a home-based program or continuation at the facility. In our study, the participants came to the facility once per week for the entire 8-month program and exercised at home as well. This prolonged contact might have enhanced adherence to the program, resulting in slightly greater improvement in physical function in our study than in the study of Messier et al.[21] Another possible explanation is that our program allowed more time for adaptation to exercise to occur than did that in the study of Messier et al.[21] The improvement in physical function was markedly higher in our study than in the study of Rejeski et al.[45] The latter study included follow-up of people who were obese, had knee OA, and received an intervention of exercise in combination with weight loss[45]; the authors of that study reported an improvement in self-reported physi-

cal function of 8.5 points after 18 months, as measured with the SF-36. We found a 21.5-point improvement after 8 months in the present study. Again, the fact that our participants were 12 years younger might have contributed to this difference. Another possible explanation is that a washout of the effect occurred after an early intervention and a follow-up at 18 months in the study of Rejeski et al.[45]

For people with hip OA, previous research focused on the effects of an exercise-only program, not a program of exercise in combination with weight loss; this fact could explain the greater improvement observed in our study. In the study of Juhakoski et al,[46] which involved exercise administered in 12 weekly sessions at a facility and then home-based exercises, participants showed a 15.7% increase in WOMAC physical function scores after 6 months. An additional possible explanation for the greater improvement in our study (32.6%) is the shorter duration of the exercise program in the study of Juhakoski et al[46] (3 months versus 8 months).

Pain

Besides the positive effect on physical function, our program of exercise in combination with weight loss resulted in a decrease in pain after 8 months. The WOMAC pain score decreased by 25.4%; this decrease is comparable to the results obtained for people with knee OA in the study of Messier et al[21] (24.8%) and slightly greater than what Rejeski et al[45] found (12.2 points for SF-36 bodily pain in their study versus 19.2 points in our study). A difference in inclusion criteria regarding BMI could have accounted for the latter difference. Our study included people who had a BMI of 25 kg/m^2 or higher, resulting in a mean BMI of 32 kg/m^2, whereas Rejeski et al[45] included people with a BMI of 28 kg/m^2 or higher, resulting in a mean BMI of 34 kg/m^2. A possible explanation for the different results is that the high loading impact of weight on the joint[47] contributes to the extent of pain symptoms.

In people with hip OA, the effect on pain of an exercise-only program was markedly inferior to the effect of our combination program; Juhakoski et al[46] found a decrease in the WOMAC pain score of only 7.1%

Table 2.
Qualitative and Quantitative Outcomes Over Time[a]

Variable	Score, $\bar{X}$ (SE)	Time	Change in Score (95% CI)[b]
Qualitative results			
WOMAC physical function	53.0 (2.9)	T0	0
	64.8 (2.3)	T1	11.8 (7.4 to 16.2)
	70.3 (2.7)	T2	17.3 (12.1 to 22.5)
WOMAC pain	59.8 (2.2)	T0	0
	69.7 (2.7)	T1	9.9 (4.6 to 15.1)
	75.0 (3.0)	T2	15.2 (9.4 to 21.0)
WOMAC stiffness	49.6 (3.6)	T0	0
	60.9 (2.8)	T1	11.3 (5.7 to 16.8)
	66.4 (2.3)	T2	16.8 (12.3 to 21.4)
VAS pain	3.7 (0.3)	T0	0
	6.2 (0.4)	T1	2.5 (1.7 to 3.3)
	6.8 (0.4)	T2	3.1 (2.3 to 4.0)
SF-36 physical function	45.6 (3.2)	T0	0
	58.1 (2.5)	T1	12.5 (7.7 to 17.4)
	67.1 (3.4)	T2	21.5 (14.8 to 28.1)
SF-36 role–physical	35.8 (7.3)	T0	0
	60.5 (7.7)	T1	24.7 (9.7 to 39.7)
	72.6 (9.7)	T2	36.8 (17.8 to 55.9)
SF-36 bodily pain	52.5 (3.0)	T0	0
	63.6 (2.8)	T1	11.1 (5.7 to 16.6)
	71.7 (4.7)	T2	19.2 (10.0 to 28.4)
SF-36 general health	61.9 (3.9)	T0	0
	67.3 (3.2)	T1	5.4 (−0.9 to 11.7)[c]
	71.3 (3.0)	T2	9.4 (3.4 to 15.3)
Quantitative results			
6-min walk test (m)	433.3 (13.5)	T0	0
	481.4 (10.9)	T2	48.1 (26.7 to 69.4)
20-m walk test (s)	15.3 (0.3)	T0	0
	14.1 (0.3)	T2	−1.2 (−1.8 to −0.6)

[a] Results of analyses with generalized estimating equations. Relative to the baseline, all changes were significant ($P<.05$), unless otherwise noted. CI=confidence interval, WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index, T0=baseline, T1=after 3 months, T2=after 8 months, VAS=visual analog scale, SF-36=Medical Outcomes Study 36-Item Short-Form Health Survey questionnaire.
[b] The baseline score was set to zero and was used as a reference.
[c] Not a significant change relative to the baseline.

after 6 months (25.4% in our study), and Tak et al[48] found a decrease in pain measured with a VAS of only 7% (84% in our study). However, our baseline pain score (3.7) was lower than that in the study of Tak et al[48] (6.2); therefore, a regression to the mean effect in our study was possible. Besides the fact that Tak et al[48] used an exercise-only program, other factors, such as the length of the intervention (8 weeks versus 8 months), could have contributed to the difference in results for pain.

Quantitative Measures

For the quantitative outcome measures (walking distance and weight loss), the findings were similar. The significant improvement of 11.1% in the 6-minute walking distance in our study was comparable to the improvement of 15.9% after 6 months in people with knee OA,[21] yet it was considerably higher than the results of an exercise-only program in people with hip OA; in the latter study,[38] improvements of only 5% and 4% were seen after 3 and 12 months, respectively. The amount of weight loss was also comparable to that reported after a combination program in people with knee OA (5%).[21,45] Our additional measurement of loss of body fat (3.3%) was not analyzed in previous studies.

Physical Activity

Despite the overall promising effect of the combination program, no significant change in self-reported activity could be demonstrated in our study. Adherence to the program was good, so participants had at least 1 scheduled active encounter per week. It is possible that participants did not perform their usual activities because they were participating in the program; this factor could have resulted in a shift in activities rather than an increase. Another possible methodological explanation for not finding a statistically significant difference is the fact that our power calculation was based on self-reported physical function, as measured with the WOMAC. Self-reported physical activity was a secondary outcome measure, and it is likely that a larger group of participants is needed to find significant differences.

Strengths and Limitations

To our knowledge, the present study is the first to investigate exercise and weight loss as a combination treatment for people with hip OA. Research on this conservative treatment has so far been lacking for people with hip OA. The fact that our participants originated from diverse sources provided good generalizability for the average person who has hip OA but has not yet had hip arthroplasty. In addition, there was outstanding adherence to the study protocol by the participants: 94% in both individual and group exercise portions of the program and 82% in the diet portion. The group of participants in the present study was relatively small. However, the power of the study was not adversely affected because a *post hoc* power calculation with the obtained data instead of the results of others revealed a power of almost 100%. It was therefore possible to detect clinically relevant changes in the primary outcome measure at the 3 measurement points.

The major limitation of our study is that it was a cohort study. Although our results seem promising and are comparable to those found in the intervention arm of randomized controlled trials performed in people with knee OA (eg, Messier et al,[21] Rejeski et al[45]), they must be confirmed in a randomized controlled trial because a placebo effect cannot be ruled out. Furthermore, the results reported here were obtained immediately after the 8-month intervention, a short-term period; it is not known whether the positive effect will be long-term. Finally, adherence to the home exercise portion of the program was not registered formally; in future research, either self-report instruments or quantitative instruments, such as accelerometers, need to be used to monitor adherence.

Five participants dropped out before the completion of the primary outcome measure (WOMAC questionnaire) and were not involved in the effect analyses. Their available characteristics (age, BMI, and body fat percentage) were comparable to those of the participants who completed the program. Reasons for not participating in the program and the study were not related to either age or BMI and included ankle fracture and depression. Therefore, the effect of these dropouts on the outcome can be considered negligible.

Future Research

Future research in a randomized controlled setting is needed to determine the effect of exercise and weight loss as a combination treatment for people with hip OA. Such research also should determine whether the positive effect can be maintained beyond 8 months and can postpone hip replacement. If proven effective in a randomized controlled setting, the combination of exercise and weight loss can be added as a nonpharmacological intervention option for medical professionals, such as physical therapists, orthopedic surgeons, and general practitioners, involved in the treatment of people with hip OA.

Conclusion

Overall, we concluded that the cohort study provided preliminary evidence of the effectiveness of a program of exercise in combination with weight loss. Our findings should be confirmed in a randomized controlled trial.

Ms Paans, Dr Akker-Scheek, and Dr Stevens provided concept/idea/research design and project management. Ms Paans, Dr Akker-Scheek, Dr van der Meer, Dr Bulstra, and Dr Stevens provided writing. Ms Paans, Ms Dilling, and Ms Bos provided data collection. Ms Paans provided data analysis. Ms Dilling provided study participants. Ms Dilling and Ms Bos provided facilities/equipment. Dr Akker-Scheek, Dr van der Meer, and Dr Bulstra provided consultation (including review of manuscript before submission). The authors are grateful to all physical therapists of the Allied Health Care Center for Rheumatology and Rehabilitation, Hilberdink, and the participants who joined the study. They thank Roy Stewart for his advice about statistical analysis and help.

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Effect of Exercise and Weight Loss in People Who Have Hip Osteoarthritis and Are Overweight or Obese: A Prospective Cohort Study

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