Aquatic fitness training for children with juvenile idiopathic arthritis

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Abstract

Objective
To evaluate the effects of an aquatic training program for JIA-patients.

Methods
Fifty-four patients with JIA (age range 5 to 13 years) participated in this study and were randomised into an experimental (N = 27) and a control (N = 27) group. The children in the experimental group received a training program consisting of a 1 hour a week supervised training program in a local pool of approximately 20 sessions. Effects were analysed on the following domains: functional ability, health-related quality of life, joint status and physical fitness.

Results
Although all measures improved more in the experimental group compared to the control group, none of the differences became statistically significant.

Conclusion
The current research found no significant effect of an aquatic fitness-training program in children with JIA. Since there were no signs for worsening in health status, one can conclude that this was a save exercise program.
Introduction

Patients with Juvenile Idiopathic Arthritis (JIA) show a decreased physical fitness compared to healthy children. JIA patients perform also less strenuous physically activities compared to their healthy peers, and are often restricted in their activities of daily living. They may experience a limitation in functioning in one or more joints, stiffness or fatigue due to the arthritis. This may have considerable impact on the patients daily functioning. For decades, rest was thought to be, besides medication, the predominant treatment for children with JIA and adults with rheumatoid arthritis (RA). This attitude recently altered. In the past, major concerns were on the detrimental effects of physical exercise; now-a-days evidence is growing on the beneficial effects of regular exercise for arthritis patients. Since aquatic therapy has been used for centuries to treat musculoskeletal disorders, and has proven to be safe in adult RA patients, and a very enjoyable form of therapy for children, we developed an aquatic aerobic physical training program for JIA patients.

Previously published studies on the effects of physical training programs for JIA patients were small pilot studies, were not controlled by randomisation, and had small sample size. In a previous publication we described the pilot study for this larger randomised clinical trial. In the previous conducted studies on this topic in JIA, the main focus was on improvements in physical fitness and on impairments like joint swelling and range of motion. None of the previous studies used contemporary, and recently validated, functional assessment tools (e.g., Childhood Health Assessment Questionnaire) as outcome measure for their study. As these instruments are more and more accepted as outcome measures in clinical trials in paediatric rheumatology, it is important for the comparison with other studies, to include these instruments as an outcome measure in an intervention study. Therefore, we studied the effects of an aquatic training program, on physical fitness, functional ability, joint status, and health-related quality of life in a randomised-controlled design.

Methods

Subjects
Fifty-four patients (40 girls, 14 boys) diagnosed with JIA, where recruited from the paediatric rheumatology outpatient clinics of the Wilhelmina Children’s
Hospital, University Medical Center Utrecht, the Netherlands and the University Hospital Groningen, the Netherlands. Inclusion criteria were: diagnosed with JIA by a medical specialist (EULAR-criteria or ILAR-criteria\textsuperscript{14}; a phase of remission without medication of no longer than 6 months in the absence of joint pain, tenderness, and/or morning stiffness and a erythrocyte sedimentation rate within normal limits. All patients were receiving a local and/or a systemic arthritis related therapy consisting of NSAID’s and/or Disease Modifying Anti-Rheumatic Drugs and/or Immunosuppressive medication and/or steroids in the last 6 months prior inclusion.

Exclusion criteria were: a systemic disease with fever, low haemoglobin level and a general feeling of malaise; exercise contraindication by medical specialist; having received a bone marrow transplantation; and not feeling confident in water. The characteristics of the patients are described in Table 1. The children and parents were informed of all aspects of the study, and written consent was obtained. The human ethical committees of the University Medical Center Utrecht/Wilhelmina Children’s Hospital and the University Hospital Groningen approved the study.

Design
Patients were stratified to disease subclass (two strata: an oligoarticular JIA group and a polyarticular (with or without systemic onset) JIA) and individually randomly assigned to the assessment only group (Con-group) or the training group (Exp-group) by an off-site data-manager. Three measurements were included in the study protocol, (T1) just before the start of the training program, (T2) 3 months after start, and (T3) immediately after the end of the training program. The investigators and the subjects were blinded for previous measurements at each stage of the evaluation; the investigators and subjects were not blinded for the group allocation of each subject.

Training program
All patients received the usual care and medical treatment during the study. The patients in the Exp-group received an aquatic group (2-4 children/group) exercise program, 1 hr a week, supervised by an instructed community physical therapist. If there was only one patient at a certain training location, the patient was allowed to bring a relative or friend to join the training program. The training took place in heated (30-33°C) community-based pools at twenty different locations throughout The Netherlands. The training program was conducted within
a half-year period. Due to holidays, seasonal holidays and pool maintenance, the program consisted of approximately twenty training sessions on the different locations.

The program was available on paper and on instructional videotape, and consisted predominantly of aerobic exercises. Training sessions were based on the same framework. The training started with a warm-up, followed by an aerobic conditioning part, a short rest period, again followed by a second conditioning part. The training ended with a cooling-down. The warm-up, rest, and cooling down periods consisted of low intensity swimming, aquarobics, play, flexibility exercises, or ball games. The conditioning parts consisted mainly of high intensity swimming, diving, walking through the water, aqua jogging, or splashing with the legs. The duration and intensity of both conditioning parts increased step-wise during the program. During the training sessions the heart rates of the patients were measured using a portable heart-rate monitor (Polar Accurex Plus, Polar Oy, Kempele, Finland) to monitor the training intensity.

**Functional ability**

Functional ability was measured using the Childhood Health Assessment Questionnaire (CHAQ)\textsuperscript{15} and the Juvenile Arthritis Functional Assessment Scale (JAFAS)\textsuperscript{16}. The Dutch translation of the CHAQ\textsuperscript{17} was used as a self-administered pencil and paper questionnaire for the parents (proxy). The CHAQ has been adapted from the Stanford Health Assessment Questionnaire so that at least one question in each domain is relevant to children aged 0.6 to 19 years. The questionnaire consists of 30 items divided into 8 domains. The question with the highest score within each domain (range 0 to 3; able to do with no difficulty = 0, able to do with some difficulty = 1, able to do with much difficulty = 2, unable to do = 3) determined the score for that domain, unless aids or assistance was required (raising the score for that domain to a minimum of 2). The mean of the scores on the eight domains provided the CHAQ disability scale (range 0 to 3) and was chosen as the primary outcome measure of this study.

The Juvenile Arthritis Functional Assessment Scale (JAFAS)\textsuperscript{16} is a performance test assessing disability in children with JIA. This test includes 10 activities of daily living. Time to perform each individual item is recorded and compared to a reference time. Each item was scored on a scale from 0-2 (able to perform the task within reference time = 0, perform the task slower than reference time = 1, not able to perform the task = 2).
Health-related Quality of Life
Health-related quality of life was assessed with a Dutch translation of the Juvenile Arthritis Quality of Life Questionnaire (JAQQ)\(^\text{18}\) and the Child Health Questionnaire (CHQ)\(^\text{17}\).

The JAQQ is a recently developed disease-specific health-related quality of life questionnaire for children with arthritis\(^\text{18}\). The JAQQ was administered to the patients; it consists of 74 items divided into five subclasses (gross motor function, fine motor function, psychosocial function, general symptoms, and a pain assessment section). The patients scored each item on a 7-point Likert-scale according to how often they encountered problems during the last 14 days (none of the time=1, hardly any of the time=2, some of the time=3, half of the time=4, most of the time=5, almost all of the time=6, all of the time=7). The score on the JAQQ was calculated as the sum of the five highest scores in each domain of the JAQQ. A higher score indicates a worse health-related quality of life.

The Child Health Questionnaire Parent-Form 50 (CHQ)\(^\text{17}\) is a parent proxy report of assessing general health. A Dutch translation of the CHQ was used in this study\(^\text{17}\). The questionnaire consists of 50 items in 14 dimensions. From these dimensions a summery can be calculated for physical (CHQ-PhS) and psychosocial health (CHQ-PsS). The CHQ was administered to the parents; a higher score reflects a better health status of the child.

Joint Status
Joint status was assessed by the number of tender and swollen joints and the range of motion. Tenderness and swelling were scored for the following joints: temporomandibular, sternoclavicular, shoulder, elbow, wrist, thumb, knee, ankle, and toes. Joint mobility was scored on the Paediatric Escola Paulista de Medicina Range of Motion Scale (pEPMROM)\(^\text{19}\). The pEPMROM measures mobility in children with JIA based on the evaluation of joint range of motion. Ten joint movements (cervical spine rotation, shoulder abduction, wrist flexion and extension, thumb flexion [metacarpophalangeal], hip internal and external rotation, knee extension, and ankle dorsiflexion and plantar flexion) were examined using a goniometer and classified on a 4-point Likert scale (0 = no limitation, 3 = severe limitation). The final score was calculated as the sum of each movement score divided by 20.
Physical Fitness

The physical fitness of the patients was assessed using a maximal exercise test (MXT) and a sub maximal 6-minute walking test. Subjects underwent a MXT on an electronically braked cycle ergometer (Lode Examiner, Lode BV, Groningen, and The Netherlands). The patients who did not fit on this ergometer were tested on a mechanically braked ergometer (Tunturi, Finland). The seat height was adjusted to the patient’s leg length. Three minutes of unloaded cycling preceded the application of resistance to the ergometer. Thereafter, the workload was increased in constant increments of 20 watts every 3 minutes. This protocol continued until the patient stopped due to volitional exhaustion, despite strong verbal encouragement from the experimenters. During the test the subjects breathed through a facemask (Hans Rudolph Inc., Kansas City, MO) connected to a calibrated metabolic cart (Oxycon Champion, Jaeger, Breda, The Netherlands). Expired gas was passed through a flow meter, an oxygen (O₂) analyser, and a carbon dioxide (CO₂) analyser. The flow meter and gas analysers were connected to a computer, which calculated breath-by-breath minute ventilation (VE), oxygen consumption (VO₂), carbon dioxide production (VCO₂), and respiratory exchange ratio (RER) from conventional equations (Jaeger Masterlab Software, Jaeger, Breda, The Netherlands). Heart rate (HR) was measured continuously during the maximal exercise test by a bipolar electrocardiogram. Absolute peak oxygen consumption (VO₂peak) was taken as the average value over the last 30 seconds during the maximal exercise test.

Sub maximal endurance was measured using the 6-minute walking test, as recommended for patients with arthritis²⁰. The 6-minute walking test was performed on an 8-meter track in a straight corridor. The patients were instructed to walk at their own chosen walking speed from one side of the corridor to the other, turn, and walk back. The total distance covered in 6 minutes was calculated as the counted “repetitions” and multiplied by 8 meters. Time was measured with a stopwatch. During the test standardised verbal encouragements from the test leader were used to encourage the subjects. Before the assessment of physical fitness, anthropometric measurements were taken: height, weight and skin fold thickness, as previously described²¹.

Statistical analysis

All data were entered into SPSS data entry 3.0 and analysed using SPSS-base 10.0 for Windows (SPSS Inc, Chicago, Ill.). General Linear Model (repeated measures ANOVA group (2)x time (3)) was used to analyse the effects of the aerobic aquatic
training program. Greenhouse-Geisser Epsilon was used for adjusting the degrees of freedom when the sphericity assumption was not met. Alpha level < 0.05 was considered as statistically significant.

Results

Descriptive characteristics of the subjects at baseline are presented in Table 1. No significant differences were found at baseline between the Exp-group and Con-group on CHAQ, JAFAS, JAQQ, CHQ-PsS, CHQ-PhS, joint status, and physical fitness levels.

The patients conducted a mean number of 19.6 ± 3.9 training sessions. There was one dropout during the training program; one boy (13 years old with an OJIA onset type) stopped the training program after 15 training sessions. Since he still met the 75% criteria of 20 sessions, his data were not excluded from the analysis.

Functional ability

For the CHAQ and the JAFAS, mean scores and standard deviations of each group are at baseline are presented in Table 2. A lower score on both instruments means better performance on functional ability and functional skills. Table 2 shows F-values of the main effect of time, and the main effect of group x time interaction. No significant effects were found, however the Exp-group improved 27% in CHAQ score, while the Con-group improved only 5%.

Table 1. Subject characteristics of the study participants.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age</th>
<th>Weight</th>
<th>Height</th>
<th>Skin folds</th>
<th>Onset type</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp-group</td>
<td>8.66±2.3</td>
<td>31.9±10.1</td>
<td>1.34±0.1</td>
<td>86.0±43.5</td>
<td>11 ojia, 15 pjia, 1 sjia</td>
<td></td>
</tr>
<tr>
<td>Con-group</td>
<td>8.88±1.9</td>
<td>30.3±9.1</td>
<td>1.33±0.1</td>
<td>80.7±27.36</td>
<td>12 ojia, 14 pjia 1 sjia</td>
<td></td>
</tr>
</tbody>
</table>

Values are mean ± standard deviation, age in years, weight in kg, height in meters, skin folds = sum of 7 different skin fold sites, ojia = oligoarticular JIA, pjia = polyarticular JIA, sjia = systemic JIA, m = male, f = female.
The scores on the JAFAS were very low (a mean score of 0.15 at baseline for the EXP-group). The range of the JAFAS is from 0 to 2, a score of 0.15 is very close to the lowest possible score on this instrument, this phenomenon, a so-called floor-effect, would make improvement on this instrument hardly possible.

**Health-related quality of life**

JAQQ and CHQ-50 (divided into a physical summary and a psychological summary), mean scores, standard deviations, and the F-values of the main effect of time, and the main effect of group x time interaction are presented in Table 3. There was a trend for the Con-group to deteriorate in JAQQ-score (-15%), as the Exp-group remained stable throughout the intervention period (0% change). However differences between the two groups did not reach statistical significance.

The Exp-group showed small improvement overtime on both CHQ summaries (8.4% and 7% respectively), while the Con-group decreased slightly (PhS -4%) or remained stable (0% PsS). These changes were almost reached statistically significance.

**Joint status**

Mean scores, standard deviations, and the F-values of the main effect of time, and the main effect of group x time interaction of both swollen and tender joints, and pEPMROM are presented in Table 4. The number of swollen and tender joints decreased in the Exp-group (-55%), while the number of swollen and tender joint increased in the Con-group (+21%). These differences were almost statistically significant (p=0.07).

For the range of motion (pEPMROM), there were no significant changes over time as both groups showed a very small decrease over time (18 and 30 % for swollen and tender joints, and pEPMROM respectively).

**Physical fitness**

Results on VO$_{2peak}$ and the distance covered on the 6-minute walking test, mean scores, standard deviations, F-values of the main effect of time, and the main effect of group x time interaction are presented in Table 5. VO$_{2peak}$ remained stable during the training period for both the Exp-group (0% change) and Con-group (-3% decrease). The 6-min walk improved slightly (+3%; non-significant) in the experimental group, while it did not change in the Con-group.
Table 2. Mean scores and standard deviations for both groups, and statistics of the analysis of variance for the functional ability instruments CHAQ and JAFAS.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
</tr>
<tr>
<td>T1 M (SD)</td>
<td>T2 M (SD)</td>
</tr>
<tr>
<td>CHAQ†</td>
<td>F</td>
</tr>
<tr>
<td>Exp-group</td>
<td>0.65±0.54</td>
</tr>
<tr>
<td>Con-group</td>
<td>0.875±0.77</td>
</tr>
<tr>
<td>JAFAS</td>
<td>F</td>
</tr>
<tr>
<td>Exp-group</td>
<td>0.14±0.12</td>
</tr>
<tr>
<td>Con-group</td>
<td>0.22±0.36</td>
</tr>
</tbody>
</table>

(T1): Baseline =, before the start of the training program, (T2) = 3 months after start, (T3) = immediately after the end of the training program, M = mean, SD = standard deviation, F = F-value, Sig = P-value, * p < 0.05, ** p < 0.001, † = adjusted using Greenhouse-Geisser Epsilon.
Table 3. Mean scores and standard deviations for both groups, and statistics of the analysis of variance for the health-related quality of life instruments JAQQ and CHQ.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 M (SD)</td>
<td>T2 M (SD)</td>
</tr>
<tr>
<td><strong>JAQQ</strong>†</td>
<td></td>
</tr>
<tr>
<td>Exp-group</td>
<td>12.4±5.6</td>
</tr>
<tr>
<td>Con-group</td>
<td>14.3±5.0</td>
</tr>
<tr>
<td><strong>CHQ-PhS†</strong></td>
<td></td>
</tr>
<tr>
<td>Exp-group</td>
<td>48.79±11.14</td>
</tr>
<tr>
<td>Con-group</td>
<td>44.27±13.11</td>
</tr>
<tr>
<td><strong>CHQ-PsS</strong></td>
<td></td>
</tr>
<tr>
<td>Exp-group</td>
<td>50.24±7.27</td>
</tr>
<tr>
<td>Con-group</td>
<td>49.32±8.98</td>
</tr>
</tbody>
</table>

(T1): Baseline = before the start of the training program, (T2) = 3 months after start, (T3) = immediately after the end of the training program. M = mean, SD = standard deviation, F = F-value, Sig = P-value, * = p< 0.05, ** = p< 0.001, † = adjusted using Greenhouse-Geisser Epsilon.
Table 4. Mean scores and standard deviations for both groups and statistics of the analysis of variance for the joint status: number of Swollen and Tender Joints and pEPMROM.

<table>
<thead>
<tr>
<th>Assessment Effect</th>
<th>T1 M (SD)</th>
<th>T2 M (SD)</th>
<th>T3 M (SD)</th>
<th>Time</th>
<th>Group x Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swollen &amp; Tender joints</td>
<td>F</td>
<td>Sig.</td>
<td>F</td>
<td>Sig.</td>
<td></td>
</tr>
<tr>
<td>Exp-group</td>
<td>2.5 ± 2.7</td>
<td>2.2 ± 2.5</td>
<td>1.11 ± 1.3</td>
<td>0.92</td>
<td>0.41</td>
</tr>
<tr>
<td>Con-group</td>
<td>2.9 ± 4.7</td>
<td>3.6 ± 5.1</td>
<td>3.6 ± 4.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pEPMROM</td>
<td>F</td>
<td>Sig.</td>
<td>F</td>
<td>Sig.</td>
<td></td>
</tr>
<tr>
<td>Exp-group</td>
<td>0.11 ± 0.19</td>
<td>0.15 ± 0.26</td>
<td>0.13 ± 0.22</td>
<td>3.0</td>
<td>0.08</td>
</tr>
<tr>
<td>Con-group</td>
<td>0.23 ± 0.39</td>
<td>0.22 ± 0.42</td>
<td>0.3 ± 0.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(T1): Baseline = before the start of the training program, (T2) = 3 months after start, (T3) = immediately after the end of the training program, M = mean, SD = standard deviation, F = F-value, Sig = P-value, pEPMROM = Escola Paulista de Medicina range of motion scale, * p< 0.05, ** p< 0.001.
Table 5. Mean scores and standard deviations for both groups, and statistics of the analysis of variance for physical fitness measures VO2peak and the 6-minute walking test.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>T1 M (SD)</th>
<th>T2 M (SD)</th>
<th>T3 M (SD)</th>
<th>Time</th>
<th>Group x Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2peak†</td>
<td></td>
<td></td>
<td></td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Exp-group</td>
<td>1.11 ± 0.32</td>
<td>1.21 ± 0.41</td>
<td>1.11 ± 0.41</td>
<td>7.746</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.736 .46</td>
</tr>
<tr>
<td>Con-group</td>
<td>1.07 ± 0.35</td>
<td>1.12 ± 0.34</td>
<td>1.00 ± 0.34</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6-mwt†</th>
<th></th>
<th></th>
<th></th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp-group</td>
<td>455.0 ± 71.8</td>
<td>471.1 ± 78.8</td>
<td>471.9 ± 67.58</td>
<td>1.281</td>
<td>.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.395 .63</td>
</tr>
<tr>
<td>Con-group</td>
<td>458.1 ± 76.9</td>
<td>469.4 ± 86.6</td>
<td>457.1 ± 105.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(T1): Baseline = before the start of the training program, (T2) = 3 months after start, (T3) = immediately after the end of the training program, M = mean, SD = standard deviation, F = F-value, Sig = P-value, VO2peak = maximum oxygen consumption (L · min⁻¹), 6-mwt = 6-minute walking test, * p< 0.05, ** p< 0.001, † = adjusted using Greenhouse-Geisser Epsilon.
Discussion

The aim of this study was to determine the effects of an aquatic training program for JIA patients on functional ability, quality of life, joint status, and physical fitness. We found no statistical significant effects of a 20-week aquatic training program for JIA patients on functional ability, quality of life, joint status, and physical fitness. However, there was a clear trend of an improved joint status during the training program. The small, non-significant effects could be explained by the chosen outcome measures. We hypothesised the aquatic exercises would improve physical fitness. This increased physical fitness could result in a better function ability, and increases in health-related quality of life. However this transfer of the training effects seems very difficult. Numerous exercise studies in adult RA patients found improvements in physical fitness, joint pain, morning stiffness and fatigue, but no clear improvements in functional ability\(^{22,23}\). In our study, the largest effects were found in the joint status domain.

The aquatic training did not improve the VO\(_{2\text{peak}}\) of leg exercise on the bicycle ergometer, maybe an arm exercise protocol would have shown improvements, since as lot of exercises in the program were performed using both legs and arms.

Moreover, the used outcome instruments might have lacked the sensitivity to detect the training effects. The majority of the instruments (CHAQ, CHQ, JAFAS, pPEMRROM, JAQQ) are developed and validated as discriminative instruments for disability, and not yet as an outcome for effect studies. However, in clinical practice they are used frequently for evaluative purposes, and the Paediatric Rheumatology International Trials Organisation selected some of them for trial evaluation (CHAQ and CHQ). Van den Ende et al.\(^{24}\) found a very limited sensitivity to change of the adult version of the CHAQ, the HAQ, in an exercise trial with adult RA patients. The value of the CHAQ for detecting changes due to an exercise-training program might be limited.

The lack of improvements in the current study could also be the result of a limited trainability of children with JIA. Even in healthy children, some investigators have found no or small effects in physical fitness of exercise training programs\(^{25}\), but data more or less confirm this finding for JIA patients. A meta-analysis of all available exercise training programs showed on average an eight percent increase in physical fitness in healthy children\(^{26}\). Compared to adults, the degree of aerobic trainability is somewhat limited in children. Additionally, for
detrained, chronically ill patients it might not be possible to adhere programs based on adult standards for intensity and duration. They might be compromised in their level of trainability.

For children with arthritis there are some guidelines available. However, they are based on preliminary-evidence\textsuperscript{27}. Moderate intensity exercise, as in our program, will facilitate most of the disease prevention and health promoting effects of exercise\textsuperscript{28}, however these are long-term effects of exercise training.

Our program lasted approximately a half-year, however, healthy peers participate for years in certain sport activities like soccer, cycling, tennis, or athletics. A long-term exercise training study (> 2 years) would be of interest to perform in the current patient group.

Our results clearly indicated however, that our program, as measured by joint status does not negatively influence the disease process. As parents and JIA patients were highly interested to participate in adapted physical training programs, this study shows that an aquatic training program could be a valuable adjunct to the common medical care of children with JIA.

Limited information is available concerning changes in physical fitness and functional ability in JIA patients following an exercise-training program. Thus more research is needed in this area. From a practical point of view, it was not possible to increase the frequency of the training (i.e. two training sessions a week), busy family schedules and a limited pool access do not allow higher training frequencies. The inclusion of a home-based exercise part (land-based) should be considered in a future study. This might also support patients, and parents in achieving a more active life style.

The lack of significant improvements in the training group also shows the importance of an active life style for children with JIA. The current research project shows that it is very difficult to improve physical fitness. The sound bite “it is easier to maintain good health through proper exercise, diet and emotional balance than to regain it once it is lost” might be also true for JIA patients.

Conclusion

With the advances in the medical treatment of JIA patients using new and successful treatments the interest in adapted physical training programs is increasing. The effects of adapted training programs are not well investigated. The current research found small, non-significant effects of an aquatic fitness-train-
ing program in children with JIA. Since there were no signs for worsening in health status, one can conclude that this was a safe exercise program. As there are lot of different exercise modalities, effort should be invested to create and investigate the safety and effectiveness of exercise training programs for children with JIA.

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References


