Escalante Y, García-Hermoso A, and Saavedra JM. Effects of exercise on functional aerobic capacity in lower limb osteoarthritis: A systematic review. Journal of Science and Medicine in Sport 2011; 14:190–198.

Design: Systematic Review and meta-analysis of randomized clinical trials
Date: 5-8-15 LM

Study Question: To summarize evidence for the effectiveness and structure of different physical exercise programs on functional aerobic capacity (ability to perform activities of daily living that require sustained aerobic metabolism) in patients with hip and knee osteoarthritis.

PICOs:

- **Patients:** Adults with hip or knee osteoarthritis (OA) according to the criteria of the American College of Rheumatology.
- **Interventions:** Physical exercise
- **Comparison interventions:** Standard care or non-exercise interventions
- **Outcomes:** Functional aerobic capacity using the 6 minute walk test
- **Study types:** Randomized controlled trials (RCTs) or quasi-experimental studies

Study selection:

- Databases included MEDLINE, CINAHL, Index Medicus, Science Citation Index, Scopus, SPORTDiscus, and PEDro through August 15, 2010. All dates and languages were eligible for inclusion.
- Two review authors independently screened articles by title and abstract for trial inclusion utilizing predetermined eligibility criteria and resolved any disagreements by consensus with a third author.
- Included studies were required to have an exercise intervention program for a duration of at least 4 weeks and assess aerobic capacity using the 6 minute walk test. This is an objective test that measures physical function and is simple and safe to use. Participants are asked to walk a far as they possibly can in 6 minutes and performance is measured as the total distance covered in feet or meters.
- The methodological quality or risk of bias of the studies was evaluated according to the Delphi List. The Delphi List sets eight criteria as indicators of the quality of trials: (i) treatment allocation (randomization, concealed treatment allocation); (ii) the groups had similar baselines; (iii) the eligibility criteria were specified; (iv) the outcome was assessor blinded; (v) the care was provider blinded; (vi) the patient was blinded; (vii) point estimates and measures of variability were presented for the primary outcome measures; and (viii) an intention-to-treat analysis was included.
- Effect sizes (ES) and 95% confidence intervals (CI) were calculated, and the heterogeneity of the studies was assessed using Cochran's Q statistic applied to the ES means. An effect size was considered small if ≤ 0.2, medium if 0.2-0.5, and large if > 0.5.
- Included studies were grouped into five categories according to the characteristics of the exercise program: land-based interventions (strength programs, tai chi, aerobic programs, and mixed exercise programs) and aquatic intervention (hydrotherapy).

The pooled data for studies in each category of exercise (except strength programs) were combined to calculate treatment effect sizes, and to obtain a summary estimate. The percentage of total variation across the studies due to heterogeneity was determined using I^2, with the magnitude of the inconsistency taken as follows: small if $I^2 \leq 25\%$; medium if $25\% < I^2 \leq 50\%$; and large if $I^2 > 50\%$.

Results:

- Overall 20 studies with a total of 2142 participants with symptomatic hip or knee OA were included. Nineteen were RCTs and one was a controlled clinical trial. Only six RCTs had more than 50 participants in each allocation. Only 4 of 13 RCTs used in the pooled analyses had more than 50 participants in each allocation.
- The number of studies that were grouped into each of the 5 categories of exercise programs was as follows: land-based interventions (strength program – 2 studies; tai chi program – 3 studies; aerobic programs – 4 studies; mixed exercise programs – 8 studies), and aquatic intervention (hydrotherapy program – 3 studies). Not all studies were included in the pooled results for each category of exercise.
- The dosages (frequency, duration, and session length) of the exercise interventions varied greatly among all the studies. Duration of the exercise programs ranged from 4 to 72 weeks. Most programs provided 3 sessions per week, but the range was 2 to 5 sessions per week. Each session on average lasted 30 to 60 minutes, but ranged from 10 to 90 minutes.
- The quality of the studies was evaluated according to the Delphi List with 83.3% of the studies fulfilling at least 50% of the 8 criteria. Six higher quality studies met six or seven of the eight criteria. In contrast, 5 low quality studies only met 3 or 4 criteria. Nine studies were of moderate quality.
- One trial evaluating a strength program with 247 participants provided high quality evidence for improved functional aerobic capacity relative to the control group. The moderate effect size was significant (ES = 0.31, 95% CI = 0.06, 0.56) and clinically relevant.
- Three trials evaluating Tai Chi programs with 89 participants provided moderate quality evidence for improved functional aerobic capacity relative to the control groups. The pooled effect size was large and statistically significant (ES = 0.66, 95% CI = 0.23, 1.09) and clinically relevant. Between-study heterogeneity was negligible ($I^2 = 0\%$).
- Three trials evaluating aerobic programs with 427 participants provided low to moderate quality evidence for improved functional aerobic capacity relative to the control groups. The pooled effect size was large and statistically significant (ES = 0.90, 95% CI = 0.70, 1.10) and clinically relevant. Between-study heterogeneity was negligible ($I^2 = 0\%$).
- Seven trials evaluating mixed exercise programs with 743 participants provided moderate quality evidence for improved functional aerobic capacity relative to the control groups. The pooled moderate effect size was statistically significant (ES = 0.47, 95% CI = 0.32, 0.62) and clinically relevant. Between-study heterogeneity was negligible ($I^2 = 0\%$).

- Two trials evaluating aquatic programs with 104 participants provided moderate to high quality evidence that hydrotherapy had no effect on the functional aerobic capacity of participants relative to the control groups. The pooled effect size was not statistically significant (ES = 0.00, 95% CI = -0.38, 0.39) and not clinically relevant. Between-study heterogeneity was negligible (I^2 = 0%).
- Nine of the 13 studies evaluating Tai Chi, aerobic, and mixed exercise programs in the pooled analyses found improvements in functional aerobic capacity that were statistically significant with moderate to large effect sizes.
- These results suggest that strength, Tai Chi, aerobic, and mixed exercise programs are all effective forms of exercise that can improve the functional aerobic capacity in participants with knee or hip osteoarthritis.

Authors' conclusions:

- The results of this systematic review provide moderate quality evidence that exercise programs based on tai chi, aerobic, and mixed exercise, and not hydrotherapy programs, are effective in improving functional aerobic capacity in patients with hip and knee osteoarthritis.
- Hydrotherapy was not effective, perhaps because these programs focused primarily on exercises in functional positions, flexibility, and strength training with only a small part of each session covering aerobic work. Whereas, the Tai Chi and aerobic programs performed aerobic exercises during most of each session.
- Walking was the main component in the aerobic exercise programs. These results show that walking may be a safe and effective form of exercise for improving aerobic capacity and physical activity, without triggering joint flares.
- The structure of the exercise programs (program content and duration, and session frequency and duration) was very heterogeneous.

Comments:

- Individual study quality and risk of bias was known for each of the included studies, but a table describing the specific criteria from the Delphi List that were met for each study was not included. In addition, the GRADE approach was not applied to each meta-analysis performed to determine the quality of evidence, thus decreasing the level of confidence in the results.
- Two of the 3 aerobic studies and all 3 Tai Chi studies used in the meta-analyses were quite small, perhaps at risk of resulting in inflated effect sizes.
- Even though the search strategy included seven databases, it did not include the Cochrane Central Register of Controlled Trials, so this could result in publication bias.
- Some type of quality criteria should also have been considered when combining trials in meta-analyses, because combining low quality trials with high quality trials puts into question the validity of the meta-analyses results and reduces confidence in the findings.
- For many participants who learn aerobic walking, they continue to walk after the classes have ended, and make further significant gains in cardiorespiratory fitness.

- The severity of the subjects' OA was varied within each of the studies. Different degrees of severity of the disease could affect the results in response to the application of a given intervention.
- One limitation of this systematic review was that very little information or description was given of the control interventions.
- The intensity of the exercise is described in only 7 of the studies reviewed. This exercise characteristic really needed to be quantified for each study, since intensity is a key element in aerobic exercise.
- The 6 minute walk test is a test that may be influenced by pain in the joint. The results may be influenced by the functional capacity to perform the test rather than by limiting factors of the aerobic exercise. The potential influence of joint pain on the test results is not altogether clear.

Assessment:

- An adequate quality systematic review and meta-analysis which supports good evidence that exercise programs based on tai chi, aerobic, and mixed exercise, and not hydrotherapy programs, are effective in improving functional aerobic capacity in patients with hip and knee osteoarthritis.