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SYSTEMATIC REVIEW

Relative Efficacy of Different Exercises for Pain, Function, Performance and Quality of Life in Knee and Hip Osteoarthritis: Systematic Review and Network Meta-Analysis

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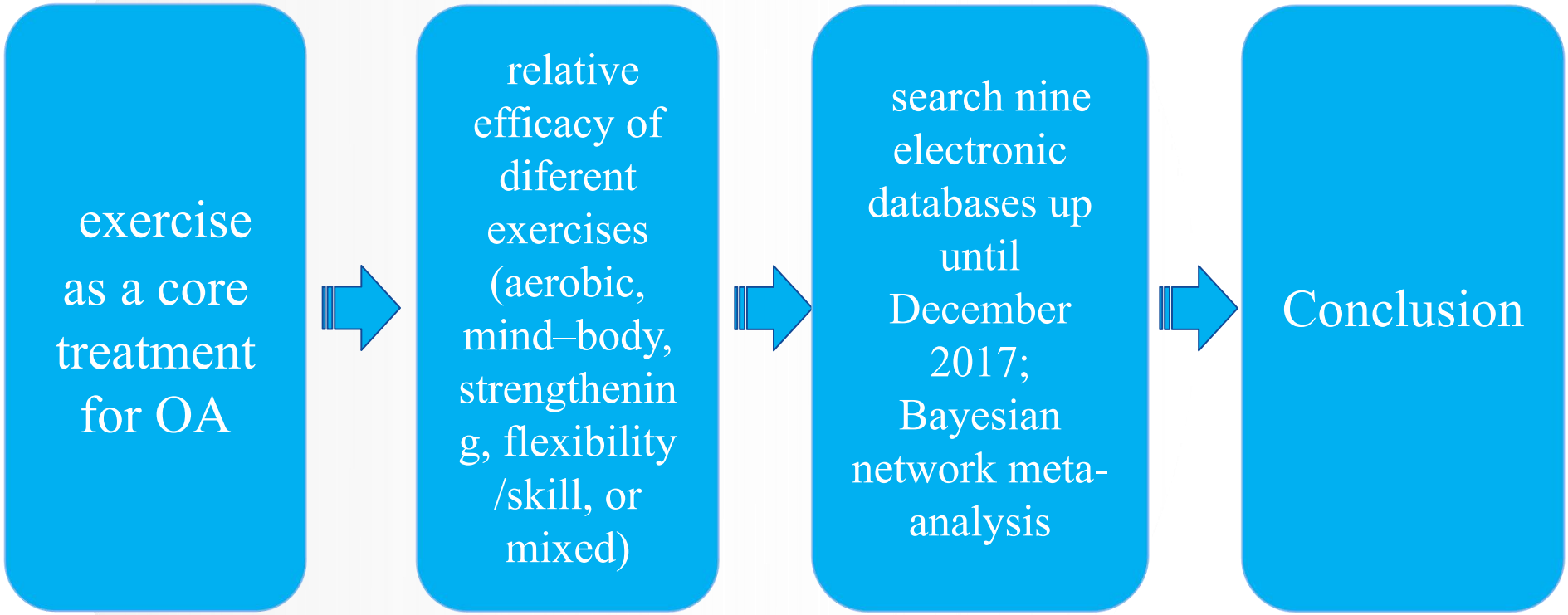


Introduction

Pain from knee and hip osteoarthritis (OA) can have a signifcant impact on the physical function and quality of life (QoL) of affected individuals worldwide. Exercise is one of the core therapies for OA to improve pain and function. Existing evidence indicates that the magnitude of response varies according to the type of exercise (e.g. strengthening, aerobic etc.) However, little is known about the relative efficacy between different exercises for different outcomes.

Most randomised controlled trials (RCTs) compare exercise regimens against non-exercise interventions, and direct comparisons between different exercises are uncommon. Alternatively, network meta-analysis (NMA) can indirectly compare multiple interventions through a common comparator when head-to-head RCTs are sparse or absent. It utilises all available evidence in the network, both direct and indirect, to enhance the power of the estimation.

Previously, Uthman et al. undertook a sequential analysis and NMA to examine whether there was suffcient evidence to support the use of exercise for people with lower limb OA, and whether one exercise was better than another. They found that up to 2002, suffcient evidence existed to show a significant benefit of exercise over no exercise. However, no performance or QoL measures were included.

In this review, the author aimed to extend the work of Uthman et al. by updating the evidence, expanding the outcomes to include objective performance measures and QoL, and refining the exercise classification to include mind–body exercise such as tai chi and yoga.

Methods

- **Search Strategy**

(1) participants with knee OA, hip OA, or mixed knee and hip OA diagnosed clinically and/or radiographically;

(2) assigned exercise programmes without additional active treatment (e.g. analgesics) as the intervention;

(3) assigned usual care/waiting list or a different exercise as the control group;

(4) measured at least one outcome for pain, function, objective performance or QoL.

The systematic search was conducted in December 2015 and updated in December 2017. Nine electronic databases (**AMED**,**CENTRAL**,**CINAHL**,**EMBASE**,**MEDLINE Ovid**, **PEDro**,**PubMed**,**SPORTiscus** and **Google Scholar**) were searched for peer-reviewed publications without language or publication date limitations.

- **Interventions**

Exercises were classified into muscle strengthening, aerobic, or flexibility/neuro-motor skills training (fexibility/skill) according to the American College of Sports Medicine (ACSM) recommendation.**Strengthening exercises** are exercises that aim to increase force of muscle contraction (e.g. lifting dumbbells, squats); **aerobic exercises** to improve cardiorespiratory endurance (e.g. swimming, jogging); **flexibility exercises** to improve joint range of motion and muscle pliability (e.g. hamstring stretch, gastrocnemius stretch); and **neuromotor skills training** to improve balance and coordination (e.g. wobble board, walking on foam).

- **Interventions**

In addition, an exercise programme was classified as **mind–body exercise** if it integrated mindfulness/relaxation into physical movements (e.g. tai chi, yoga), and classified as **mixed exercise** when it included more than one core exercise type mentioned above, or when the authors did not specify it as a single component exercise.

- **Outcomes**

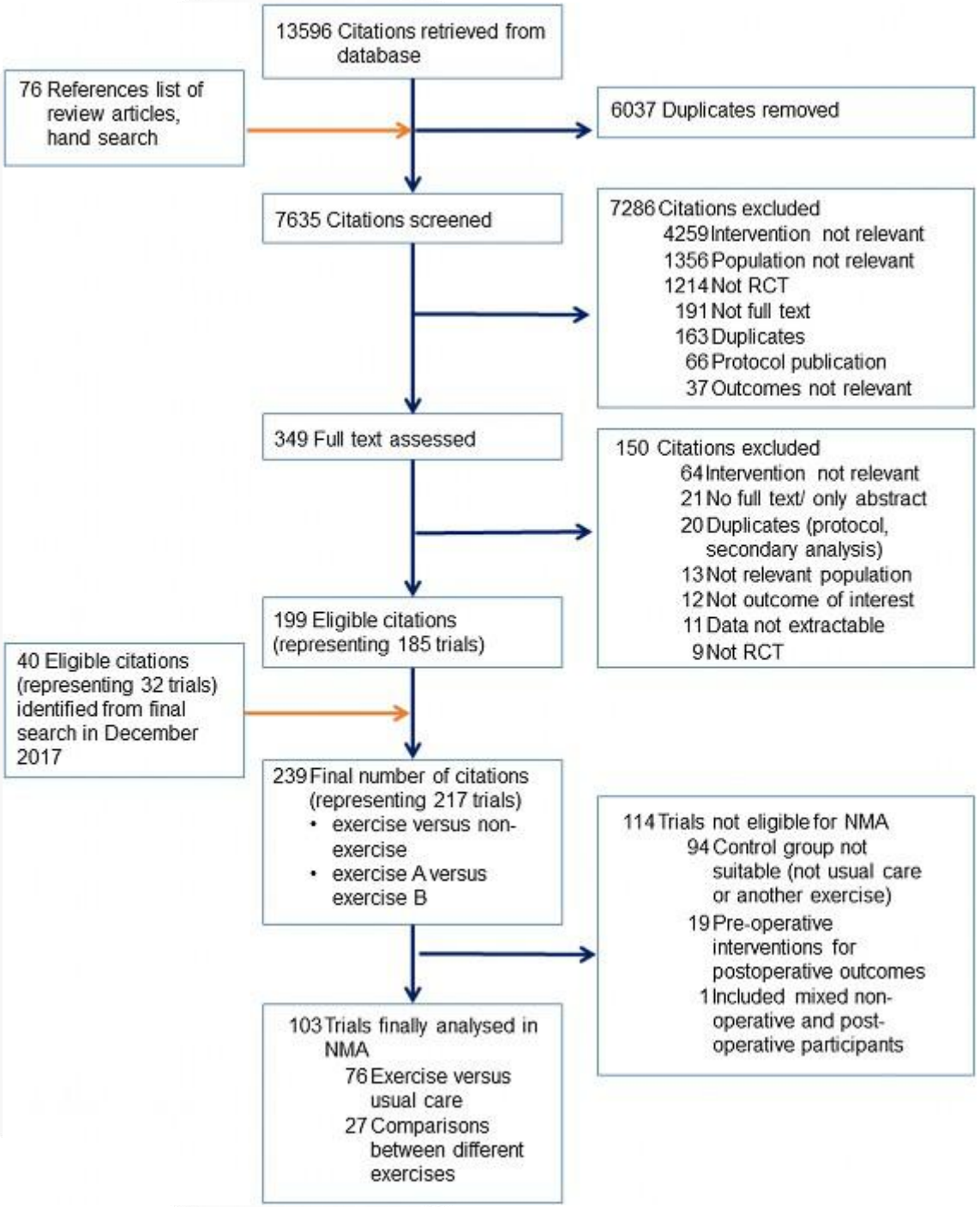
Their primary outcome of interest was pain, and secondary outcomes were self-reported function, objective performance (e.g. walking speed, strength, range of motion), and QoL.

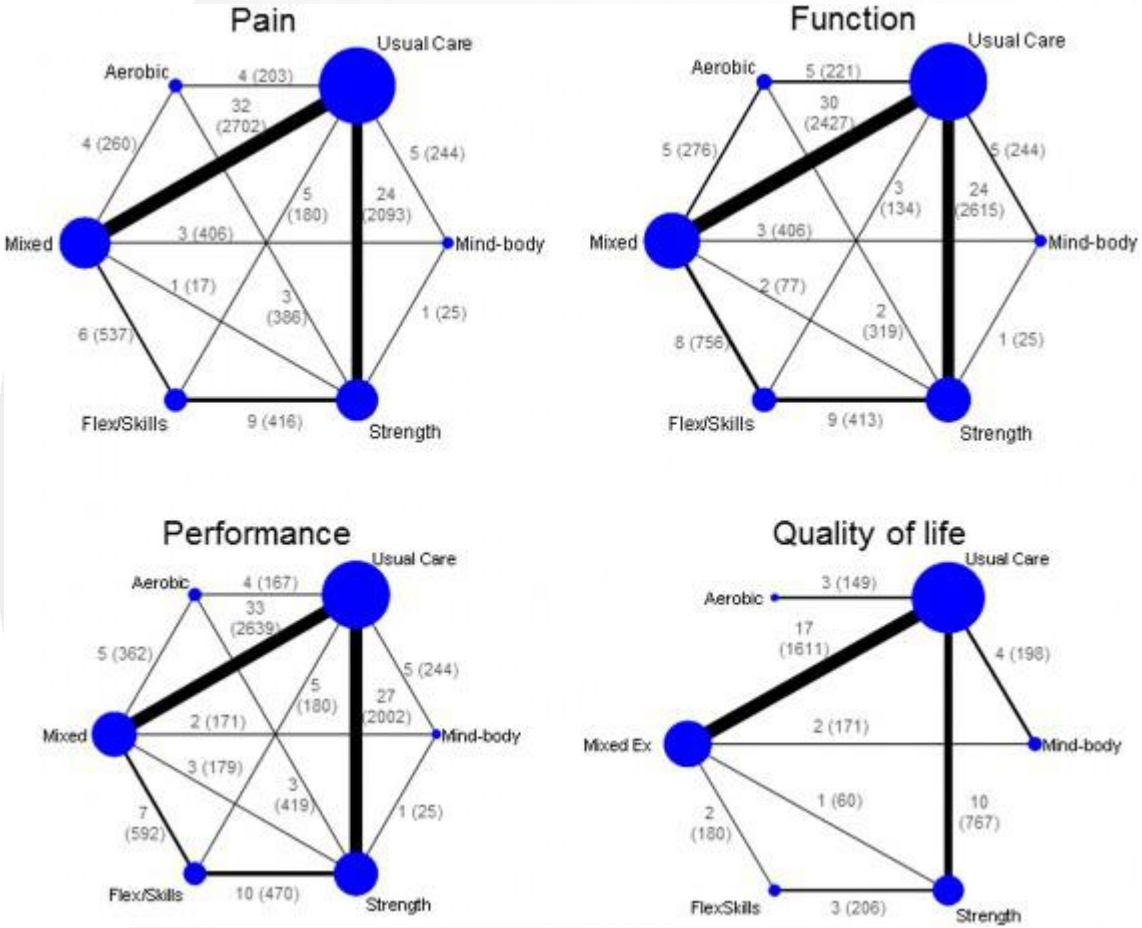
The primary time point was 8 weeks after commencement of the exercise regimen or the time point nearest to this. Eight weeks was chosen because it was the most frequently reported time point.

- **Outcomes**

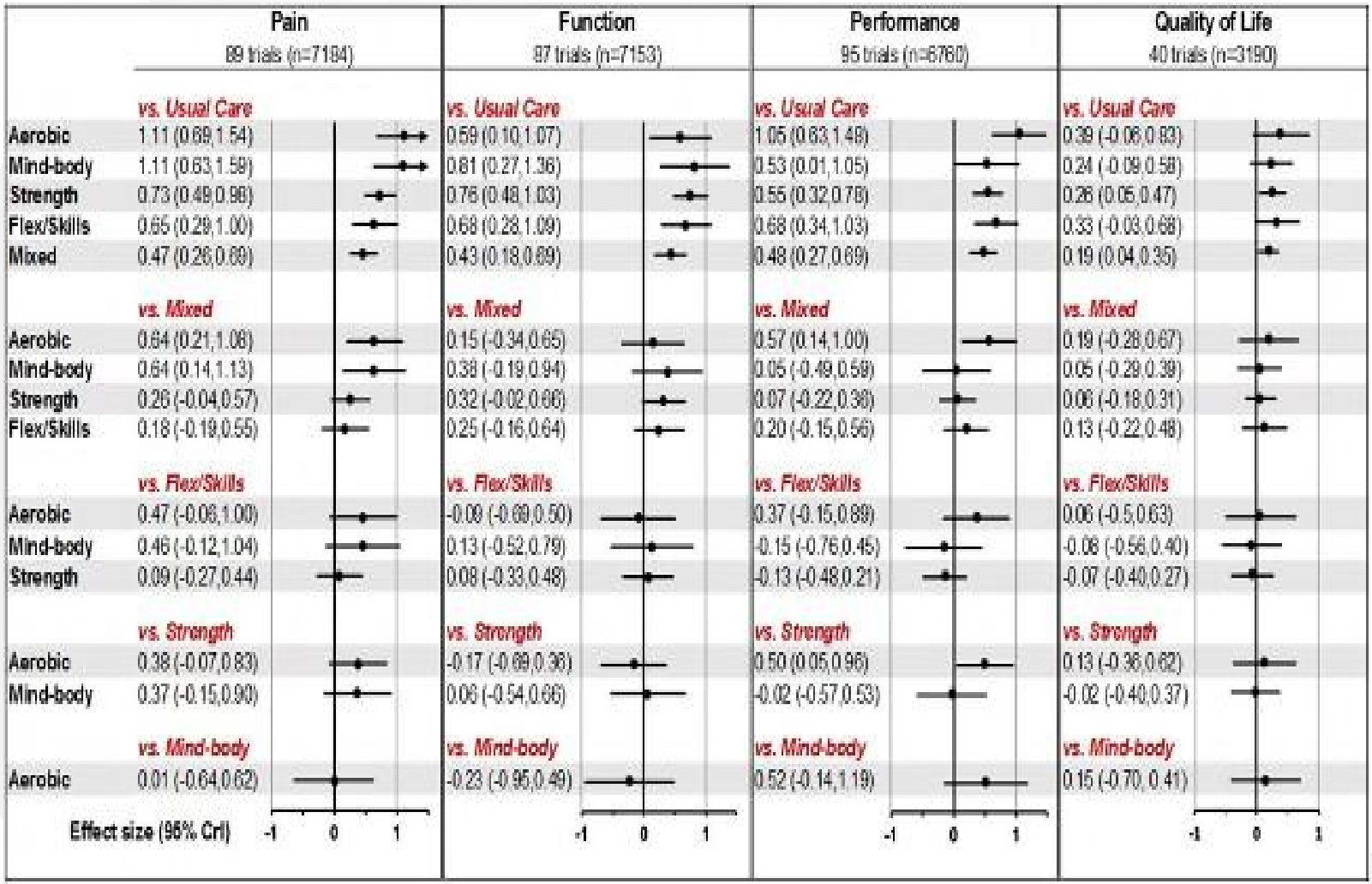
For the performance, gait and walking parameters (e.g. walking distance, walking time, etc.) were prioritised. This was because the measurement and reporting of these parameters were relatively standard across trials compared with other performance outcomes such as strength or power.

Results





This figure demonstrates the network for pain, function, performance and QoL. The comparisons were most seen between strengthening versus usual care, as well as between mixed exercise versus usual care.


Pain
89 trials (n=7184)
Function
97 trials (n=7153)
Performance
95 trials (n=6760)
Quality of Life
40 trials (n=3190)
vs. Usual Care
Aerobic 1.11 (0.69,1.54) 0.59 (0.10,1.07) 1.05 (0.63,1.48) 0.39 (-0.06,0.83)
Mind-body 1.11 (0.63,1.59) 0.81 (0.27,1.36) 0.53 (0.01,1.05) 0.24 (-0.09,0.58)
Strength 0.73 (0.49,0.96) 0.76 (0.48,1.03) 0.55 (0.32,0.78) 0.26 (0.05,0.47)
Flex/Skills 0.65 (0.29,1.00) 0.68 (0.28,1.09) 0.68 (0.34,1.03) 0.33 (-0.03,0.68)
Mixed 0.47 (0.26,0.69) 0.43 (0.18,0.69) 0.48 (0.27,0.69) 0.19 (0.04,0.35)
vs. Mixed
Aerobic 0.64 (0.21,1.08) 0.15 (-0.34,0.65) 0.57 (0.14,1.00) 0.19 (-0.28,0.67)
Mind-body 0.64 (0.14,1.13) 0.38 (-0.19,0.94) 0.05 (-0.49,0.59) 0.05 (-0.29,0.39)
Strength 0.26 (-0.04,0.57) 0.32 (-0.02,0.66) 0.07 (-0.22,0.36) 0.06 (-0.18,0.31)
Flex/Skills 0.18 (-0.19,0.55) 0.25 (-0.16,0.64) 0.20 (-0.15,0.56) 0.13 (-0.22,0.48)
vs. Flex/Skills
Aerobic 0.47 (-0.06,1.00) -0.09 (-0.69,0.50) 0.37 (-0.15,0.89) 0.06 (-0.5,0.63)
Mind-body 0.46 (-0.12,1.04) 0.13 (-0.52,0.79) -0.15 (-0.76,0.45) -0.06 (-0.56,0.40)
Strength 0.09 (-0.27,0.44) 0.08 (-0.33,0.48) -0.13 (-0.48,0.21) -0.07 (-0.40,0.27)
vs. Strength
Aerobic 0.38 (-0.07,0.83) -0.17 (-0.69,0.36) 0.50 (0.05,0.96) 0.13 (-0.36,0.62)
Mind-body 0.37 (-0.15,0.90) 0.06 (-0.54,0.66) -0.02 (-0.57,0.53) -0.02 (-0.40,0.37)
vs. Mind-body
Aerobic 0.01 (-0.64,0.62) -0.23 (-0.95,0.49) 0.52 (-0.14,1.19) 0.15 (-0.70, 0.41)
Effect size (95% CrI)
-1
0
1

Discussion

- This NMA confirms that exercise is beneficial for people with knee and hip OA for outcomes of pain, function, performance and QoL.
- Aerobic and mind–body exercise have the largest ES for improvements in pain and function; strengthening and flexibility/skill exercises improve multiple outcomes to a varying degree; mixed exercise (more than one core type) is the least effective exercise across all outcomes and is significantly inferior to aerobic and mind–body exercise for pain.
- Their results align with other conventional systematic reviews and meta-analyses where aerobic and mind–body exercise tend to have larger effect sizes than strengthening exercise, and mixed exercise tends to have the lowest effect size for pain.

- A novel finding from this NMA is that mind–body exercise had similar effects to aerobic exercise for pain. Mind–body exercise such as tai chi and yoga can be characterised as low to moderate intensity exercise performed with an intentional awareness (mindfulness) on breathing and slow controlled movement.
- Although the underlying mechanism remains unclear, the effect of both aerobic and mind–body exercise may be attributable to the potential of these exercises to influence altered central elements such as central pain sensitisation, sleep disturbance, and mood disorders.
- There is no satisfactory biological explanation for the poor efficacy of mixed exercise across all outcomes, it may be that the lack of response to mixed exercise reflects flawed implementation of the programme, such that intensity of the individual components was insuffcient or poorly adhered to due to the complexity of the regimen compared with a single exercise programme.

Conclusions

- This NMA confirms that exercise therapy has clear benefits for people with knee and hip OA and also shows that the magnitude of effect varies according to type of exercise and outcome of interest.
- Aerobic and mind–body exercises were found to be the best for pain and function, whereas strengthening and flexibility/skill exercises are potentially next best for multiple outcomes. Mixed exercise is the least effective exercise for knee and hip OA but is still superior to usual care for all outcomes and therefore remains an acceptable option for patients who do not respond well to single-component exercises.
- The findings of this review may help clinicians guide their prescription of exercise type with respect to treatment outcomes.

Thank you for your attention!

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