Is regular exercise a friend or foe of the aging immune system? A systematic review
Haaland DA, Sabljic TF, Baribeau DA, Mukovezov IM, Hart LE

CRD summary
The review concluded that regular (particularly aerobic) exercise appeared to benefit the immune system in healthy older adults and help to offset diminished adaptive responses and chronic inflammation. In view of concerns about aspects of the review methods (such as a lack of details of statistical analysis) the reliability of the authors’ conclusions is unclear.

Authors' objectives
To assess the effect of regular aerobic and/or resistance exercise on the immune system of healthy older adults.

Searching
Eleven databases that included MEDLINE, EMBASE, CINAHL, AMED and all EBM Reviews (CDSR, ACP Journal Club, DARE, CCTR, CMR, HTA and NHS EED) were searched for English-language studies from inception to 2008. Search terms were reported. Reference lists of relevant publications were screened.

Study selection
Prospective controlled clinical trials that evaluated an aerobic or resistance exercise intervention (with a minimum duration of four weeks) on immune outcomes in healthy older adults with at least 50 years old were eligible for inclusion. Studies of participants with inflammatory diseases or that related to patient-disease groups were excluded. The review outcomes included adaptive immunity, innate immunity, inflammation and infection rate.

Most included studies evaluated either strength or endurance interventions; some evaluated a combination of both. Controls of included studies were not adequately reported; it appeared that they included social interventions, water exercise and other forms of exercise (flexibility, strength, balance or toning). Where reported, intervention intensity and duration of endurance sessions varied between included studies. Frequency of intervention sessions per week in included studies ranged from two to 20. Intervention duration in included studies ranged from eight weeks to about 43 months. Mean age of participants in included studies ranged from 64.6 to 90.6 years. Most of the included participants were female.

The authors did not state how many reviewers assessed studies for inclusion.

Assessment of study quality
The quality of included studies was assessed using the five-point Jadad scale of randomisation, blinding and withdrawals. One point was assigned for studies that were single-blind.

Two reviewers independently performed the quality assessment. Any disagreement was resolved by a third reviewer.

Data extraction
Data were extracted using a standardised instrument. Data were extracted by one reviewer and checked by a second reviewer.

Methods of synthesis
The studies were combined in a narrative synthesis supported by data tables.

Results of the review
Seventeen studies were identified (n=794). Sample size ranged from 13 to 190. Quality scores ranged from zero to 3.

Adaptive immunity: Nine studies showed no chronic or acute effects of exercise intervention on absolute circulating CD4+ (T helper) cells. Eight out of nine studies showed no chronic effects of training on CD8+ (effector T) cells. Two
out of four studies reported showed acute exercise-induced increases in circulating CD8+ T cell numbers.

**Innate immunity:** Six studies showed no chronic effects of exercise intervention on natural killer (NK) cell numbers in peripheral blood. Four endurance training studies showed no chronic or acute effects of exercise on NK cell activity. One strength training study showed a chronic increase in women and another mixed intervention study showed a chronic decrease in men.

**Inflammation:** Two studies reported that regular endurance exercise reduced markers of inflammation. One study showed no change in C-reactive protein in the exercise group. Two studies reported that strength training had no effect on inflammatory markers.

One mixed and three endurance studies show no significant beneficial or detrimental effects of regular exercise on infection rates.

**Authors’ conclusions**

Regular (particularly aerobic) exercise appeared to benefit the immune system of healthy older adults and helped to offset diminished adaptive responses and chronic inflammation. There was a possibility that strenuous exercise may cause acute immunologic changes (such as diminished NK cell activity), which may predispose to infection in certain individuals.

**CRD commentary**

This review's inclusion criteria were clear. Relevant sources were searched extensively. The extent of the search for unpublished studies was unclear, which introduced potential for publication bias. The decision to restrict the review to English-language studies may have increased the risk of language bias. Steps were taken to minimise errors and biases by having more than one reviewer undertake validity assessment and data extraction; it was unclear whether study selection was performed in duplicate. Relevant criteria were used to examine study quality. Most of the included studies were poor quality. Given the diversity of included studies, a narrative synthesis was appropriate. Results were presented and interpreted based on the direction of effect without details of any statistical analysis, which made it difficult to verify the authors' interpretation. In view of these concerns about aspects of the review methods, the reliability of the authors' conclusions is unclear.

**Implications of the review for practice and research**

**Practice:** The authors stated that given the possible benefits of regular exercise on the immune system, the evidence from this review should not dissuade practitioners from suggesting regular exercise to healthy older adults.

**Research:** The authors stated that further well-designed trials with a proper sample size were required to investigate the effect of regular aerobic and/or resistance exercise on the immune system of healthy older adults. Trials should have an appropriate duration and include controls with properly timed samples to control for documented diurnal and seasonal fluctuations in a range of immunologic outcome measures. Further studies were required to investigate in vitro and clinical immunologic effects of long-term regular exercises.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.