Hormone therapy and skeletal muscle strength: a meta-analysis

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CRD summary
This review concluded that oestrogen-based hormone therapy had a beneficial effect on muscle strength in postmenopausal women. However, given the pooling of studies with quite different study designs and characteristics, and the risk of missing studies, the findings may not be reliable.

Authors' objectives
To compare muscle strength in postmenopausal women who received oestrogen-based hormone therapy compared with those who were not.

Searching
PubMed, The Cochrane Library, Biological Abstracts, Web of Science, Digital Dissertation Database and ClinicalTrials.gov were searched between October 2007 and April 2009 for studies published in English. Search terms were reported. Reference lists of retrieved articles and relevant review articles were searched for additional studies.

Study selection
Studies that compared muscle strength (maximal force, torque or power generated by a group of muscles) in postmenopausal women who were and were not receiving oestrogen-based hormone therapy were eligible for inclusion in the review. Methods used to assess muscle strength had to be clearly described, as did participant ages and study inclusion/exclusion criteria. Studies that presented outcome data as adjusted means were excluded. Studies on the effects of oestrogen on muscle strength in rodents were also included in the review, but these data were not reported in this summary.

Most included studies assessed women who took different oestrogen-based therapies. The most frequently used dose, where stated, was 0.6mg of oestrogen per day (range 0.4mg to 4.3mg per day). Therapies were used for a mean of 110 months. Mean age of participants ranged from 51 to 77 years. Mean time since menopause ranged from 0.5 to 30 years. All of the reported cross-sectional studies included women who had previously used hormone therapies; most of the longitudinal studies excluded participants who had previously used hormone therapies.

Two reviewers independently assessed studies for inclusion in the review.

Assessment of study quality
Study quality was assessed independently by two authors using the Physiotherapy Evidence-based Database (PEDro) Scale (individual criteria were not reported). Each study was awarded a score up to a maximum of 11 points.

Data extraction
One author extracted data and a second author checked the data for accuracy. For randomised controlled trials (RCTs), mean changes in muscle strength (and standard deviation) from baseline to follow-up were extracted. Where mean values were not available, percentage changes and p values were extracted. Authors were contacted where necessary to try and obtain data for strength normalised to muscle cross-sectional area. Standardised mean differences were calculated for cross-sectional studies from percentage differences and p values (a correlation of 0.8 was used). Where studies assessed outcomes at different time points, data were averaged across the time points and similarly data were averaged across different muscle groups.

Methods of synthesis
Pooled effect sizes with 95% confidence intervals were calculated using a random-effects model. Further analyses were carried out to investigate the effects of oestrogen in different subgroups dependent on previous hormone therapy use, study design (RCT and non-RCT), type of muscle group (thumb abductors, forearm flexors, hip abductors, knee extensors and knee flexors) and type of muscle contraction (isometric and isokinetic). The effects of participants' time...
since menopause and time on hormone therapy were investigated using meta-regression. Publication bias was investigated with a funnel plot and Duval and Tweedie's trim and fill correlation.

Results of the review
Twenty-three studies (2,668 hormone therapy and 7,288 control) reported in the review comprised five RCTs and 18 non-RCTs. Study quality ranged from 4 to 10 points; RCTs ranged from 7 to 10 and cross-sectional studies scored 4 or 5 points.

A small beneficial effect of oestrogen-based hormone therapy was found on muscle strength (overall effect size 0.23, p=0.003). Results from studies that reported effects on normalised muscle strength were not significant. It was not possible to assess the effects of different types of hormone therapy and there were no significant relationships between effect size and mean time since menopause or previous hormone therapy use.

Subgroup analysis showed that the greatest increase in strength was found for thumb abductors (ES=1.14, p<0.001). A greater effect size was reported for the five RCTs (0.46) in comparison with the 18 non-RCTs (0.16), but this difference was not statistically significant. No other significant differences in effect size according to potential effect size moderators were reported.

A funnel plot and Duval and Tweedie's trim and fill method suggested that the risk of publication bias for both unadjusted and adjusted effect sizes was low.

Authors' conclusions
Oestrogen-based hormone therapy had a beneficial effect on muscle strength in postmenopausal women.

CRD commentary
This review answered a clearly defined review question using different types of studies. Searches for relevant studies were carried out in a number of different databases, but only studies published in English were eligible for inclusion. This suggested that relevant studies may have been missed and that there was a risk of publication and language biases, although this was not evident from the authors' assessment of publication bias. Attempts were made to reduce the risk of reviewer error and bias through involvement of two reviewers when selecting studies, extracting study data and assessing methodological quality. Study quality varied particularly between the different types of study design, which was to be expected. Data from the different randomised and non-randomised designs were combined in many of the analyses and different (but not significantly different) effect sizes were reported for the two types of design. Further subgroup and meta-regression analyses were planned to try and identify potential sources of heterogeneity, but in a number of cases these analyses were not possible or failed to show any significant findings. A significant difference was shown for different muscle groups, but this was based on only three studies and so may not be reliable. Overall, given the pooling of studies with quite different study designs and characteristics, and the risk of missing studies, the findings may not be reliable.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that further research was required to investigate the mechanism of action by which oestrogen affected muscle strength.

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