The acute effects of physical activity on cigarette cravings: systematic review and meta-analysis with individual participant data


CRD summary
This review concluded that there was strong evidence that short bouts of physical activity acutely reduced cigarette cravings. The differences between the included trials suggest that these conclusions may be overstated, although the authors’ recommendations for exploratory analyses and further research are justified.

Authors’ objectives
To assess the acute effects of short bouts of physical activity on strength of desire and desire to smoke cigarettes using individual participant data.

Searching
Five databases were searched (including MEDLINE and EMBASE) up to May 2011 for papers in English published from 2004 onwards. Search terms were reported. One trials register and two databases of theses/dissertations were also searched. Reference lists of relevant articles and annual meeting abstracts from the Society for Research on Nicotine and Tobacco were handsearched. Requests for literature were posted on key list-serves, and authors of the relevant studies were contacted.

Study selection
Eligible studies were randomised controlled trials (RCTs) that examined the acute effects of physical activity on cigarette cravings (desire to smoke, or strength of desire to smoke, using a seven-point Likert scale as defined in the review). A minimum abstinence period of two hours prior to baseline measurement was necessary for trials to be included. Trials of participants taking part in a smoking cessation programme or using nicotine replacement therapy were excluded.

The mean age of included participants ranged from 20.3 to 36.2 years; baseline scores from the Fagerstrom Test for Nicotine Dependence ranged from 2.3 to 5.9 (minimally to moderately dependent). Periods of abstinence prior to baseline measurement ranged from two to 17.3 hours. Physical activity interventions included walking (moderate-intensity), running, cycling (light-, moderate-, or vigorous-intensity), and isometric exercise. Most control conditions consisted of sitting passively; others included sitting passively and listening to an audio recording, a cognitive task, watching a video, or body scanning techniques. Durations of intervention/control conditions ranged from 5 to 40 minutes.

The authors did not report how many reviewers selected studies for inclusion.

Assessment of study quality
It appeared that some trial level quality assessment was carried out, but the criteria and the number of reviewers involved was not fully reported. There was no apparent checking of the individual patient data.

Data extraction
Data on individual participants’ pre- and post-treatment craving levels (mean and standard deviation values representing desire to smoke, or strength of desire to smoke) were extracted to calculate mean differences and 95% confidence intervals. Where trials reported two intervention arms, they were collapsed into one intervention arm; where trials reported two control arms, they were collapsed into one control arm. If a trial used a five-point Likert scale, the values were adjusted to make a 7-point scale. Where necessary, authors were contacted for additional raw data.

Methods of synthesis
Mean differences and 95% confidence intervals were pooled in one- and two-stage random-effects meta-analyses, to provide standardised mean differences and 95% confidence intervals. Statistical heterogeneity was assessed using the
Q statistic and Ι².

**Results of the review**

Nineteen RCTs were included in the meta-analyses (616 participants, range 10 to 84 participants per trial) including seven parallel group trials and 12 cross-over trials. The sample size of one trial was not reported. All of the trials reported randomisation, although one trial reported that the randomisation was based on recruitment order. No other quality details were reported.

Two-stage random-effects meta-analysis revealed that, compared with controls, intervention groups demonstrated statistically significant reductions in the strength of desire to smoke (SMD -1.91, 95% CI -2.59 to -1.22; 797 participants; Ι²=94%) and in desire to smoke (SMD -2.03, 95% CI -2.60 to -1.46; 837 participants; Ι²=92%).

Similar results were observed in the one-stage meta-analyses for these outcomes (strength of desire to smoke SMD -1.89, 95% CI -2.52 to -1.26, 797 participants; desire to smoke SMD -2.03, 95% CI -2.54 to -1.51, 837 participants), and in two-stage meta-analyses including only parallel group trials (strength of desire to smoke SMD -1.78, 95% CI -3.17 to -0.40, 415 participants, Ι²=97%; desire to smoke SMD -2.27, 95% CI -3.82 to -0.72, 322 participants, Ι²=97%), or only trials that delivered moderate physical activity interventions (strength of desire to smoke SMD -2.20, 95% CI -2.89 to -1.51; 603 participants; Ι²=92%; desire to smoke SMD -2.14, 95% CI -2.71 to -1.57; 706 participants; Ι²=90%).

**Authors' conclusions**

There was strong evidence that short bouts of physical activity acutely reduced cigarette cravings.

**CRD commentary**

The review question and inclusion criteria were clearly defined. Efforts were made to locate both published and unpublished literature, although the language restriction to English meant that relevant studies may have been missed. It was not reported whether the review process was performed in duplicate, so the presence of reviewer error and/or bias could not be ruled out.

Details of the quality assessment were extremely limited and it was not possible to gauge the risks of bias within the individual trials included. There was no apparent process of data checking, a recommended feature of individual patient data quality assessment. Clinical heterogeneity and very high levels of statistical heterogeneity between the trials were reported; this suggested that the statistical pooling of the trials may not have been appropriate.

The authors' conclusions may be overstated, although their recommendations for exploratory analyses and further research are justified.

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

**Practice:** The authors stated that short bouts of physical activity may have practical implications as a smoking cessation aid.

**Research:** The authors stated that the moderating effects of physical activity aspects (such as type, duration and intensity), participant characteristics, and smoking characteristics on the relationship between acute physical activity and cigarette cravings required further investigation. Further analysis exploring the heterogeneity between the included studies was suggested to increase understanding of the relationship between acute physical activity and cigarette cravings.

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**Bibliographic details**

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.