Short-term effects on outcomes related to the mechanism of intervention and physiological outcomes but insufficient evidence of clinical benefits for breathing control: a systematic review

Lewis L K, Williams M T, Olds T

CRD summary
This review evaluated the effects of breathing control on targets and mechanisms, and physiological and clinical outcomes. Amongst the authors' conclusions, there were potentially favourable impacts on short-term physiological outcomes. Detrimental effects were reported for dyspnoea and work of breathing in people with severe respiratory disease. The authors' conclusions reflect the evidence presented and are likely to be reliable.

Authors' objectives
To evaluate the effects of breathing control on intervention targets and mechanisms, and on physiological and clinical outcomes in symptomatic and asymptomatic participants. This abstract reports primarily on the physiological and clinical outcomes.

Searching
AMED, CINAHL, MEDLINE, Scopus, Web of Science and the Cochrane Library were searched for published English language studies from 1966 to 2006. Search terms were reported. The reference lists of retrieved studies were screened. Experts were contacted to identify any additional articles of interest.

Study selection
Experimental studies, where breathing control (relaxed basal, diaphragmatic or abdominal breathing) was the sole intervention compared with a control or another intervention, were eligible for inclusion in the review. The majority of interventions were investigated in pre-post designs, focusing on breathing control programmes over a three to 12 week period; others compared breathing control with natural or spontaneous breathing. Eligible participants were those of any age, with or without symptoms for chronic respiratory disease where breathlessness was likely, or with acute or chronic medical, surgical or traumatic conditions.

Outcomes of primary interest in this abstract are those reported for physiological change (eg, oxygen consumption (VO₂), work of breathing, respiratory muscle efficiency, ventilation distribution, arterial oxygen saturation) and clinical outcome (dyspnoea, and the 12-minute walk test). Reported outcomes relating to intervention targets and mechanisms are reported in the paper.

The majority of included participants had chronic respiratory disease (including emphysema, moderate or severe chronic obstructive pulmonary disease, asthma, bronchitis, bronchiectasis and pulmonary fibrosis); the mean age range was 21 to 71 years. All studies measuring outcomes with continuous data were of interest.

Two independent reviewers selected the studies for inclusion, and disagreements were resolved by consensus.

Assessment of study quality
Study quality was assessed using a customised tool. The authors stated that a maximum possible score of 9 was derived by assessing participant recruitment, adequacy of control group and baseline measures, accuracy of outcome measures, confounding, and the adequacy of reporting of results.

Two independent reviewers assessed study quality and disagreements were resolved by a third independent reviewer.

Data extraction
Means and standard deviations were extracted or calculated for each outcome, in order to derive the standardised mean difference (SMD) and 95% confidence interval (CI). Data were grouped in similar domains of measurement (even if
different measurement instruments were used).

Two reviewers extracted data for the review.

**Methods of synthesis**
Standardised mean differences and 95% confidence intervals were pooled in a fixed-effect meta-analysis. Statistical heterogeneity (defined as $p<0.05$) was explored using the $X^2$ test, and sources of significant variation were further examined by the reviewers. Sensitivity analyses were carried out in some analyses, using study quality and outcome measure as variables of interest.

**Results of the review**
Twenty studies ($n=285$ participants) were included in the review. Sample sizes ranged from six to 33 participants. Methodological quality of the included studies ranged from 3 to 8 points, with over half scoring 6 point or more. Fifteen studies did not employ a separate control group.

Statistically significant benefits from breathing control were reported for abdominal movement, diaphragm excursion, respiratory rate and tidal volume. Statistically significant heterogeneity was reported in the majority of these analyses.

Pooled analyses showed statistically significant benefits from breathing control in terms of physiological changes relating to gas exchange, including arterial oxygen saturation (SMD 0.63, 95% CI: 0.25 to 1.02; three studies with no significant heterogeneity) and percutaneous oxygen (SMD 1.48, 95% CI: 0.85 to 2.11; one study).

In terms of changes relating to energy cost and breathing, breathing control had a detrimental effect on the work of breathing (SMD 1.06, 95% CI: 0.52 to 1.60; two studies with no significant heterogeneity).

For clinical outcome, a detrimental effect was reported for dyspnoea in studies including participants with severe respiratory disease (SMD 1.47, 95% CI: 0.88 to 2.05; two studies with statistically significant heterogeneity). In sensitivity analysis, this direction of effect was supported when a visual analogue scale was used, but not when using the Borg Rating of Perceived Exertion.

Outcomes that were not statistically significant are reported in the paper.

**Authors’ conclusions**
Breathing control, when used as a sole intervention, could positively impact on short-term physiological outcomes. In people with severe respiratory disease, breathing control had a detrimental effect on dyspnoea and work of breathing.

**CRD commentary**
The review question was clear, and included broad (but potentially reproducible) inclusion criteria. The search strategy appeared to consult some relevant sources; however, the restriction to published English language articles may mean that studies were missed, and that language and publication biases could not be ruled out. A customised quality assessment tool which attempted to cover a wide range of study designs was applied, and the results of this were used to interpret the review findings. All parts of the review process appeared to have been conducted with appropriate attempts to minimise errors and biases. The presence of statistical heterogeneity amongst many of the pooled analyses (including the one for dyspnoea) suggests that the method of synthesis (using a fixed-effect model) may not have been appropriate. However, the authors adequately explained the potential source of variation in this case. The authors’ conclusions accurately reflect the evidence presented and are likely to be reliable.

**Implications of the review for practice and research**
**Practice:** The authors stated that clinicians should exercise caution in using breathing control as a short-term strategy in people with severe airflow obstruction. Dyspnoea and work of breathing should be closely monitored.

**Research:** The authors stated that high quality research is needed to explore the effect of breathing control in people with moderate or mild pulmonary impairment.
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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.