Nutrition intervention for weight gain in cystic fibrosis: a meta analysis
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Authors' objectives
To evaluate the efficacy of nutrition interventions in the treatment of undernutrition in cystic fibrosis.

Searching
MEDLINE and ClinPSYC were searched, although the search terms used and the years searched were not stated. In addition, bibliographies and relevant journals were handsearched. Only published studies were eligible for inclusion.

Study selection
Study designs of evaluations included in the review
Studies were included if nutritional rehabilitation was the primary objective; there were sufficient data to enable an effect size for weight gain to be calculated; and there was a minimum sample of three participants. Most of the studies were of a single-group pre-test post-test design. The sample sizes of the included studies ranged from 3 to 15 patients.

Specific interventions included in the review
Behavioural therapy, oral supplements, enteral nutrition (EN), and parenteral nutrition (PN) were included. Behavioural therapy consisted of contingency management, nutritional education, and relaxation training; the duration of treatment ranged from 8 days to 7 weeks. Oral supplements included various regimens to increase energy and/or protein intake; the duration of treatment ranged from 3 to 30 months. EN and PN included varying regimens for daily energy intake; the duration of treatment ranged from 12 days to 3 years and 9 days to 1 month, respectively. Studies were excluded if the patients were receiving other medical treatment concurrently, or if the nutrition intervention was provided as an adjunct rather than as a treatment.

Participants included in the review
Children or adolescents with cystic fibrosis, and some adults, were included. The mean age of the participants was 8.75 years (range: 6 months to 29 years).

Outcomes assessed in the review
The outcomes assessed were weight gain, calorie intake, pulmonary function and percentage body fat. The latter was estimated from skinfold measures, midarm circumference or bioelectrical impedance.

Assessment of study quality
The authors do not state how the papers were selected for the review, or how many of the authors performed the selection.

Data extraction
The authors were requested to supply missing data where necessary, so that effect sizes could be calculated. This included individual patient data and any available information on calorie intake across treatment phases. The effect sizes for weight gain and calorie intake were calculated for each study.

Methods of synthesis
How were the studies combined?
The pooled weighted effect sizes were calculated for weight gain and calorie intake for each intervention type. The
relationship between the participant's age and weight gain was examined using correlation analysis. Data on pulmonary function and the percentage body fat were summarised descriptively.

**How were differences between studies investigated?**

Studies were considered to be homogeneous for design aspects but this was not analysed formally. An analysis of variance was conducted among the interventions to determine whether there were significant differences in effect sizes across the intervention types.

**Results of the review**

Eighteen studies reporting on 163 participants were included: 4 of behavioural therapy, 6 of oral supplements, 5 of EN, and 3 of PN.

**Weight gain.**

The pooled weighted effect sizes were 1.51 (95% confidence interval, CI: 0.60, 2.28) for behavioural treatments, 1.62 (95% CI: 0.67, 2.71) for oral supplementation, 1.78 (95% CI: 1.43, 2.11) for EN, and 2.20 (95% CI: 1.48, 2.98) for PN. There were no significant differences in the effect sizes for weight gain across the intervention types. The correlation coefficient calculated between the effect size for weight gain and the mean age of the study sample was non-significant.

**Calorie intake (8 studies).**

The pooled weighted effect sizes were 2.56 for behavioural treatments (3 studies), 0.37 for oral supplementation (2 studies), 1.31 for EN (2 studies) and 3.11 for PN (1 study). The effect size for behavioural interventions was significantly greater than that for oral supplementation.

**Pulmonary function testing (8 studies).**

Most of the studies reported stability of pulmonary functioning before and after treatment. However, there were some mixed results among the PN studies.

**Percentage body fat (13 studies).**

All studies reported an increase in the percentage body fat; the mean increase was 3.3% across behavioural treatments (3 studies) and 2.2% in EN (3 studies).

**Publication bias.**

The authors estimated that 4 studies with null results would be required to decrease the probability of reaching significance with the behavioural intervention to 0.05; 13 studies would be necessary for oral supplements, 24 for EN and 14 for PN.

**Authors’ conclusions**

Despite limitations within the primary studies concerning design and heterogeneity, the results of the review indicated that increasing caloric intake may be beneficial in the treatment of underweight patients with cystic fibrosis. In addition, the result supported the continuation of such an investigation on the most efficacious delivery of calories at different stages of the disease.

**CRD commentary**

The research question was clearly explained, and details of the primary studies were provided in the text and in tabular format. The selection criteria for the papers were described in relation to the outcomes and interventions. In terms of participants, some adults (up to 29 years) were included in the papers even though children and adolescents were stipulated for inclusion. No selection criteria were given for study design.

The search strategy was limited, and it would be impossible to replicate the search from the scant information provided.
There was no search for unpublished data, although the authors did report an analysis estimating the impact of publication bias.

The authors did not report a quality assessment of the included studies, nor any details of the review process itself, i.e. how decisions about study selection were made, how many reviewers were involved, and whether decisions were made in duplicate and independently.

The results of this review should be treated with caution because: (1) the data were pooled across studies which were likely to be heterogeneous, particularly with regard to regimen and duration of treatment (as noted by the authors); (2) there was no formal analysis of heterogeneity; and (3) most of the evidence came from before-and-after studies.

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

The authors state that research must shift its focus from the reporting of clinical interventions to the design of clinical trials. These trials should have interventions administered in a uniform fashion to patients of similar age and disease severity; use patients identified prospectively as controls; and have frequent assessment periods during both treatment and long-term follow-up. Attention must also be given to the cost, both economic and psychosocial, associated with the various types of intervention.

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