Physical activity interventions in children and young people with Type 1 Diabetes

A systematic review with meta-analysis

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Overview

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Introduction

• Type 1 Diabetes (T1D): autoimmune disease that destroys insulin producing cells in the pancreas.

• Managed by insulin injection and balancing carbohydrate intake with physical activity.

Physical activity

• Children with T1D advised: 60 minutes moderate-to-vigorous physical activity per day [1].
Problem and Aims

- Children with T1D are not meeting recommended level of activity [2].
- Might be less active than peers without T1D [3].
- Interventions to promote active lifestyles are needed.

- To examine a range of clinically relevant health outcomes of physical activity interventions.
- To examine the characteristics of existing interventions.
- To recommend physical activity promotion strategies.
## Methods

### Inclusion
- RCTs & Non-RCTs
- Subjects aged ≤18 years with T1D
- Physical activity intervention (more than a one-off session)

### Databases
- CINAHL Plus, the Cochrane Library, EMBASE, MEDLINE, PsychINFO, SCOPUS, SportDiscus and Web of Science

### Analysis
- Meta-analysis using Revman

### Quality Assessment
- RCTs – Cochrane risk of bias tool [4]
- Non-RCTs – Revised version of Cochrane tool
Potential relevant published articles identified by searching databases
n = 1,721

Articles screened after removal of duplicates
n = 771

Articles excluded based on title
n = 630

Additional records identified through hand-search of reference lists
n = 15

Articles excluded after scrutiny of abstracts
n = 100
Not a physical activity intervention = 55
Conference/abstract only = 28
Protocol / thesis = 2
Not Type 1 diabetes = 1
Not children = 2
Not in English = 7
Reports a study already included = 1
Unable to access full article = 4

Articles excluded after detailed evaluation of full article
n = 30
Not a physical activity intervention = 26
Not children = 4

Published articles included in the review after detailed evaluation
n = 26

Number of studies represented
n = 23

- 10 RCT
- 16 non-RCT
- Published 1964–2012
Results

Subjects

- Sample size 10 - 196
- 756 participants (661 with T1D)
- Mean age ranged from 8 – 17 years
- 5 boys only, 3 girls only

Interventions

- Most recruited through clinic (8 unknown)
- 1 reported recruitment method (e.g., invitation)
- Duration: 2 – 39 weeks
- All had single post-intervention follow-up
- 2 with long-term follow-up
- Activity sessions 30 – 120 mins, 1 – 5 times a week
- Wide variety of activities of varying intensities
- 1 reported a theoretical underpinning
Study location
Physical activity and fitness

- 4 studies measured physical activity as an outcome.
- One used accelerometry: found adolescents spent an average of 10hr a day in sedentary activity, 42 min in moderate-to-vigorous physical activity [2].
- 19 measured various markers of fitness.
- 14 reported a beneficial effect on some area of fitness.
- Three studies pooled in a meta-analysis which found a non-significant effect of physical activity on VO2 max.
- 4 studies failed to measure physical activity or fitness.
Blood glucose control (HbA1c)
Random effects meta-analysis

- 20 studies measured HbA1c as an outcome.

![Meta-analysis graph showing the results of 20 studies measuring HbA1c as an outcome. The graph includes a table with mean, standard deviation, total, and weighted mean values for experimental and control groups, along with the standard mean difference and 95% confidence intervals.]
BMI

- 9 studies measured BMI as an outcome.
Lipid Profile

- 11 studies measured serum lipids as an outcome.
- Non-significant effect on HDL or LDL cholesterol.

Triglycerides (TG)

- 5 studies measured TG as an outcome.
Total cholesterol (TC)

- 5 studies measured TC as an outcome.
Psychological outcomes

- 4 studies assessed quality of life. One study reported improvement in ‘satisfaction with diabetes’.
- 1 study measured exercise perceptions. No change in perceived self-efficacy, perceived benefits of action or perceived barriers.

Adverse effects

- Hypoglycaemia reported in 9 studies.
- Hypos were mild and ranged from none to at least one episode in most participants.
- No other adverse effects reported.
Quality assessment: Risk of bias

The Cochrane Collaboration’s tool for assessing risk of bias in randomised trials [4].
Discussion

• Physical activity interventions have the potential to delay or reduce the risk of microvascular complications and CVD.
• None met recommended 60 minutes moderate-to-vigorous physical activity daily
• Lack of research exploring psychological effects.
• Lack of theoretical underpinning.

➢ Bias was present in all studies.
➢ Unknown confounding effect of diet and insulin.
➢ Inclusion of non-RCTs increases the risk of bias.
Implications

- Moderate effect of physical activity intervention on HbA1c could be *clinically* significant.
- Interventions should explore potential behavioural and psychological effect of physical activity.
- Interventions should be based on psychological theory of behaviour change.

References

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Thank you for listening, any questions?