UMEÅ UNIVERSITET

Umeå University Medical Dissertations, New Series No 2335

PHYSICAL ACTIVITY IN CHILDREN AND EFFECTS OF MATURATION ON EXERCISE

With reference to training, biomarkers, anthropometrical factors, and methods

Daniel Jansson

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i Aula Biologica, Biologihuset den 17 januari, kl 09.00.

Avhandlingen kommer att försvaras på engelska.

Fakultetsopponent: Professor, Örjan Ekblom

Institutionen för fysisk aktivitet och hälsa, Gymnastik och Idrottshögskolan, Stockholm, Sverige.

Department of Community Medicine and Rehabilitation

Organization
Umeå University
Department of Community Medicine and Rehabilitation

Document type
Doctoral thesis

Date of publication
20 december 2024

Author
Daniel Jansson

Title
Physical Activity in Children and Effects of Maturation on Exercise

Abstract
Background: Regular physical activity in childhood improves cardiometabolic health, motor skills, bone density, quality of life, and psychological well-being. Advances in wearable technology have enhanced activity assessment in young children but require age-specific calibration. Muscle strength, a key health indicator, is less understood regarding its relationship with age, maturity, hormones, and cytokines. This thesis explores methods for estimating physical activity, factors influencing muscular strength, and the adaptation of exercise-related hormones and cytokines to training in children.
Methods: Paper I aimed to calibrate two accelerometer devices, MotionWatch 8 (MW8) and ActiGraph GT3X (GT3X), on the hip and wrist (n = 30) and develop age-specific cut-offs for physical activity intensities in 3-year-old children. Paper II was a cross-sectional study that examined the associations of muscular strength measures with anthropometric factors, chronological age, maturation, and training experience in trained prepubertal and pubertal males (n = 41). Another aim of Paper II was to examine whether a handgrip strength test can predict total muscle strength. Paper III examined acute hormonal and cytokine response to free-weight resistance training in trained prepubertal and pubertal male children (n = 41). Paper IV was a systematic review with meta-analysis that assessed the evidence of the effects of exercise training on hormones and cytokine adaptations in children and adolescents.
Results: There was a strong correlation between MW8 (counts/30 s) and the GT3X device (counts/30 s) at both hip and wrist levels (Paper I). The devices ' cut-off scores for physical activity levels were classified with outstanding and excellent accuracy (Paper I). The cross-sectional study showed that muscular strength tests in trained male children are mostly associated with anthropometric factors, which differ depending on the exercise test chosen (Paper II). Furthermore, the handgrip strength test was strongly associated with total muscle strength in trained male children (Paper II). A single resistance training session induced greater acute post-exercise testosterone and IGF-I levels in pubertal children than in prepubertal male children (Paper III). Post-exercise IL-6 levels significantly increased only in the prepubertal group. Lastly, the systematic review and meta-analysis showed that long-term exercise training had a small effect on resting hormonal concentrations (Paper IV).
Conclusions: Measuring and classifying physical activity levels in preschoolers can be achieved accurately using MW8 or the GT3X device (Paper I). Another finding was that anthropometric measures such as body mass and fat-free mass are important factors associated with muscle strength, and they may be used to scale muscle strength scores to provide a fair interpretation across children of different body sizes (Paper II). A simple handgrip strength test could be a quick and effective screening tool for practitioners and researchers to estimate the total muscle strength in trained male children (Paper II). Furthermore, pubertal children were stronger than prepubertal children and had greater post-exercise IGF-I and testosterone response following a single resistance training session (Paper III). Finally, the systematic review and meta-analysis suggested that exercise training had a small effect on hormonal concentrations in healthy children and adolescents (Paper IV).

Keywords
Hormones, cytokines, growth, maturation, muscle strength, accelerometer, physical activity

Language
English

ISBN
print: 978-91-8070-528-8
PDF: 978-91-8070-529-5

ISSN
0346-6612

Number of pages
68 + 4 papers