

New Finnish growth references for children and adolescents: Height-for-age, weight-for-height and BMI-for-age

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Background

Growth curves require regular updates due to secular changes in linear growth. The growth references currently in use in Finland were launched 1986 and are based on measurements of children born between 1959 and 1971 (1).

Objective

We constructed contemporary growth curves, assessed secular trends in height, and defined body mass index (BMI) cut-off points for thinness, overweight, and obesity in Finnish children.

Material and methods

Mixed cross-sectional and longitudinal data of 73,659 healthy subjects aged 0-20 years (born 1983–2008) were collected from providers in the primary healthcare setting.

Growth references for length/height-for-age, weight-for-length/height and BMI-for-age were fitted using Generalized Additive Models for Location, Scale, and Shape (GAMLSS), the same method recommended by the WHO Multicentre Growth Study Group (2).

BMI percentile curves passing through BMIs 30, 25, 18.5, 17, and 16 kg/m² at the age of 18 years were calculated to define limits for obesity, overweight, and various grades of thinness.

Results

Increased length/height-for-age was seen in virtually all age groups when compared to previous Finnish growth data of subjects born 1959-1971. Adult height was increased by 1.9 cm (0.32 SDS) in girls and 1.8 cm (0.27 SDS) in boys. The largest increases were seen during the peripubertal years: up to 2.8 cm (0.41 SDS) in girls and 5.6 cm (0.70 SDS) in boys. Median weight-for-length/height had not increased.

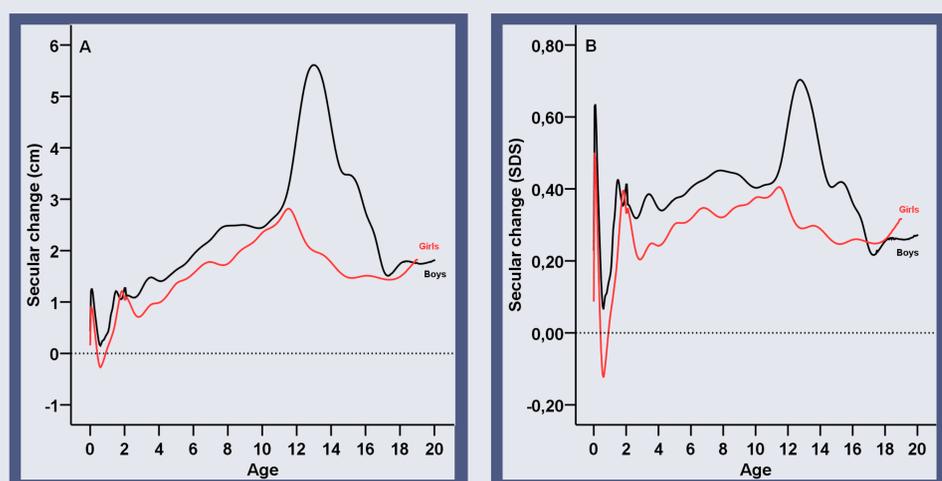


Figure 1. Age- and sex-specific features of the secular change in mean length/height in Finland
 Comparison between old and new Finnish height-for-age reference for girls (red line) and boys (black line). Curves indicate differences from the old reference (straight dashed line) A) in centimeters (left) and B) in SDS (right).

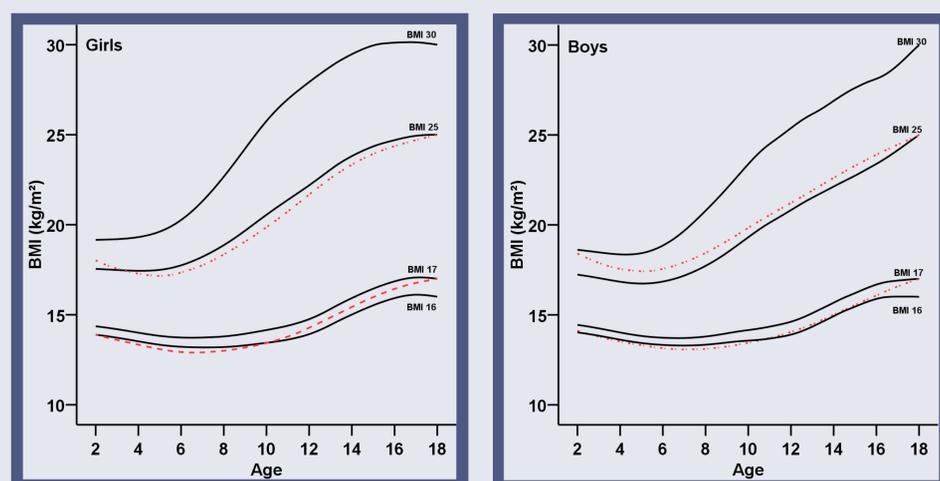


Figure 2. Finnish BMI-for-age percentile curves for obesity (BMI 30), overweight (BMI 25), grade 2 (BMI 17) and grade 3 (BMI 16) thinness for girls (left) and boys (right). Lines represent the percentiles passing through BMIs of 30, 25, 17, and 16 kg/m² at the age of 18 years. Corresponding BMI-for-age percentile curves of International Obesity Task Force reference indicate grade 2 thinness and overweight (dashed red lines) (3).

Conclusions

A significant secular change has occurred in the longitudinal growth of Finnish children. New Finnish references for length/height-for-age, weight-for-length/height, and BMI-for-age were constructed and should be implemented to monitor growth of children in Finland.

References

1. Sorva R, Perheentupa J, Tolppanen EM. A novel format for a growth chart. *Acta Paediatr.Scand.* 1984 Jul;73(4):527-529.
2. WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. *Acta Paediatr.Suppl.* 2006 Apr;450:76-85
3. Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *BMJ* 2007 Jul 28;335(7612):194