Analysis of longitudinal data of height z-scores in kindergarten children – A pilot study

Anna-Franziska Czernitzki1,*, Christina Pospisil1, Martin Musalek2, Rebekka Mumm3,4, and Christiane Scheffler1

1 University of Potsdam, Human Biology, Am Neuen Palais 10, 14469 Potsdam, Germany
2 Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic
3 Biological Anthropology, Faculty of Medicine, University of Freiburg, Freiburg, Germany
4 Evolutionary Biology and Animal Ecology, Institute of Biology I, Faculty of Biology, University of Freiburg, Freiburg, Germany

* Corresponding author: annacz@hotmail.de

With 2 figures

Abstract: Changes in body height throughout extended historic periods are very complex and dynamic processes. This pilot study aimed to investigate the pattern of longitudinal height z-scores changes in children before and after entering kindergarten. In summer 2016, we measured height and weight of 32 children from 4 groups of two kindergartens aged 3–6 years. All ages were centered according to the age of entry into the kindergarten. For each child we determined mean z-scores for height before and after entering the kindergarten, and assessed the variances for each kindergarten group. Twenty-two children targeted in height z-scores towards average height of their respective kindergarten group, 10 children did not. Due to the small numbers, the convergence in height variance however, remained insignificant (chi-squared independence test, $p = 0.127$). Additional studies with larger sample sizes are needed to confirm this pilot study.

Keywords: Height z-score; kindergarten children; secular trend; strategic growth adjustment; social signal

Introduction

Changes in body height throughout extended historic periods are very complex and dynamic processes. These so called secular trends are characterized by changes in various body dimensions and proportions, as well as by changes in the developmental tempo. The acceleration of developmental tempo was first noted in the 1920 (e.g. Koch 1935). These authors introduced the term “secular acceleration”. Later it became obvious that the changes in tempo were accompanied by concomitant changes in body dimensions and proportions. The global nature of secular trends has been well documented. Meanwhile, in many Western countries, the trends in height have slowed down or even stopped (Cole 2003).

Many factors can influence body height. Some, such as genetic influences, nutrition, state of health, and family living conditions, have well been studied.

The magnitude of the secular changes in body height is significant and amounts to some 1–2 cm per decade. In migrants, this trend is even stronger. They often completely catch up in height with the host population within only 1–2 generations. E.g. Mayas children born in Guatemala who migrated into the United States, are 11.5 cm taller than relatives who remained in Guatemala (Bogin et al. 2002). This has traditionally been interpreted as the result of improved nutrition, better living conditions, better sanitary and better health system. Yet the traditional explanatory patterns have been questioned. Ipsen et al. (2016) examined the relation between the body height of children and economic inequality.

Mumm et al. (2016) meta-analysed within-population variation in height and weight and concluded that height gains and weight gains do not depend on each other. The same authors (Mumm et al. 2017) also showed that within-country body height variance is also independent from economic prosperity as measured by GDP per capita and by the Gini coefficients as an indicator of income inequality. These results underscore the independent regulation of body height.

Contrasting common wisdom, evidence has been accumulated that body height may largely depend on psychosocial factors. Children and adolescents tend to adjust in height towards the average height of their peers. The