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Comprehensive determinants of growth trajectories and body composition in school children: A longitudinal cohort study

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Summary
Objective: To fully explain the dynamic and comprehensive etiology of the trajectory associated with adiposity indices.
Methods: This study involved data of 5572 children, aged 6—11 years, as part of the Taiwan Children Health Study (TCHS). The present study introduced four distinct BMI trajectories, identified previously among children: persistently healthy weight; late-onset overweight or obesity; persistent overweight or obesity; and declining BMI class. Logistic regression was used to examine the effect of non-modifiable factors on BMI trajectory classes. Generalized estimating equations were used to examine the effect of dynamically modifiable factors on either BMI trajectory classes or adiposity indices.
Results: Compared with class 1 (persistently healthy weight), class 2 exhibited a significantly increased risk of weight gain and fat mass, affected by lower family incomes and poor-quality sleep. Class 3 had a higher risk of persistent obesity and

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abdominal obesity, affected by higher birthweight and sedentary lifestyle. Class 4 approached a healthy weight due to increased physical activity, which was associated with a decrease in body fat and central obesity.

Conclusions: We found crucially non-modifiable and modifiable factors that could describe each high BMI growth pattern, and calculated their modifiable contributions to adiposity indices. Modifiable factors that focus on those crucially dynamic factors are recommended for preventing obese growth trajectories.

Introduction

Body mass index (BMI) trajectories are dynamic changes of BMI that arise from both non-modifiable and modifiable factors [1,2]. Non-modifiable factors are intrinsic factors that cannot be changed easily; such factors include birthweight, sex, race, family history, genetic composition, etc. [1]. Therefore, many studies have focused on modifiable factors that usually are behavioural factors such as physical activity, sedentary time, eating behaviours, and sleep quality [2]. For instance, the overweight—obese BMI trajectory was associated with reduced physical activity [3]; an increasing BMI trajectory resulted from reduced physical activity, more sedentary time and unhealthy eating behaviours [4]. A potential limitation of these studies is that only a single measurement of these modifiable factors was used. However, whether modifiable factors that focus on those crucially and dynamically modifiable factors changes in longitudinal studies affect BMI trajectories is not known.

BMI trajectories are known to associate with body compositions; however, a detailed understanding of how the dynamically modifiable factors affect adiposity-specific anthropometric characteristics remains unclear. Many studies have also indicated that modifiable factors are crucial determinants of different adiposity indices. For instance, children with low levels of physical activity and long periods of sedentary behaviour are more likely to have an above-average waist circumference [5]. Childhood obesity with different types of adiposity deposition might result in different future outcomes. Childhood adiposity continues into adulthood and further increases the risk of adult metabolic syndrome [6], cardiovascular diseases [7], and asthma [8]. Therefore, studying the effect of various factors on different types of adiposity deposition could provide additional information regarding the possible etiology from modifiable factors, adiposity to diseases.

In our previous study, Taiwan Children Cohort Study (TCHS), four distinct BMI trajectories were identified: [9] persistent healthy weight, late-onset overweight or obesity, persistent overweight or obesity, and declining BMI. We had three goals for this study based on these previously constructed trajectories: first, to explore non-modifiable factors such as genetics and early childhood risk factors for each trajectory; second, to examine modifiable factors in relation to different BMI trajectories; and third, to identify the crucially and dynamically modifiable factors of various adiposity indices for each high BMI growth trajectory.

Methods

This study used data pertaining to children aged 6—11 years, obtained as part of the Taiwan Children Health Study (TCHS), a nationwide study involving two cohorts. Full study methodology is published elsewhere [9]. The first cohort of seventh- to eighth-grade school children; the second cohort of fourth-grade schoolchildren, were enrolled in 2007 and 2010, respectively. Genomic DNA was extracted from oral mucosa for each participant. A questionnaire was given to children to assess modifiable factors such as sedentary behaviour, level of physical activity, sleep quality, and eating behaviour. An extra questionnaire was distributed to parents to report non-modifiable factors such as sociodemographic factors and associated confounders. The follow-ups regarding the child questionnaire, obesity measures, and physical fitness tests were performed annually between 2010 and 2012. Addi-

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