

# Children grow faster during school year than during summer holidays

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It has been long recognized that in Western countries, children are more likely to become overweight or obese over the summer. Causes of this include changes in kids' physical activity and diet over during the

summer period, including the summer holidays. But in a new study in *Frontiers in Physiology*, scientists from the US show that this "obesogenicity" of summers has another unexpected cause: children grow faster over the school year than over the summer. And because Body Mass Index (BMI) is the ratio of body weight in kg and height in meters squared, faster vertical growth during the school leads to increased BMI during summers.

"Here we show seasonality in standardized [body mass index](#) (BMIz), with [children](#) gaining height at a greater rate during the [school year](#) compared to the summer," said Dr. Jennette P Moreno, an assistant professor at the USDA/ARS Children's Nutrition Research Center, Baylor College of Medicine in Houston, Texas, and the study's first author.

BMIz is individual BMI scaled to the population-specific average BMI, so that a BMIz of one is equal to a BMI one standard deviation above average. Typically, a BMIz of 1.04 is considered overweight, and a BMIz of 1.64 obese.

"The children's rate of weight gain was more consistent than their rate of gain in height across the year, except among children who started to transition to an unhealthy weight status in the summer after completion of the second grade," said Moreno.

Moreno et al. statistically reanalyzed the results from their 2013 [study](#), where they followed 3588 children who entered kindergarten in September 2005, at any of 41 schools in the Fort Bend Independent School District around the city of Sugar Land in Texas. They followed these children, who were five to six years old at the start, until the fall that followed completion of the fourth grade of primary school, five years later. Nurses measured each child's height and weight twice a year, in mid-September and mid-April. The present reanalysis is more

powerful than in 2013.

The authors divided the children into five 'BMI trajectory groups', based on their pattern of change in BMIz over the study. Here, 22.6% of children scored as 'chronically overweight or obese', 8.2% 'becoming healthy weight', 8.5% as 'late-onset overweight or obese', 8.2% as 'early-onset overweight or obese', and 52.5% as 'persistently healthy weight'. Early-onset was defined as transitioning toward an above-average BMIz beginning the summer after kindergarten, and late-onset as beginning this transition the summer after 2nd grade.

Besides BMI trajectory group and season (fall or spring), the authors used the school, the child's Age in months, gender, race or ethnicity, and relative body weight or height compared to peers as explanatory variables to model seasonal changes in height, weight, and BMIz, as well as their modifying statistical interactions.

Vertical growth was seasonal: children's height increased faster over the school year than over the summer by an average rate difference of .055 cm/month. As a result, graphs for linear growth across time—corrected for other variables—show a jagged pattern, with peaks in spring and valleys in the fall. This deficit in vertical growth over summer was greatest for 'chronically overweight or obese' with a total of approximately -0.1 cm/month less growth over summer than over the school year.

The rate of weight gain did not differ between seasons. But the latter combined patterns of height and weight meant that BMIz was highest in summer, while the probability of becoming overweight or obese increased sharply over every summer.

"Despite the pattern of height gain showing greater increase in height during the school year, children's height gain influenced BMIz more

strongly during the [summer](#) holiday year than during the school year, with weight gain showing a constant increase during the school year," said co-author Dr. Debbie Thompson, a USDA/ARS research nutritionist and professor at the USDA/ARS Children's Nutrition Research Center at Baylor College of Medicine.

"This differential seasonal impact of height and [weight](#) on BMIz lead to a healthier BMIz status during the school year."

What causes the strong seasonality of vertical growth is not yet clear. "It's possible that the demands of the [school](#) year alter children's exposure to the daily light-dark cycle, which may cause the seasonal pattern in height. Additional studies on children who receive year-round schooling might help to answer this question," said final author Dr. Craig A Johnston, an associate professor at the Department of Health and Human Performance of the University of Houston.

"What is clear is that children at the greatest risk of becoming overweight and obese have a less pronounced seasonal impact of height gain on BMIz, indicating they would benefit from obesity prevention efforts throughout the year," concluded Johnston.

**More information:** Seasonality of children's height and weight and their contribution to accelerated summer weight gain, *Frontiers in Physiology* (2022). [DOI: 10.3389/fphys.2022.793999](https://doi.org/10.3389/fphys.2022.793999)

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