Teenage weight gain down to dramatic drop in calories they burn

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Credit: Peter Häger/Public Domain

An acceleration in obesity among young teenagers could be explained by a 12-year-long study which found that the number of calories they burn while at rest drops suddenly in puberty.

Research led by the University of Exeter Medical School, published in

the Nature journal *The International Journal of Obesity*, found unexpectedly that when they reach puberty, both girls and boys experience a rapid drop in the number of calories they burn - at a time when the number would be expected to rise with the growth spurt.

The research by Professor Terence Wilkin, of the University of Exeter Medical School, found that 15-year-olds use 400 to 500 fewer calories while at rest per day compared to when they were 10-years-old - a fall of around a quarter. But by the age of 16, their calorie expenditure begins to climb once again. For comparison, a McDonalds Big Mac contains 508 calories and it would take an hour of Zumba to burn 500 calories through exercise. The study also found that teenagers exercise less during puberty, adding to the calorie excess that underlies obesity. This exercise drop is particularly stark in girls, whose activity level drops by around a third between the ages of seven and 16.

The new findings, which come after the government launched a strategy to tackle the dramatic rise in childhood obesity, may help explain why may youngsters become obese in puberty. The World Health Organization (WHO) regards childhood obesity as one of the most serious global public health challenges for the 21st century. The National Child Measurement Programme (NCMP) measures the height and weight of around one million school children in England every year, found that a third of 10-11 year olds were overweight or obese.

Professor Terry Wilkin, of the University of Exeter Medical School, said: "Child obesity and associated diabetes are both among the greatest health challenges of our time. Our findings can explain why puberty why teenagers gain excess weight in puberty, and it could help target strategies accordingly."

We spend calories in two ways - voluntary spend through physical activity and the much larger involuntary spend, simply to stay alive.

Thinking, keeping blood warm, and keeping the heart, liver and kidneys working together use up to 1,600 calories per day in adolescence.

This involuntary spend might be expected to rise with body size, and among the children studied, the calorie expenditure rose as expected from the age of five onwards - but researchers were surprised to see the children studied experience a sudden drop in calorie expenditure during puberty, from the age of 10 onwards. This was particularly surprising as it is a period of rapid growth, and growth uses lots of calories.

During the 12-year-long study, between 2000 and 2012, the research team analysed data gathered from nearly 350 school children in the Earlybird study, based in Plymouth in the UK. The children were assessed every six months between the ages of five and 16, during which blood samples were given to assess metabolic health and measurements of size, body composition, metabolic rate and physical activity taken. Of this set, 279 children gave data that made them eligible for the latest study.

Burning calories uses up a fixed amount of oxygen. The children rested in a sealed canopy and their oxygen consumption was measured over a period of time, to enable researchers to calculate their calorie use from the amount of oxygen consumed.

The study builds on research published by Professsor Wilkin last year which showed that children are particularly susceptible to weight gain at two stages - once in infancy, probably attributable to diet and lifestyle choices made by the child's parents, and again in puberty. This second peak was previously unexplained. The new research suggests it may be explained by a drop in the number of calories young teenagers burn while at rest during puberty.

Professor Wilkin said: "When we looked for an explanation for the

rising obesity in adolescence, we were surprised to find a dramatic and unexpected drop in the number of calories burned while at rest during puberty. We can only speculate as to why, but it could be a result of an evolutionary trait to save calories for growth that may now contribute to a dangerous rise in adolescent obesity in cultures where food is in abundance. It could be that we have evolved to preserve calories to ensure we have enough to support changes in the body during puberty, but now we they have sufficient calories each day, the drop in spend means excess weight gain"

Proessor Wilkin's research career spans more than 30 years, with early work in thyroid disease and more recent work on causes and treatments of type 1 diabetes. The Earlybird study has published more than 60 peer-reviewed papers and unique data on the behaviour of insulin resistance during childhood.

The study was set up to try to establish why so many young people are at risk of developing diabetes. Some 2.3 million people in the UK know they have diabetes. A further 750,000 have diabetes but don't yet know it. By the time they are diagnosed, half will already have complications. Type 2 diabetes, so-called 'adult' diabetes, is by far the commonest form, and it is of concern that teenagers and even younger children are now affected by it. It has been predicted that, unless present trends are slowed, one in five of children born in 2000 will develop diabetes in their lifetime - largely because of obesity.

More information: M Mostazir et al, Evidence for energy conservation during pubertal growth A 10-year longitudinal study (EarlyBird 71), *International Journal of Obesity* (2016). DOI: 10.1038/IJO.2016.158