ENCYCLOPEDIA
on Early Childhood
Development

Appetitive Traits and Weight in Children

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Introduction

Global prevalence of obesity is increasing rapidly, with rates in low- and middle-income countries catching up with those in richer nations. In 2010, roughly 42 million children under five were estimated to be overweight or obese, of whom almost 35 million were from developing countries.[1] The simple explanation for the obesity epidemic is that there is less need to be physically active and more availability of low-cost, high-calorie food, creating an *"obesogenic" environment*.

Subject

There is a growing variation in *adiposity* in the population, with the lean staying lean while the fat get fatter. What is driving these differences? One explanation is that specific appetitive traits or eating behaviours may render some individuals more susceptible to environmental pressures – the behavioural susceptibility hypothesis.

Key Research Questions

- Do individual differences in appetite contribute to variation in weight gain?

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- Are the determinants of appetite genetic or environmental?
- Can we devise interventions to modify ‘risky’ appetitive traits?

Recent Research Results

Research with children indicates that certain eating styles may be more pronounced in higher weight groups. For example, overweight children ate more snack foods than their lighter peers when not hungry,[2,3] and were less able to regulate their food intake after consuming an appetizing preload than their leaner peers in two other studies.[4,5] Overweight children appear to find food more reinforcing than lean children.[6] Finally, research has also documented a faster eating rate in obese 6 year olds[7] and 11 year olds,[8] while the eating rate of 9-12 year olds increased linearly with *body mass index (BMI)*.[9] These observations suggest that the following appetitive traits increase the risk of weight gain: responsiveness to food, lack of sensitivity to fullness, a tendency to find food particularly reinforcing and higher speed of eating.

In addition to behavioural tests, recent research has investigated associations between appetitive traits and adiposity using psychometric measures. The Child Eating Behavior Questionnaire (CEBQ[10]) is a widely used parent-report instrument that includes both “food approach” behaviours (e.g., enjoyment of food, food responsiveness, and emotional over-eating) and “food avoidant” behaviours (e.g., speed of eating, satiety responsiveness, and food fussiness). Consistent associations between CEBQ subscale scores and weight have been observed in both normal and clinical populations of children. For example, higher food cue responsiveness and lower satiety responsiveness were associated with progressively higher adiposity in 8-11 and 3-5 year olds in one study.[11] Another study of 7-9 and 9-12 year-olds found that all food approach behaviours measured using the CEBQ showed a graded positive association with weight, while food avoidant behaviours showed the opposite pattern.[12] Similar findings have been reported in samples of 3 to 13-year-old Portuguese children[13] and 7 to12 year-old British children[14] both of which included clinical groups seeking treatment. Longitudinal studies are adding weight to the argument that the relationship is causal.[15,16]

If appetite is a determinant of weight gain, two questions arise: Firstly, how do eating behaviours develop and secondly, are they modifiable? In attempts to discern at what stage of development these appetitive traits emerge, two cohort studies have investigated whether variation in appetite can be identified early in life, and whether they are associated with later differences in weight.[9,17] In a large twin study, parents completed the Baby Eating Behavior Questionnaire

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which measures enjoyment of food, food responsiveness, slowness in eating and satiety responsiveness during the period of milk-only feeding. Infants were weighed at 3, 9 and 15 months of age. Longitudinal analyses showed clear associations between appetitive traits and subsequent weight gain; stronger than between weight and subsequent appetite, supporting of the idea that differences in appetite influence weight gain in infancy, rather than weight gain driving appetite.[17] That differences in appetite avidity emerge so early in life suggest a genetic component. In support, data from this and another twin cohort have revealed substantial heritability of eating behaviour traits in children[9,18] and more recently in very young infants[19] as well as an association with *FTO genotype*.[20,21]

Familial influences on eating behaviour and adiposity are also of great importance. For very young children, parents determine their children's food environment by deciding what, when and how much food is offered. In addition, parents use specific feeding strategies to promote or restrict the type or amount of food that their child eats. There has therefore been considerable research interest in the extent to which these parental feeding practices might mitigate or exacerbate the influence of the wider environment, in terms of their impact on children's eating behaviour and ultimately, weight. One proposal is that when parents restrict their child's access to highly palatable unhealthy foods, children's liking for these foods is increased via a 'forbidden fruit' effect, thereby creating greater desire to eat more of them when they do become available. This is posited to teach children to eat when food is available regardless of whether they are hungry or not (food responsiveness). There is considerable support for the association between parental restriction and children's eating and weight (see reference 22 for a review) although findings are not entirely unequivocal.[23] Cross-sectional studies are the norm and the direction of causality remains unclear as a result. Rare longitudinal investigations have suggested interactional relationships[24] between parental feeding strategies and appetitive traits and weight. The suggestion is that parents adjust their feeding practices in response to the appetitive and anthropometric characteristics of their children. In other words, parents' feeding practices are responsive to, rather than causal of, the eating behaviour of their children. In support of this there is evidence, both qualitative and quantitative, of parents using different feeding strategies with different siblings.[25,26] A full understanding of the complex interplay of factors that shape children's eating behaviours and weight remains out of reach at present.

Research Gaps

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- Identification of specific genes affecting eating behaviours would elucidate the mechanisms through which individuals are rendered susceptible.
- Measurement of biological indicators of food-cue responsiveness indicating different salivary and hormonal responses and different patterns of brain activation in obese individuals.
- More prospective and longitudinal studies of the relationships between children's eating behaviours and weight, and parental feeding practices.
- Exploration of the impact on children's weight of behaviour change interventions targeting 'risky' appetitive traits.

Conclusions

The increase in childhood obesity since the 1980s has not been the result of genetic changes in the population, but is attributable to environmental changes favoring sedentary lifestyles and food over-consumption. However, obesity risk is not equal across the population – there are wide individual differences in body weight and these appear to be at least partly explained by differences in inherited appetitive traits. Broadly speaking, obese individuals appear be less satiety responsive, more food cue responsive, to find food more reinforcing, and to eat more quickly than their leaner counterparts. To some extent these eating behaviours are heritable, but the degree to which they are expressed is determined by environmental conditions and for the youngest children, parents dictate those conditions in the family home. Early research suggested that maladaptive parental feeding styles might be to blame for children's obesogenic eating behaviour. More recent research suggests a complex and dynamic bi-directional process by which parents respond to children's eating style and weight status, which in turn are influenced by the behaviour of parents and the characteristics of the home and wider environment.

Implications for Parents, Services and Policy

Childhood obesity has reached epidemic proportions with enormous attendant costs, both in terms of health and in financial resources. Recognizing that children at high risk of obesity (with one or more overweight parents) frequently display risky eating behaviours offers the opportunity to intervene early in the home setting as well as in childcare facilities before problematic weight gain occurs. The effectiveness of interventions (both preventative and therapeutic) could be increased by incorporating strategies to modify these appetitive traits and

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therefore help children to better manage their own eating. Few intervention studies have been conducted, but there is some evidence to support the targeting of food responsiveness and satiety responsiveness/slowness in eating. If successful, such interventions could inform better child-feeding guidance to parents and health professionals so that inherited obesogenic eating styles are not exacerbated and exaggerated by counter-productive feeding practices. In terms of wider food environment, it is clear that children who are poor at regulating their food consumption would benefit from changes in terms of reduced portion sizes and energy density of foods offered, increased availability and promotion of healthy foods and opportunities for physical activity.

From government downwards, better understanding of the interaction between genes and environmental factors affecting appetite and weight would be of enormous benefit.

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