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Research report

Measuring hunger and satiety in primary school children. Validation of a new picture rating scale ☆

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ABSTRACT

Measuring hunger and satiety in children is essential to many studies of childhood eating behaviour. Few validated measures currently exist that allow children to make accurate and reliable ratings of hunger/satiety. Three studies aimed to validate the use of a new categorical rating scale in the context of estimated and real eating episodes. Forty-seven 6- to 8-year-olds participated in Study 1, which used a between-participant design. Results indicated that the majority of children were able to make estimated hunger/satiety ratings for a story character using the scale. No significant differences in the ratings of hunger/satiety of children measured before and after lunch were observed and likely causes are discussed. To account for inter-individual differences in hunger/satiety perceptions Study 2 employed a within-participant design. Fifty-four 5- to 7-year-olds participated and made estimated hunger/satiety ratings for a story character and real hunger/satiety ratings before and after lunch. The results indicated that the majority of children were able to use the scale to make estimated and real hunger and satiety ratings. Children were found to be significantly hungrier before compared to after lunch. As it was not possible to establish the types and quantities of food children ate for lunch a third study was carried out in a controlled laboratory environment. Thirty-six 6- to 9-year-olds participated in Study 3 and made hunger/satiety ratings before and after ingesting an ad libitum snack of known composition and quantity. Results indicated that children felt hungrier before than after the snack and that pre-snack hunger/satiety, and changes in hunger/satiety, were associated with snack intake. Overall, the studies indicate that the scale has potential for use with primary school children. Implications of the findings are discussed.

Introduction

Being able to accurately assess hunger and satiety in children is essential to many studies in the field of childhood eating behaviour. Studies measuring snack intake with the Eating in the Absence of Hunger (EAH) paradigm rely on children's self-reported hunger and satiety. Other studies rely on children being in a fasted or non-fasted state to later establish factors like children's abilities to compensate for different caloric preloads. Despite this, few validated measures exist that are known to accurately reflect children's own perceptions of their hunger and satiety.

Some studies into childhood eating behaviour have relied on visual analogue scales (VAS) commonly applied in research with adults and adolescents to establish hunger and satiety in children aged 8–12. Roemmich, Wright, and Epstein (2002) asked children to rate their hunger/satiety using a 100 mm VAS with the anchors "very hungry/very full." Nevertheless, the paper did not present any indication of children's comprehension of this scale or of changes in hunger/satiety ratings prior to and after snack intake. Developmental research suggests that children need to be able to seriate their perceptions of hunger and satiety from hungry to full correctly before being able to use a VAS correctly and reliably (Shields, Palermo, Powers, Grewe, & Smith, 2003). Keller et al. (2006) found that the majority of children in their sample aged 4–5 years were able to use an age-appropriate VAS to reflect changes in estimated fullness, after having received a considerable amount of training. This suggests that abilities to seriate may be present from an earlier age, but that tasks relying on the application of seriation techniques may be dependent on training. It is therefore likely that ratings of hunger and satiety on an abstract VAS demand greater cognitive abilities than those commonly present in untrained children aged 7 years or younger (Shields et al., 2003). Research by Shields et al. indicated

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that child age and IQ, used as an indicator of cognitive ability, were the best predictors of kindergarteners' abilities to correctly make ratings using a VAS. As more than 50% of children aged 5–7 years who participated in their study failed to use the VAS correctly, the authors suggest that alternative rating scales should be used when working with children aged 7 years or younger. In a further study carried out by Shields, Cohen, Harbeck-Weber, Powers, and Smith (2003) the ability of children aged 5–14 years to correctly mark a VAS and understand the concept of a VAS for pain experiences was tested. Shields et al. (2003) report that only one-third of the 106 children who participated in their study were able to correctly use and understand the VAS, with age being the best predictor of performance. Importantly, there were no differences in children's abilities to use and understand the VAS based on whether they received a basic or a more intensive amount of training to use it. Pilot work with three 7- to 8-year-olds in our own lab indicated that even children of this older age-range found abstract VAS difficult to use and that their ratings did not correspond with verbal explanations of their current hunger/satiety perceptions.

Previously developed hunger and satiety rating scales for use with children have generally consisted of figures with manipulated stomach regions as children have been found to reliably associate this body region with feelings of hunger and satiety (Faith, Kermanshah, & Kissileff, 2002). Fisher and Birch (1999) used cartoon figures with varying amounts of food in their stomachs to assess 3- to 6-year-old children's reported hunger and satiety in the context of an EAH paradigm. The authors only included the data of those children who reported being full after a meal and who had access to snacks afterwards, in their analyses. It remains unclear though how many children were excluded due to a failure to understand the scale.

Research by Faith et al. (2002) and Keller et al. (2006) has also focused on the development of measures assessing estimated hunger and satiety. Faith et al. developed a range of silhouettes to assess satiety in children aged 4–6 years. Silhouettes were gender specific and contained various amounts of food in the stomach regions, allowing children to make judgements of estimated fullness. Based on the research by Faith et al., Keller et al. developed an analogue scale (Freddy), which consisted of a cardboard cut-out doll, with an adjustable stomach, allowing children to dynamically regulate estimated hunger and satiety. This scale has shown good applicability to estimated hunger and satiety states in children aged 4–5 years and has also been used in the context of real eating episodes. Kissileff, Keller, Lofink, Torres, and Thornton (2008) evaluated the ability of 5- to 6-year-olds to use the scale to reflect increases in satiety in response to 15 individual 15 ml portions of a yoghurt shake and found that after two training/testing sessions the majority of the 11 children who participated in their study were able to indicate greater fullness in response to intake.

To address the lack of hunger/satiety rating scales that can be used in the context of estimated as well as real eating episodes, we developed a new picture rating scale, "Teddy the Bear," consisting of five pictures of teddies which had varying amounts of food in their stomachs and which were accompanied by descriptive vignettes. The purpose of the scale was to allow children to make accurate ratings of their current feelings of hunger/satiety. Our studies therefore aimed to establish whether the Teddy scale could be used to measure hunger/satiety in primary school children aged 5–9 years. We assessed children's comprehension of the scale while examining possible effects of age and gender (Study 1) and also assessed the scale's ability to reflect changes in estimated hunger/satiety states (Study 1) and with respect to a real eating episode (Study 2). Additionally we established whether the scale was able to reflect changes in hunger/satiety in the context of the ingestion of an ad libitum snack in a controlled environment (Study 3).

Study 1

Method

Participants

Forty-seven children aged 6 to 8 years participated in this study. The sample consisted of 27 females and 20 males who were predominantly White British. Children were typically developing and attended years 3 and 4 of a primary school in Birmingham, UK. The Index of Multiple Deprivation (2010) for the school and the surrounding areas indicated that the sample of children participating in this study is likely to be drawn from the most deprived 50% of English communities (Index of Multiple Deprivation, 2012).

Measure

For the purpose of this study a picture rating scale, aimed at assessing hunger and satiety, was developed. The scale consisted of five black and white cartoon bear silhouettes. Varying amounts of "food" were represented by black ovals in each bear's stomach area, which increased in size proportionally as the amount of food consumed and the satiety of the bear increased. Each of the five bear silhouettes was accompanied by a label placed above the silhouette, which described the bear's level of hunger and satiety, starting from 1 (*very hungry*) to 5 (*not hungry at all/very full*) (see Fig. 1).

Procedure

The study was conducted over one school day starting at 09:00 and ending at 15:10. Children were tested at school on a one-to-one basis, within a quiet corner of the classroom. Children were asked if they would like to do some work with the researcher and, if they agreed, children were told the story about Teddy the Bear (story outline below). The story had an interactive element; children were asked to rate Teddy's hunger at two points during the story, while also rating their own currently perceived hunger/satiety state. Each child's participation lasted for no more than 10 min. The researcher recorded whether children took part in the study in the morning after breakfast but before a mid-morning snack, in the morning after a mid-morning snack and before lunch or in the afternoon after lunch. Children were given stickers as a thank you for taking part and returned to their seats following their participation. This study was approved by the Ethical Review Committee of the University of Birmingham.

The scale's appropriateness to accurately reflect estimated states of hunger/satiety was evaluated through a fictional story, which revolved around "Teddy the Bear." In the story Teddy went to the park, and after spending the whole day there playing he realized that he was very hungry and consequently returned home to prepare and eat a large meal after which he felt very full. (For the full story please see Appendix A.)

Stage 1 involved children's familiarization with the scale. Initially the researcher introduced the child to the scale by looking at the pictures of Teddy and reading the labels accompanying each picture of Teddy with the child. The child was made aware of the differences between each picture and label and the researcher checked child comprehension by asking the child to tell the researcher how hungry and how full she/he thought the different Teddy bears were.

Stage 2 involved the application of the scale to estimated hunger and real hunger. The researcher read the story to the child and asked the child to show how hungry she/he thought Teddy was at two time points during the story, once prior to a large meal and once after consuming it, by using the scale. Children were also asked to rate how hungry they felt themselves currently by using the scale (see Appendix B for script).