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Eating behaviour is associated with eating frequency and food consumption in 6–8 year-old children: The Physical Activity and Nutrition in Children (PANIC) study

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ABSTRACT

The association between eating behaviour and dietary factors has been studied narrowly in children. Therefore, we investigated whether eating frequency and food consumption are influenced by eating behaviour in a population sample of 406 children aged 6–8 years. We assessed features of eating behaviour by the Children's Eating Behaviour Questionnaire and dietary factors by a 4-day food record. The results showed that *enjoyment of food* was directly associated with a number of main meals ($p = 0.041$) and consumption of vegetables ($p = 0.041$), cheese ($p = 0.005$), and meat ($p = 0.002$). *Food responsiveness* was directly associated with consumption of fruit and berries ($p = 0.013$) and meat ($p = 0.016$). *Desire to drink* was directly associated with consumption of fat-containing milk ($p = 0.002$) and inversely associated with consumption of skimmed milk ($p = 0.001$). *Food fussiness* was inversely associated with a number of main meals ($p = 0.013$) and consumption of vegetables ($p < 0.001$), cheese ($p = 0.001$), and meat ($p = 0.027$). *Satiety responsiveness* was inversely associated with consumption of vegetables ($p = 0.031$), cheese ($p = 0.010$), and meat ($p < 0.001$) and directly associated with consumption of candies and chocolate ($p = 0.026$). *Slowness in eating* was inversely associated with consumption of meat ($p = 0.018$). Where sex differences existed the associations tended to be observed mostly in girls but not in boys. Our study shows that *enjoyment of food* and *food responsiveness* are directly associated with consumption of protein-rich foods and vegetables, fruit and berries, whereas *food fussiness* and *satiety responsiveness* are inversely associated with consumption of these foods. Assessment of eating behaviour can help in identifying children with various dietary needs.

1. Introduction

School-aged children in the developed countries commonly eat too much foods containing lots of sucrose, saturated fat, and salt, such as sugar-sweetened beverages, candies, and meat, and too little foods high in vitamins, minerals, fibre, and other nutrients that are essential for growth, development, and health, such as vegetables, fruit, berries, high-fibre grain products, and fish (Diethelm et al., 2012; Elmadfa et al., 2009; Eloranta et al., 2011; Hoppu, Lehtisalo, Tapanainen, & Pietinen, 2010; Kyttala et al., 2010; Lambert et al., 2004). School-aged children also tend to skip meals and this habit has been found to increase the risk of becoming overweight in childhood (Eloranta et al., 2012; Jaaskelainen et al., 2013). One crucial way to facilitate normal growth and development and reduce the risk of health problems originating in childhood would be to improve the eating habits of school-aged children.

Previous studies have found that certain features of eating behaviour, such as food approach eating behaviour sub-scales *enjoyment of food* and *food responsiveness,* have been related to

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weight (Croker, Cooke, & Wardle, 2011; Webber, Hill, Saxton, van Jaarsveld, & Wardle, 2009), body fat percentage (Eloranta et al., 2012), and obesity in children (McCarthy et al., 2015). In addition, food-avoidant eating behaviour sub-scale *food fussiness* has been associated with the risk of inadequate energy and nutrient intake (Galloway, Fiorito, Lee, & Birch, 2005). These previous findings emphasise the important link between eating behaviour and health aspects in children. Some studies have also found an association between eating behaviour and food preferences in children. For example, *food fussiness* and *satiety responsiveness* have been associated with a lower liking of vegetables and fruit (Fildes et al., 2015). However, rather few studies in children have investigated the associations between eating behaviour and actual food consumption (Carnell et al., 2016; Cooke et al., 2004; Dubois, Farmer, Girard, & Peterson, 2007; Galloway et al., 2005; Rodenburg, Kremers, Oenema, & van de Mheen, 2012) and meal frequency (Syrad, Johnson, Wardle, & Llewellyn, 2016). In these studies *food responsiveness* has been associated with a higher meal frequency (Syrad et al., 2016) and a higher consumption of vegetables and fruit (Carnell et al., 2016; Cooke et al., 2004), whereas so-called picky or fussy eating has been associated with a lower consumption of these foods (Dubois et al., 2007; Galloway et al., 2005).

According to previous studies, eating behaviour does not differ between girls and boys at preschool age (Svensson et al., 2011) or if there are differences, they are small when children are aged 2–7 years (Wardle, Guthrie, Sanderson, & Rapoport, 2001). However, boys have been reported to score higher in *food fussiness* and *emotional overeating* and lower in *enjoyment of food* than girls when they reach primary school age (Sleddens, Kremers, & Thijs, 2008). In addition, a systematic literature review concluded that boys were more likely to eat breakfast than girls (Currie et al., 2012) but that girls consumed more vegetables and fruit than boys (Rasmussen et al., 2006). Therefore, there may be some differences in factors affecting the food selection between boys and girls that only begin to manifest later on in childhood. However, there are no earlier studies investigating differences in the associations of eating behaviour with eating frequency and food consumption between primary school aged boys and girls.

It is important to determine which factors may influence food intake in boys and girls in order to enhance their diet quality, health and growth. We therefore investigated the association of eating behaviour with eating frequency and food consumption among 6-8-year-old primary-school children and whether there are sex differences in these associations.

2. Methods

2.1. Study population and study design

This is a part of the Physical Activity and Nutrition in Children (PANIC) study which is an ongoing physical activity and dietary intervention in a population sample of children (Eloranta et al., 2012). A total of 736 children aged 6–8 years who started first grade in 16 primary schools of the city of Kuopio, Finland, in 2007–2009, were invited to participate in the study via letters forwarded to their parents from the schools, with 512 (70%) participating in the baseline evaluation. According to the school health examination data, the participants did not differ in age, sex, distribution, or body mass index standard deviation score (BMI-SDS) from all children who started the first grade in the primary schools of Kuopio during the years 2007–2009. The final study population comprised of 406 children (204 girls and 202 boys) who had complete data on food consumption and eating behaviour. The participants did not differ in terms of age, sex distribution, or BMI-SDS from those children (n = 106) who were excluded from the analyses due to missing data.

The PANIC study protocol was approved by the Research Ethics Committee of the Hospital District of Northern Savo (Kuopio, Finland). All the children and their parents gave their written informed consent for participation in the study.

2.2. Assessment of body size and composition

Anthropometric measures were assessed at the beginning of the study. Body height (cm) was measured to an accuracy of 0.1 cm using a wall-mounted stadiometer. Body weight (kg) was measured to an accuracy of 0.1 kg after overnight fasting and with an empty-bladder with an InBody 720 bioelectrical impedance device (Biospace, Seoul, Korea). Body mass index (BMI) was calculated by dividing mean body weight in kg by mean body height in meters squared (kg m^2). BMI-SDS was calculated based on Finnish references (Saari et al., 2011) and overweight and obesity were defined using international cut-off values (Cole, Bellizzi, Flegal, & Dietz, 2000).

2.3. Assessment of eating behaviour

We assessed eating behaviour using the Children's Eating Behaviour Questionnaire (CEBQ) (Carnell & Wardle, 2007; Wardle et al., 2001) translated into Finnish using the forward-backward translation method (Seppänen, 2005). On the first study visit, parents were given instructions on how to complete at home the 35-item questionnaire on behalf of their child. Parents returned the questionnaire on the second visit to the researchers who checked and filled the missing information together with parents.

CEBQ was used to assess eight different features of eating behaviour: *enjoyment of food*, *food responsiveness*, *emotional overeating*, *desire to drink*, *food fussiness*, *satiety responsiveness*, *emotional undereating*, and *slowness in eating* with the eight corresponding subscales. Each subscale consists of 3–6 statements for example: "My child loves food" *(enjoyment of food),* "My child is always asking for food" *(food responsiveness),* "My child eats more when worried" *(emotional overeating),* "My child is always asking for a drink" *(desire to drink),* "My child refuses new foods at first" *(food fussiness),* "My child gets full up easily" *(satiety responsiveness),* "My child eats less when angry" *(emotional undereating),* and "My child eats slowly" *(slowness in eating),* the response options given as five-point Likert-scales (never = 1, rarely = 2, sometimes = 3, often = 4, and always = 5). The mean of each subscale was used in the analyses. The greater the mean value the greater the prevalence of that feature in that child's eating behaviour.

Internal reliability coefficients (Cronbach's alphas) were calculated for each eating behaviour subscale, and furthermore, item to total correlations were calculated for all statements of the subscales. Good internal consistency was found in seven of the eight studied subscales, with values of Cronbach's alpha ranging from 0.765 to 0.896 (Table 1). Only the subscale *emotional undereating* exhibited a low internal consistency. In that subscale, one of the statements ("My child eats more when s/he is happy") showed a low item to total correlation, whereas the item to total correlations for the other statements were within acceptable ranges (r = 0.382 to 0.450). When we calculated the subscale *emotional undereating* after excluding the divergent statement, the subscale showed good internal consistency (Table 1). Therefore, we used the modified subscale in the subsequent analyses.

2.4. Assessment of eating frequency and food consumption

We assessed eating frequency and food consumption using 4-