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What determines the fruit and vegetables intake of primary school children? - An analysis of personal and social determinants

Julia Haß*, Monika Hartmann

Institute for Food and Resource Economics, Department of Agricultural and Food Market Research, University of Bonn, Nussallee 21, 53115 Bonn, Germany

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ABSTRACT

The high prevalence of childhood obesity is a major concern in developed and developing countries. An increase in fruit and vegetable (F&V) intake is perceived as one of the numerous strategies to prevent and reduce the risk of adiposity. The purpose of this study was to investigate the relevance of personal and social determinants in explaining children's F&V intake. Written questionnaire data were collected from 702 parent-child pairs that included 3rd and 4th graders (aged 7 to 10) and their parents. Children's F&V intake was recorded over three food records. Hierarchical linear regression models were applied to assess the impact of personal and social determinants on children's F&V intake. Regression models focusing on personal and social determinants revealed that the most promising personal determinants pertained to the *knowledge of different types of F&V* and *preferences for F&V*. Moreover, an exclusive focus on social determinants indicated that *parental modeling* and *peer influence* had significant and positive relationships with children's F&V intake, whereas *verbal directives* to eat F&V exhibited a significant and negative relationship. In combination, the following four personal and social determinants were demonstrated to be significant: *knowledge of different types of F&V*, *preferences for F&V* and *parental modeling*, all of which had positive relationships, and *verbal directives* to *eat F&V*, which had a negative impact. The results identify important associative determinants of children's F&V intake. These are in part personal and in part social and are shown by our analysis to be of equal and perhaps mutual importance. Therefore, we suggest that interventions aimed at improving children's F&V intake should address children's preferences for F&V, impart knowledge concerning the variety of F&V and encourage parents to act as role models.

1. Introduction

The high prevalence of childhood obesity is a major concern in developed and developing countries (Brettschneidera et al., 2015; Ng et al., 2014). An increase in fruit and vegetable (F&V) intake is perceived as one of the numerous strategies to prevent and reduce the risk of adiposity (He et al., 2004; Oliveira, Sichieri, & Venturim Mozzer, 2008; Vioque, Weinbrenner, Castelló, Asensio, & Garcia de la Hera, 2008). Although F&V consumption has not always been directly linked to the prevalence of obesity among children (Ledoux, Hingle, & Baranowski, 2011), there is some evidence that eating more F&V leads to reduced consumption of energy-dense foods in families (Epstein et al., 2001). However, children's average consumption of these food items is – in Germany as well as in many other countries – still below the recommended consumption level (Borrmann & Mensink, 2015; Yngve et al., 2005). Importantly, eating habits acquired in childhood track, to some extent, into adulthood (Fletcher, Wright, Jones, Parkinson, & Adamson, 2016; Lien, Lytle, & Klepp, 2001). Accordingly, programs to induce dietary behavior changes, such increased F&V intake, should particularly target younger age group. Because of this, understanding the determinants of children's F&V intake is necessary and may help in designing interventions that are successful in achieving the desired behavioral changes.

According to the reciprocal determinism model from social cognitive theory, there is a dynamic reciprocal interaction among behavior, the environment, and personal characteristics. Thus, a child's dietary behavior, including his/her F&V intake, is influenced by environmental and personal factors, and the behavior itself influences those other factors. In the context of families, family members are part of the child's social environment and are

* Corresponding author.
E-mail addresses: julia.hass@ilr.uni-bonn.de (J. Haß), monika.hartmann@ilr.uni-bonn.de (M. Hartmann).

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simultaneously agents for and responders to change. Concerning dietary behavior, parents influence their children as role models with respect to, for example, the consumption of specific food items, as well as through rewarding, reinforcement or punishment strategies (Baranowski & Hearn, 1997). Empirical research confirms the major role that social environment plays in the development of healthy eating habits of children. Dave, Evans, Condrasky, and Williams (2012), as well as Trost et al. (2003), showed that parental social support has a significant impact on children's health and has measurable effects on behavioral change. Along the same lines, Patrick and Nicklas (2005) highlighted the importance of the mealtime structure within the family context. Additionally, Gross, Pollock, and Braun (2010) found an association of family and home environmental factors with F&V consumption of school-aged children. In the context of the social environment, peers are known to have a significant impact on a child's dietary behavior (Cullen et al., 2001). For example, Lowe, Horne, Tapper, Bowdery, and Egerton (2004) successfully used the influence of peers to increase the F&V intake of pupils in an intervention study targeting primary school children. The same holds true for a more recent study by Staiano, Marker, Frelier, Hsia, and Martin (2016), who used video-based peer modeling to increase young children's F&V consumption.

Personal characteristics that have been considered an important element within the reciprocal determinism model include regulatory skills, self-efficacy, taste and knowledge. In particular, self-efficacy, a motivation-related construct, has gained considerable attention in academic research. It has been found to be associated with dietary behavior and has been successful in influencing the F&V intake of children (Fitzgerald, Heary, Kelly, Nixon, & Shevlin, 2013; Luszczynska et al., 2016; Rasmussen et al., 2006; Santiago Rivera et al., 2013). Despite this more theoretical-based construct, empirical evidence suggests that taste preferences are promising determinants that should be addressed by interventions. Preferences in general, as well as the liking of a high number of different types of F&V, have been shown to be positively associated with actual F&V intake of children (Rasmussen et al., 2006). Furthermore, Fletcher et al. (2016) demonstrated that the number of vegetables toddlers liked predicted the vegetable consumption of children at age seven. Research on the association with nutritional knowledge, that is, knowing the recommended F&V intake of these food items, has been examined in several studies. Brug, Tak, te Velde, Bere, and Bourdeaudhuij (2008) found that knowledge of recommended F&V intake levels was significantly associated with F&V consumption by school-aged children in nine European countries. Additionally, Erinosho, Moser, Oh, Nebeling, and Yaroch (2012) showed that adults who were aware of the '5 A Day/Fruits and Veggies - More Matters campaign' were likely to eat more than five servings of F&V per day. In a current review conducted by Spronk, Kullen, Burdon, and O'Connor (2014), the authors concluded that most studies reported a significant but weak positive association between higher nutrition knowledge and dietary intake, whereas regarding desirable nutrition behavior, higher F&V intake was most often observed.

Overall, it can be stated that factors influencing dietary behavior are complex and have not been sufficiently investigated to date; this is especially true for children's F&V intake. Given this background, the present study aims to identify social and personal determinants that are relevant to primary school children's F&V intake and thus provides insights into the most promising factors for intervention programs.

2. Methodology

2.1. Sample and procedure

We used cross-sectional design data from the baseline survey of the evaluation of the European School Fruit and Vegetable Scheme (SFVS) in North Rhine-Westphalia (NRW), a federal state of Germany. The program provides free F&V to school children, co-financed by the European Union. The exact implementation of the scheme at the national level is left to the member states, but should be based on national or regional strategies (DG AGRI services., 2015). In NRW, schools must apply for inclusion in the program and are selected by the Ministry for Climate Protection, Environment, Agriculture, Conservation and Consumer Protection of the State of North Rhine-Westphalia (MKULNV) according to the EU framework. After acceptance into the program, all children of the concerned school receive 100 g F&V (equivalent to one banana, one medium size apple, or one carrot, for example) three times weekly, served during the breakfast break in the class room. Data for the present study were collected before program start from children of 48 primary school classes (3rd and 4th graders aged 7–10 years) at twelve schools during August and September 2012. Eight schools were recruited from those that had applied for participation in the SFVS for the upcoming school year. The remaining four schools had not applied for the scheme and served as controls in a subsequent program evaluation phase. The study was conducted in cooperation with the MKULNV and parents were asked for permission to include their child in the survey. Data handling was approved by the data protection officer of the University of Bonn.

2.2. Dietary assessment

Children's F&V intake was recorded over three repeated food records. The paper and pencil questionnaire was conducted as a whole-class exercise. Children were encouraged to recall eight meals from the previous day as open questions (breakfast at home, on the way to school, breakfast break at school, lunch, on the way home, snacks in the afternoon, dinner, snacks after dinner) using words and pictures. For the analysis, F&V frequencies were tabulated using a pre-defined coding strategy measuring frequencies but not quantities. Aspects of validity and reliability as well as sensitivity to change of this measurement were tested during development of the questionnaire in the UK (Edmunds & Ziebland, 2002) with solid results for the version adapted to the German school system (Methner, Maschkowski, & Hartmann, 2016). To ensure high data quality, manual data entry was performed twice and inter-coder-reliability was ascertained (standard: > 95% inter-coder reliability). Each participating class was asked to complete three food records on predefined days during one school week. The first questionnaire (Q-Child I) consisted of the food record plus an additional section to assess personal determinants and two of the social determinants (parental modeling, peer influence) considered in the analysis. This questionnaire (Q-Child I) was supervised by the research team to ensure that children understood the questions. The second (Q-Child II) and third questionnaires (Q-Child III) comprised only the food records and were completed with the instruction of the class teacher, who received detailed verbal and written instructions how to guide children during questionnaire completion.

Parental dietary assessment was performed using a Food Frequency Questionnaire (FFQ), which asked for the F&V intake during the past four weeks. Parent questionnaires were handed out to the children on the day on which children filled in the Q-Child I questionnaire. The FFQ is a validated instrument as well as a revision of the questionnaire used for the German Health Interview and Examination Survey for Children and Adolescents (Haftenberger et al., 2010). It includes questions about the frequency (11 response categories from more than five times per day to never) as well as the number (5 varying response categories, depending on