

The relationship between children's home food environment and dietary patterns in childhood and adolescence

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Abstract

Objective: To identify the correlates of the home food environment (parents' intake, availability and food-related parenting practices) at the age of 10 years with dietary patterns during childhood and in adolescence.

Setting: Primary-school children of fifty-nine Flemish elementary schools completed a questionnaire at school in 2002. Four years later they completed a questionnaire by e-mail or mail at home. Their parents completed a questionnaire on food-related parenting practices at baseline.

Design: Longitudinal study.

Subjects: The analyses included 609 matched questionnaires.

Statistics: Multi-level regression analyses were used to identify baseline parenting practices (pressure, reward, negotiation, catering on demand, permissiveness, verbal praise, avoiding negative modelling, availability of healthy/unhealthy food items and mothers' fruit and vegetable (F&V) and excess scores) associated with children's dietary patterns (F&V and excess scores).

Results: Mother's F&V score was a significant positive independent predictor for children's F&V score at baseline and follow-up, whereas availability of unhealthy foods was significantly negatively associated with both scores. Negotiation was positively associated with children's follow-up score of F&V, while permissiveness was positively associated with children's follow-up excess score. Availability of unhealthy foods and mother's excess score were positively related to children's excess score at baseline and follow-up.

Conclusions: Parental intake and restricting the availability of unhealthy foods not only appeared to have a consistent impact on children's and adolescents' diets, but also negotiating and less permissive food-related parenting practices may improve adolescents' diets.

Keywords

Parenting practices
Children

Adolescents
Food habits

Home food environment

Parents are of high importance in the development of their children's dietary preferences that eventually lead to their dietary patterns. Parents directly determine the child's physical and social environment by deciding which foods are available and in what quantity^(1–3). Parents' own food-related behaviours serve as a role model and thereby affect the dietary habits of their children^(4,5). Indirectly, parents influence their children's behaviour and habits through socialization. They can apply different food management practices that control, encourage or restrict the intake of certain foods. Research of the recent past has drawn attention to these food-related parenting practices as having an important influence on children's diet⁽⁶⁾.

With the transition from childhood to adolescence, at the age of 12–13 years, adolescents become more independent, and therefore it might well be that the impact of parenting practices diminishes⁽⁷⁾. Few studies have,

however, investigated the influences of the home food environment (parental intake, availability and parenting practices) on adolescents' diets.

In a study by Young *et al.*⁽⁸⁾, perceived parental modelling and home availability were significantly associated with their children's fruit and vegetable (F&V) consumption. In a cross-sectional study of project EAT (Eating among Teens)⁽⁹⁾, parental intake was positively associated with dairy intake for boys and with dairy, F&V intake for girls; significant positive associations were found for F&V intake by home availability among girls and for dairy intake by serving milk at meals for male adolescents. In a longitudinal study of project⁽¹⁰⁾ EAT, investigating a long-term role for parent modelling and availability above and beyond any short-term impact, parental intake predicted the dietary intake of young adults but not of high-school students; serving of vegetables at dinner (a measure of

availability and accessibility) was a significant predictor of adolescents' and young adults' intake.

Focus groups suggest that food rules⁽¹¹⁾ and prior food rules⁽⁷⁾ continue to exert their influence on adolescents' food choices. In studies of van der Horst *et al.*⁽¹²⁾ and de Buijn *et al.*⁽¹³⁾, more restrictive parenting practices were found to be associated with less soft drink consumption in adolescents. Congruent herewith are the retrospective studies of De Bourdeaudhuij⁽⁷⁾, in which more fat and sweet foods were consumed by adolescents who reported more permissiveness (fewer restrictions and obligations) in their family at the age of 10 years. However, they found no evidence of a relationship of prior food rules with the consumption of healthy foods in adolescence. In a study by Haerens *et al.*⁽¹⁴⁾, less restrictive food rules were associated with a higher fat intake in boys and lower fruit consumption in girls; however, no association was found with soft drink consumption.

The present study will build on the previous studies of De Bourdeaudhuij⁽⁷⁾ in which a cross-sectional design was used to study influences on healthy and less healthy foods and in which the results are based on perceptions of family food rules in the past. In the present study, a longitudinal design was used: the mothers' reports on parenting practices at the age of 10 years are used to predict intake of healthy and less healthy foods during childhood and adolescence as well as changes in intake during this transition. In addition, inclusion of measures of parental intake and availability will allow one to investigate the hypothesis that each of these factors is independently related to children's and adolescents' dietary intake.

Methodology

Procedure

The results presented here are based on the first and fourth measurements of the Longitudinal Eating and Activity study in which children have been followed from 2002 to 2005 (Fig. 1). In 2002, 100 elementary schools from two Flemish regions (East and West Flanders) were randomly selected from the official list of the Flemish government. The principals were sent a recruitment letter and afterwards contacted by phone. There were fifty-nine principals who agreed to cooperate in the study. The main reason for non-participation was lack of time. All children in the fifth grade (10-year-olds) were invited to participate in the study ($n = 1957$). Informed consent to participate in the longitudinal study was received by 1725 parents (88% of eligible children). In 2002 (T1), the children completed a self-administered questionnaire on eating habits and physical activity, demographic variables and possible psychosocial determinants in the classroom under the supervision of one researcher and their classroom teacher. The same procedure was followed for T2 (2003). In 2004, children changed, however, from primary to secondary schools,

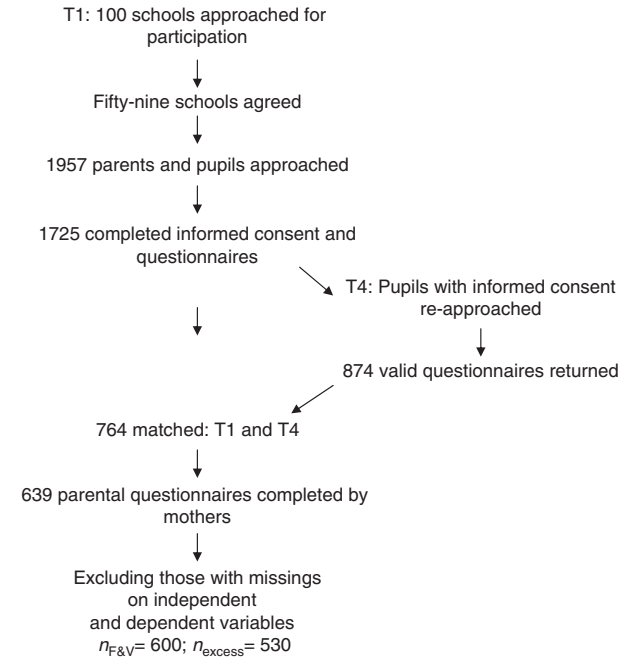


Fig. 1 Response at school and individual levels – Longitudinal Eating and Activity study, East and West Flanders, Belgium, 2002–2005

making classroom administration not feasible. Therefore, for T3 and T4, the children were contacted at home by postal mail. The envelope contained a letter addressed to the parents asking them to encourage their child to participate in the study, and a letter addressed to the child asking them to login with a personal code to a website and complete an online questionnaire. As the response rate was very low (about 30%), non-respondents were sent a reminder including a paper-pencil questionnaire and a pre-stamped envelope, 8 weeks later.

In total, 874 adolescents completed the questionnaire at T4. Of these, 764 could be matched to T1. The main reason for not participating at T3 and T4 was inability to be reached (moved) or unwillingness to fill in the questionnaire. Only the respondents for whom the parental questionnaire was completed by the mother/stepmother were included in the current analyses ($n = 639$).

Ethical approval was obtained from the Ethics Commission of the Ghent University Hospital.

Measures

Dietary patterns

The children/adolescents were asked how many times a week they usually consumed fruit, vegetables, sugared soft drinks, sweets and crisps (FFQ). The response options were: 'never (= 0)', '<1 d/week (= 0.25)', '1 d/week (= 1)', '2–4 d/week (= 3)', '5–6 d/week (= 5.5)', 'once a day', 'every day (= 7)', and 'every day more than once (= 14)'. The consumption of F&V is important in reducing the risk of cancer and CVD^(15–17). The consumption of soft drinks and

sweet and savoury snacks can impede the intake of more nutritious foods by reducing appetite control⁽¹⁸⁾.

The two F&V items were added together to form an F&V score; the consumption of regular soft drinks, sweets and crisps was combined to form an excess score⁽¹⁹⁾.

Parents were asked to report their own intake with parallel questions at T1.

Food-related parenting practices

Items measuring food-related parenting practices were based on a pilot study⁽²⁰⁾. The items addressed the use of pressure (six items), encouragement through material reward (three items), encouragement through negotiation (five items), catering on children's demand (four items), permissiveness (seven items), avoiding negative modelling (two items) and verbal praise (two items). Parents were asked to respond on a 5-point scale: 1 = never, 2 = mostly not, 3 = sometimes, 4 = most of the time and 5 = always. Internal consistencies of the subscales are reported in Table 1. For each scale, the average of the group of the respective practices was computed, if more than 50% of the scale items were answered.

The availability of fruit, soft drinks, biscuits, sweets and crisps was questioned on a 3-point scale (2 = always/mostly

available, 1 = sometimes and 0 = rarely/never). The four unhealthy items were combined to form an unhealthy availability scale.

Statistics

Three sets of models were conducted. To examine associations between potential baseline correlates and the food scores, separate multi-level regression analyses were conducted for each parenting practice with baseline and follow-up food scores, controlled for sociodemographic characteristics (gender and mother's educational level; model 1). To examine the multivariate association of all parenting practices simultaneously, all parenting practices were entered simultaneously in a second set of models (model 2). To examine the associations between parenting practices and change in food scores between baseline and follow-up, the previous model was additionally adjusted for baseline food scores (model 3).

All variables (except sociodemographics) were standardized to allow for relative comparisons of strength between the observed associations. The β -coefficients can be interpreted as the amount of SD change in food score associated with a 1 SD change in the respective parenting practice. Analyses were conducted using MLwiN version 2.02⁽²¹⁾, with respondents nested within schools at T1 (two-level random intercept model). To estimate the proportion of the explained variance of the home food environment, the proportion of unexplained variance of the full model is compared with a model including only a constant and sociodemographics for baseline measurement and including a constant, sociodemographics and baseline measurement for follow-up data. *P* values at <0.05 are considered significant.

Results

Of the 609 respondents included in the analyses (600 for the F&V score; 530 for the excess score), 50.6% were boys. Mother's educational level was distributed as follows: 24.5% low (lower technical, higher vocational or less), 23.2% medium (technical or general higher secondary education) and 52.4% high (bachelor's or master's degree). There were 95% of mothers who reported that fruit was always or mostly available; therefore, this variable is not likely to be able to distinguish and was excluded for further analyses. Descriptives of the scale variables are presented in Table 1. Correlations between the dependent and independent variables are presented in Table 2.

Table 3 shows that lesser permissiveness, a lower unhealthy availability score and a higher F&V score for mothers were associated with a higher F&V score, both at baseline and follow-up (model 1). More negotiation was only significantly associated with a higher F&V score at baseline, although a significant association with follow-up data became visible when all variables were included

Table 1 Descriptives of dependent and independent variables: LEA study, East and West Flanders, Belgium, 2002–2005 (*n* 609)

Measures at baseline			
Sociodemographics (%)			
	Mean	SD	Cronbach's α
Age (years)			
9	14.4		
10	82.1		
11	3.4		
Gender			
Boy	50.6		
Girl	49.4		
Mother's education			
Low	24.5		
Medium	23.2		
High	52.4		
Parenting practices			
Pressure	2.2	0.6	0.65
Reward	1.5	0.7	0.73
Negotiation	3.5	0.7	0.69
Catering on demand	2.6	0.7	0.78
Permissiveness	2.3	0.5	0.64
Avoid negative modelling	3.2	1.1	0.88
Verbal praise	3.5	1.2	0.94
Unhealthy food items at home	2.4	0.5	0.68
Dietary scores			
Mothers' dietary scores			
F&V score	13.3	5.3	
Excess score	5.0	4.4	
Children's dietary scores			
F&V score	11.7	5.8	
Excess score	10.8	8.8	
Measures at follow-up			
Children's dietary scores			
F&V score	11.6	5.7	
Excess score	9.8	7.9	

LEA, Longitudinal Eating and Activity study; F&V, fruit and vegetables.

Table 2 Correlations between standardized dependent and independent variables – LEA study, East and West Flanders, Belgium, 2002–2005 (n 609)

	Child's T1 F&V score	Child's T1 excess score	Child's T4 F&V score	Child's T4 excess score	Pressure	Reward	Negotiation	Catering on demand	Permissiveness	Verbal praise	Avoid negative modelling	Availability of unhealthy food	Mother's F&V score	Mother's excess score
Child's T1 excess score	-0.03													
Child's T4 F&V score	0.38***	-0.21***												
Child's T4 excess score	-0.01	0.43***	-0.18***											
Pressure	0.04	0.06	-0.00	0.01										
Reward	0.02	0.08	-0.03	0.04	0.31***									
Negotiation	0.10*	-0.01	0.11**	-0.02	0.26***	0.21***								
Catering on demand	-0.06	0.11**	-0.08	0.05	-0.13**	0.12**	-0.09*							
Permissiveness	-0.12**	0.18***	-0.17***	0.27***	-0.18***	-0.01	-0.18***	0.35***						
Verbal praise	0.08*	-0.02	0.03	-0.02	0.18***	0.21***	0.30***	0.06	-0.08*					
Avoid negative modelling	0.07	-0.12*	0.12*	-0.17***	0.04	0.05	0.24***	-0.05	-0.26***	0.16***				
Availability of unhealthy food	-0.12**	0.22***	-0.16***	0.33***	0.04	0.00	0.07	0.10*	0.17***	0.00	-0.07			
Mother's F&V score	0.24***	-0.09*	0.24***	-0.08	0.00	0.04	0.04	0.00	-0.19***	0.07	0.11**	-0.08		
Mother's excess score	-0.02	0.28***	-0.09*	0.29***	0.10*	0.10*	-0.06	0.10*	0.20***	-0.01	-0.14**	0.32***	-0.16***	
Mother's education	0.03	-0.23***	0.17***	-0.21***	0.03	0.03	0.20***	-0.07	-0.23***	0.04	0.12**	-0.11**	0.13**	-0.10*

LEA, Longitudinal Eating and Activity study; F&V, fruit and vegetables.
* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

in the analyses (model 2). However, the positive association between avoiding negative modelling and follow-up was washed out in the latter model. The only significant predictors for changes in F&V score were mother's F&V score and availability of unhealthy foods.

Reward, catering on demand, permissiveness, availability of unhealthy foods and mother's excess score were all positively associated with children's excess score at baseline, whereas avoiding negative modelling behaviour was negatively associated (Table 4, model 1). However, when all variables were entered in the same model (model 2), only availability and mother's excess score remained significant. Availability of unhealthy foods, mother's excess score and permissiveness were also positively related to the follow-up score (models 1 and 2) and changes in excess score from baseline to follow-up (model 3). However, the negative association of avoiding negative modelling disappeared in model 2.

Finally, higher dietary scores at baseline predicted higher consumption at follow-up for both dietary scores.

The proportions of variance explained by parenting practices for the baseline measurements are 8% for the F&V score and 12% for the excess score. The proportions of variance explained for the follow-up measurements are 5% and 10%, respectively.

Attrition analyses

Significant differences were found between the participants included in the present analyses and the baseline only or excluded participants for six of the twelve variables. Those who did not participate at follow-up or were excluded were less likely to have a mother with higher education and had a higher excess score. Their mothers not only had a higher excess and a lower F&V score, but also reported less negotiation and more permissiveness. No gender difference was found.

Discussion

In the present study, a longitudinal design is used to identify parenting practices during childhood that predict intake of healthy and less healthy patterns during childhood and, in future, during adolescence.

The results indicate a consistent association between mothers' and their children's intake for both the F&V score and the excess score indicating that children and adolescents' diets are associated with the foods eaten by their parents.

The present study also explored the role of availability. Availability of fruit seemed not to be a problem: 95% had mostly or always fruit available at home. Congruent with a study by Larson *et al.*, the availability of less healthy foods and beverages was not only positively associated with the excess score but also negatively with the F&V score⁽²²⁾, suggesting that parents should be encouraged

Table 3 Associations of baseline factors with the F&V score at baseline and follow-up, 4 years later – LEA study, East and West Flanders, Belgium, 2002–2005 (*n* 600)

	Baseline				Follow-up					
	Model 1		Model 2		Model 1		Model 2		Model 3	
	β	SE	β	SE	β	SE	β	SE	β	SE
Fixed part										
Girl	0.159	0.082	0.109	0.076	0.318	0.073	0.345	0.077	0.312	0.073
Mother's education level										
Medium	-0.036	0.118	-0.090	0.111	-0.113	0.106	-0.186	0.111	-0.158	0.105
High	0.031	0.100	-0.131	0.097	0.228	0.098	0.066	0.097	0.107	0.092
Parenting practices										
Pressure	0.036	0.041	-0.010	0.043	-0.016	0.039	-0.027	0.041	-0.030	0.039
Reward	0.021	0.041	0.012	0.042	-0.028	0.039	-0.038	0.041	-0.035	0.039
Negotiation	0.094	0.042	0.083	0.044	0.079	0.040	0.091	0.043	0.065	0.041
Catering on demand	-0.052	0.041	-0.023	0.043	-0.058	0.040	-0.015	0.041	-0.008	0.039
Permissiveness	-0.120	0.042	-0.046	0.045	-0.139	0.040	-0.069	0.044	-0.055	0.041
Verbal praise	0.070	0.041	0.034	0.042	0.002	0.040	-0.035	0.041	-0.046	0.039
Avoid negative modelling	0.059	0.041	-0.001	0.042	0.103	0.040	0.052	0.040	0.052	0.038
Availability of unhealthy food	-0.117	0.041	-0.104	0.040	-0.135	0.039	-0.118	0.039	-0.085	0.037
Mother's F&V score	0.238	0.040	0.222	0.040	0.211	0.039	0.190	0.039	0.120	0.038
Child's baseline F&V score					0.360	0.037			0.312	0.037
Random Part										
School-level variance	0.000	0.014	0.003	0.015	0.000	0.000	0.000	0.000	0.000	0.000
Individual-level variance	0.992	0.059	0.911	0.055	0.800	0.046	0.851	0.049	0.761	0.044

LEA, Longitudinal Eating and Activity study; F&V, fruit and vegetables.

Model 1: Separate regression analyses for each individual factor, controlling for gender and mother's educational level; for the random part of model 1 only sociodemographics are included for baseline data and sociodemographics and child's baseline F&V score for follow-up data.

Model 2: Multivariate regression model adjusted for all other variables.

Model 3: Model 2 additionally adjusted for baseline data.

Significant parameters are given in bold.

Table 4 Associations of baseline factors with the excess score at baseline and follow-up, 4 years later – LEA study, East and West Flanders, Belgium, 2002–2005 (*n* 530)

	Baseline				Follow-up					
	Model 1		Model 2		Model 1		Model 2		Model 3	
	β	SE	β	SE	β	SE	β	SE	β	SE
Fixed part										
Girl	-0.283	0.083	-0.263	0.079	-0.248	0.082	-0.245	0.079	-0.167	0.076
Mother's education level										
Medium	-0.274	0.121	-0.235	0.116	-0.190	0.121	-0.150	0.115	-0.083	0.110
High	-0.510	0.103	-0.398	0.102	-0.524	0.103	-0.362	0.100	-0.243	0.097
Parenting practices										
Pressure	0.075	0.041	0.045	0.043	0.030	0.042	0.009	0.042	0.006	0.040
Reward	0.086	0.042	0.040	0.043	0.049	0.043	0.024	0.042	0.012	0.040
Negotiation	0.045	0.043	0.058	0.044	0.031	0.043	0.053	0.044	0.036	0.042
Catering on demand	0.112	0.041	0.072	0.042	0.049	0.042	-0.043	0.042	-0.063	0.040
Permissiveness	0.124	0.042	0.042	0.045	0.224	0.042	0.161	0.044	0.149	0.042
Verbal praise	-0.007	0.042	-0.037	0.043	0.009	0.043	0.004	0.035	0.007	0.040
Avoid negative modelling	-0.091	0.041	-0.055	0.041	-0.128	0.041	-0.062	0.036	-0.052	0.039
Availability of unhealthy food	0.230	0.041	0.151	0.042	0.312	0.040	0.231	0.041	0.186	0.040
Mother's excess score	0.252	0.040	0.178	0.042	0.260	0.040	0.157	0.042	0.104	0.040
Child's baseline excess score					0.391	0.041			0.295	0.041
Random part										
School-level variance	0.022	0.021	0.020	0.019	0.017	0.018	0.000	0.000	0.000	0.000
Individual-level variance	0.884	0.057	0.780	0.050	0.783	0.050	0.781	0.048	0.716	0.043

LEA, Longitudinal Eating and Activity study; F&V, fruit and vegetables.

Sociodemographics are categorical and all other variables are scale variables.

Model 1: Separate regression analyses for each individual factor, controlling for gender and mother's educational level; for the random part only sociodemographics are included for baseline data and sociodemographics and child's baseline excess score for follow-up data.

Model 2: Multivariate regression model adjusted for all other variables.

Model 3: Model 2 additionally adjusted for baseline data.

Significant parameters are given in bold.

to reduce the availability of less healthy foods. In a study of 12-year-olds by Haerens *et al.*⁽¹⁴⁾, the availability of unhealthy foods was related to fat intake and soft drink consumption in boys, but not in girls; however, no association was found with the consumption of fruit.

Further, we investigated the role of food parenting practices on children's and adolescents' dietary intake. After taking into account all other factors, especially permissiveness, and to a lesser extent, negotiation seemed to be promising factors. Letting children decide on what they eat and when, and allowing them to consume sweets and soft drinks when they like was significantly detrimental to their future intake of less healthy foods. These results are in line with the findings of De Bourdeaudhuij⁽⁷⁾: they also found a positive relationship between permissiveness in their family at the age of 10 years and the consumption of more fat and sweet foods during adolescence and no association with healthy foods. In contrast, other studies, however, found that strict parental control may have adverse effects such as increasing children's preference for and intake of restricted foods^(23,24).

Strengths and limitations

The first limitation of the present study is the use of brief scales to report very complex behaviours. In addition, the parenting practice scales differ from those used in the current literature and have not been validated. However, at the start of the present study, little research had been conducted in this area. The second limitation is the rather crude dietary intake assessment. We only asked about consumption frequency in d/week, and therefore no information on portion size is collected. Third, both dietary intake and parenting scales are based on self report and therefore might be responded to in a socially desirable way. The fourth limitation is the selective dropout, which compromises the generalizability of the results. A strength of the present study is the prospective character and the rather large sample despite the considerable attrition. Nonetheless, causality can still not be stated as prospective relationships can, as for cross-sectional studies, be due to a third antecedent.

Conclusion

These results extend previous ones obtained from cross-sectional studies and give further support to the importance of including the family in prevention campaigns aimed at children and adolescents. Parents' intake and restricting the availability of unhealthy foods not only appeared to have a consistent impact on children's and adolescents' diet, but also less permissive food-related parenting practices may improve adolescents' diet.

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