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Contribution of home availability, parental child-feeding practices and health beliefs on children's sweets and salty snacks consumption in Europe: Feel4Diabetes-Study

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Abstract

Adoption of healthy dietary and snacking habits could support optimum physical and mental development in children as they define health in adulthood. This study assessed parameters associated with children's snacking such as food home availability, parenting practices, and parents' health beliefs. In this cross-sectional study 12 039 children, 49·4% boys 5–12 years, participating in the European Feel4Diabetes-Study were included. Children's weekly consumption of sweets and salty snacks, home availability of snacks, food parenting practices, and health beliefs were assessed via questionnaires. Logistic regression was applied to explore associations of a) home availability of snacks, b) food parenting practices (permissiveness and rewarding with snacks) and c) parent's opinions on deterministic health beliefs with children's consumption of sweets and salty snacks. Results showed that home availability (sweets: OR_{adj}: 4·76, 95 % CI: 4·32, 5·23; salty snacks: OR_{adj}: 6·56, 95 % CI: 5·64, 7·61), allowing to consume (sweets: OR_{adj}: 3·29, 95 % CI: 2·95, 3·67; salty snacks: OR_{adj}: 3·41, 95 % CI: 2·98, 3·90) and rewarding with sweets/salty snacks (sweets: OR_{adj}: 2·69, 95 % CI: 2·23, 3·24; salty snacks: OR_{adj}: 4·34, 95 % CI: 3·57, 5·28) 'sometimes/or less frequently' compared to 'always/or often' were associated with lower weekly consumption of sweets and snacks. Parents' disagreement compared to agreement with deterministic health beliefs and inattentive eating were associated with lower consumption of salty snacks and sweets in children. Overall, the findings of this study indicate that attempts to promote healthy snacking habits in children should aim to improve parental dietary habits, food parenting practices, health beliefs, and reducing home availability of unhealthy foods and snacks.

Key words: **Home availability: Parenting practices: Health beliefs: Snacking: Salty snacks: Sweets**

During childhood, it is well known that dietary habits are important for children's development[1]. Over the last few decades, global modernisation has resulted in the abandonment of wholesome traditional dietary patterns to the adoption of a Westernised diet, including overconsumption of energy-dense, nutrient-poor foods such as sweets, salty snacks, sugar-sweetened beverages and fast

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foods, characterised for being high in sugars, fats, processed meats and salt[2]. Data derived from round 4 (2015–2017) of the WHO European Childhood Obesity Surveillance Initiative that involved 132 489 children from twenty-three European countries showed that 10 % of children consumed sweet snacks or soft drinks daily and less than 50 % fruits and vegetables[3]. These findings signify the urgent need to create healthier food and beverage environments within the family circle. Furthermore, adherence to this type of dietary pattern promotes inflammation triggering the premature onset of adult chronic diseases such as CVD, diabetes and obesity[1]. Contrastingly, a healthy diet rich in fruits, vegetables, wholegrain cereals, nuts and fish diminishes inflammation and lowers the risk for future chronic diseases[1]. Therefore, to ensure optimum health, it is crucial that children adopt good dietary and snacking habits early in life to track into adulthood.

The home is the most widely studied setting for influences on children's dietary habits[4]. Parents play a primary role in influencing children's dietary habits[4]. Types of foods purchased, made available and accessible in the home including during family meals as well as their own dietary practices, health attitudes and beliefs are correlated with children's food intake[5,6]. Parents' role as food providers can impact children's intake of healthy foods such as fruits and vegetables or intake of unhealthy foods sweets and salty snacks through the foods they provide as well as the social environment they create[7–10]. Furthermore, feeding practices employed by parents to influence children's food intake represent a large component of parental behaviours[4]. Child-feeding practice constructs including controlling and restricting/or forbidding sweets, snacks and junk foods can be counterproductive and inadvertently enhance children's intake of these foods, cause dysregulation of food intake and increase adiposity[11–14]. Alternatively, fewer family rules concerning the type of foods eaten and rewarding using poor quality foods can contribute to a higher intake of fat and sugars, snacks along with fewer fruits and vegetables[10,14]. Given that school-aged children consume two-thirds of their meals at home, environmental exposures external to the home, namely the school setting, via availability of foods served in canteens, and peers, appear to play a minor role. Understanding the factors that shape food preferences in childhood is critical in identifying aspects that promote dietary habits beneficial to health and deter unhealthy ones. Furthermore, the impact of family on children's fruit and vegetable intake has been extensively studied[15,16]; however, less attention has been given to food parenting practices that are associated with snacking in European children[10]. Currently, there are no universal definitions for snacks, snacking or quantitative recommendations for weekly intake[17]. Most nutritional guidelines define snacking as energy-dense foods high in sugar and fat with minimal nutritional content consumed in between habitual meals, providing fewer calories than in typical meals[17] and recommend 'limiting' intake of sweet and savoury snacks[17]. On the other hand, foods such as fruit, vegetables, nuts, milk and yogurt can be considered healthy snacks.

Therefore, the scope of this study was to explore parameters associated with children's intake of sweets and salty snacks, such as food home availability, food parenting practices and beliefs. We hypothesised that home availability of snacks and certain parental practices, such as permissiveness and the use of food as reward, and beliefs are positively associated with sweets and salty snacks intake in European school children. In terms of public health significance, this research suggests parenting practices and beliefs that could be discouraged when targeting to improve children's dietary behaviours as well as provide direction for health professionals working with families.

Methods

Study design

This study is a cross-sectional analysis of baseline data of all families (parents-children dyads) participating in the Feel4Diabetes-Study. This multi-national population study was a 2-year school and community-based intervention designed to prevent type 2 diabetes and promote healthy eating and physical activity in vulnerable families across six European countries: Bulgaria, Hungary, Belgium, Finland, Greece and Spain. In short, the Feel4Diabetes intervention promoted healthy eating and exercise by creating a supportive environment at three levels that included the home/family, school and municipalities. Recruitment was based on a standardised multi-sampling procedure and was undertaken in selected provinces of the six European countries. Elementary schools were randomly selected and recruited within each area. The population of interest was 5–12-year-old children attending the first three grades of elementary school in the selected municipalities of each country. The participating families were either randomised to active intervention or the control group. Details of the screening procedure and study methodology have been previously described[18]. For the purpose of the current study, only baseline data involving all families have been analysed. The study protocol was approved by the Institutional Ethics committees in each of the six European countries, and informed consent was obtained from all participating families. The work described has been conducted in accordance with the Declaration of Helsinki guidelines for experiments involving humans.

Study sample

In the Feel4Diabetes-Study, 12 041 families (parent-dyads) were enrolled at baseline, and data was assessed for 12 039 children (age range 5–12 years old). Two children (4 and 16 years old) were excluded because their ages were not within the specified limits. Given that some families consisted of more than one child and to avoid duplication of parental information, one child per family was randomly selected. Data on children's sweets intake were complete for 11 356 children and on salty snacks for 9928 children.

In the present study, we postulated that parenting is one of the main influential components of the home food and social environment that defines children's snacking patterns. Based on previous literature[19], we defined snacking as ready-to-eat, energy-dense, nutrient-poor foods consumed in between meals and less than four times per week as the recommended intake given the health benefits of reduced snacking in the prevention of obesity and dental caries in children[17]. According to food composition tables, snack foods were categorised as 'sweets'

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(such as chocolate bars, cookies or ice-cream) or 'salty snacks' (hamburgers, chips and pizza) based on raw materials used in their production (high content of sugars, fat and Na)[20] and manufacturing process (frying, drying, baking and roasting)[21].

Demographic information

Demographic information that included country of residence, children's sex and age along with maternal educational level as an indicator of socio-economic status[22] was collected via a printed version of a standardised self-administered questionnaire that was distributed to children during school hours and completed by one parent at home. Parents were instructed to seal completed questionnaires in an envelope that was returned by children to the school and collected by researchers on a weekly basis. Parents were provided with the contact details of researchers in order to clarify any queries that they might have during the study period.

Children's snacking habits

Children's snacking was evaluated using a self-administered validated FFQ developed for the Feel4Diabetes-Study[23]. Data regarding children's snack intake were collected from one parent per family. Respondents were instructed to report children's usual frequency of sweets and salty snacks in terms of specified serving size. Conventional household measures were used to represent one standard portion size for each food item (1 cup, ½ cup) as well as commercial units (1 small hamburger, 1 small bag of chips, 1 slice of pizza, 1 small chocolate bar, ½ cup of ice-cream, cookies or sweets). Frequency of sweets and salty snacks intake was recorded as weekly or daily consumption of food items which were categorised as less than 1 time per week, 1 or 2 times per week, 3 or 4 times per week, 5 or 6 times per week, 1 or 2 times per day, 3 or 4 times per day, 5 or 6 times per day and more than 6 times per day. Parents' intake of snacks was evaluated using the same FFQ.

Home availability of salty snacks/and sweets, food parenting practices and health beliefs

Home availability of snacks, parental practices and beliefs were evaluated by the following questions.

Q1a) On a weekly basis, how often are sweets available at your home?

Q1b) On a weekly basis, how often are salty snacks available at your home?

Q2a) On a weekly basis, how often do you allow your child to eat sweets and/or salty snacks?

Q2b) On a weekly basis, how often do you reward your child with sweets or salty snacks?

Q3a) I believe that my health and well-being are determined by my destiny.

Q3b) I believe that people have little power on preventing disease

Q3c) I choose to eat the food that I like without thinking too much about it.

For Q1, response options were 'always, often, sometimes, rarely and never', for Q2 options were 'very often, often, sometimes, rarely and never and for Q3 options were 'strongly disagree, disagree, agree or strongly agree'. Parents were instructed to tick one of the responses. To maintain comparability across countries, all questionnaires were translated into six languages.

Anthropometry

During school hours, basic anthropometric measurements were conducted on a weekly basis in children by trained personnel. Bodyweight was recorded to the nearest 0·1 kg using digital scales (SECA, 813) with children standing without shoes in minimal clothing. Height was measured to the nearest 0·1 cm using a stadiometer (SECA, 217) with children standing without shoes, their shoulders relaxed, arms hanging freely and head aligned in the Frankfort horizontal plane. Then, BMI was calculated using Quetelet's equation (weight (kg)/height^2 (m^2)) and z-scores estimated as defined by the International Obesity Task Force sex- and age-specific BMI cut-offs[24].

Sample size calculation/randomisation

Screen time is one of the most important energy balance related behaviours in children[25] and also one of the main objectives of the Feel4Diabetes-Study was to reduce sedentary behaviour in school children[18]. In this context, a power calculation was performed using G × Power analysis[26] and estimated based on reducing sedentary behaviour in school children. It was estimated that a minimum sample of 600 families per treatment arm (i.e 1200 families in total) was required to achieve statistical power >80 % at a two-sided 5 % significance level for reducing screen time by 0·2 h/d in children within 8 months[18]. After including an attrition rate of 20 %, a total sample of 9000 families would be required to be recruited in order to detect a statistically significant difference between the arms. Schools and families were randomised to the intervention and control arms within each municipality with a 1:1 allocation ratio after the completion of baseline assessments.

Statistical analysis

Continuous variables were assessed for normality by applying the Kolmogorov–Smirnov test and the histogram plot. Demographic data are presented as means and standard deviations (SD) or as frequencies (n) and percentages (%) in the case of skewness. Response options for frequencies of sweets and salty snacks were dichotomised to ≤ and > 4 times per week[19]. Home availability responses were also recoded into two categories 'always/often' and 'sometimes/rarely/never'. Similarly, food parenting practices were merged to 'very often/often' and 'sometimes/rarely/never' and health beliefs 'strongly agree/agree' and 'strongly disagree/disagree'. In the univariate analysis, group differences were examined using Mann–Whitney or Pearson's χ^2 test. Spearman's rank correlation coefficient rho (r) was used to determine correlations between parents and children's intake of sweets and salty snacks, where values of rho ranging from 0·10 to 0·39 indicate weak correlations and 0·40 to 0·69 moderate[27]. The associations between home availability, parental practices/beliefs and children's intake of sweets and salty snacks were explored applying multivariate logistic regression. In analyses,

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children's sweets intake and salty snacks were defined as the dependent variables and food parenting practices and health beliefs as the independent variable. Given that children's age, sex, BMI z-score, country and maternal education are factors influencing children's food choice, these were entered as covariates in the adjusted regression model. How well the theoretical model fitted the data was measured using the Nagelkerke coefficient R^2. The degree of association is expressed as OR and 95 % CI. Exploratory to this study, we repeated the regression analysis stratified by age group (5·0–9·0 years *v.* 10·0–12·5 years) according to the WHO definition for teenagers (10–19 years old)[28], given that this can be an influencing factor in children's eating habits[29]. All *P*-values reported are two-tailed, and statistical significance was set at alpha < 0·05. SPSS version 20 (IBM) was employed for all statistical analyses.

Results

Demographic details of the population are presented in Table 1. From the initial sample at baseline, mean age of children was 8·20 (SD 0·99) years with 49·35 % (5942/12 039) boys; 85·20 % (10 255/12 039) of respondents were mothers and 10·17 % fathers (1224/12 039) with 66·56 % (8014/12 039) of mothers completing tertiary education and 52·30 % (6295/12 039) of fathers.

Regarding intake of sweets and salty snacks, frequency (%) of children and parents consuming these foods ≤ 4 times per week is presented in Table 2. Sex differences in sweets intake were observed in children, with more girls consuming sweets ≤ 4 times per week than boys (girls *v.* boys: 56·41 % *v.* 53·85 %; $P = 0·01$). Comparison of parents' *v.* children's sweets and salty snacks intake showed moderate correlations (sweets: $r = 0·451$, $P < 0·001$; salty snacks $r = 0·531$, $P < 0·001$).

The relationship between home availability, food parenting practices and health beliefs and children's intake of sweets and salty snacks less/equal to or more than four times/week is shown in Table 3. The univariate analysis revealed that for children consuming sweets and salty snacks ≤ 4 times/week there were substantial differences in home availability ($P < 0·001$), food parental practices ($P < 0·001$) and beliefs ($P < 0·001$). It appears that when sweets and salty snacks were available in the home 'sometimes/rarely', children were more likely to consume these foods ≤ 4 times/week as compared with these foods being available 'always/often'. The same trend was observed for food parenting practices such as 'allowing to eat these foods' and 'rewarding with sweets and salty snacks. With respect to health beliefs, parents who 'strongly disagree/disagree' that 'health was determined by destiny', 'I have little control on preventing disease' and 'I choose to eat food I like without thinking', more children consumed sweets and salty snacks ≤ 4 times/week as compared with those whose parents 'strongly agree/agree' to these questions.

Applying logistic regression to explore the association between home availability, food parenting practices and health beliefs, and children's intake of sweets and salty snacks yielded statistical significance for all factors (Table 4). In the crude analysis, a positive association was observed between home availability of sweets (OR: 5·82, 95 % CI: 5·33, 6·35), allowing to eat sweets (OR: 3·73, 95 % CI: 3·38, 4·11) and being rewarded with sweets (OR: 3·30, 95 % CI: 2·78, 3·92) 'sometimes/rarely' and children's intake of sweets ≤ 4 times/week, as compared with 'always/often'. After adjusting for children's age, sex, BMI, country of residence and maternal education level, home availability of sweets at a frequency of 'sometimes/rarely' was associated with children being 4·76 times more likely to consume sweets ≤ 4 times/week than those when sweets were available 'always/often' (OR_{adj} 4·76, 95 % CI: 4·32, 5·23), whereas 3·29 times more likely when allowing to eat sweets 'sometimes/rarely' (OR_{adj}: 3·29, 95 % CI: 2·95, 3·67) and 2·69 times more likely when rewarding with sweets at the same frequency (OR_{adj}: 2·69, 95 % CI: 2·23, 3·24). The degree of association as reflected by the Nagelkerke coefficient R^2 indicated substantial influence of home availability, food parenting practices including allowing to consume and rewarding with sweets (29·4, 23·1, and 19·1 %, respectively). Regarding parental health beliefs, in the adjusted analysis, no significant associations were observed for parents who 'strongly disagree/disagree' that their 'health is determined by destiny', 'I have little power preventing disease' and children's sweets intake compared with parents who 'strongly agree/agree' to these statements. In contrast, for parents who 'strongly disagree/disagree' with 'I choose to eat food I like without thinking', children were 1·61 times more likely to consume sweets ≤ 4 times/week than those parents who 'strongly agree/agree' (OR_{adj}: 1·61, 95 % CI: 1·45, 1·80). Comparable findings were observed in the crude and adjusted regression analysis for children's intake of salty snacks, although to a greater extent than sweets intake as reflected by the size of the odds ratio. Home availability of salty snacks, allowing to consume and rewarding with salty snacks 'sometimes/rarely' was associated with children consuming these foods ≤ 4 times/week compared with 'always/often' ((OR_{adj}: 6·56, 95 % CI: 5·64, 7·61); (OR_{adj}: 3·41, 95 % CI: 2·98, 3·90); (OR_{adj}: 4·34, 95 % CI: 3·57, 5·28), respectively). With respect to parental health beliefs, children from parents who 'strongly disagree/disagree' that 'my health depends on destiny', 'I have little power preventing disease' and 'I choose to eat food I like without thinking' were twice as likely to consume salty snacks ≤ 4 times/week compared with children whose parents 'strongly agree/agree' with the above statements ((OR_{adj}: 2·08, 95 % CI: 1·74, 2·49); (OR_{adj}: 1·86, 95 % CI: 1·58, 2·20); (OR_{adj}: 2·65, 95 % CI: 2·26, 3·11), respectively).

Furthermore, the same trend was observed for children's sweet and salty snacks intake *v.* home availability and parenting practices in the regression analysis stratified by age group (5·0–9·0 years *v.* 10·0–12·5 years) (online Supplementary Table S1). However, regarding health belief 'parents disagreeing with my health is determined by destiny' which was borderline significant in the original adjusted analysis ($P_{adj} = 0·05$), became significant for sweet intake < 4 times/week in the 5·0–9·0 year olds ($P_{adj} = 0·03$) and nonsignificant for salty snack intake < 4 times/week in 10·0–12·5 year olds ($P_{adj} = 0·35$). Likewise, for 'I have little power preventing disease' was non-significant in the original analysis for sweet intake ($P_{adj} = 0·80$) but significant in the 10–12·5 years age group $P_{adj} = 0·01$). On the other hand, results remained significant in both age groups for 'I choose to eat food I like without thinking' which is consistent with the original analysis.

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Table 1. Demographic characteristics of population per total sample of families and by children's sex

			Children's sex				
	Total (*n* 12 039)		Boys (*n* 5942)		Girls (*n* 6097)		
Characteristic	%	*n*	%	*n*	%	*n*	*P*
Country							
Belgium	14·84 %	1787/12 039	14·99 %	891/5942	14·66 %	894/6097	0·02*,‖
Finland	12·49 %	1504, 12 039	12·72 %	756/5942	12·27 %	748/6097	
Greece	18·90 %	2283/12 039	18·38 %	1092/5942	19·53 %	1191/6097	
Hungary	15·18 %	1828/12 039	14·69 %	873/5942	15·66 %	955/6097	
Bulgaria	24·68 %	2972/12 039	24·40 %	1450/5942	24·96 %	1522/6097	
Spain	13·84 %	1667/12 039	14·81 %	880/5942	12·91 %	787/6097	
Children details							
Age†	8·20	0·99	8·22	1·00	8·19	0·99	0·05‡
SES status							
Maternal education level > 12 years	66·56 %	8014/12 039	71·97 %	3975/5523	70·95 %	4039/5693	0·23*

P-value significant at 5 %.
* *P*-value estimated using χ^2 test.
† Data are presented as mean (SD).
‡ Mann–Whitney test.
§ Data for mothers and fathers are not shown but described in text.
‖ Statistically significant *P*-values.

Table 2. Percentage of children and parents consuming sweets and salty snacks ≤ 4 times per week

			Children				
Food group	Total %	*n*	Boys %	*n*	Girls %	*n*	*P**
Children							
Sweet intake (%) ≤ 4×/week	55·16 %	6264/11 356	53·87 %	3009/5586	56·41 %	3255/5770	0·01†
Salty snacks ≤ 4×/week	87·11 %	8649/9928	86·74 %	4206/4849	87·48 %	4443/5079	0·27
Parents							
Sweets ≤ 4×/week	66·13 %	7474/11 302	65·29 %	3633/5564	66·94 %	3841/5738	0·06
Salty snacks ≤ 4×/week	92·53 %	10281/11 111	92·54 %	5062/5470	92·52 %	5219/5641	0·96

Data shown for frequency of sweets and salty snacks intake ≤ 4×/week only.
Key: ≤ 4×/week – less than or equal to four times per week.
* *P*-value derived from χ^2 test comparing differences in children's frequency of snacks and sweets intake ≤ 4×/week and > 4×/week.
† Statistically significant *P*-values.

Table 3. Relationship between home availability, food parenting practices and health beliefs and children's intake of sweets and salty snacks ≤ 4 times per week

		Children's intake					
		Sweets			Salty snacks		
		≤ 4×/week			≤ 4×/week		
Question from questionnaire	Response	%	*n*	*P**	%	*n*	*P**
Home availability							
Sweets and salty snacks	Always/often	43·42 %	2675/6161	< 0·001†	27·38 %	2337/8536	< 0·001†
	Sometimes/rarely/never	56·58 %	3486/6161		72·62 %	6199/8536	
Parental practices							
Allow child to eat sweets and/or salty snacks	Very often/ often	11·40 %	702/6160	< 0·001†	18·09 %	1541/8520	< 0·001†
	Sometimes/rarely/never	88·60 %	5458/6160		81·91 %	6979/8520	
Reward child with sweets or salty snacks	Very often/ often	3·11 %	192/6166	< 0·001†	4·12 %	351/8524	< 0·001†
	Sometimes/rarely/never	96·89 %	5974/6166		95·88 %	8173/8524	
Health beliefs							
Health is determined by destiny	Strongly agree/agree	9·43 %	573/6079	< 0·001†	9·89 %	834/8430	< 0·001†
	Strongly disagree/disagree	68·81 %	4183/6079		67·44 %	5685/8430	
I have little power preventing disease	Strongly agree/agree	13·60 %	830/6101	< 0·001†	13·96 %	1178/8436	< 0·001†
	Strongly disagree/disagree	72·09 %	4398/6101		70·40 %	5939/8436	
I choose to eat foods I like without thinking	Strongly agree/agree	16·40 %	1000/6097	< 0·001†	18·59 %	1568/8435	< 0·001†
	Strongly disagree/disagree	63·98 %	3901/6097		62·17 %	5244/8435	

Data shown for frequency of sweets and snack intake ≤ 4×/week only.
Key: ≤ 4×/week – less than or equal to four times per week.
* *P*-value derived from χ^2 test comparing differences in children's frequency of snacks and sweets intake ≤ 4×/week and > 4×/week.
† Statistically significant *P*-values.

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Table 4. Association between home availability, food parenting practices, beliefs and children's intake of sweets and salty snacks ≤ 4 times per week from the crude and adjusted logistic regression model

	Children's sweets intake ≤ 4 times per week							
	Crude				Adjusted			
Question/response	R^2	OR	95 % CI	*P*	R^2	OR	95 % CI	P_{adj}
Home availability of sweets								
Always/often	Ref*							
Sometimes/rarely/never	19·7 %	5·82	5·33, 6·35	< 0·001†	29·4 %	4·76	4·32, 5·23	< 0·001†
Allow to eat sweets								
Very often/often	Ref							
Sometimes/rarely/never	8·6 %	3·73	3·38, 4·11	< 0·001†	23·1 %	3·29	2·95, 3·67	< 0·001†
Reward with sweets								
Very often/often	Ref							
Sometimes/rarely/never	2·5 %	3·30	2·78, 3·92	< 0·001†	19·1 %	2·69	2·23, 3·24	< 0·001†
Health is determined by destiny								
Strongly agree/agree	Ref							
Strongly disagree/disagree	0·9 %	1·55	1·37, 1·75	< 0·001†	18·2 %	1·14	0·99, 1·30	0·054
Little power preventing disease								
Strongly agree/agree	Ref							
Strongly disagree/disagree	0·4 %	1·25	1·12, 1·39	< 0·001†	18·1 %	1·01	0·90,1·14	0·804
Choose to eat food I like without thinking								
Strongly agree/agree	Ref							
Strongly disagree/disagree	1·2 %	1·64	1·49, 1·81	< 0·001†	18·9 %	1·61	1·45, 1·80	< 0·001†
	Children's salty snacks intake ≤ 4 times per week							
	Crude				Adjusted			
	R^2	OR	95 % CI	*P*	R^2	OR	95 % CI	P_{adj}
Home availability of salty snacks								
Always/often	Ref							
Sometimes/rarely/never	13·9 %	5·58	4·91, 6·35	< 0·001†	29·5 %	6·56	5·64, 7·61	< 0·001†
Allow to eat salty snacks								
Very often/often	Ref							
Sometimes/rarely/never	12·7 %	5·34	4·71, 6·05	< 0·001†	23·7 %	3·41	2·98, 3·90	< 0·001†
Reward with salty snacks								
Very often/often	Ref							
Sometimes/rarely/never	7·7 %	6·58	5·54, 7·81	< 0·001†	21·8 %	4·34	3·57, 5·28	< 0·001†
Health is determined by destiny								
Strongly agree/agree	Ref							
Strongly disagree/disagree	4·0 %	3·07	2·61, 3·61	< 0·001†	19·3 %	2·08	1·74, 2·49	< 0·001†
Little power preventing disease								
Strongly agree/agree	Ref							
Strongly disagree/disagree	3·9 %	2·66	2·29, 3·09	< 0·001†	19·3 %	1·86	1·58, 2·20	< 0·001†
Choose to eat food I like without thinking								
Strongly agree/agree	Ref							
Strongly disagree/disagree	4·4 %	2·83	2·45, 3·26	< 0·001†	20·8 %	2·65	2·26, 3·11	< 0·001†

R^2 – Nagelkerke coefficient R^2.
Dependent variables children's frequency of intake of sweets and salty snacks as the dichotomous variables (0 = > 4 times/week, 1 = ≤ 4 times/week).
P – *P*-value derived from the crude logistic regression analysis.
P_{adj} – *P*-value from the regression model adjusted for children's age, sex, BMI (z-score), country and maternal education.
* Reference category.
† Statistically significant *P*-values.

Discussion

The present study aimed to determine factors of the home environment, food parenting practices and health beliefs that associate with sweets and salty snack intake in children. Understanding how children's food consumption choices are developed will aid in the adoption of good dietary habits in children which have potential lifetime health benefits. The findings of this study highlight that home availability of sweets and salty snacks, 'sometimes or less frequently' compared with 'always or often', was associated with lower weekly intake of these foods in children. The same trend was observed when parents 'allowed' children to consume sweets and salty snacks 'sometimes or rarely' and 'rewarded' them with these foods at the same frequency as compared with 'very often'. Interestingly, stratification of data according to age group did not alter associations between parenting practices, home availability and children's weekly intake of sweets and salty snacks. In reference to health beliefs, parents who 'disagree' that 'my health is determined by destiny', 'I have little power preventing disease' and 'I choose to eat the food I like without thinking' were related to lower intake of sweets and salty snacks in children as compared with those whose parents 'agree' to the above statements. Notably, differences were observed in associations between health beliefs and snacking in the 10–12·5 year age group. These data support our primary hypothesis and is

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promising because it suggests that by modifying parental behaviour and rectifying false health beliefs it is possible to discourage snacking in children. Therefore, our study is important and useful as a practical guide for health professionals on strategies that could hinder unhealthy snacking in European children and closes the gaps in the literature[7,30–32].

Various factors might explain children's reduced intake of sweets and salty snacks when snacks were available in the home 'sometimes/rarely' as compared with always/often. Aspects of the home environment can contribute to children's dietary behaviour especially in children within the 5–12 years age group. The family is the major provider of food and therefore parents influence availability, accessibility, foods purchased and served during family mealtimes and function as important role models[6]. Furthermore, parents provide experiences with food and children imitate parental dietary behaviours, food-related attitudes including preferences. In addition, we found moderate correlations between parents' and children's intake of sweets and salty snacks which reflect a significant modelling effect via direct observation of parental behaviour and through increased taste exposure[33]. This is in line with prior studies documenting resemblance between parents' and children's intake of sweets, salty snacks and fat across Europe[7,31,32,34]. Therefore, in the home setting, early repeated exposure of children to foods high in energy, sugar and fat might enhance children's liking and prioritise preference and selection for them.[11,33,35]. In this context, it is plausible that by decreasing frequency of exposure to poor quality foods in the home would inevitably result in decreased consumption by children, as was demonstrated in our study. Overall, our observations highlight the need for improving parents' food preferences to enhance positive changes in children.

Another intriguing observation we noted was that parents 'disagreeing' that 'my health is related to destiny', 'I have little power over disease' and 'I choose to eat food I like without thinking', was associated with children consuming fewer sweets and salty snacks. It appears that parents' health-related beliefs were transferred to offspring. Previous research has demonstrated that a positive, health-conscious family environment can establish and enhance adoption of beneficial health behaviours through role modelling, provision of healthy foods, along with encouragement and support for practising healthy dietary behaviours by children[4]. Hoffman *et al.* in a study of 7–11-year-old schoolchildren found that apart from parental feeding practices, parents' health-related attitudes, goals and motivations influenced their children's food intake[36]. In children whose mothers emphasised health-related goals, children consumed more healthy foods and less unhealthy[36]. Similarly, low levels of nutrition knowledge and food-related health attitudes in mothers along with less knowledge regarding snack recommendations were related to poor diet quality and increased snacking in pre-schoolers[5,32]. On the other hand, intriguingly, we noted age differences in associations between health beliefs and children's snacking, predominately in the 10–12·5 year age group, most likely related to cognitive development, health and nutrition literacy in adolescents[37].

These observations posit that educating parents the importance of diet in relation to health and addressing unhealthy parental beliefs might be a cost-effective, feasible and practical means of improving dietary habits of the entire family and ultimately overall health of the population. Nutrition education would provide parents with the skills to make informed choices about foods that their family consume and support autonomy because such information would provide direction for dietary behaviours.

With regard to food parenting practices such as 'permissiveness' and rewarding with snacks, we showed that rewarding or allowing children to snack sometimes or rarely resulted in lower weekly intake of sweets and salty snacks which is supported by the literature[38–40]. Wang *et al.* demonstrated that using food as a reward was associated with higher odds of children snacking more than once daily (OR, 1·43; 95 % CI 1·01 to 2·04)[40]. Sleddens *et al.* reported that instrumental feeding (or rewarding) practised by parents' increased snacking behaviour in 6–7-year-old children[39]. On the same note, Hennessy *et al.* showed that a permissive feeding style (lack of control and indulging to children's requests) was associated with increased intake of low nutrient dense foods including sweets and salty snacks in 9-year-old children[38]. Although WHO dietary recommendations advocate reduction in intake of energy-dense high fat and sugary foods[41], using highly palatable foods (for example sweets) as a reward, this is common practice by parents that can promote children's overconsumption of low-nutrient energy dense foods by diminishing the extent that children rely on their own hunger and satiety cues to initiate and terminate eating[13]. Collectively, the aforementioned studies reinforce our observations that allowing or rewarding children by sweets and salty snacks 'sometimes' by parents might decrease the consumption of these foods. Thus, suggesting that health professionals should be aware of the different parental child-feeding practices and styles when evaluating children's diet quality and perhaps focus on interventions modifying parental behaviour that will encourage healthy eating habits in children and discourage unhealthy.

Strengths and limitations

The findings of the current study should be interpreted in light of several considerations. Novel to this study was the exploration of associations between health beliefs and snacking patterns in children. To our knowledge, most studies have focused on children's intake of healthy foods such as fruits and vegetables, and more research is needed to determine factors that reduce intake of unhealthy foods and snacking[42]. Hence, the development of intervention strategies to improve children's dietary patterns is likely to be more successful if supported by an understanding not only of healthy but also unhealthy food intake. Furthermore, given the lack of a uniform definition for snacking as well as snack-specific dietary recommendations for children available in the WHO European region[17], our study could be useful in setting the foundations for guidelines on how parents should incorporate snacks into children's healthy diet, and parenting practices that could effectively modify the intake of unhealthy snacks. Additional strong points of the present work are the standard methods and procedures used by all participating countries to record dietary intake, food parenting practices and home availability along with the large sample size and homogeneity among children with respect to age.

A possible limitation is the cross-sectional design that does not allow conclusions to be drawn about causal relationships. The use of parental reports to capture children's sweet and salty snacks intake may evoke a source of bias due to recall error[43]. Moreover, parents

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may not be aware of foods purchased and consumed by children outside of the home and during school hours[43]. Although the use of FFQ in collecting dietary data is common practice in nutritional epidemiology, they are subject to over-reporting of healthy foods and under-reporting of non-healthy due to social desirability[44]. Nevertheless, FFQ are cost effective and appropriate for large epidemiological cohort studies to assess habitual intake of populations[44], and we employed a concise, simple FFQ of low-respondent burden. Another drawback, questionnaire response options 'always, often, sometimes, rarely and never' were not defined to respondents which could lead to inaccuracy in results. One more domain worth further investigation, sex differences in parenting styles were not explored in the present study. Previous research has identified fathers as predictors of children's unhealthy food intake[31,45].

Conclusion

The family unit is an important social context where children learn and adopt dietary behaviours that persist throughout the lifespan. During childhood, parents play a prime role as health promoters, role models and educators in the lives of their children, influencing food perceptions and choices including snacks. This study demonstrated that home availability of sweets and salty snacks, permissiveness and rewarding with these foods 'sometimes or less frequently' compared with 'always/or often' were associated with lower weekly intake of snacks in children. These findings indicate that attempts to promote healthy snacking habits in school-aged children should target improving parental dietary habits, food parenting practices, health beliefs and reducing home availability of unhealthy foods such as sweets and salty snacks which could bring about adoption of healthy eating practices in children that track into adulthood.

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Supplementary material

For supplementary material/s referred to in this article, please visit https://doi.org/10.1017/S0007114521004190

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