Title: Parents' dietary patterns are significantly correlated: Findings from The Melbourne Infant Feeding Activity and Nutrition Trial (InFANT) Program.[1]

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Contributors: Sandrine Lioret[2], Sarah A. McNaughton[2], David Crawford[2], Alison C. Spence[2], Kylie Hesketh[2], Karen J Campbell[2]

[2]**Affiliations:** Centre for Physical Activity and Nutrition Research; School of Exercise and Nutrition Sciences; Deakin University; 221 Burwood Hwy, Burwood Victoria 3125, Australia.

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Corresponding Author: Sandrine Lioret
Centre for Physical Activity and Nutrition Research, C-PAN; School of Exercise and Nutrition Sciences; Deakin University
221 Burwood Hwy, Burwood Victoria 3125, Australia
Phone: 03 9251 7236 International: +61 3 9251 7236
Fax: 03 9244 6017 International: +61 3 9244 6017
Email: sandrine.lioretsuteau@deakin.edu.au

Abbreviations: BMI, Body Mass Index; FFQ, Food Frequency Questionnaire; InFANT, Infant Feeding Activity and Nutrition Trial; SEP, Socio-Economic Position.

Abstract

The objectives of the current study were to identify dietary patterns independently in first-time mothers and fathers, and to examine if these patterns were correlated within families. Dietary intakes were collected at baseline in The Melbourne Infant Feeding Activity and Nutrition Trial (InFANT) Program using a validated food frequency questionnaire in 454 pairs of first-time mothers and fathers. Education level was reported in associated questionnaires. Principal components analyses included frequencies of 55 food groups and were performed independently in mothers and fathers. Spearman correlation coefficients were used to assess associations between dietary patterns' scores.

Four dietary patterns were identified in mothers and fathers. Three dietary patterns had similar characteristics between these two populations, namely "Fruits and vegetables", "High-energy snack and processed foods", "High-fat foods" in mothers; and "Fruits", "High-energy snack and processed foods", "High-fat foods" in fathers. Two additional patterns were identified: "Cereals and sweet foods", in mothers and "Potatoes and vegetables" in fathers. Patterns incorporating healthier food items were found to be positively associated with parent education. An inverse association with education was found for the high-fat or processed foods dietary patterns. Qualitatively similar patterns between corresponding mothers and fathers were the most strongly correlated (rho 0.34 to 0.45, $p<0.001$).

There were some differences in dietary patterns between mothers and fathers, suggesting that it is worth deriving patterns separately when considering couples, and more generally between men and women. Exploring how these various patterns correlate within households provides important insights to guide the development and implementation of family-based interventions.

Introduction

The rapid increase in obesity prevalence among children and adults over the last three decades primarily suggests the role of behavioral factors, which are influenced by social and economic environments. Unhealthy eating behaviors, low physical activity and increased sedentary behaviors have often been implicated, but their exact contribution to energy imbalance remains contentious. In their Ecological Systems Theory approach, Davison and Birch [(1)] have highlighted the importance of considering the context in which a person is located when studying the determinants of obesity. The family environment, which is the first ecological niche of children, is hypothesized to play a crucial role as this is where parents model eating and activity behaviors.

Evidence indeed suggests that parents have a strong influence on the development and maintenance of their children's eating behaviors and that this begins in infancy [(2, 3)]. Parents are

notably responsible for the foods available at home and the way in which foods are prepared and shared within the family [4, 5]. Further research is however warranted to better describe the way these behaviors aggregate within households. It is also of interest to consider the congruence between parents' dietary intakes as this may provide important insights into the ways in which interventions targeting home environments may need to be developed.

The statistical methods used to assess the overall diet include *a posteriori* approaches such as cluster and factor analyses, and the *a priori* dietary index approach [6]. These methods have been developed in nutritional epidemiology to overcome the inability of the traditional single-nutrient or single-food approaches to account for colinearity among dietary components. In fact, although single-nutrient and single-food studies are valuable, they do not accurately represent the complexity of the diet. Principal component analysis (PCA) has therefore been used to identify and assess overall food patterns of a given population. PCA is a multivariate method that allows the potential effect of the interactions within combinations of foods and nutrients to be taken into account. Based on this methodology, dietary patterns have been shown to vary according to age and socio-economic status [6]. Differences in dietary patterns between men and women have also been investigated. Most existing studies have derived patterns for men and women combined and then compared the resulting scores by gender, usually reporting non-significant differences [6]. Others have focused on populations of women more specifically [7-10]. Rarer are the studies that have considered men and women separately [11, 12], and even less attention has been given to dietary patterns within families. A recent study conducted with young Australian women [13] has suggested that the diet quality of young mothers is similar of that of young women in general. Less is known about the eating behaviors in men in the context of family life [14]. Northstone and Emmet (2010) [15] have recently shown that although men and women in marriage-like partnerships displayed similar dietary patterns, differences in food groups were observed.

In this context, the present study aimed to identify dietary patterns independently in first-time mothers and fathers, using the cross-sectional baseline data of The Melbourne Infant Feeding Activity and Nutrition Trial (InFANT) Program. A second objective was to examine if these patterns were correlated within couples.

Materials and methods

Participants and study design

The Melbourne InFANT Program is a cluster randomized controlled trial, which is described in detail elsewhere [16, 17]. The intervention involved first-time mothers from when their infants were 3 to 18 months of age, which is a stage of transition to motherhood when women are likely to be more

receptive to nutrition advices. The study was conducted within Greater Melbourne, Victoria, Australia across all socio-economic position (SEP) areas. Baseline data were collected from June to December 2008. Briefly, a two-stage random sampling design was used to include primary caregivers attending first-time parents' groups, which are coordinated through Maternal and Child Health Centers across Victoria. Inclusion criteria were literacy in English and a minimum of eight parents (six in low SEP area groups) in the groups consenting to take part. Eighty six percent (n = 542) of eligible parents consented to participate in The Melbourne InFANT Program. The present analysis excluded non first-time mothers (n = 14), single parent families (n = 8), one couple where the father was the main carer, another couple composed of two women, and 64 couples with incomplete FFQ in mothers (n = 19) and/or fathers (n = 62). Therefore the final sample was 454 pairs of first-time mothers and fathers.

The Melbourne InFANT Program was approved by the Deakin University Human Research Ethics Committee and the Victorian Government Department of Human Services, Office for Children, Research Coordinating Committee.

Measurements

Data were collected using self-administered questionnaires provided to mothers and fathers at baseline. Questionnaires were returned and checked by research staff at the first of The Melbourne InFANT Program sessions or returned by mail with follow up by phone if necessary.

Demographic and socio-economic data included parents' and children's dates of birth; marital status; country of birth; main language spoken at home; employment status and education level. Education level was defined in three categories: low (secondary school or below), intermediate (trade and certificate qualifications) or high (university degree or higher). Duration of pregnancy, breastfeeding status at baseline, weight and height before pregnancy in mothers and weight and height at baseline in fathers were also reported. Body mass index (BMI) was calculated as weight/height^2 (kg/m^2).

Parental dietary intake was collected using the validated Cancer Council of Victoria food frequency questionnaire (FFQ) (version 3), which is an updated version of the semi-quantitative FFQ specifically developed for the Melbourne Collaborative Cohort Study [18]. Parents were asked to indicate how often they had consumed each food or beverage item over the preceding 12 months. The FFQ has 10 response options for 98 food items ranging from "never" to "three or more times per day".These data were converted into daily equivalent frequencies according the Cancer Council Victoria protocol. The FFQ also included 11 additional questions relating to the type and amount of milk consumed (number of glasses per day); the amount of diet and non-diet soft drinks consumed

(number of glasses per day); the type and amount of bread consumed (number of slices per day); the number of eggs per week; and the frequency per week of both alcoholic and hot beverages. Nineteen mothers and 30 fathers had partially completed FFQ, but as the corresponding missing data corresponded to <5% of the questions, the missing values were imputed as zeros and the corresponding subjects included in the analyses, as is standard practice in nutritional epidemiology (19). Based on the assessment of the similarities in food type, energy density and context of consumption, all foods and beverages were assembled into 55 groups (Table 2) and frequencies of foods within each group were summed. As different units were used throughout the questionnaire, all dietary data were standardized by subtracting the mean and dividing by the standard deviation within each of these food groups.

Statistical analyses

Dietary patterns were derived independently in mothers and fathers using PCA with varimax rotation of the 55 food groups [20]. The number of patterns was selected considering eigenvalues >1.0, the scree plot and the interpretability of the patterns [21]. To interpret the results, we considered the items most strongly related to the pattern, i.e. those for which the loading coefficient was >|0.20| (which represent the correlations of each variable with one given dietary pattern). Dietary pattern labels were allocated according to the most significant items associated with the dietary pattern. The factor score for each dietary pattern was calculated at the individual level by summing the observed standardized frequencies of consumption per food group weighed according to the factor loadings.

For a given dietary pattern, multivariable regression analysis was performed to investigate the relationships between the pattern's score (as the outcome) and two classical covariates of food intake: age (continuous) and education level (categorical). Clustering by first-time parents' group was accounted for in all models. Adjusted parameter estimates and 95% confidence intervals were calculated. Spearman correlation coefficients were then used to assess the associations between the patterns scores of mothers and fathers.

The accepted significance level was set at 5%. Analyses were computed on Stata software (release 10; StataCorpLP, College Station, TX, USA).

Results

Sample characteristics

Demographic and socio-economic characteristics of the 454 first-time mothers and 454 fathers included in the current study are shown in Table 1. Mothers had an average age of 32.3 years.

Approximately 75% of them were breastfeeding their baby at baseline. A majority (55.5%) had achieved a University education level (high education level), 25.3% trade and certificate qualifications (intermediate education level), and 19.2% secondary school or below (low education level). Fathers were aged 34.2 years on average. Around 40 % had achieved a high education level, 33.1% intermediate education level, and 26.7% a low education level. Nearly all of them were employed (97.3%). Overall, more than ¾ of mothers and fathers were born in Australia.

It should be noted that the 64 mothers excluded from the analyses due to incomplete FFQ data in mothers and/or fathers did not differ significantly from those retained in terms of age or educational level (results not shown).

Characteristics of dietary patterns

Four dietary patterns were identified in mothers, accounting for 24.1% of the explained variance (Table 2). The first pattern was positively correlated with the consumption of fruits and vegetables, non-fried fish, salad dressing, nuts other than peanuts, and herbal tea. This pattern was labeled "Fruits and vegetables". Pattern two, labeled "High-energy snack and processed foods", was mainly characterized by high consumption of processed foods, such as savory pastries, pizzas, crisps, chocolate products, peanut products, yeast extracts/spreads and Ketchup. The third pattern had high positive loadings for full cream milk, white bread, fried fish, potatoes cooked with added fat, cakes and pastries, fat spreads, and fat added to vegetables. This pattern was named "High-fat foods". The fourth pattern was a mixed pattern with high loadings for cereals (wholemeal crackers; breakfast cereals), reduced-fat milk, and sweets (ice cream; confectionary other than chocolate-based). This pattern was labeled "Cereals and sweet foods". It is noteworthy that similar results were observed when we included 54 first-time mothers who completed their FFQ but whose partner had not (results not shown).

Four dietary dimensions were also identified for fathers, and these accounted for 23.5% of the explained variance (Table 2). The first pattern, labeled "Fruits", was characterized by high consumption of wholemeal crackers, fruits, non-fried fish, ricotta and cottage cheese, as well as two non-core foods (salty biscuits and confectionaries). The second pattern had high loadings for potatoes and vegetables, and was thus labeled "Potatoes and vegetables". The third pattern, "High-fat foods" was characterized by high consumption of white bread, red meats, sausages, fried fish, pizzas, butter added to vegetables and low consumption of non-white bread and breakfast cereals. The fourth pattern was mainly characterized by potatoes (both with no added and added fat), cheese, savory pastries, crisps, sweet biscuits, cakes and pastries, ice cream, chocolate-based products, and Ketchup. This pattern was labeled "High-energy snack and processed foods".

Associations with age and education level

Age was positively associated with dietary patterns characterized by high consumption of fruits and non-fried fish, namely "Fruits and vegetables" in mothers (P<0.001); and "Fruits" in fathers (P=0.005) (Table 3). In contrast, age was inversely associated with the fathers' scores for the "High-fat foods" pattern (P=0.03). Higher means in three prudent patterns' scores (i.e. "Fruits and vegetables" (P<0.001), "Cereals and sweet foods" (P-trend=0.002) in mothers; "Fruits" (P-trend=0.03) in fathers) were seen with increasing education levels. However, "High-fat foods" patterns in both mothers (P-trend=0.05) and fathers (P-trend=0.008) were inversely associated with education level. The "High-energy snack and processed foods" pattern was inversely correlated with education in fathers only (P-trend=0.001).

Correlations between mothers and fathers

Qualitatively similar patterns for mothers and fathers were the most strongly correlated (rho ranging from 0.34 to 0.45, p<0.001), namely "Fruits and vegetables" in mothers with both "Fruits" and "Potatoes and vegetables" in fathers; "High-fat foods" in mothers and fathers; and "High-energy snack and processed foods" in mothers and fathers (Table 4). These results were confirmed by relatively high percentages of agreement regarding the third tertiles of mothers' and fathers' patterns scores, that is: 54.3% with "Fruits and vegetables" and "Fruits" dietary patterns; 47.7% with "Fruits and vegetables" and "Potatoes and vegetables" dietary patterns; 45.7% with "High-energy snack and processed foods" patterns; and 49% with "High-fat" patterns (results not shown).

"High-fat foods" and "High-energy snack and processed foods" patterns were also significantly correlated between mothers and fathers, but to a lesser extent (rho=0.19 and rho=0.21). Finally, the pattern labeled "Cereals and sweet foods" in mothers was positively correlated with the "Fruits" pattern in fathers (rho=0.18), and inversely correlated with the "High-fat foods" pattern in fathers (rho=-0.19). These correlations did not differ according to education level (results not shown).

Discussion

While some studies have examined dietary patterns in men and women generally, studies focusing on dietary intake of parents specifically are rare [15]. To our knowledge, the current study is the first to have explored dietary patterns in a large sample of first-time mothers and fathers in Australia. This study has provided interesting insights into parents' dietary choices and the correlations between mothers' and fathers' diets. These insights are important in informing appropriately targeted family based interventions concerning diet.

The current study identified four dietary patterns independently in mothers and fathers. We identified common traits between our findings and a recent study involving Australian women aged 25-30 and 50-55 years [10]. That study used similar methodology (in terms of FFQ and analytical approaches), but a higher number of food groups were considered in that study (i.e. 85), leading to dietary patterns with a higher level of detail regarding food items. Their first three patterns labeled "Cooked vegetables", "Fruit" and "Mediterranean style" are similar to those summarized in the "Fruits and vegetables" pattern derived for mothers in the current study. They identified two other patterns labeled "Processed meat, meat and takeaway", "High-fat and sugar foods", while we derived similar patterns named "High-fat foods" and "High-energy snack and processed foods".

Studies internationally have also shown some consistency with these findings. Knudsen at al. [22] used factor analysis to define dietary patterns in Danish pregnant women and identified two major patterns: "Western diet"; and "Health conscious". In another study involving 6,125 non pregnant women aged 20-34 years from Southampton (UK) [23], two main patterns were again derived: "Prudent"; and "High-energy". Although food groups which load high under a given label are not necessarily all the same from one study to another, overall, factor analyses undertaken in adults have often described the so-called "Prudent" (or "Healthy", "Health conscious") pattern; the latter has notably characterized by high consumption of fruit and vegetables, dairy, and fish [6]. The patterns identified in our study, "Fruits and vegetables" in mothers, and "Fruits" and "Potatoes and vegetables" in fathers, had similar characteristics to the prudent pattern. Conversely, patterns with high loadings for red and processed meats, refined grains, and processed foods have often been labeled as "Western" [6], similar to the "High-fat foods" and "High-energy snack and processed foods" patterns identified in the current study in mothers and fathers.

Age has been shown to positively correlate with "Prudent"-like patterns [6]. Interestingly, this relationship was confirmed in the current dataset despite the narrow age range considered, indicating that these age trends are already set in early adulthood. The higher consumption of nutrient-dense and low energy-dense foods among highly educated individuals and, conversely, the intake of nutrient-poor and energy-dense foods in the lowest socio-economic groups have been previously reported in other studies undertaken in industrialized countries [24], including Australia [25, 26]. The current study confirmed that the "Prudent" patterns' average scores were higher in the most educated backgrounds, as opposed to the "Western" patterns' scores. It has been suggested that level of education is likely to influence literacy, knowledge of nutrition, and health-related behavior including diet [27, 28]. It is noteworthy that maternal nutrition knowledge was found to partly mediate the association between educational achievement and maternal diet quality, in another study based on the same dataset [17].

As noted by Northstone and Emmett (2010)[15], most studies using exploratory analyses have derived patterns for men and women combined. However, observed differences in patterns' scores by gender are controversial [6] and may depend on the age range considered, the origin of the population studied, and methodological issues. Deriving patterns independently in men and women, and more specifically in fathers and mothers, is likely to lead to more nuanced results. This was confirmed in the findings of a study in young mothers [9] and fathers [15], which revealed similar but not identical dietary patterns between genders. In the current study, three qualitatively similar patterns were observed in mothers and fathers: "Fruits and vegetables"; "High-fat foods"; and "High-energy snack and processed foods". However, while for example the "Healthy" pattern included fruits and vegetables in mothers, it did not include vegetables but included non-core foods in fathers. In addition, the "High-energy snack and processed foods" pattern was characterized more by savoury snacks in mothers than in fathers. Two other patterns were more gender-specific: "Cereals and sweet foods" in mothers; and "Potatoes and vegetables" in fathers. Interestingly, Northstone and Emmett [15] also observed in men that vegetables and potatoes did not load strongly in their pattern called "Health conscious". Instead, these groups were strongly correlated with a specific pattern observed in men only, which was labeled "Traditional". Therefore, while women's consumptions of fruits and vegetables are related, the fact that they remain independent in men suggests that health promotion messages would need to target both fruits and vegetables independently. Despite these gender specificities, qualitatively similar patterns in mothers and fathers were the most strongly correlated, as also observed in the study by Northstone et al. [15]. Increasing our understanding of the foods that characterize the eating patterns of mothers and fathers independently, along with the information on how these various patterns correlate within households, provides complementary indications to refine the development and implementation of family-based interventions.

Studies that have investigated and reported positive relationships between fathers' and children's diets [29-31] are uncommon. There is, however, clearer evidence that children's eating patterns are influenced by their mothers' diet [32-38]. This influence is likely to be exerted from very early ages, not only through modeling of eating behaviors but also through the foods available within the household [4, 5]. It is possible that the influence on children's diets may be stronger if dietary patterns correlate between parents.

Some limitations of the study need to be acknowledged. First, although all levels of SEP were represented in this study, the sample is generally well educated, with 55.5% reporting high education level. In addition, participants in this study were older than the average age of first-time mothers in Victoria (32.3 years compared to 29.1 years) [39]. These characteristics may have

implications for generalisibility. However, they may be partially explained by the inclusion of only urban Melbourne residents in the trial, who are likely to differ from the broader Victorian population. A study of 1507 first-time mothers recruited during early pregnancy from metropolitan hospitals across Melbourne in 2003-2005 provides a comparable urban sample [40]. In that study, 46% reported tertiary or higher education, and 57% were aged 30 years or older at childbirth (compared to 69% in the Melbourne InFANT Program) [41]. Second, we acknowledge that the estimation of food intake is more precise with a quantitative FFQ. However, research shows that frequency of consumption is actually the major determinant of intake, and the addition of portion or serve size to food frequency questionnaires does not improve their ability to predict intake at a population level [42]. The use of frequencies of consumption is commonly used in identification of dietary patterns by factor analysis or principal component analysis [6]. We also acknowledge that the factor loadings reported in our study are not as high as other previously reported studies [7-10, 15, 22], which might have been a concern for interpretability of the patterns. However, our approach has been to consider the highest loading foods to describe the patterns (i.e. the ranking of foods in the pattern); as such, they were useful to differentiate the dietary patterns from each other. Overall, the current study involved PCA, which is an exploratory statistical alternative among the factor analyses general methodology. Comparison with other findings is not straightforward due to the data-driven approach to pattern analysis, with different methodologies employed in the collection of dietary data, subjective redistribution of the former items (i.e. foods) into food groups, the transformation of these variables (e.g. standardization), defining the number of groups for inclusion in factor analyses, the methods of rotation of components (if any) employed, and the number of patterns identified – all complicating the opportunities for comparison. Despite these potential variations in methodology, Newby et al. (2004) [6] reported in their review that some reproducibility has been observed between most studies which have identified patterns in adults. This consistency over national and international studies was confirmed for the current study, as previously described.

These findings from the baseline data are all the more relevant in the context of The Melbourne InFANT Program, which focused on parenting skills and strategies aimed at promoting the development of healthy behaviors from early infancy, including eating. Deleterious food choices have been shown to correlate with sedentary behaviors, low physical activity and overweight not only in adults [6] but also in children [43-45]. Moreover, diet related behaviors established in early life have been shown to track throughout childhood [46], suggesting that the home environment influences on children tend to persist over time [47]. Behavioral trajectories are therefore likely to

start at very young ages, along with a strong familial component. Identifying first-time parents with unhealthy dietary patterns is likely to be an effective strategy in targeting child-obesity prevention.

Authors' contributions

S. L. conducted the statistical analysis, contributed to interpretation of results, drafted and edited the manuscript, and had primary responsibility for final content. S. A. M. conducted the dietary data collection, guided the statistical analysis, contributed to interpretation of results, drafted and edited the manuscript. D. C. guided the statistical analysis, contributed to interpretation of results, drafted and edited the manuscript. A. C. S conducted the dietary data collection, drafted and edited the manuscript. K. H. designed and led The Melbourne InFANT Program, guided the statistical analysis, contributed to interpretation of results, drafted and edited the manuscript. K. J. C. was the principal investigator on The Melbourne InFANT Program. She designed and led that study, conducted the dietary data collection, guided the statistical analysis, contributed to interpretation of results, drafted and edited the manuscript. All authors have read and approved the final manuscript. None of the authors had a conflict of interest.

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Table 1. Characteristics of the sample

	Mothers		Fathers	
	%	95%CI	%	95%CI
N	454		454	
Age (y), mean (s.d.)	32.3 (4.2)		34.2 (4.9)	
BMI (kg/m^2), mean (s.d.)	24.4 (5.2)		27.8 (5.1)	
Age of the new born at baseline (months), mean (s.d.)	3.7 (1.2)			
Duration of pregnancy (weeks), mean (s.d.)	38.8 (2.4)			
Currently breastfeeding the baby				
Yes	72.7	67.6;77.9		
No	27.3	22.1;32.4		
Education level				
Low	19.2	14.9;23.4	26.7	21.7;31.7
Intermediate	25.3	20.7;30.0	33.1	28.8;37.4
High	55.5	49.1;61.9	40.2	33.5;46.9
Employment status				
On maternity/paternity leave or home duties full time	84.1	80.4;87.8	0	
Employed	8.4	5.7;11.1	97.3	95.8;98.9
Unemployed, student, or other	7.5	4.9;10.1	2.7	1.1;4.2
Country of birth				
Australia	78.9	74.5;83.2	77.2	73.5;80.9
Other	21.1	16.8;25.5	22.8	19.3;26.5
Language spoken at home				
English	94.3	91.6;97.0	95.6	93.3;97.8
Other	5.7	3.0;8.4	4.4	2.2;6.7

Table 2. Factors loadings for the rotated patterns in mothers and fathers

Labels	Mothers (*n*=454)				Fathers (*n*=454)			
	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 1	Pattern 2	Pattern 3	Pattern 4
	Fruits and vegetables	High-energy snack and processed foods	High-fat foods	Cereals and sweet foods	Fruits	Potatoes and vegetables	High-fat foods	High-energy snack and processed foods
Food groups								
Full cream milk.	0.06	-0.02	**0.21**	**-0.26**	-0.01	0.01	0.13	0.01
Reduced fat milk.	-0.11	0.07	-0.20	**0.28**	0.07	0.02	-0.18	0.05
Other milks: soy milk or others.	0.16	0.01	-0.07	-0.07	0.09	-0.02	-0.13	0.01
Diet carbonated soft drink.	**-0.21**	0.05	0.02	0.19	-0.08	-0.03	0.01	0.16
Non-diet carbonated soft drink.	-0.10	0.03	0.16	-0.02	-0.08	-0.10	0.14	0.09
Fruit juices.	-0.02	0.03	0.16	0.02	0.10	0	0.07	0.10
White bread*.	-0.10	0.04	**0.25**	-0.10	-0.07	-0.06	**0.27**	0.05
Non white bread†.	0.09	0.08	-0.13	0.14	0.07	0.10	**-0.23**	0.17
Wholemeal crackers.	0.04	-0.05	0.01	**0.47**	**0.33**	-0.05	-0.03	0.04
Porridge.	0.18	-0.03	-0.07	-0.12	0.14	0.07	0.14	-0.14
Breakfast cereals.	-0.05	0.07	-0.11	**0.24**	0.18	-0.02	**-0.23**	0.08
Rice.	0.09	-0.15	0.19	-0.02	0.04	0.04	0.08	-0.13
Pasta.	0.08	0.01	0.13	0.02	0.05	0	0.18	-0.11
Non-fat Potatoes.	-0.11	0.06	0	0.06	-0.07	**0.29**	-0.02	**0.20**
Raw vegetables.	**0.31**	0	0.06	0.13	0.05	**0.45**	0	-0.03
Cooked vegetables.	**0.26**	-0.05	0.07	0.09	0.01	**0.48**	0	0.03
Legumes.	**0.28**	-0.08	0	0.03	-0.03	**0.42**	-0.01	-0.07
Common fresh fruits‡.	**0.23**	-0.01	-0.06	0.11	**0.27**	0.12	-0.09	0
Other fresh fruits.	**0.23**	0	0.02	0.02	**0.29**	0.06	0.08	-0.09
Tinned or dried fruits.	0.14	0.02	0.09	0.11	**0.25**	0.09	0.04	-0.02

Labels	Mothers (*n*=454)				Fathers (*n*=454)			
	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 1	Pattern 2	Pattern 3	Pattern 4
	Fruits and vegetables	High-energy snack and processed foods	High-fat foods	Cereals and sweet foods	Fruits	Potatoes and vegetables	High-fat foods	High-energy snack and processed foods
Food groups								
Ricotta and cottage cheese.	0.10	-0.05	0.10	0.07	**0.20**	0	0.10	-0.13
All other cheeses.	0.11	0.18	0.06	0.10	0.10	0.05	0	**0.22**
Yogurt.	0.19	0.02	-0.02	0.15	0.17	0.01	-0.19	0.08
Eggs.	0.15	-0.02	0.12	0	0.01	0.10	0.04	0.09
Chicken.	-0.13	-0.02	0.12	0.09	-0.04	0.07	0.11	0.14
Red meats§.	-0.02	-0.02	0.16	0.05	0.05	0.03	**0.29**	0.07
Sausages.	-0.07	0.04	0.18	0.07	0	0.03	**0.34**	0.07
Deli meats‖.	-0.08	0.13	0.15	0.09	-0.03	0.05	0.10	0.26
Non-fried fish.	**0.25**	-0.04	-0.03	0.03	**0.21**	0.05	0.03	-0.03
Fried fish.	0.09	-0.03	**0.24**	-0.03	0.06	0.03	**0.35**	-0.03
Potatoes cooked in fat.	-0.09	0.05	**0.29**	0.02	-0.13	**0.24**	0.16	**0.21**
Savoury pastries.	-0.02	**0.42**	-0.01	-0.04	-0.04	-0.02	0.17	**0.20**
Pizzas.	0	**0.43**	-0.07	-0.06	0	-0.04	**0.27**	0.04
Salty and non-wholemeal biscuits.	0.02	-0.03	0.17	0.14	**0.21**	-0.14	0.05	0.15
Crisps¶	-0.03	**0.32**	0.09	0.02	-0.03	-0.05	0	**0.28**
Sweet biscuits.	0.02	0	0.18	0.06	0.15	-0.13	-0.02	**0.23**
Cakes and pastries.	0.03	0.05	**0.23**	0.01	0.17	-0.16	0.08	**0.20**
Ice cream.	-0.14	0.04	0.15	**0.21**	0.06	-0.08	-0.01	**0.23**
Chocolate-based products**.	-0.02	**0.21**	0.15	0.03	0.06	-0.05	-0.04	**0.28**
Other confectionery.	0.04	-0.05	0.01	**0.47**	**0.33**	-0.05	-0.03	0.04
Olives.	0.19	**0.25**	0	-0.04	0.15	0.07	0.05	-0.08
Peanut products††.	0.09	**0.25**	0.02	-0.02	0.07	0.01	-0.01	0.18

Labels	Mothers (*n*=454)				Fathers (*n*=454)			
	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 1	Pattern 2	Pattern 3	Pattern 4
	Fruits and vegetables	High-energy snack and processed foods	High-fat foods	Cereals and sweet foods	Fruits	Potatoes and vegetables	High-fat foods	High-energy snack and processed foods
Food groups								
Nuts other than peanuts.	**0.24**	0.17	-0.08	-0.04	0.18	0.10	-0.11	-0.02
Tomato sauce or Ketchup.	-0.09	**0.30**	0.10	0	-0.12	0.06	0.02	**0.28**
Fat spreads‡‡.	0.03	0.10	**0.23**	0.03	0.09	0.09	0.09	0.15
Oil and vinegar salad dressing.	**0.20**	0.03	0.12	0.01	0.16	0.05	0.17	-0.18
Low-calorie salad dressing.	0.01	-0.05	0.09	0.16	0.14	0.04	0.09	-0.01
Butter on vegetables.	0.02	-0.05	**0.27**	-0.08	0.11	-0.05	**0.20**	0.01
Margarine or oil on vegetables.	0.05	-0.12	**0.26**	0	0.17	-0.06	0.13	-0.03
Yeast extracts/spreads§§.	0.01	**0.23**	-0.04	0.13	0.05	0.08	-0.09	0.17
Jam, marmalade, honey, or syrups.	0.14	0.17	-0.01	-0.05	0.11	0.06	-0.04	0.14
Coffee.	0.10	-0.01	0.03	-0.06	0	0.08	0.02	0.02
Tea.	0.13	0.05	-0.04	-0.08	0.10	0.01	-0.01	-0.07
Herbal tea‖‖.	**0.21**	0.05	-0.03	0.01				
Alcohol.	0.04	0.10	-0.08	-0.09	-0.07	0.16	0.03	0
Proportion of explained variance (%)	7.4	6.8	5.0	4.9	6.8	5.8	5.6	5.3

* Including high fibre white; † Including wholemeal, multi-grain, rye, soy and linseed; ‡ Bananas, apples, pears, and oranges; § Beef or veal (not corned), lamb, and pork; ‖ Processed meats (e.g. ham, corned beef, prosciutto, salami) and bacon; ¶ Corn chips, potato crisps, Twisties; ** Chocolate and confectionary containing chocolate. †† Peanuts, peanut butter or peanut paste; ‡‡ Cream, sour cream, or Mayonnaise; §§ Vegemite, Marmite, or Promite; ‖‖ Not included in the PCA in fathers, due to a majority of non consumers.

Loadings above 0.20 are shown in bold.

Table 3. Dietary patterns scores in both mothers and fathers according to age and education level, adjusted parameter estimates (95% CIs)

	Mothers (*n* = 454)				Fathers (*n* = 454)			
	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 1	Pattern 2	Pattern 3	Pattern 4
	Fruits and vegetables	High-energy snack and processed foods	High-fat foods	Cereals and sweet foods	Fruits	Potatoes and vegetables	High-fat foods	High-energy snack and processed foods
Age (continuous)	0.12	0.02	-0.02	0.03	0.05	0.02	-0.04	-0.02
	(0.07;0.16)	(-0.03;0.07)	(-0.06;0.02)	(-0.01;0.07)	(0.02;0.09)	(0;0.05)	(-0.08;0)	(-0.05;0.01)
P	<0.001	0.42	0.36	0.10	0.005	0.09	0.03	0.16
Education								
Low	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Intermediate	-0.03	-0.18	-0.14	0.24	0.29	-0.04	-0.33	-0.16
	(-0.44;0.39)	(-0.58;0.23)	(-0.68;0.40)	(-0.16;0.65)	(-0.17;0.76)	(-0.57;0.48)	(-0.85;0.20)	(-0.55;0.23)
High	0.73	0.10	-0.46	0.61	0.54	0.21	-0.58	-0.62
	(0.35;1.11)	(-0.33;0.53)	(-1.01;0.08)	(0.23;0.98)	(0.04;1.04)	(-0.28;0.70)	(-1.01;-0.14)	(-1.00;-0.25)
P	<0.001	0.28	0.07	0.008	0.11	0.16	0.03	0.005
P-trend	<0.001	0.43	0.05	0.002	0.03	0.31	0.008	0.001

Table 4. Spearman's correlation coefficients between mothers' and fathers' patterns (N=454 pairs)

	Fathers' patterns			
	Fruits	Potatoes and vegetables	High-fat foods	High-energy snack and processed foods
Mothers' patterns				
Fruits and vegetables	0.42***	0.37***	-0.14**	-0.19***
High-energy snack and processed foods	-0.02	0.03	0.21***	0.34***
High-fat foods	-0.05	-0.06	0.45***	0.19***
Cereals and sweet foods	0.18***	0.07	-0.19***	0.12**

*P<0.05; **p<0.01; ***p<0.001.

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