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## Characteristics associated with feeding organic foods during complementary feeding: the nationwide Étude Longitudinale Française depuis l'Enfance (ELFE) birth cohort

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1 **Characteristics associated with feeding organic foods during complementary feeding:**  
2 **the nationwide ELFE birth cohort**

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18 **Short title**

19 Organic foods during complementary feeding

20 **Keywords**

21 infant, organic foods, birth cohort, complementary feeding

22

23 **Abstract**

24 Organic food consumption and its effects on health remain understudied in adults and in  
25 children. The aim of this study was to describe family characteristics associated with feeding  
26 infants organic foods during the complementary feeding (CF) period. The analysis included  
27 9,764 children from the French ELFE birth cohort. In addition to telephone interviews  
28 conducted at 2, 12 and 24 months, a monthly questionnaire about milk feeding and CF  
29 (including organic foods) was completed by parents between 3 and 10 months. Associations  
30 between family characteristics and feeding with organic foods during CF were analyzed by  
31 multivariable multinomial logistic regression. Overall, 51% of infants never consumed  
32 organic food during the CF period (up to 10 months), 24% sometimes, 15% often and 9%  
33 always or almost always. As compared with infants never fed organic foods during CF, those  
34 “often” or “always” fed organic foods were born to older mothers, with higher education level  
35 or family income, and lower pre-pregnancy body mass index. As compared with never-  
36 smoking women, women who had stopped smoking before pregnancy were more likely to  
37 feed their infant organic foods during CF. Feeding with organic foods during CF was also  
38 related to long breastfeeding duration and later introduction to complementary foods.  
39 To conclude, associations between feeding with organic foods and family socioeconomic  
40 position as well as infant feeding practices need to be considered when studying the impact of  
41 organic foods on children’s health and development.

42

43

## 44 **Introduction**

45 Organic foods, acclaimed for environmental benefits related to their production <sup>(1)</sup>, are also  
46 perceived as having beneficial effects on health <sup>(2; 3; 4; 5)</sup> because they contain fewer pesticide  
47 residues as compared with conventionally grown foods <sup>(6)</sup>. European rules imposed a very low  
48 common limit for all pesticides on all baby foodstuffs <sup>(7)</sup>. whatever the mode of agricultural  
49 production. Studies examining the consumption of organic foods during pregnancy have  
50 reported a protective effect on some birth outcomes, such as pre-eclampsia, hypospadias, and  
51 cryptorchidism <sup>(8; 9)</sup>, as well as a child's later health, such as atopic diseases <sup>(10; 11; 12; 13)</sup>.  
52 However, the evidence remains sparse and controversial <sup>(14)</sup>.  
53 Despite the complexity of characterizing organic food consumers <sup>(5)</sup>, their profiles have been  
54 reported in numerous studies mainly in adulthood. Such consumers tend to be older and  
55 female, have a high education level, have children, and follow an overall healthy lifestyle  
56 (compliance with dietary recommendations and regular physical activity, no smoking) <sup>(2; 5)</sup>.  
57 Except for a previous study of pregnant women <sup>(15)</sup>, little is known about consuming organic  
58 foods in the perinatal period and the associated family characteristics. This previous study  
59 showed that socioeconomic characteristics related to frequent consumption of organic foods  
60 during pregnancy were not just those usually related to healthier behaviors: women with both  
61 low and high education and in the lowest income group were more likely to eat organic foods  
62 than other women.  
63 Infant feeding practices are known to affect numerous aspects of health in later life <sup>(16; 17; 18; 19;</sup>  
64 <sup>20)</sup>. However, several aspects of feeding practices such as breastfeeding duration, age at  
65 complementary feeding (CF) introduction, and type of foods used in infancy are interrelated  
66 <sup>(21)</sup> and known to be associated with family characteristics and the health status of the infant  
67 <sup>(21; 22; 23)</sup>. Organic food consumption is associated with a healthy lifestyle <sup>(11)</sup>, so we should  
68 examine the links between feeding organic foods during CF and other feeding practices.

69 The aim of the present study was to describe the choice of organic foods for CF in a large  
70 nationwide birth cohort and its association with family characteristics and other infant feeding  
71 practices.

## 72 **Materials and methods**

### 73 *Study population*

74 The present analysis was based on data from the Étude Longitudinale Française depuis  
75 l'Enfance (ELFE) study, a multidisciplinary, nationally representative birth cohort that  
76 included 18,329 children born in a random sample of 349 maternity units in France in 2011  
77 <sup>(24)</sup>. From April 2011, inclusion took place during 25 selected recruitment days over four  
78 waves of 4 to 8 days each and covering all four seasons. Inclusion criteria were birth after 33  
79 weeks' gestation to mothers aged 18 years or older who were not planning to move outside of  
80 metropolitan France in the following 3 years. Data were collected in standardized interviews  
81 conducted by trained interviewers and self-completed questionnaires.

82 Mothers were interviewed in the maternity ward for medical information about their  
83 pregnancy and their newborn, sociodemographic and lifestyle-related characteristics, and  
84 eating habits during pregnancy. Additional information was collected from obstetric and  
85 paediatric medical files. At 2, 12 and 24 months post-partum, telephone interviews with  
86 mothers and fathers collected data on infant feeding and more details on demographic and  
87 socioeconomic characteristics. From 3 to 10 months after delivery, families were asked to  
88 complete a monthly questionnaire via the Internet (70%) or by paper that asked about the  
89 infant's diet (feeding methods, food and beverage introduction).

### 90 *Ethical approval*

91 Participating mothers provided written consent for themselves and their child. When present  
92 at inclusion, fathers signed the consent form for the child's participation or were informed  
93 about their right to oppose it. The ELFE study received approvals from the Advisory

94 Committee for the Treatment of Information on Health Research (Comité Consultatif sur le  
95 Traitement des Informations pour la Recherche en Santé), the National Agency Regulating  
96 Data Protection (Commission Nationale Informatique et Libertés), and the National Statistics  
97 Council.

98 *Family characteristics assessment*

99 Parental socio-demographic characteristics of interest were maternal migration status  
100 (migrant, descendant of migrant, majority population), age at delivery (18-25, 25-29, 30-34,  
101  $\geq 35$  years), number of older children in the household (ELFE child is the first child, one older  
102 child, at least two older children), single parenthood, maternal education level (up to lower  
103 secondary, upper secondary, intermediate, 3-y university degree, at least 5-y university  
104 degree), monthly family income per consumption unit <sup>(25)</sup> ( $\leq$  € 750, € 751-1,111, € 1,112-  
105 1,500, € 1,501-1,944, € 1,945-2,500,  $>$ € 2,500), employment status during pregnancy  
106 (employed, unemployed, out of the labor force [housewife/student/retired/disabled]), and  
107 motives for choice of feeding method (breast or formula milk) at birth: child's health or well-  
108 being/practical reasons/interaction with infant/usual feeding method/other or unknown.  
109 Maternal health characteristics included self-reported height and pre-pregnancy weight,  
110 maternal smoking during pregnancy (never smoker, smoker only before pregnancy, smoker in  
111 early pregnancy and smoker throughout pregnancy).  
112 During the hospital stay, the recruited women (n = 18,042) were asked to complete a self-  
113 administered food-frequency questionnaire to describe their dietary intake over the last 3  
114 months of their pregnancy <sup>(26)</sup>. A diet quality score, based on consumption of the main food  
115 groups, was calculated by using 17 quantitative benchmarks as previously described <sup>(27)</sup>.

116 *Infant characteristics*

117 Newborn characteristics were collected from the medical record: sex, twin birth, gestational  
118 age and birth weight. Medical diagnosis of the infant's allergy to cow's milk protein was also  
119 collected from the parents with the 2-month questionnaire.

120 *Infant feeding*

121 Details on milk feeding practices were collected monthly from 2 to 10 months and then at 12  
122 and 24 months. From these data, any breastfeeding duration and age at infant formula  
123 introduction were calculated as previously described <sup>(28)</sup>.

124 Details on CF practices were collected monthly from 3 to 10 months. We calculated the age  
125 of introduction of 13 food groups (fruits, vegetables, potatoes, water, fruit juice, infant  
126 cereals, meat, fish, eggs, bread and pasta, dairy products, cow's milk and dessert), along with  
127 the age of introduction of unmixed meat and crushed vegetables and fruits, as previously  
128 defined <sup>(22)</sup>. Each month, the parents reported the frequency of use of organic foods to feed  
129 their infant (0-never, 1-sometimes, 2-often, 3-always or almost always), as well as the  
130 frequency of use of ready-prepared baby foods to feed their infant. The frequency of feeding  
131 with organic foods during CF was individually summarized as the median frequency of  
132 feeding with organic foods reported between the age of introduction to CF and age 10 months.  
133 The frequency of feeding with ready-prepared baby foods during CF was individually  
134 summarized as the median frequency of feeding with ready-prepared baby foods reported  
135 between the age of introduction to CF and age 10 months. Among families completing the 3-  
136 to 10-month questionnaires, 86% of children had at least 5 collection points for organic foods.

137 *Sample selection*

138 Children whose parents withdrew consent (n=57) were excluded from the study. We  
139 randomly selected one twin of two (n=287) to avoid family clusters. We excluded children  
140 whose frequency of consumption of organic foods was missing, as they did not complete the

141 3-10-month questionnaire or did not provide enough information to summarize intake during  
142 complementary feeding (n=6,899), which left 11,086 children to compute national statistics  
143 on feeding with organic foods during CF.

144 To analyze the associations between familial/infant characteristics and frequency of feeding  
145 with organic foods during CF, we excluded children with a medical diagnosis of allergy to  
146 cow's milk protein reported at the 2-month follow-up (n=144) because it might deeply affect  
147 infant feeding. After excluding children with missing data on family or infant characteristics  
148 (n=1,180), the complete-cases analysis was based on 9,762 children. The analyses accounting  
149 for maternal diet quality during pregnancy involved 8,985 children, and those accounting for  
150 other feeding practices involved 8,588 children.

151 As compared with the 9,762 included children, excluded children often had younger mothers  
152 ( $30.2 \pm 5.6$  vs  $31.3 \pm 4.6$  years,  $p < 0.0001$ ) with lower education level (14.7% vs 23.5% with a  
153 Master's degree,  $p < 0.0001$ ) and lower income (mean €  $1,423 \pm 1,033$  vs €  $1,751 \pm 979$  per  
154 consumption unit,  $p < 0.0001$ ). They more frequently had two or more siblings (22.7% vs  
155 16.5%,  $p < 0.0001$ ), an immigrant mother (15.9% vs 6.5%,  $p < 0.0001$ ), and a mother who  
156 smoked throughout pregnancy (21.0% vs 12.4%,  $p < 0.0001$ ).

### 157 *Statistical analyses*

158 To provide representative descriptive statistics of births in 2011 in metropolitan France, the  
159 data (rates of choosing organic food) were weighted to take into account the inclusion  
160 procedure and biases related to non-consent<sup>(29)</sup>. Weighting also included calibration on  
161 margins from the state register's statistical data and the 2010 French National Perinatal study  
162<sup>(30)</sup> on the following variables: age, region, marital status, migration status, level of education,  
163 and primiparity. This weighting was calculated for the subsample that completed the  
164 questionnaire on infant diet at least once from 3 to 10 months.

165 Bivariate associations between family characteristics and frequency of feeding with organic  
166 foods during CF were analyzed with chi-square tests and those between infant feeding  
167 practices and frequency of feeding with organic foods during CF with ANOVA. Multivariable  
168 associations between familial or infant characteristics and frequency of feeding with organic  
169 foods during CF (never, sometimes, often, always or almost always) were assessed by  
170 multinomial logistic regression, simultaneously including the family characteristics presented  
171 previously and additionally adjusted for variables related to study design (mother's region of  
172 residence, size of maternity unit and wave of recruitment). Not feeding with organic foods  
173 during CF was considered the reference category. Analyses were conducted with a three-step  
174 approach. First, only maternal sociodemographic characteristics were considered: age,  
175 education level, migration status, single motherhood, number of children in the household,  
176 employment during pregnancy, and household income. In addition to sociodemographic  
177 characteristics, analyses included maternal health and health-related behaviors: smoking  
178 status during pregnancy, pre-pregnancy body mass index (BMI), diet quality during  
179 pregnancy, and motives for choice of initial feeding method. In a final model, infant  
180 characteristics and infant feeding practices were considered: sex, birth weight-for-gestational-  
181 age, any breastfeeding duration, age at complementary feeding introduction and frequency of  
182 feeding with ready-prepared baby foods during CF.

183 To deal with selection and attrition bias, we performed a sensitivity analysis with weighted  
184 data according to the weighting described previously on the complete-cases sample. Because  
185 the main analyses were based on the complete-cases sample, we also performed a sensitivity  
186 analysis using multiple imputation to deal with missing data on family characteristics. We  
187 assumed that data were missing at random and generated five independent datasets with the  
188 fully conditional specification method (SAS software: MI procedure, FCS statement,  
189 NIMPUTE option) and then calculated pooled effect estimates (SAS software: MIANALYSE

190 procedure). In imputation models, we included all variables of interest after ranking them in  
191 ascending order of missing data. Categorical variables were imputed with a multinomial  
192 model, ordinal or binary variables with logistic regression, and continuous variables with  
193 linear regression. These sensitivity analyses involved data for all participants with data on  
194 organic foods choice for CF (n=10,945). All analyses involved using SAS V9.4 (SAS, Cary,  
195 NC).

## 196 **Results**

### 197 *Descriptive statistics*

198 For the 11,086 infants with data on organic foods, the weighted frequencies of feeding with  
199 organic foods between CF introduction and 10 months were : never 51.3% (95% CI: 50.1,  
200 52.6%), sometimes 24.0% (22.9, 25.0%), often 15.2% (14.4, 16.1%), and always or almost  
201 always 9.5% (8.8, 10.1%).

### 202 *Maternal sociodemographic and socioeconomic characteristics*

203 Family and infant characteristics were compared by frequency of feeding with organic foods  
204 during complementary feeding (Table 1).

205 On multivariable analysis (Table 2), as compared with no feeding with organic foods, the  
206 frequency of feeding with organic foods during CF was positively associated with maternal  
207 age, education level, and household income. Immigrant women were more likely to feed their  
208 infant organic foods during CF, but the association was only statistically significant for  
209 “sometimes” and “often” categories. Unemployed mothers were more likely to always feed  
210 their infant organic foods when adjusted for family income and other characteristics. Single  
211 parenthood and maternal return to work at 2 months were not associated with frequency of  
212 feeding with organic foods during CF. Finally, families with older siblings were less likely to  
213 feed their infant organic foods often or always.

214 *Health, motives and health-related behaviors*

215 As compared with women who never smoked, those who stopped smoking before pregnancy  
216 or in early pregnancy were more likely to always feed their child organic foods during CF  
217 (Table 3, model 2). Children born to mothers with overweight or obesity were less likely to be  
218 fed organic foods than those born to women with normal weight. Likelihood of feeding with  
219 organic foods was associated with maternal diet quality during pregnancy. Finally, likelihood  
220 of feeding with organic foods was reduced for children of women who initially chose their  
221 infant feeding method (breast or formula feeding) for practical or “other reasons” rather than  
222 for their child’s health or well-being.

223 *Infant characteristics and infant feeding practices*

224 The model further accounting for infant characteristics is shown in Table 3 (Model 3). Girls  
225 were less likely to almost always be fed organic foods during CF than boys but not  
226 significantly ( $p=0.08$ , Table 3). Infants born small-for-gestational-age were less likely to be  
227 fed “sometimes” or “often” with organic foods than their adequate-for-gestational-age  
228 counterparts. The frequency of feeding with organic foods was strongly and positively related  
229 to any breastfeeding duration and was positively related to age at complementary foods  
230 introduction, especially introduction to CF after age 6 months. Infant fed with ready-prepared  
231 baby foods were more likely to be fed with organic foods than infant never fed with ready-  
232 prepared baby foods, but the association between ready-prepared baby foods and organic  
233 foods was quite complex. In fact, the association was stronger infants consuming ready-  
234 prepared baby food “sometimes” or “often” than “almost always”. Moreover, within each  
235 frequency of feeding with ready-prepared baby foods, the association was stronger for  
236 intermediate frequency of feeding with organic foods than for high frequency.

237 *Sensitivity analyses*

238 Findings were similar in analyses based on weighted data or with multiple imputations of  
239 missing data (Supplementary tables 1 and 2).

## 240 **Discussion**

241 To our knowledge, this study is the first to characterize feeding with organic foods during CF  
242 and the associated family characteristics or feeding practices during the first year of life.

243 Beyond its positive association with several indicators of socioeconomic position, the  
244 frequency of feeding with organic foods was strongly related to other infant feeding practices  
245 such as long breastfeeding duration and introduction to CF after age 6 months. Furthermore,  
246 feeding the child organic foods during CF was related to maternal health concerns such as  
247 smoking cessation before pregnancy.

### 248 *Frequency of feeding with organic foods during CF*

249 Published data on the consumption of organic foods in the perinatal period are sparse. The  
250 prevalence of organic foods consumption by infants born in 2011 in the ELFE study is  
251 consistent with that found in literature (although the data collection methods are different),  
252 with half of infants never fed organic foods and 25% often or always fed organic foods. Only  
253 one study provided statistics on organic food consumption in the first years of life: in the  
254 KOALA Birth Cohort study (beginning in 2000), 16% of infants consumed a diet with at least  
255 50% organic foods in their first 2 years of life<sup>(10)</sup>. More data are available on organic foods  
256 consumption during pregnancy. In the KOALA Birth Cohort study, many pregnant women  
257 (86%) consumed a diet based on conventional foods and 14% a diet with at least 50% organic  
258 foods<sup>(10)</sup>. In the Norwegian Mother and Child Cohort Study (MoBa, recruitment from 1999  
259 through 2008), about half of women never/seldom ate organic foods during pregnancy as  
260 compared with 16% who often ate organic foods<sup>(9)</sup>. In the Danish National Birth Cohort

261 (recruitment between 1996 and 2002), an estimated 56% of pregnant women were non- or  
262 low organic-food consumers and 7% frequent consumers <sup>(31)</sup>.

263 *Sociodemographic characteristics and feeding with organic foods during CF*

264 The frequency of feeding with organic foods during CF has never been described. Therefore,  
265 we compared our findings to correlates and motives reported in adult populations (including  
266 pregnant women). Consistent with the literature, feeding with organic foods was related to  
267 increased maternal age <sup>(31; 32; 33)</sup> and education level <sup>(34; 35)</sup> and related to increased household  
268 income, even if the association with income and organic foods could be stronger for some  
269 food groups (e.g., vegetables) than others (e.g., milk) <sup>(34)</sup>. However, in the MoBa study, the  
270 consumption of organic foods during pregnancy was related to both younger and older age as  
271 well as low education level and low household income <sup>(31)</sup>. In the Elfe study, after adjustment  
272 for education level and family income, maternal employment was negatively related to  
273 feeding with organic foods.

274 Households with children seemed more likely to purchase organic foods than those without  
275 children <sup>(32)</sup>, but in the ELFE study, parents with older children less likely fed their infant  
276 organic foods during CF as compared with those without older children. In the MoBa study,  
277 pregnant women with an older child were more likely to consume organic foods than  
278 primiparous women, whereas those with at least two previous children were less likely to  
279 consume organic foods <sup>(31)</sup>, which suggests that the association between parity and choice of  
280 organic foods is complex and depends on the population.

281 The accessibility and availability of organic foods is strongly associated with organic foods  
282 consumption <sup>(32; 36; 37; 38; 39)</sup>, but unfortunately such an information was not available in the  
283 ELFE study.

284 *Maternal health and health-related behaviors and feeding with organic foods during CF*

285 In the ELFE study, frequent feeding with organic foods during CF was related to maternal  
286 health and health behaviors, assessed by maternal weight status, smoking cessation, and  
287 health concerns such as motives for choice of initial infant feeding method. In the literature,  
288 the inverse association between BMI and consumption of organic foods was consistent across  
289 studies<sup>(15; 31; 33; 35; 40)</sup>. The association with smoking seems complex: some studies highlighted  
290 higher consumption of organic foods among former or current smokers than non-smokers<sup>(15;</sup>  
291 <sup>33)</sup> but not all<sup>(40)</sup>. In the last study, with about 5% women smoking during pregnancy, no  
292 association was found with active smoking; but women consuming organic foods were less  
293 likely to be exposed to passive smoking than women consuming conventional foods<sup>(40)</sup>. In  
294 the MoBa study, occasional smokers were more likely to consume organic foods during  
295 pregnancy than were non-smokers, but the reverse was found for regular smokers<sup>(31)</sup>.  
296 Stronger health concerns were often observed among organic food consumers than others<sup>(4; 5;</sup>  
297 <sup>32; 36; 39; 41; 42; 43)</sup>. High diet quality was also related to increased likelihood of organic food  
298 consumption<sup>(2; 31; 33; 35; 44; 45; 46; 47; 48; 49)</sup>. Overall these aspects suggested a cluster of healthy  
299 behaviors.

300 *Organic foods and infant feeding during the first year of life*

301 Organic food consumers appeared to have a diet more in line with nutritional guidelines<sup>(33)</sup>  
302 and high awareness for some nutritional guidelines<sup>(2)</sup>. Moreover, consumers of organic foods  
303 are more likely to have a healthy lifestyle<sup>(2; 31; 33; 47; 48; 49; 50)</sup>. These findings in adults appeared  
304 consistent with the associations between extended breastfeeding (recommended by  
305 international societies<sup>(51; 52)</sup>) or low likelihood of early CF introduction (<4 months) and  
306 feeding with organic foods during CF. However, feeding with organic foods during CF was  
307 also related to late CF introduction (>6 months), which is not recommended by international  
308 societies.

309 *Strengths and limitations*

310 The ELFE cohort is a nationwide study of birth in 2011 in metropolitan France (excluding  
311 very premature babies). The main analyses were conducted on a complete-cases sample.  
312 However, when missing data on family characteristics were addressed by the multiple  
313 imputation method, results remained consistent. Moreover, the sample considered for the  
314 present analysis was based on more advantaged families than the initial ELFE sample, which  
315 limits the generalizability of our results. However, sensitivity analysis based on weighted  
316 data, which deals with part of the selection and attrition biases, provided similar findings,  
317 which suggests that these biases had limited impact on our results. The main strengths of the  
318 ELFE study include the large sample and the wide range of sociodemographic and  
319 socioeconomic variables and profiles. Moreover, data collection was repeated and prospective  
320 throughout infancy, thus limiting the memory bias regarding infant diet. Consumption of  
321 organic foods during CF was assessed with only one item, repeated each month from 3 to 10  
322 months, and based only on feeding at home, which allowed for only a quantitative assessment  
323 of infant exposure. However, this is the first study with data on organic-food consumption  
324 during CF, and the frequency of consumption of organic foods was consistent with previous  
325 studies in the perinatal period <sup>(10; 31; 53)</sup>.

326 **Conclusion**

327 About a quarter of infants were fed organic foods (often or always) during the CF period in  
328 France in 2011-2012, as assessed by the ELFE data. Beyond the positive association of  
329 organic food feeding and several indicators of the family socioeconomic position, organic  
330 food feeding was strongly associated with infant feeding practices, in particular long  
331 breastfeeding duration and introduction to complementary foods beyond 6 months. All these  
332 characteristics need to be carefully considered when studying the potential role of organic  
333 food consumption on children's subsequent health and development.

334

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358 ***Conflict of interest***

359 The authors had no conflict of interest relevant to this article to disclose.

### 360 ***Authorship***

361 BLG and FG conceptualized and designed the work, conducted the statistical analyses,  
362 drafted the initial manuscript, and approved the final manuscript as submitted.

363 AC and CDP conducted part of the statistical analyses, critically reviewed the manuscript, and  
364 approved the final manuscript as submitted.

365 BLG, SL, SN and MAC designed nutritional data collection instruments, supervised their data  
366 collection and data management, critically reviewed the manuscript, and approved the final  
367 manuscript as submitted.

368 MAC coordinated the Elfe cohort management team.

369 EKG conceptualized and designed the work, contributed to the interpretation of the study,  
370 reviewed and revised the manuscript, and approved the final manuscript as submitted.

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372 The authors had no conflict of interest relevant to this article to disclose.

373

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511

512 **Table 1.** Family and infant characteristics by choice of organic foods for complementary  
 513 feeding (n=9,762)

	Choice of organic foods for complementary feeding				P value
	Never (n=4731)	Sometimes (n=2333)	Often (n=1614)	Almost always (n=1084)	
<b>Family characteristics</b>					
Maternal age at delivery (years)	30.6 (4.6)	31.5 (4.4)	32.1 (4.3)	32.5 (4.4)	<0.0001
Maternal education level					<0.0001
Up to lower secondary	3.1% (145)	2.4% (56)	1.5% (25)	1.0% (11)	
Upper secondary	36.1% (1707)	25.5% (595)	19.6% (317)	13.0% (141)	
Intermediate	27.2% (1285)	24.3% (568)	23.7% (383)	20.7% (224)	
3-year university degree	17.6% (832)	22.5% (525)	22.2% (358)	26.8% (291)	
At least 5-year university degree	16.1% (762)	25.2% (589)	32.9% (531)	38.5% (417)	
Maternal migration status					<.0001
Immigrant	5.0% (235)	7.5% (176)	9.1% (147)	7.5% (81)	
Descendant of at least one immigrant	8.7% (410)	8.9% (208)	9.4% (151)	8.9% (96)	
Rest of population	86.4% (4086)	83.5% (1949)	81.5% (1316)	83.7% (907)	
Parents living with the child					0.2
Both parents	97.4% (4607)	98% (2286)	98.1% (1583)	98.0% (1062)	
Single parenthood	2.6% (124)	2.0% (47)	1.9% (31)	2.0% (22)	
Older children in household					0.003
No sibling	44.6% (2110)	44.0% (1026)	47.5% (766)	50.3% (545)	
One sibling	38.7% (1832)	38.0% (887)	37.0% (597)	35.7% (387)	
At least 2 siblings	16.7% (789)	18.0% (420)	15.6% (251)	14.0% (152)	
Maternal employment during pregnancy					0.028
Employed	77.3% (3655)	80.1% (1868)	80.9% (1305)	79.5% (862)	
Unemployed	11.1% (526)	9.3% (218)	9.0% (145)	9.8% (106)	
Other (housewife, retired, student, retired etc.)	11.6% (550)	10.6% (247)	10.2% (164)	10.7% (116)	
Household income	1620 (1003)	1776 (785)	1933 (917)	2000 (1216)	<0.0001

(€/month/CU)

Maternal return to work at 2 months 0.15

No returned to work	94.4% (4464)	95.6% (2231)	94.9% (1531)	95.0% (1030)
Returned to work	5.6% (267)	4.4% (102)	5.1% (83)	5.0% (54)

### Maternal health and health-related behaviors

Smoking during pregnancy <0.0001

Never smoker	57.5% (2718)	57.9% (1351)	58.4% (943)	58.7% (636)
Smoker only before pregnancy	24.6% (1164)	26.9% (628)	28.5% (460)	28.4% (308)
Smoker only in early pregnancy	3.6% (170)	3.6% (85)	3.2% (51)	3.9% (42)
Smoker throughout pregnancy	14.4% (679)	11.5% (269)	9.9% (160)	9.0% (98)

Pre-pregnancy BMI (kg/m<sup>2</sup>) <0.0001

Maternal diet quality (0-17 score)	12.6 (1.2)	12.9 (1.2)	13.1 (1.2)	13.3 (1.2)	<0.0001
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Initial feeding method choice <0.0001

Health, well-being	35.6% (1685)	41.2% (961)	42.8% (690)	48.1% (521)
Practical reasons	14.1% (666)	10.0% (233)	9.1% (147)	5.4% (59)
Other/unknown	30.1% (1422)	26.5% (619)	25.0% (403)	22.1% (240)
Interaction with infant	6.3% (296)	7.8% (183)	7.9% (127)	7.8% (85)
Usual feeding method	14.0% (662)	14.4% (337)	15.3% (247)	16.5% (179)

### Infant characteristics and feeding practices

Child sex 0.047

Boy	49.9% (2362)	52.3% (1221)	53.5% (864)	51.9% (563)
Girl	50.1% (2369)	47.7% (1112)	46.5% (750)	48.1% (521)

Any breastfeeding duration (months) <0.0001

Age at infant formula introduction (months)	2.8 (4.4)	4.0 (5.3)	5.0 (6.1)	7.0 (7.1)	<0.0001
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Age at complementary foods introduction (months)	5.2 (1.2)	5.4 (1.1)	5.5 (1.1)	5.8 (1.0)	<0.0001
Use of ready-prepared baby foods					<0.0001
Never	28.0% (1278)	16.7% (371)	17.9% (275)	25.0% (254)	
Sometimes	28.3% (1290)	36.7% (814)	36.7% (563)	38.8% (395)	
Often	24.1% (1098)	29.0% (642)	32.7% (502)	22.7% (231)	
Almost always	19.7% (899)	17.6% (389)	12.7% (195)	13.5% (137)	

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514 Data are mean (SD), unless otherwise indicated

515 **Table 2.** Multivariate associations between family characteristics and feeding with organic  
 516 foods during complementary feeding (CF) (n=9,762)

	Organic foods during CF (ref=never)			P value
	Sometimes	Often	Almost always	
<b>Model 1</b>				
Maternal age at delivery (years)				<0.0001
< 25	0.83 [0.65, 1.05]	<b>0.71 [0.51, 0.97]</b>	0.79 [0.53, 1.19]	
25-29	1 [Ref]	1 [Ref]	1 [Ref]	
30-34	<b>1.22 [1.08, 1.39]</b>	<b>1.40 [1.20, 1.62]</b>	<b>1.62 [1.35, 1.94]</b>	
≥ 35	<b>1.22 [1.05, 1.43]</b>	<b>1.68 [1.41, 2.01]</b>	<b>2.36 [1.92, 2.91]</b>	
Maternal education level				<0.0001
Up to lower secondary	<b>0.67 [0.47, 0.94]</b>	<b>0.41 [0.26, 0.64]</b>	<b>0.19 [0.10, 0.36]</b>	
Upper secondary	<b>0.60 [0.51, 0.71]</b>	<b>0.43 [0.35, 0.52]</b>	<b>0.21 [0.17, 0.27]</b>	
Intermediate	<b>0.68 [0.58, 0.80]</b>	<b>0.57 [0.48, 0.68]</b>	<b>0.41 [0.33, 0.50]</b>	
3-year university degree	0.92 [0.78, 1.08]	<b>0.75 [0.63, 0.89]</b>	<b>0.75 [0.62, 0.91]</b>	
At least 5-year university degree	1 [Ref]	1 [Ref]	1 [Ref]	
Maternal migration status				0.0002
Migrant	<b>1.40 [1.13, 1.73]</b>	<b>1.78 [1.42, 2.25]</b>	1.24 [0.93, 1.64]	
Descendant of migrant	1.02 [0.85, 1.22]	1.13 [0.92, 1.38]	1.05 [0.82, 1.34]	
Majority population	1 [Ref]	1 [Ref]	1 [Ref]	
Parents living with the child				1
Both parents	1 [Ref]	1 [Ref]	1 [Ref]	
Single parenthood	0.91 [0.64, 1.30]	0.99 [0.65, 1.51]	0.98 [0.60, 1.60]	
Older children in household				<0.0001
ELFE child is the first child	1 [Ref]	1 [Ref]	1 [Ref]	

One older child	0.97 [0.86, 1.09]	<b>0.84 [0.74, 0.97]</b>	<b>0.71 [0.61, 0.83]</b>	
At least 2 older children	1.10 [0.93, 1.29]	0.84 [0.69, 1.01]	<b>0.62 [0.50, 0.78]</b>	
Maternal employment during pregnancy				0.2
Employed	1 [Ref]	1 [Ref]	1 [Ref]	
Unemployed	1.01 [0.85, 1.21]	1.14 [0.92, 1.41]	<b>1.33 [1.05, 1.70]</b>	
Not in the labor force	1.00 [0.84, 1.20]	1.12 [0.91, 1.37]	<b>1.27 [1.00, 1.61]</b>	
Household income (/month)				<0.0001
≤ € 750 <sup>a</sup>	0.99 [0.76, 1.29]	0.78 [0.55, 1.10]	1.04 [0.69, 1.57]	
€ 751–1,111 <sup>b</sup>	0.92 [0.76, 1.11]	0.83 [0.65, 1.05]	1.24 [0.95, 1.63]	
€ 1,112–1,500 <sup>c</sup>	1 [Ref]	1 [Ref]	1 [Ref]	
€ 1,501–1,944 <sup>d</sup>	1.06 [0.92, 1.22]	1.09 [0.93, 1.29]	1.01 [0.82, 1.23]	
€ 1,945–2,500 <sup>e</sup>	<b>1.25 [1.06, 1.48]</b>	<b>1.41 [1.17, 1.70]</b>	<b>1.38 [1.11, 1.71]</b>	
> € 2,500 <sup>f</sup>	<b>1.40 [1.13, 1.73]</b>	<b>1.82 [1.45, 2.29]</b>	<b>1.43 [1.10, 1.86]</b>	
Maternal return to work at 2 months				0.2
Not working at 2 months	1 [Ref]	1 [Ref]	1 [Ref]	
Working at 2 months	<b>0.77 [0.61, 0.98]</b>	0.90 [0.69, 1.17]	0.88 [0.64, 1.20]	

517 Data are odds ratios (ORs) [95% confidence intervals (CIs)] from multivariable multinomial  
518 logistic regression also adjusted for variables related to study design (region, maternity unit  
519 size and wave of recruitment). <sup>a</sup> corresponding to (in US\$) ≤ \$815/month; <sup>b</sup> corresponding to  
520 \$816–1,207/month; <sup>c</sup> corresponding to \$1,208–1,630/month; <sup>d</sup> corresponding to \$1,631–  
521 2,113/month; <sup>e</sup> corresponding to \$2,114–2,717/month; <sup>f</sup> corresponding to > \$2,717/month.

**Table 3.** Multivariable associations between maternal health and health-related behaviors (model 2) or infant characteristics and feeding practices (model 3) and feeding with organic foods during CF

	Organic foods during CF (ref=Never)			
	Sometimes	Often	Almost always	
<b>Model 2 (n=8,985)</b>				
Smoking during pregnancy				0.01
Never smoker	1 [Ref]	1 [Ref]	1 [Ref]	
Smoker only before pregnancy	<b>1.15 [1.01, 1.30]</b>	<b>1.30 [1.13, 1.50]</b>	<b>1.31 [1.10, 1.55]</b>	
Smoker only in early pregnancy	1.14 [0.85, 1.53]	1.19 [0.84, 1.69]	<b>1.49 [1.01, 2.20]</b>	
Smoker throughout pregnancy	1.13 [0.95, 1.34]	1.14 [0.92, 1.40]	1.26 [0.97, 1.63]	
Pre-pregnancy BMI (kg/m <sup>2</sup> )				<0.0001
<18.5	1.08 [0.87, 1.34]	1.11 [0.87, 1.41]	1.16 [0.88, 1.53]	
18.5-24.9	1 [Ref]	1 [Ref]	1 [Ref]	
25-29.9	<b>0.79 [0.68, 0.91]</b>	<b>0.72 [0.60, 0.86]</b>	<b>0.62 [0.50, 0.78]</b>	
≥ 30	0.83 [0.69, 1.00]	<b>0.77 [0.61, 0.97]</b>	<b>0.61 [0.45, 0.84]</b>	
Maternal diet quality	<b>1.15 [1.10, 1.20]</b>	<b>1.29 [1.23, 1.37]</b>	<b>1.49 [1.39, 1.59]</b>	<0.0001
Initial feeding method choice				<0.0001
Health, well-being	1 [Ref]	1 [Ref]	1 [Ref]	
Practical reasons	<b>0.70 [0.58, 0.84]</b>	<b>0.65 [0.52, 0.81]</b>	<b>0.35 [0.26, 0.48]</b>	
Other	<b>0.71 [0.60, 0.85]</b>	<b>0.62 [0.50, 0.77]</b>	<b>0.43 [0.32, 0.57]</b>	
Interaction with infant	1.16 [0.94, 1.43]	1.10 [0.86, 1.41]	0.96 [0.72, 1.28]	
Usual feeding method	0.90 [0.76, 1.06]	0.95 [0.79, 1.14]	0.99 [0.81, 1.23]	
<b>Model 3 (n=8,588)</b>				
Child sex				0.05
Boy	1 [Ref]	1 [Ref]	1 [Ref]	
Girl	0.90 [0.81 ; 1.01]	<b>0.87 [0.76 ; 0.99]</b>	<b>0.85 [0.73 ; 0.99]</b>	
Child birthweight				0.07
Small weight for GA	<b>0.80 [0.65 ; 0.97]</b>	<b>0.72 [0.57 ; 0.92]</b>	0.98 [0.75 ; 1.27]	

Adequate weight for GA	1 [Ref]	1 [Ref]	1 [Ref]	
Large weight for GA	0.93 [0.78 ; 1.12]	1.07 [0.87 ; 1.31]	1.01 [0.78 ; 1.30]	
Any breastfeeding duration (months)				<0.0001
Never	1 [Ref]	1 [Ref]	1 [Ref]	
<1	1.20 [0.99 ; 1.46]	<b>1.30 [1.02 ; 1.65]</b>	<b>1.77 [1.25 ; 2.50]</b>	
1 to <3	<b>1.44 [1.17 ; 1.76]</b>	<b>1.41 [1.10 ; 1.81]</b>	<b>2.33 [1.65 ; 3.29]</b>	
3 to <6	<b>1.39 [1.13 ; 1.70]</b>	<b>1.79 [1.41 ; 2.27]</b>	<b>3.20 [2.30 ; 4.44]</b>	
≥ 6	<b>2.00 [1.64 ; 2.45]</b>	<b>2.93 [2.32 ; 3.72]</b>	<b>7.47 [5.44 ; 10.26]</b>	
Age at complementary foods introduction (months)				0.001
<4	0.91 [0.74 ; 1.11]	0.97 [0.76 ; 1.24]	<b>0.65 [0.45 ; 0.93]</b>	
4-6	1 [Ref]	1 [Ref]	1 [Ref]	
>6	1.11 [0.92 ; 1.34]	1.20 [0.98 ; 1.48]	<b>1.53 [1.23 ; 1.9]</b>	
Feeding with ready-prepared baby foods during CF				<0.0001
Never	1 [Ref]	1 [Ref]	1 [Ref]	
Sometimes	<b>2.13 [1.82 ; 2.49]</b>	<b>1.98 [1.66 ; 2.37]</b>	<b>1.60 [1.31 ; 1.96]</b>	
Often	<b>2.15 [1.82 ; 2.53]</b>	<b>2.37 [1.97 ; 2.86]</b>	<b>1.40 [1.12 ; 1.74]</b>	
Almost always	<b>1.77 [1.48 ; 2.12]</b>	<b>1.30 [1.04 ; 1.62]</b>	<b>1.28 [1.00 ; 1.66]</b>	

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Data are odds ratios (ORs) [95% confidence intervals (CIs)] from multivariable multinomial logistic regressions also adjusted in model 2 and 3 for family characteristics (maternal age, education level, migration status, employment during pregnancy, return to work at 2 months, single parenthood, number of children in the household, household income) and variables related to study design (region, maternity size and wave of recruitment), and in model 3 for maternal health and health-related behaviors (smoking during pregnancy, pre-pregnancy BMI, diet quality during pregnancy, motives for feeding method).

Figure 1. Flow chart

