Dietary taste patterns in early childhood: the Generation R Study

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ABSTRACT

Background: Taste preference is an important determinant of dietary intake and is influenced by taste exposure in early life. However, data on dietary taste patterns in early childhood are scarce.

Objectives: We aimed to evaluate dietary taste patterns in early childhood, to examine their tracking between the ages of 1 and 2 y, and to examine their associations with socioeconomic and lifestyle factors.

Methods: Dietary intake of children participating in a population-based cohort was assessed with a 211-item age-specific FFQ at the ages of 1 y (n = 3629) and 2 y (n = 844) (2003–2007). Taste intensity values of FFQ food items were calculated based on a food taste database that had been previously constructed and evaluated using a trained adult sensory panel. Cluster analysis based on taste values identified 5 taste clusters that we named: "neutral," "sweet and sour," "sweet and fat," "fat," and "salt, umami and fat." Linear regression models were used to examine associations of percentage energy (E%) intake from these taste clusters with socioeconomic and lifestyle factors.

Results: At the age of 1 y, 64% ± 13% (mean ± SD) of energy intake was obtained from the "neutral" cluster, whereas at age 2 y, this was 42% ± 8%. At age 2 y, children had higher energy intakes from the "sweet and fat" (18% ± 7%), "fat" (11% ± 4%), and "salt, umami, and fat" (18% ± 6%) clusters than at age 1 y (7% ± 6%, 6% ± 4%, and 11% ± 6%, respectively). In multivariable models, older maternal age, longer breastfeeding duration, and later introduction of complementary feeding were associated with more energy from the "neutral" cluster (e.g., β: 0.31 E%; 95% CI: 0.19, 0.43 E% per 1 mo longer breastfeeding). Higher child BMI was associated with more energy from the "salt, umami, and fat" cluster (β: 0.22 E%; 95% CI: 0.06, 0.38 E% per BMI standard deviation score).

Conclusions: Dietary taste patterns in this Dutch cohort were more varied and intense in taste at age 2 y than at 1 y, reaching a level similar to that previously observed in Dutch adults. Important factors related to dietary taste patterns of young children are maternal sociodemographic factors and feeding practices. This trial was registered at trialregister.nl as NL6484. *Am J Clin Nutr* 2021;113:63–69.

Keywords: taste, tracking, dietary patterns, child nutrition, infancy, infant diet, population-based

Introduction

Early childhood is a critical period for establishing dietary habits. Although inborn preferences and genetic factors are important for taste preferences in early childhood (1), several studies have shown that early experiences also shape taste preferences and eating behaviors that persist in adulthood (2–4). In addition, taste preference has repeatedly been shown to be an important determinant of food intake. For example, previous studies suggested that a higher preference for sour tastants is linked to a higher fruit consumption (2) and that

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Supplemental Figures 1 and 2 and Supplemental Tables 1–7 are available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at https://academic.oup.com/ajcn/.

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Data Availability: Data described in the article, code book, and analytic code can be obtained upon request.

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bitter taste perception is associated with the acceptance of several vegetables (3). However, these studies focus only on specific taste qualities. To examine the effect of dietary taste exposure one needs data on the taste properties of many foods.

In recent years, several databases have been constructed containing multiple taste properties of commonly consumed foods (5–8). One of these databases also includes infant foods such as fruit purees and infant formula (8). Two studies in France used this latter database to examine taste exposure in young children (8, 9). Schwartz et al. (8) observed that foods consumed by 1- to 12-mo-old infants (n = 76) were generally low in taste intensity, but that—as expected—taste exposure increased when weaning started. The other study, by Yuan et al. (9), included 268 infants and examined only sweetness and fattiness exposure at ages 3–6, 7–9, and 10–12 mo. In line with the study by Schwartz et al., Yuan et al. (9) reported that exposure to sweetness and fattiness increased from complementary feeding initiation to the age of 12 mo. In addition, they observed that both longer (nonexclusive) breastfeeding duration as well as earlier initiation of complementary feeding were associated with higher sweetness exposure in infancy (9).

Moreover, the same study reported that exposure to fattiness, but not sweetness, was higher among infants of more highly educated mothers (9). In contrast, another study showed that higher intake of sweet foods in children was associated with higher maternal educational level and also with a higher BMI (10). However, both studies that examined taste exposure in young children were only until the age of 12 mo (8, 9), yet weaning still continues after this age, where there is also a transition into a more regular adult diet. Therefore, we expect that after the age of 1 y, taste patterns become more varied. Furthermore, more knowledge on factors that are related to certain dietary taste patterns, such as sociodemographic factors or feeding practices, could help to identify children that may benefit from dietary improvements through taste exposure.

In the current study, we aimed to assess dietary taste patterns in a large cohort of children at the age of 1 y and again at the age of 2 y, and the agreement between taste patterns at the 2 time points. For this purpose, we used a previously constructed extensive taste database supplemented with taste properties of food products frequently consumed by infants. In addition, we examined whether these dietary taste patterns in early childhood related to maternal sociodemographic factors, child's sex, and to breastfeeding and timing of introduction of complementary feeding.

Methods

Study design and population

This study was embedded in the Generation R Study, an ongoing multi-ethnic population-based prospective cohort from fetal life onward in Rotterdam, the Netherlands. Pregnant women with an expected delivery date between April 2002 and January 2006 were enrolled. The study was approved by the Medical Ethics Committee of Erasmus Medical Center and written informed consent was obtained from parents of all participating children (11). More details on the general design of the Generation R Study can be found elsewhere (11).

An FFQ to assess diet around the age of 1 y was sent to mothers of 5088 children; dietary data were available for 3629 of these children (response rate: 72%) (**Supplemental Figure 1**) (12). Mothers of a subgroup of this cohort, consisting of 899 children with a Dutch ethnic background only, received an additional FFQ when their child was aged ∼2 y. Dietary data were available for 844 of these children (response rate: 94%). For 777 children, dietary data were available at both time points (i.e., ages 1 and 2 y) (12).

Dietary intake assessment

Dietary intake around age 1 y was assessed using a semiquantitative 211-item FFQ covering the past month at a median age of 12.9 (95% range: 12.2–19.0) mo (12). This FFQ included foods that are frequently consumed by children aged 9–18 mo according to the Dutch National Food Consumption Survey of 2002 (13). Energy and nutrient intakes were calculated using the Dutch Food Composition Table 2006 (14). Validation of this FFQ against 24-h recalls showed reasonable to good intraclass correlation coefficients for energy and nutrient intakes (12). The FFQ that was used around the child's age of 2 y (median age: 24.9 mo; 95% range: 24.2–27.6 mo) consisted of 230 food items and was similar to the one that was used at the age of 1 y, but included a few more items on specific dairy products, nuts and seeds, and toddler foods, and fewer items on specific types of infant formula (12). Further details on both FFQs are provided elsewhere (12).

Dietary taste assessment

We applied a taste database that had been previously constructed (15, 16) and evaluated (17). Briefly, a trained sensory panel was set up to assess the basic taste intensity and fat sensation values of a large set of commonly consumed foods in the Netherlands, also including foods that are frequently eaten by young children (e.g., different types of porridges, fruit puree, and infant biscuits) (18). For taste assessment, we prepared foods using recipes from the product's package or according to normal household practice, but unseasoned. Compilation of a Dutch taste database was part of a larger project, during which we also compiled a Malaysian taste database. For the current study, we used taste intensity values of the infant formulas from the Malaysian database, because Dutch and Malaysian infant formulas were similar in macronutrient content, as described in detail elsewhere (18).

The taste database was linked to individual foods within the food items in the FFQs. Taste values of specific foods in the FFQs that were not available in the taste database were estimated based on mean taste intensity values of the corresponding food groups as described previously (16). Subsequently, we calculated weighted mean taste intensity values of each aggregated food item, as previously described (17). The food items in the FFQs were grouped into taste clusters using agglomerative hierarchical clustering on the taste intensity values of these food items. The number of clusters was decided using Ward's minimum variance method (proc CLUSTER and proc FASTCLUS, SAS, Euclidean distances) (19). As a result, each taste cluster consisted of a group of similar-tasting food items. Subsequently, the taste clusters were labeled according to the leading taste intensity values of that particular cluster. The food items in the FFQs and the corresponding taste clusters were combined with the children's food intake data to calculate the percentage of energy intake from each taste cluster (dietary taste patterns). Further details on the taste clusters are described in the Results section.

Maternal and child characteristics

At enrollment in the study, questionnaires were used to obtain information on maternal age, ethnic background (Dutch; non-Dutch, on the basis of country of birth of her parents), and educational level (lower: ranging from no education up to lower vocational training; higher: ranging from higher vocational training to higher academic education). Maternal height and weight were measured at enrollment in the study, and BMI (in kg/m^2) was calculated.

Information on the child's date of birth and sex was obtained from birth records. Information on breastfeeding duration and timing of complementary feeding introduction (<3; 3–6; ≥6 mo) was obtained from postnatal questionnaires. A diet quality score reflecting adherence to age-specific dietary guidelines was calculated based on food intake data from the FFQ (12). This score ranged from 0 to 10 on a continuous scale, with higher scores representing a better diet quality. Height and weight of the children were measured at median ages of 14.3 (95% range: 13.5–16.0) and 24.7 (95% range: 23.4–28.1) mo without shoes and heavy clothing, and age- and sex-specific standard deviation scores (SDS) for BMI were calculated based on available data from participants in the Generation R Study.

Statistical analyses

To examine tracking of dietary taste patterns in early childhood, we ranked children on their percentage energy (E%) intake from the taste clusters at the ages of 1 and 2 y. Consistency in ranking between the 2 ages was studied with *1*) Pearson's or Spearman's correlations and *2*) cross-classification of tertiles (low, medium, and high) for the percentage of energy intake from each taste cluster. CIs of the correlation coefficients were calculated by Fisher's Z transformation. Cohen's κ was used to test cross-classification of tertiles. A statistically significant κ value indicates that tracking of the dietary taste patterns is higher than would be expected by chance.

We used univariable and multivariable linear regression models to study associations of socioeconomic and lifestyle factors with the obtained dietary taste patterns in early childhood. We selected variables based on previous literature as expected predictors of taste preferences or exposure and included maternal age, ethnic background, educational level, and BMI; breastfeeding duration and timing of introduction of complementary feeding; and child's age, sex, and BMI SDS. We first performed univariable models with each potential predictor separately and subsequently entered all socioeconomic and lifestyle factors in 1 multivariable model to examine whether associations were independent of each other. To reduce potential bias due to missing values on some of the socioeconomic and lifestyle factors (ranging from 0% to 18.8%), these variables were multiply imputed (m = 10 imputations) using the fully conditional specification method (predictive mean matching). Estimates were similar before and after imputation, and the presented effect estimates are the pooled regression coefficients of the 10 imputed data sets. As sensitivity analyses, these linear regression models were repeated, restricted to participants with a Dutch ethnic background. We also repeated our analyses while excluding children who were older than 18 mo at the moment of filling out the 1-y FFQ (n = 161). All statistical analyses were performed using SPSS version 21.0 software (IBM Corp., 2012) and SAS version 9.3 (SAS Institute, Inc.).

TABLE 1 General characteristics of the study population[1]

Characteristic	
Maternal characteristics	
Age at enrollment, y	31.4 ± 4.6
Dutch ethnic background	65.4
Higher educational level	62.8
BMI at enrollment, kg/m^2	23.5 (18.8–35.4)
Child characteristics	
Girls	51.0
Age at 1-y FFQ, mo	12.9 (12.2–19.0)
Total energy intake at 1-y FFQ, kcal	1270 (663–2279)
Breastfeeding duration, mo	3.5 (0.5–12.0)
Breastfeeding in the first 4 mo	
Never	12.8
Partial	59.4
Exclusive	27.8
Introduction of complementary feeding	
After 6 mo	37.9
3–6 mo	56.4
0–3 mo	5.7
BMI at around age 1 y, kg/m^2	17.1 ± 1.3

[1] n = 3629. Values are means ± SDs for continuous variables with a normal distribution, medians (95% range) for continuous variables with a skewed distribution, and percentages for categorical variables. Values are based on imputed data (m = 10 imputations).

Results

Population characteristics

Table 1 presents characteristics of the children and their mothers. Mean ± SD age of the mothers at enrollment in the study was 31.4 ± 4.6 y. The majority were highly educated (62.8%) and had a Dutch ethnic background (65.4%). A total of 87.2% initiated any breastfeeding, with a median breastfeeding duration of 3.5 (95% range: 0.5–12.0) mo, and 27.8% of the total group receiving exclusive breastfeeding in the first 4 mo. Most of the children were introduced to complementary feeding between the ages of 3 and 6 mo (56.4%). **Supplemental Table 1** presents characteristics of the subsample of children for whom we had dietary data at both the ages of 1 and 2 y.

Dietary taste clusters in early childhood

Cluster analyses on the taste intensity values from food items included in the FFQs resulted in 5 taste clusters of similar-tasting foods, which we labeled as "neutral," "sweet and sour," "sweet and fat," "fat," and "salt, umami, and fat" according to the leading tastes in each cluster (**Supplemental Table 2**A, B, **Supplemental**

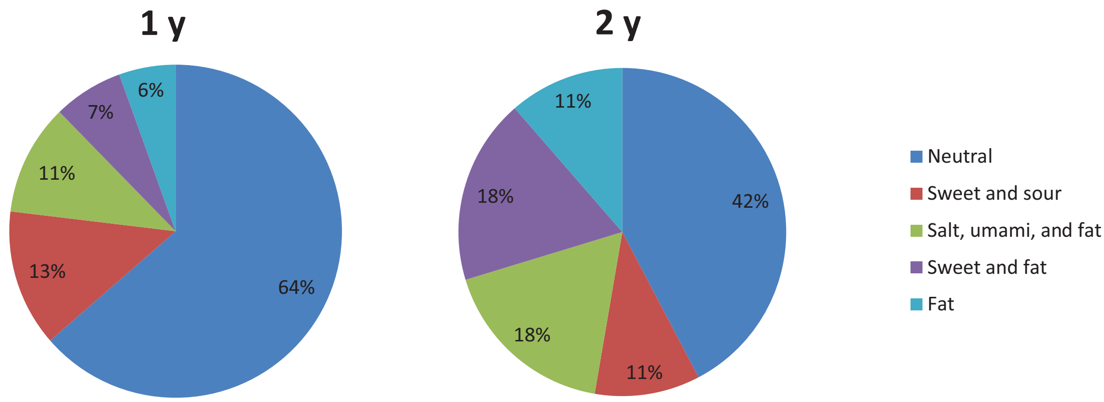

FIGURE 1 Percentage energy intake from each taste pattern in children at the ages of 1 y ($n = 3629$) and 2 y ($n = 844$).

Figure 2). Foods in the neutral cluster had relatively low taste intensities for all tastes, whereas foods in the other clusters had clear leading taste values (**Supplemental Tables 3**, **4**). The 5 clusters accounted for 82% of the total variance in taste. At the age of 1 y, the children ($n = 3629$) consumed most energy from the "neutral" taste cluster (mean ± SD: 64% ± 13% of total energy intake). Mean ± SD %E intake of the other taste clusters ranged from 6% ± 4% for "fat" to 13% ± 8% for "sweet and sour" (**Figure 1**). Among the 777 children for whom we had dietary data at both the ages of 1 and 2 y, mean ± SD %E intake from the "neutral" cluster decreased from 63% ± 13% at age 1 y to 42% ± 8% at age 2 y. Energy intake for all other taste clusters increased between these ages, except for the "sweet and sour" cluster, which decreased between ages 1 and 2 y (all $P < 0.001$) (**Supplemental Table 5**). When examining correlations of each individual taste cluster with diet quality score at the age of 1 y, %E intakes from the "neutral," "sweet and sour," and "sweet and fat" taste clusters were inversely correlated with diet quality (Pearson's $r = -0.16$, -0.07, and -0.10, respectively, $P < 0.001$), whereas %E intakes from the "fat" and "salt, umami, and fat" taste clusters were positively correlated with diet quality (Pearson's $r = 0.29$ and 0.34, respectively, $P < 0.001$).

To study tracking of dietary taste patterns in early childhood, we ranked children on their %E intake from the taste clusters at the ages of 1 and 2 y. For all taste clusters, we found a positive correlation between %E intake from clusters at the age of 1 y and at the age of 2 y (Pearson's r ranging from 0.20 for the "sweet and sour" to 0.40 for the "fat" cluster, all $P < 0.001$) (**Table 2**). The number of children that were classified in the same tertile at the ages of 1 and 2 y ranged from 40% for "sweet and fat" to 48% for "fat" (i.e., 48% of all children remained in the same tertile of the fat cluster at the ages of 1 and 2 y). Classification in opposite tertiles ranged from 12% for energy intake from the "fat" cluster to 17% for the "sweet and fat" and "sweet and sour" clusters (Table 2). The weighted κ was positive for all, and ranged from 0.14 (95% CI: 0.08, 0.20) for the "sweet and fat" cluster to 0.28 (95% CI: 0.22, 0.33) for the "fat" cluster (all $P < 0.001$), indicating slight to moderate agreement between the clusters at both ages.

Associations of dietary taste clusters at age 1 y with maternal and child characteristics

Within the group of children around age 1 y, a higher child age was associated with lower energy intake from the "neutral" taste cluster (multivariable model; β: −1.82 E%/mo; 95% CI: −2.04, −1.60 E%/mo) and with relatively more energy from all other taste clusters. Higher child BMI was associated with relatively more energy from the "salt, umami, and fat" taste cluster (multivariable model; β: 0.22 E% per BMI-SDS, 95% CI: 0.06, 0.38 E% per BMI-SDS). Higher maternal educational level was associated with relatively lower consumption from the "fat" (multivariable model; β: −0.47; 95% CI: −0.80,

TABLE 2 Tracking of dietary taste patterns between ages 1 and 2 y[1]

Taste cluster	Correlations: Correlation coefficient[3] (95% CI)	Cross-classifications[2]: % Same tertile	% Opposite tertile	κ (95% CI)
Neutral	0.28 (0.21, 0.34)*	42	16	0.17 (0.12, 0.23)*
Sweet and sour	0.20 (0.13, 0.27)*	42	17	0.15 (0.09, 0.21)*
Sweet and fat	0.23 (0.16, 0.30)*	40	17	0.14 (0.08, 0.20)*
Fat	0.40 (0.34, 0.46)*	48	12	0.28 (0.22, 0.33)*
Salt, umami, and fat	0.25 (0.18, 0.31)*	41	16	0.16 (0.10, 0.21)*

[1] $n = 777$. *$P < 0.001$.
[2] Cross-classification into tertiles.
[3] Pearson's correlation coefficient for the neutral taste cluster, Spearman's rank correlation coefficients for the other taste clusters.

−0.15) and "sweet and fat" (multivariable model; β: −0.85; 95% CI: −1.32, −0.37) clusters (**Table 3**). Children from mothers of non-Dutch ethnicity consumed relatively more energy from the "neutral" cluster (multivariable model; β: 2.34; 95% CI: 1.42, 3.26) and relatively less energy from the "sweet and sour" cluster (multivariable model; β: −2.93; 95% CI: −3.50, −2.36) than children of mothers of Dutch ethnicity.

Additional analyses

Analyses on associations between dietary taste clusters and maternal and child characteristics restricted to children with a Dutch ethnic background yielded similar effect estimates as observed in the whole population (**Supplemental Table 6**). In this subgroup, the effect estimate for the association of higher educational level with energy consumption from the "neutral" taste cluster was slightly higher and remained statistically significant (β: 1.48; 95% CI: 0.19, 2.77). Analyses restricted to children younger than 18 mo at food intake ascertainment showed similar associations to those observed in the whole population (data not shown).

For taste clusters in children aged 2 y, associations with maternal and child characteristics were generally similar to those obtained for taste clusters of the children at the age of 1 y, except that higher maternal BMI was associated with relatively less energy from the "neutral" cluster and with relatively more energy from the "salt, umami, and fat" cluster at age 2 y, which was not observed at age 1 y (**Supplemental Table 7**). Also, higher maternal age was associated with relatively lower energy consumed from the "sweet and sour" cluster at children's age of 2 y, but this was not found at the age of 1 y. At the age of 2 y, girls consumed relatively more energy from the "sweet and sour" cluster and less from the "sweet and fat" cluster than boys, whereas at the age of 1 y girls consumed more energy from the "fat" cluster and no sex differences were observed for the other clusters (Supplemental Table 7).

Discussion

In this large population-based cohort, we observed that children aged 1 y consumed most of their energy intake from foods with a neutral taste. By the age of 2 y, exposure to neutral-tasting foods was reduced, whereas exposure to other tastes had increased. A high intake of neutral-tasting foods in early childhood was especially pronounced among children whose mothers were more highly educated and among children who had received breastfeeding for a longer time and were introduced to complementary feeding later.

These findings are in line with 2 previous studies reporting that foods were generally low in basic taste intensity during the first year of life (8, 9). Within the variation in age at dietary assessment around the age of 1 y in our study (95% range: 12.2–19.0 mo), we observed that a higher age was associated with less energy intake from neutral-tasting foods and more energy from other tastes. In line with this, we observed that by the age of 2 y, children consumed more energy from other taste clusters than neutral than at the age of 1 y. This is in line with Dutch dietary recommendations to eat regular table foods, which often are more varied in taste, from the age of 1 y onward (20). We observed that energy intake from neutral-tasting foods decreased from 64% at age 1 y to 42% at age 2 y. In a previous study among Dutch adults, 35%–39% of energy intake was obtained from neutral-tasting foods (16). Our findings thus suggest that the taste intensity and the variety in taste of the diet increase in the second year of life, and it becomes more similar to that of adults when children reach the age of 2 y.

Within this general shift in taste clusters from neutral- to more intense-tasting foods between the ages of 1 and 2 y, we observed significant tracking of the taste clusters in the same children between the 2 ages. Although, to our knowledge, no studies have investigated tracking of overall dietary taste exposure during early childhood so far, previous studies did report that intake of general food groups in toddlerhood could be predicted by their frequency of consumption during infancy (21). Previous studies have shown genetic variations in taste preference and acceptance (1). Our current findings, combined with previous studies on food intake, suggest that early taste exposure is also important for establishing preferences in early childhood. Because young children generally have little food choice autonomy, these findings also reflect stability in parenting practices. Given the young age of the children, future studies are needed to examine whether exposure to these dietary taste clusters indeed relates to food choices and dietary intake in later childhood and even adulthood.

Several maternal and child characteristics were associated with dietary taste clusters in early childhood. Higher maternal educational level was associated with more energy from the "neutral" cluster and less energy from the "sweet and fat" cluster. Similar associations were observed for higher maternal age. Foods that taste "sweet and fat" are generally high in mono- and disaccharides and fat content (18, 22) and may therefore be less healthy. Indeed, we observed a negative correlation between the "sweet and fat" taste cluster and diet quality in our population. Because both age and educational level are proxies for socioeconomic status, these associations may suggest that mothers with a higher socioeconomic status provide their children with a healthier diet, which has also been suggested by previous studies examining dietary patterns of children (23–25). Other taste clusters may also be related to nutrient content, e.g., the "salt, umami, and fat" cluster contains foods that are generally higher in protein and fat and lower in mono- and disaccharides. In line with a previous study in adults (16), we observed that children with a higher BMI SDS obtained more energy from foods in the "salt, umami, and fat" taste cluster. These associations may reflect a previously described effect of high protein intake in early childhood on more adiposity in later childhood (26–30).

We studied all basic tastes in the overall diet in early childhood rather than focusing on 1 single taste, and we examined their tracking between the ages of 1 and 2 y. Unfortunately, not all children had dietary data available at both the ages of 1 and 2 y, resulting in a smaller and less varied sample for the tracking analyses. In addition, not all children were measured at exactly the age of 1 or 2 y, resulting in some variation in age within measurement points. A strength of our study was that we used an extensive taste database, which contained sensory profiles of many foods, including foods commonly consumed by toddlers (18). The taste database was created using a trained adult sensory panel. Trained panels are commonly used to objectively quantify

TABLE 3 Associations of maternal and child characteristics with %E from each taste cluster at the age of 1 y[1]

	Neutral β (95% CI)	Sweet and sour β (95% CI)	Sweet and fat β (95% CI)	Fat β (95% CI)	Salt, umami, and fat β (95% CI)
Maternal characteristics					
Maternal age, y					
Model 1	0.40 (0.30, 0.49)*	− 0.04 (−0.10, 0.02)	− 0.15 (−0.19, −0.12)*	− 0.07 (−0.10, −0.04)*	− 0.13 (−0.18, −0.09)*
Model 2	0.35 (0.25, 0.44)*	− 0.09 (−0.15, −0.03)	− 0.10 (−0.14, −0.06)*	− 0.05 (−0.08, −0.01)*	− 0.11 (−0.16, −0.07)*
Educational level					
Lower	Reference	Reference	Reference	Reference	Reference
Higher					
Model 1	2.30 (1.31, 3.30)*	0.64 (0.08, 1.19)*	− 1.61 (−2.05, −1.16)*	− 0.70 (−1.00, −0.40)*	− 0.64 (−1.08, −0.20)*
Model 2	0.97 (−0.04, 1.99)	0.51 (−0.09, 1.11)	− 0.85 (−1.32, −0.37)*	− 0.47 (−0.80, −0.15)*	− 0.16 (−0.64, 0.31)
Maternal BMI, kg/m^2					
Model 1	− 0.24 (−0.34, −0.13)*	0.02 (−0.04, 0.08)	0.15 (0.10, 0.19)*	0.04 (0.00, 0.07)*	0.04 (−0.01, 0.09)
Model 2	− 0.20 (−0.30, −0.10)*	0.04 (−0.02, 0.11)	0.12 (0.07, 0.16)*	0.03 (−0.01, 0.06)	0.02 (−0.03, 0.07)
Ethnic background					
Dutch	Reference	Reference	Reference	Reference	Reference
Non-Dutch					
Model 1	1.40 (0.49, 2.31)*	− 2.92 (−3.46, −2.38)*	0.78 (0.40, 1.16)*	0.35 (0.06, 0.63)*	0.39 (−0.04, 0.82)
Model 2	2.34 (1.42, 3.26)*	− 2.93 (−3.50, −2.36)*	0.31 (−0.08, 0.69)	0.13 (−0.16, 0.43)	0.15 (−0.29, 0.60)
Child characteristics					
Sex					
Boy	Reference	Reference	Reference	Reference	Reference
Girl					
Model 1	0.58 (−0.28, 1.44)	0.14 (−0.38, 0.66)	− 0.26 (−0.62, 0.10)	− 0.37 (−0.64, −0.10)*	− 0.09 (−0.50, 0.31)
Model 2	0.29 (−0.54, 1.12)	0.33 (−0.18, 0.85)	− 0.29 (−0.64, 0.06)	− 0.38 (−0.65, −0.11)*	0.04 (−0.36, 0.45)
Child age at taste exposure assessment, mo					
Model 1	− 1.84 (−2.07, −1.61)*	0.40 (0.26, 0.55)*	0.57 (0.48, 0.67)*	0.28 (0.21, 0.36)*	0.58 (0.47, 0.68)*
Model 2	− 1.82 (−2.04, −1.60)*	0.39 (0.25, 0.53)*	0.58 (0.48, 0.67)*	0.28 (0.21, 0.35)*	0.57 (0.47, 0.68)*
Child BMI (SDS)					
Model 1	− 0.32 (−0.67, 0.04)	0.18 (−0.03, 0.39)	− 0.06 (−0.21, 0.08)	− 0.03 (−0.14, 0.08)	0.23 (0.07, 0.39)*
Model 2	− 0.19 (−0.54, 0.16)	0.16 (−0.05, 0.38)	− 0.13 (−0.28, 0.02)	− 0.06 (−0.17, 0.05)	0.22 (0.06, 0.38)*
Breastfeeding duration in infancy, mo					
Model 1	0.44 (0.32, 0.56)*	− 0.22 (−0.29, −0.15)*	− 0.12 (−0.17, −0.08)*	0.00 (−0.04, 0.03)	− 0.09 (−0.15, −0.03)*
Model 2	0.31 (0.19, 0.43)*	− 0.20 (−0.27, −0.13)*	− 0.07 (−0.12, −0.02)*	0.02 (−0.02, 0.06)	− 0.06 (−0.12, 0.00)
Timing of introduction of complementary feeding					
After 6 mo	Reference	Reference	Reference	Reference	Reference
3–6 mo					
Model 1	− 1.82 (−2.75, −0.90)*	0.50 (−0.06, 1.06)	0.67 (0.29, 1.04)*	0.18 (−0.10, 0.47)	0.47 (0.04, 0.90)*
Model 2	− 1.24 (−2.15, −0.34)*	0.31 (−0.25, 0.86)	0.46 (0.09, 0.83)*	0.15 (−0.14, 0.43)	0.33 (−0.10, 0.76)
0–3 mo					
Model 1	− 3.16 (−5.18, −1.14)*	− 0.87 (−2.08, 0.35)	1.96 (1.15, 2.78)*	0.85 (0.24, 1.46)*	1.21 (0.28, 2.15)*
Model 2	− 2.25 (−4.22, −0.28)*	− 0.79 (−1.97, 0.39)	1.45 (0.65, 2.25)*	0.68 (0.07, 1.30)*	0.91 (−0.03, 1.85)

[1] $n = 3629$. Values are regression coefficients and 95% CIs from linear regression analyses and reflect differences in %E intake for each taste cluster.
*Statistically significant at $P < 0.05$. Model 1 is univariable. Model 2 adjusted for all other maternal and child characteristics that were examined, i.e., obtained from a single model including all factors presented in the table. SDS, standard deviation score; %E, percentage energy.

taste properties of food products (31, 32). However, perception of tastes may differ between individuals and for different age groups, and these objective taste properties may therefore not directly reflect taste sensations in infants. Other strengths of this study include the population-based longitudinal design, the large sample size, and the availability of information on several maternal and child characteristics. A limitation is that although the FFQs were extensive, included a large number of items, and were developed for this specific age group, they were developed to differentiate in nutrient intakes (12, 23), and not to differentiate between tastes. For example, sweet and sour tasting soft drinks were combined with sweet, not sour tasting lemonades in 1 food item in the FFQ. Therefore, the calculation of weighted mean taste intensity values may have resulted in less precise taste values for such food items. However, the majority of foods within 1 food item in the FFQ were similar in taste intensity values. In addition, the foods that were included in the taste database were unseasoned. However, we do not have information on the seasoning used for foods that the children consumed. The use of taste enhancers and seasoning affects the taste intensity of foods and therefore the absence of this information could have led to an underestimation of the intensity of dietary taste patterns observed in our study. Finally, generalizability of our findings to other populations with different feeding practices and dietary patterns may be limited. Therefore, further studies in different settings and with follow-up to study long-term effects of exposure to taste patterns remain needed.

In conclusion, we observed that young children consumed most of their energy intake from foods that can be clustered as having a neutral taste, and that dietary taste patterns become more varied and intense in taste between 1 and 2 y of age, reaching a level more similar to that observed in adults. Higher maternal educational level, having received longer breastfeeding, and being introduced to complementary feeding later in infancy were associated with more exposure to neutral-tasting foods and less to sweet- and fat-tasting foods. Future long-term studies are needed to investigate how exposure to different dietary taste patterns during early childhood relates to food preferences and how this may affect health in later childhood and adulthood.

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