The development of salty taste acceptance is related to dietary experience in human infants: a prospective study[1–3]

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ABSTRACT

Background: Sodium intake is related to hypertension and other diseases, but little is known about the early development of salty taste acceptance.

Objective: The prospective study asked whether dietary experience with foods containing sodium is associated with development of infant salty taste preference.

Design: Infants (n = 61) were tested at 2 and 6 mo to assess their response to 0.17 and 0.34 mol NaCl/L in water. Intake tests consisted of randomized double-blind 120-s exposure to salt solutions and water. Acceptance, calculated as solution intake relative to water, was examined as a function of exposure to starchy table food—a significant source of sodium. Dietary exposure (yes or no) was defined by maternal report. As a control, similar comparisons were based on exposure to fruit table food. A subset of 26 subjects returned at 36–48 mo for assessment of salty taste hedonics and preference.

Results: Dietary experience was related to salt acceptance, with only those infants previously exposed to starchy table foods (n = 26) preferring the salty solutions at 6 mo (P = 0.007). Fruit exposure was not associated with sodium chloride acceptance. Infants eating starchy table foods at 6 mo were more likely to lick salt from the surface of foods at preschool age (P = 0.007) and tended to be more likely to eat plain salt (P = 0.08).

Conclusions: The findings suggest an influential role of early dietary experience in shaping salty taste responses of infants and young children. *Am J Clin Nutr* 2012;94:123–9.

INTRODUCTION

Overconsumption of sodium, primarily in the form of salt (sodium chloride), is associated with an increased incidence of hypertension, which increases the risk of cardiovascular disease and stroke (1–4). This relation has led health agencies worldwide to call for a reduction in sodium consumption, most recently evidenced by the revised US *Dietary Guidelines* (5). Because sodium is believed to be the ligand for salty taste (6), a more comprehensive understanding of the factors that drive salt consumption is needed to help develop effective and successful strategies to reduce sodium intake.

A major factor underlying excess sodium consumption is the human preference for salted foods. Although this preference likely is shaped by innate components, dietary experience also contributes significantly to the liking for salt. Most experiential studies have been conducted in adults (7, 8), but a few suggest that early experiences, both in utero (9–12) and during infancy (11, 13), may shape the preference for salty taste.

At birth, human infants are either insensitive or indifferent to salty taste (14, 15), with development of the ability to detect and respond to salty tastes thought to occur over the first 6 mo of postnatal life (16). To further examine the relation between early sodium exposure and the development of salty taste acceptance, we hypothesized that if dietary exposure to sodium was important in the development of salty taste preference (17), infants exposed to starchy table foods would have an elevated salt preference at ~6 mo of age compared with infants not yet exposed to these foods. Starchy foods were selected because, after cow milk, processed grain products account for the second greatest dietary source of sodium during the weaning period (18), and cereal products constitute the major source of sodium as the infant continues to grow (19).

We assessed salty taste acceptance in infants at 2 mo of age, before significant variation in postnatal sodium intake and again in the same infants at 6 mo, after the introduction of supplemental feeding, including starchy table foods, in some of the infants. The decision of whether and when to introduce such foods was made by the infants' caregivers; thus, infants were not randomly assigned to groups. Additionally, in an initial exploration of the persistence of the sodium exposure–salt avidity relation, a subset of subjects returned at 36–48 mo of age for additional assessment.

SUBJECTS AND METHODS

Subjects

The data reported here were obtained from subjects enrolled between November 1988 and May 1996 into a longitudinal study of preference for salty taste, as reported previously (13). Briefly, 120 infants and their mothers were enrolled into a prospective study; infants ranged in age from 3 to 84 d at study entry. The subjects were recruited from the Philadelphia metropolitan area during well-baby visits at a low-income infant health clinic, through advertisements in regional parent-oriented periodicals and through flyers distributed at several suburban nursery schools. Criteria for infant inclusion were overall good health and

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Received February 17, 2011. Accepted for publication September 15, 2011.
doi: 10.3945/ajcn.111.014282.

birth weight >2500 g (the criterion for normal birth weight), which was selected as a partial proxy for a healthy pregnancy. The study was approved by the Institutional Review Board of the University of Pennsylvania. Informed consent was obtained from mothers, who were paid for their participation.

Salt intake and taste preferences

Data on salt intake and taste preference were collected from 86 infants at both 2 and 6 mo postnatal age. All testing was performed at the Monell Center. Information on infant feeding practices was obtained from questionnaires completed by mothers at each visit. Detailed questions probed history of breast compared with formula feeding and supplemental feeding practices. Mothers also were asked whether their infants had been introduced to baby foods, table foods, or both. The terms *baby food* and *table food* were not defined, nor were specific examples of the table food categories given. However, baby food is commonly understood in both the vernacular and scientific literature to refer to foods made specifically for infants and younger toddlers, whereas table food is food consumed by older children and adults. If affirmative for table foods, mothers were asked to indicate whether the infants were eating any of the following categories of table food: starch, fruit, vegetable, meat, dairy products, or eggs. Demographic information and birth weight were obtained through maternal report at the first assessment.

Acceptance of salty taste

Methods to determine acceptance of salty taste in infants were as previously described (12, 16). Infants completed brief intake tests for water and 2 concentrations of sodium chloride (0.17 and 0.34 mol/L, dissolved in deionized water). These concentrations or similar have been used in previous studies from this laboratory (12, 16); the lower concentration was originally selected to mimic the level of salt found in commercial soups, whereas the higher is a concentration reported by most adults to taste "strongly salty." Solutions were prepared by using reagent-grade sodium chloride and presented to infants in standard plastic baby bottles with disposable nipples. Time of testing reflected schedules of individual mother-infant dyads. Each bottle contained 30 mL deionized water or one of the 2 salt solutions. When the mother and infant had acclimated to the testing room, the 3 bottles were presented in double-blind randomized order for 60 s each, with a 30-s break between each presentation. After all 3 concentrations had been presented, there was a 60-s rest period, after which the order was reversed and each bottle was presented for an additional 60 s. Bottles were weighed after each series of presentations to the nearest 0.1 g to determine intake. Salt acceptance was assessed by using the proportional intake of each sodium chloride solution relative to the combined intake of that concentration of sodium chloride solution and deionized water [g NaCl solution/g (water + NaCl solution)]. Total sodium chloride intake (g) ingested at each age was computed by using the combined intake of the 0.17- and 0.34-mol/L solutions.

Early dietary experience and salt acceptance at 36–48 mo

Twenty-six of the children tested at both 2 and 6 mo returned for additional assessment at preschool age (36–48 mo). These children were part of a subset of 38 subjects tested at this age, recalled in order of enrollment until financial constraints prohibited additional testing. At this visit, mothers again completed detailed questionnaires on the children's feeding histories and current food preferences.

A separate questionnaire assessed the child's salt-directed behaviors by asking mothers to rate how often the child exhibited the following behaviors related to the taste and use of salt: eats plain salt, licks salt from foods, adds salt to food before tasting it, and adds salt to inappropriate foods (eg, an orange). Each behavior was rated on a 4-point scale ranging from "never" to "daily." The 4 scores were summed to create a salt-directed behavior score. As a control, a parallel questionnaire asked the same questions about sugar-related behaviors.

Liking and preference for salt were evaluated independently in preschoolers, because these measures are believed to represent independent constructs (20). The children's "liking for salty foods" was assessed by each mother using a 5-point category scale to indicate her child's liking of 27 common table foods that varied in degree of perceived saltiness (21). Scale anchors were "a favorite" and "will not eat." A mean liking score was computed for the 10 foods previously judged by an independent panel of adults to taste most salty (21), with lower scores representing greater liking. This score served as a proxy for the child's liking of high-salt foods. A similar procedure using the 9 least salty-tasting foods created a score representing liking for low-salt foods. Similar scores were computed for the foods as a function of sweetness and were used as controls to evaluate the specificity of early dietary experience with salty taste. Foods used to construct the scores are listed in **Table 1**.

To assess preference for salty foods, children used a 2-step ranking procedure modified from Birch et al (22) to indicate relative preference for 7 snack foods (potato chips, pretzels, chocolate candies, pickles, dried banana chips, bacon bits, and shortbread cookies). Four foods (potato chips, pickles, pretzels, and bacon bits) were classified by convention to be salty, and the remaining 3 foods were similarly classified as sweet. Foods were presented individually in randomized order. Children were asked to taste each food and to categorize their response as "like" or "dislike." Liking was indicated by sharing the food with a doll representing a popular cheerful television character (Big Bird), whereas disliked foods were given to a familiar grumpy character

TABLE 1
Foods used to construct liking scores for preschool sensory assessments[1]

High salt	Low salt	High sweet	Low sweet
Potato chips	Apples	Cake	Potato chips
Bacon	Oranges	Cookies	Bacon
Olives	Bananas	Ice cream	Crackers
Soup	Soda	Soda	Olives
Ham	Ice cream	Oranges	Soup
Hot dogs	Cake	Bananas	Hamburgers
French fries	Milk	Apples	Tuna
Crackers	Carrots	Peanut butter	Pickles
Pizza	Cookies	Carrots	Celery
Pickles		Bread	

[1] Adapted from Beauchamp et al (21). Mothers rated their child's liking of each food on a 5-point category scale. Foods were assigned to categories on the basis of perceptual ratings of an adult panel.

doll (Oscar the Grouch) to "put in his trash can" (11). After all the foods were categorized in this fashion, the children were asked to rank order the liked foods using the question, "Which of these foods is the yummiest (or, do you like best?)." After responding, either verbally or by pointing, the children were allowed to sample the food; it then was removed from view, and the process was repeated with the remaining foods in that category. With disliked food, children were asked, "Which food is the yuckiest?" When complete, this procedure produced a complete ranking of the 7 foods. Ranks of the 4 salty foods were summed to compute a salty food preference score; lower scores indicate higher preference.

Statistical procedures

Determination of relative intake requires that subjects taste each solution. Accordingly, the analysis was restricted to those infants who ingested a minimum of 0.3 g (the approximate volume of one suck) of each of the 3 solutions at both 2 and 6 mo of age.

Associations of dietary history with salt acceptance were investigated by using ANOVA, with age and concentration as within-subject factors and feeding history as a between-subject factor. Separate analyses were conducted for 2 food categories, as defined by the mothers' responses: starchy table food and fruit table food. Because birth weight is inversely associated with salt acceptance at 2 mo of age (12), birth weight was entered as a covariate in each analysis. Group differences were assessed by using post hoc *t* tests. Kendall's τ was used to test associations of salt intake and preference at 6 mo with measures of liking and preference at preschool age. Unless otherwise stated, the results are reported as means ± SEMs. A significance value of $P < 0.05$ was used for all analyses, which were performed with Statistica data analysis software (version 9.1, 2010; StatSoft Inc).

RESULTS

Of the 120 subjects who entered the prospective study, 86 (72%) remained enrolled at 6 mo of age. Reasons for subject loss were not formally assessed, but appeared to be related to parental disinterest and scheduling difficulties.

Because they failed to consume the minimum ingestion criterion (≥0.3 g of each of the 3 test fluids) at both 2 and 6 mo of age, 24 infants were excluded from the analyses. The excluded infants did not appear to manifest a generalized salt aversion, because mean intakes of the salt solutions did not differ between the excluded and the remaining infants (**Table 2**). The excluded infants and those remaining did not differ in birth weight, sex, race-ethnicity, feeding method (formula, breast, or both) at 2 mo of age, age at the 2-mo assessment, extent of mothers' education, or family income. The annual family income of 65.2% of the excluded infants and of 67.2% of the remaining infants was <\$50,000. Mothers of excluded infants were younger than mothers of infants who remained in the study [26.2 ± 1.53 y compared with 30.0 ± 0.81 y; $t(83) = 2.11$, $P < 0.05$], and the excluded infants were slightly older than the remaining infants at the 6-mo assessment [196 ± 2.8 d compared with 189 ± 1.8 d; $t(83) = -2.39$, $P < 0.05$]. Data from one additional infant were excluded because of measurement error. As a result, intake data were available for 61 infants at both 2 and 6 mo of age. The demographic characteristics of the 61 infant-mother dyads are detailed in **Table 3**.

TABLE 2
Fluid intake of excluded and included infants

Age and fluid	Included (n = 61)	Excluded (n = 24)
	g	*g*
2 mo		
Water	7.4 ± 0.86[1]	12.1 ± 3.0[2]
0.17 mol NaCl/L	7.3 ± 0.88	10.8 ± 2.6
0.34 mol NaCl/L	5.3 ± 0.72	7.7 ± 1.9
6 mo		
Water	11.0 ± 1.40	10.4 ± 2.1
0.17 mol NaCl/L	11.2 ± 1.28	13.8 ± 2.0
0.34 mol NaCl/L	11.6 ± 1.47	10.9 ± 2.2

[1] All values are means ± SEMs.
[2] Included compared with excluded infants: $t(83) = 2.08$ ($P < 0.05$).

Feeding history

The infants' feeding practices at 6 mo of age are summarized in **Table 4**. According to maternal report, almost all (90.2%) of the infants had been introduced to complementary first-stage baby food and approximately half (48%) had some experience with table food. The mothers indicated that infants eating table food were primarily receiving starchy table food (43% of all infants), followed by fruit (30%). The mothers' education level was not related to the introduction of table food before 6 mo of age. However, given that 40 families were earning <\$50,000 and 20 were earning more (one subject did not report income), lower-income mothers were more likely to have introduced their infants to starchy table foods by 6 mo of age ($P < 0.001$).

Six mothers indicated that their infants had salt added to their food, either at the table or in cooking: 3 of those infants were receiving starchy table food and 3 were not. Of these 6 infants, 2 who had been introduced to fruit table food had salt added to their food and 4 had not. Infant birth weight, formula and breast feeding status, maternal age, and maternal education level did not differ between infants eating and not eating starchy table foods (data not shown).

TABLE 3
Demographic characteristics of the 61 mother-infant dyads

	Value
Birth weight (kg)	3.42 ± 0.1[1]
Maternal age (y)[2]	29.8 ± 0.8
Maternal education (y)	14.8 ± 0.4
Ethnicity (%)	
African American	44.3
White	49.1
Hispanic, Asian, other	6.6
Male (%)	59.0
2-mo assessment age (d)	64.7 ± 1.0
6-mo assessment age (d)	188 ± 1.8

[1] Mean ± SEM (all such values).
[2] n = 59.

TABLE 4
Infant feeding practices at 6 mo of age as reported by mothers

	Yes	No	Yes
	n	*n*	%
Baby food	55	6	90.2
Baby-food starch	52	9	85.2
Baby-food fruit	46	15	75.4
Baby-food vegetable	41	20	67.2
Baby-food meat	18	43	29.5
Table food	29	32	47.5
Table-food starch	26	35	42.6
Table-food fruit	18	43	29.5
Table-food vegetable	12	49	19.7
Table-food meat	6	55	9.8
Table-food dairy	6	55	9.8
Table-food egg	6	55	9.8
6-mo milk feeding			
Formula only	23		37.7
Breast only	10		16.4
Both	28		45.9

Salt solution consumption and acceptance

Sodium chloride acceptance

As shown in **Figure 1**, dietary experience was associated with an age-related shift of salt acceptance. Acceptance of both concentrations of sodium chloride increased from indifference (0.17 mol NaCl/L) or rejection (0.34 mol NaCl/L) at 2 mo to preference at 6 mo, but this shift was observed only in those infants who had prior experience with starchy table foods (age × experience; $P = 0.047$). The relation between dietary experience and an increase of salty taste acceptance was specific to starchy table foods, as intake of table-food fruit did not influence sodium chloride acceptance (age × experience; NS). As a result, only those infants who had been exposed to starchy table foods displayed a preference for the salty solutions at 6 mo of age, (age × experience; $P = 0.007$). A similar analysis performed with starchy baby food was insignificant, perhaps reflecting the fact that infant cereals are manufactured with little to no added sodium. Additional analyses examining the influence of exposure to meat, vegetables, dairy products, and egg table foods also had insignificant results, although it should be noted that only a small number of infants had been introduced to each of these food groups (Table 4). A final multiple regression analysis failed to identify an influence of exposure to the combined table-food groups (other than starch) on salt preference at 6 mo.

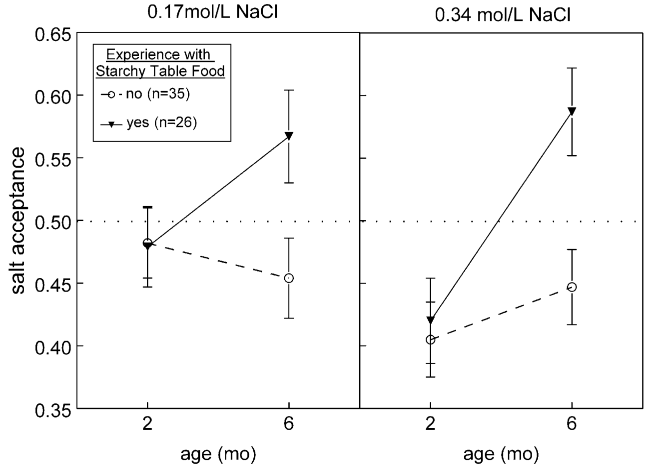

FIGURE 1. Acceptance of salt solutions as a function of age and experience with starchy table foods at 6 mo. Age × experience interaction: $F_{[1,58]} = 4.11$, $P < 0.047$. Acceptance calculated as follows: solution intake/(solution + water intake); values >0.5 indicate preference, and values <0.5 indicate rejection.

Sodium chloride intake

Previous dietary experience with starchy table foods also was associated with the infants' overall intake of sodium chloride during testing at 6 mo of age, with exposed infants ingesting 55% more sodium chloride than those who were not yet eating these foods [$t(59) = 2.29$, $P = 0.026$]. This effect again was specific to experience with starchy table food, because experience with table-food fruit was not related to sodium chloride intake at 6 mo (**Table 5**).

Inspection of intake volumes (**Table 6**) showed that exposure to starchy table food was related to increased consumption of the more concentrated 0.34-mol/L solution (age × experience; $P = 0.01$). Intakes of water and the 0.17-mol/L solution were not related to dietary experience.

Dietary experience and salt acceptance at preschool age

A subset of 26 children returned for additional assessment at preschool age (36–48 mo). Twelve had been introduced to starchy table food before 6 mo, whereas 14 had not. Mothers reported that preschool-age children who had been introduced to starchy table food by 6 mo of age were more likely to lick salt from the surface of foods (Mann-Whitney $U = 34.5$, $P = 0.007$). There was also a trend for these children to be more likely to eat plain salt (Mann-Whitney $U = 54.0$, $P = 0.08$). Similar findings were not evident for sugar-directed behaviors, and early experience with fruit table food was not associated with salt-directed or sweet-directed behaviors.

Salt liking at preschool age was related to responsiveness to sodium chloride at 6 mo. The preschool child's overall salt directed behavior score was associated with both preference for the 0.17-mol/L solution ($\tau = 0.404$, $P < 0.01$) and overall intake of sodium chloride ($\tau = 0.397$, $P < 0.01$) at 6 mo of age.. Early

TABLE 5
Sodium chloride ingested during a 6-min intake test as a function of exposure to table food[1]

	Starch[2]		Fruit[2]	
Age	No ($n = 35$)	Yes ($n = 26$)	No ($n = 43$)	Yes ($n = 18$)
	g	*g*	*g*	*g*
2 mo	0.172 ± 0.027	0.191 ± 0.031	0.177 ± 0.024	0.187 ± 0.037
6 mo	0.278 ± 0.044	0.432 ± 0.051	0.322 ± 0.041	0.395 ± 0.063

[1] All values are means ± SEMs. Sodium chloride ingested calculated from the combined intake of 0.17- and 0.34-mol/L solutions. Intake was analyzed by using 2 × 2 (experience × age) ANOVA for starch and fruit. Age × experience interaction for starchy table foods: $F_{[1,58]} = 6.18$ ($P < 0.02$). All other effects were not significant.

[2] Table food consumed by infants at 6 mo, defined by maternal report.

TABLE 6
Fluid consumed during a 2-min intake test as a function of exposure to table-food categories, by age[1]

	Starch[2]		Fruit[2]	
	No (n = 35)	Yes (n = 26)	No (n = 43)	Yes (n = 18)
	g	*g*	*g*	*g*
0 mol NaCl/L				
2 mo	7.13 ± 1.10	7.85 ± 1.28	7.06 ± 0.99	8.35 ± 1.53
6 mo	10.10 ± 1.50	12.10 ± 1.75	10.67 ± 1.36	11.63 ± 2.11
0.17 mol NaCl/L				
2 mo	6.76 ± 1.02	8.08 ± 1.18	7.02 ± 0.92	8.02 ± 1.42
6 mo	9.44 ± 1.54	13.68 ± 1.76	10.65 ± 1.40	12.66 ± 2.16
0.34 mol NaCl/L[3]				
2 mo	5.23 ± 0.93	5.57 ± 1.08	5.38 ± 0.84	5.37 ± 1.30
6 mo	9.26 ± 1.53	14.86 ± 1.77	10.86 ± 1.43	13.53 ± 2.21

[1] All values are means ± SEMs. Intake was analyzed with the use of separate 2 × 2 (experience × age) ANOVA for starch and fruit at each concentration.

[2] Table food consumed by infants at 6 mo, defined by maternal report.

[3] Age × experience interaction for starchy table foods: $F_{[1,58]} = 7.07$ ($P = 0.01$). All other effects were not significant.

dietary experience was not related to other measures of salt liking or acceptance at preschool age (**Table 7**).

DISCUSSION

The findings of this study suggest an influential role of early dietary experience in shaping the salty taste responses of infants and preschoolers. Specifically, salt acceptance increased from indifference or rejection at 2 mo to preference at 6 mo only in those infants who had been introduced to starchy table foods, most of which contain sodium. In contrast, the salt-related hedonic response of infants having no experience with starchy table foods did not shift during that same time period, remaining negative at 6 mo of age. As such, at 6 mo of age, the salty taste preference of infants exposed to starchy table foods was elevated relative to infants who were not yet eating these foods.

The enduring association between early dietary experience and taste responses was tested in a small subset of subjects. Although these results must be viewed as preliminary, early exposure to starchy table foods and the corresponding elevated preference for salty taste at 6 mo of age were associated with 2 measures of increased liking for the taste of salt at preschool age. Similar relations were not apparent for exposure to fruit-based table food at either 6 mo or preschool age.

TABLE 7
Salt and sweet food liking and preference scores of preschool-age children as a function of early exposure to starchy table foods

	Experience with starchy table foods	
	No	Yes
Preference: lower-salt foods[1]	4.50 ± 0.09 (11)[2]	4.29 ± 0.14 (14)
Preference: higher-salt foods[1]	4.01 ± 0.18 (11)	4.01 ± 0.16 (12)
Liking rank: salty foods[2]	3.98 ± 0.17 (11)	4.23 ± 0.16 (13)
Liking rank: sweet foods[3]	4.03 ± 0.22 (11)	3.65 ± 0.20 (14)

[1] All values are means ± SEMs; n in parentheses. Children's preferences reported by mother using a 5-point scale ranging from 1 ("a favorite") to 5 ("will not eat"). *See* Table 1 for foods used to construct scores.

[2] Mean ± SEM; n in parentheses (all such values).

[3] Child's ranking of liking for 7 snack foods (4 salty foods and 3 sweet foods); 1 indicates "most liked." *See* text for details and list of foods.

It is important to note that any conclusions from this study are limited by its correlational nature and that an experimental study is needed to firmly prove causation. Whereas the sodium content of the foods was not recorded or measured, baby foods—especially those given to younger infants—typically are low in sodium. Conversely, the starchy table foods that many parents use to transition their infants to table foods contribute substantially to the adequate sodium intake (370 mg/d) recommended by the Institute of Medicine for 7- to 12-mo-old infants (23). Such foods often include ready-to-eat cereal such as Cheerios (106 mg Na/0.12 L; General Mills), packaged instant wheat cereal (120 g Na/0.5 package), mashed potatoes with milk and margarine (350 mg Na/0.12 L), and toaster waffles (130 mg Na/0.5 waffle) (24).

It currently is not possible to determine whether the present results reflect a response to the presence of sodium or to the taste of salt. More knowledge is needed regarding the development of the underlying mechanisms that detect sodium and transmit information on salty taste before that question can be conclusively addressed.

The development of the human hedonic response to salty taste differs from the responses to sweet and bitter, both of which are evident at birth (14, 15). In contrast, the positive response to salty taste appears to mature postnatally (16, 26). The timing and underlying physiologic and sensory triggers for this transition remain not well understood. Human infants are indifferent to or reject salt solutions at birth (14–16) and through the first several months of life (16, 25–27). The extent of this response remains unclear and may be related in part to prenatal factors (12). By 6 mo of age, infants have been reported to prefer salty solutions to plain water, a developmental shift that has been interpreted to reflect postnatal maturation of underlying salt-detection mechanisms (16). Another, not mutually exclusive, possibility is that diet-related sensory experience could initiate a hedonic shift from indifference to acceptance (17). The results of the current study are consistent with this second interpretation, because both intake and acceptance of salty solutions at 6 mo of age were associated with and possibly influenced by prior dietary experience.

Taste development appears to be shaped by several sensitive periods. During the prenatal period, maternal physiologic perturbations such as severe emesis or dehydration can lead to prolonged shifts in offspring sodium sensitivity and the hedonic response to salt (9–11, 13). Postnatally, the first 6 mo of life are increasingly thought to represent a second sensitive period for shaping overall taste responses. For example, infants fed bitter and sour hydrolysate formulas accept these formulas easily, but only if introduced before 6 mo of age (28). Early exposure appears to have an enduring influence, because children raised on these same formulas have an enhanced liking for certain bitter tasting vegetables at 6–11 mo (29) and for sour beverages at 5 y of age (30).

In the current study, 6-mo-old infants exposed to starchy table foods increased their intake of the stronger salt solution, which had a concentration typically considered to be strongly salty by adults. These findings are consistent with a role for early dietary experience in determining the set point for what is considered normal salty taste (31). This premise is supported by the finding that infants introduced to starchy table foods by 6 mo had an increased affinity for the taste of plain salt at preschool age. These results are similar to those from another study, in which an earlier introduction to table foods was associated with a higher salt intake at preschool age (19). However, it also remains possible that early exposure to sodium or salty taste may have reduced a neophobic reaction to the salty solutions, thus increasing intake relative to unexposed infants. Likewise, children introduced to high-sodium foods at an early age could continue to be fed, and prefer, such foods later in life.

Preference is a strong predictor of food choice and intake in young children (32), which suggests that an elevated preference for salty taste could lead to increased intake of higher-sodium foods during early childhood. Early food preferences also predict preferences later in life, both during childhood (33) and adulthood (34). As such, events promoting heightened avidity for salt during early development could potentially set in place a self-perpetuating cycle of salt preference and ingestion that could become particularly entrenched in high-sodium environments. Such a cycle is suggested by the relations observed in the current study. This could lead these infants to continue to eat more salt later in life (19). If lower-income families introduce starchy table foods to their infants at a younger age, this segment of the population may be particularly in need of nutritional education to point out potential health-related ramifications.

Although early experience with starchy table foods was associated with an affinity for the taste of plain salt at preschool age, a similar relation was not observed for salty table foods as assessed by the liking for salty foods scale and the preference for salty foods measurement. Several factors can be invoked to explain this finding. The food-liking scale was developed for use in adults (21) and may not be appropriate for young children, who like higher concentrations of saltiness relative to adults (35) and are still in the neophobic stage of food acceptance (36). Because children have a strong biological inclination toward sweet taste (37, 38), it also is possible that the drive for sweet taste limited the ability to detect salt-related dietary effects.

In conclusion, the current findings showed a relation between early dietary experience and liking for the taste of salt, both in infants and at preschool age. Additional studies are needed to test the proposed causal relation between early dietary experience and later salt preference. Future research should also explore the long-term consequences of these associations and whether early experience with the taste of salt in young infants is a predictor of future sodium intake, blood pressure, or other health-related outcomes.

We thank the many technicians who assisted with this study.

The authors' responsibilities were as follows—BJC and GKB: designed the research; LJS, BJC, and GKB: conducted the research; LJS: analyzed the data; LJS, BJC, and GKB: wrote the manuscript; and LJS: had primary responsibility for the final content. All authors read and approved the final manuscript. The authors had no conflicts of interest to declare.

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