

# Sodium and Sugar in Complementary Infant and Toddler Foods Sold in the United States

Mary E. Cogswell, DrPH, RN<sup>a</sup>, Janelle P. Gunn, RD, MPH<sup>a</sup>, Keming Yuan, MS<sup>a</sup>, Sohyun Park, PhD<sup>b</sup>, Robert Merritt, MA<sup>a</sup>

## abstract

**OBJECTIVES:** To evaluate the sodium and sugar content of US commercial infant and toddler foods.

**METHODS:** We used a 2012 nutrient database of 1074 US infant and toddler foods and drinks developed from a commercial database, manufacturer Web sites, and major grocery stores. Products were categorized on the basis of their main ingredients and the US Food and Drug Administration's reference amounts customarily consumed per eating occasion (RACC). Sodium and sugar contents and presence of added sugars were determined.

**RESULTS:** All but 2 of the 657 infant vegetables, dinners, fruits, dry cereals, and ready-to-serve mixed grains and fruits were low sodium ( $\leq 140$  mg/RACC). The majority of these foods did not contain added sugars; however, 41 of 79 infant mixed grains and fruits contained  $\geq 1$  added sugar, and 35 also contained  $>35\%$  calories from sugar. Seventy-two percent of 72 toddler dinners were high in sodium content ( $>210$  mg/RACC). Toddler dinners contained an average of 2295 mg of sodium per 1000 kcal (sodium 212 mg/100 g). Savory infant/toddler snacks ( $n = 34$ ) contained an average of sodium 1382 mg/1000 kcal (sodium 486 mg/100 g); 1 was high sodium. Thirty-two percent of toddler dinners and the majority of toddler cereal bars/breakfast pastries, fruit, and infant/toddler snacks, desserts, and juices contained  $\geq 1$  added sugar.

**CONCLUSIONS:** Commercial toddler foods and infant or toddler snacks, desserts, and juice drinks are of potential concern due to sodium or sugar content. Pediatricians should advise parents to look carefully at labels when selecting commercial toddler foods and to limit salty snacks, sweet desserts, and juice drinks.

FREE

**WHAT'S KNOWN ON THIS SUBJECT:** US children consume excessive amounts of sodium and substantial amounts of added sugars. Early life exposures to salt and sugar can set taste preferences and health trajectories.

**WHAT THIS STUDY ADDS:** A substantial proportion of toddler meals and other commercial foods meant for children age  $\geq 12$  months are of potential concern because of their high sodium content or presence of  $\geq 1$  added sugar.

<sup>a</sup>Division for Heart Disease and Stroke Prevention, and <sup>b</sup>Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Dr Cogswell contributed to the study concept and design, categorized the foods, developed the analytic plan, and drafted and revised the manuscript; Ms Gunn assisted in the study design, helped with the development of the database and data interpretation, and revised the manuscript for critical content; Mr Yuan analyzed the data; Dr Park assisted in the study design and revised the manuscript for critical content; and Mr Merritt conceptualized and designed the study, and revised the manuscript for critical content. All authors approved the final manuscript as submitted.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

[www.pediatrics.org/cgi/doi/10.1542/peds.2014-3251](http://www.pediatrics.org/cgi/doi/10.1542/peds.2014-3251)

**DOI:** 10.1542/peds.2014-3251

Accepted for publication Nov 25, 2014

Approximately 79% of US children aged 1 to 3 years exceed the upper level of 1500 mg/d of sodium recommended by the Institute of Medicine (IOM) for this age group, and 23% of US children aged 2 to 5 years are overweight or obese.<sup>1-3</sup> Obesity and excess sodium intake are associated with an increased risk of high blood pressure among children,<sup>2,4-6</sup> and children with high blood pressure are more likely to develop hypertension as adults and, subsequently, cardiovascular disease.<sup>7,8</sup> Because of the association of added sugar content to obesity and chronic diseases,<sup>9,10</sup> the *Dietary Guidelines for Americans, 2010*, recommends limiting added sugar intake to no more than 5% to 15% of total energy intake.<sup>11</sup> On average, 13% of total energy intake among US children aged 2 to 5 years is from added sugars.<sup>12</sup>

Pediatricians can play an important role in counseling parents about the appropriate foods to feed young children for a healthy diet and thus aid in the prevention of obesity, high blood pressure, and the subsequent increased risk of heart disease and stroke. Early life exposures to sodium and sugar can set taste preferences and determine health trajectories.<sup>13-15</sup> Furthermore, the majority of US children visit pediatricians annually, thus providing opportunities for counseling parents about food choices for their children.<sup>16</sup> According to the 2014 American Academy of Pediatrics Nutrition Handbook, “food choices to be encouraged, whether home or commercially prepared, are those with no added salt or sugar.”<sup>17</sup>

There are gaps in the data regarding the sodium and sugar content of commercial US foods marketed for infants and toddlers. Studies with information on the sodium and sugar content of complementary foods sold in the United States are outdated<sup>18-21</sup> or include few or no toddler foods.<sup>18-24</sup> Studies conducted in

other countries<sup>22-26</sup> may not apply to the nutrient content of foods sold in the United States. National intake recommendations and food regulations differ, for example, between the United States and Canada<sup>27,28</sup>; different types of food may be offered, and differences in the same type of food may exist.<sup>29</sup> Nutrition information on added sugar content is not available, with previous studies relying on total sugar content.<sup>25,26,30</sup> The sodium density of specific categories of foods marketed to infants and toddlers is unknown. Among US children aged 1 to 3 years, mean sodium intake density is ~1400 mg of sodium per 1000 kcal compared with 550 mg/1000 kcal among infants, suggesting toddlers compared with infants consume foods that are significantly more sodium dense.<sup>1,31,32</sup>

The objectives of the present study were to determine the sodium and sugar content of commercial infant and toddler foods sold in the United States and to identify food products high in sodium or sugar content or containing added sugars.

## METHODS

### Data Collection

We initially used the commercial Gladson Nutrition Database<sup>33</sup> to identify the US infant and toddler foods and brands. The Gladson database includes package information (eg, Nutrition Facts label and full ingredient lists) for >200 000 products. In this database, 1495 infant and toddler food products were identified by searching for the terms “baby” or “toddler” in the category and description fields. Infant formulas, fortified milk, and oral electrolytes were excluded because they are regulated by the US Food and Drug Administration (FDA) for labeling and nutrition content.<sup>34</sup>

We confirmed or updated information from the Gladson database and added additional

products through searching brand or manufacturer Web sites of the foods identified. Additional information was obtained through purchases from 5 metropolitan Atlanta retail/wholesale grocers (Kroger, Publix, Target, Costco, and Wal-Mart) listed among the top 10 food retailers and wholesalers in the United States and Canada in 2013.<sup>35</sup> Purchases included private label products ( $n = 37$ ) and products without information on manufacturer Web sites ( $n = 26$ ). No private label infant or toddler products were found at Costco. As in a Canadian study,<sup>25,26</sup> we identified food products for purchase from the section labeled as “baby” or “infant” foods and purchased a sample of each of unique product. Data were confirmed and/or collected from March through December 2012. Duplicates, and products that we could not confirm as being present in the marketplace during that period, were deleted; the result was a final sample of 1074 separate food products, some representing the same food type (eg, different brands of apple sauce). Information was entered from the Nutrition Facts label and the ingredient list to capture sodium and sugar content. The majority of the nutrition information came from manufacturer’s Web sites ( $n = 889$  products), with the remainder from purchased products ( $n = 63$ ) and the Gladson database ( $n = 122$ ).

### Food Categories

Food categories were based on those used to set the FDA’s reference amount customarily consumed per eating occasion (RACC) according to age for infant and toddler foods.<sup>36</sup> Food products were categorized based on the food type, intended age or developmental stage, and manufacturer defined serving size (eg, stage 1 vegetables) (Table 1). Categories were further combined or split on the basis of the listed ingredients. For example, ready-to-serve fruits of the strained or junior type were combined and examined

separately from ready-to-serve junior type dairy-based desserts and ready-to-serve junior type dinners, vegetables, or soups. The term “infant” was used for complementary food products aimed at children aged 4 to 12 months (stages 1–3) and “toddler” foods for foods aimed at children aged 12 to 36 months (stage 4).

### Nutrient Assessment

Currently, no standard guidelines exist for assessing sodium or sugar content of complementary infant and toddler foods. We identified the amount of sodium and sugar in selected foods from the Nutrition Facts label and used other information on the label to assess content by using 3 constructs: (1) per 100 g (concentration); (2) per serving; and (3) in relation to calories. The ingredient list was also examined to identify the presence of added sugars. Nutrient concentrations (milligrams per 100 g) account for variability in serving sizes across food categories. Nutrient content per standard serving (the assigned RACC provided in Table 1) allows comparison of the nutrient content across brands for the same food type or category and is meant to reflect the amount consumed. Examining the nutrient content in relation to calories (per 1000 calories or percentage of calories) allows comparisons in the nutrient content across foods adjusting for the caloric content. This adjustment is important because sugar is a source of calories and persons who consume more calories generally have higher sodium intake.

### Sodium Content

Sodium content was evaluated in 3 ways: (1) sodium concentration (milligrams per 100 g); (2) sodium per RACC; and (3) sodium density (milligrams per 1000 kcal). High sodium content was defined as >210 mg of sodium per RACC. After evaluating various approaches to define high sodium content,<sup>25,26,35–37</sup> we used a similar approach to the

Elliott study<sup>25,26</sup> to define high sodium content for each food product but used the recommendations of the United States Department of Agriculture (USDA) MyPlate<sup>27</sup> to determine the total recommended servings per day rather than Canada's Food Guide.<sup>28</sup> Sodium content was defined as high based on the IOM's dietary reference intakes for sodium for children aged 1 to 3 years<sup>2</sup> and 7 daily servings from the grains, protein, and dairy food groups to meet recommended intakes according to the USDA's MyPlate for children aged 2 to 3 years.<sup>27</sup> For sodium, this corresponds to 210 mg of sodium per serving (a tolerable upper intake level of 1500 mg divided by 7 servings). In addition, low-sodium products were identified as containing  $\leq 140$  mg/RACC (an adequate intake of 1000 mg divided by 7 servings). This level ( $\leq 140$  mg/RACC) also corresponds with FDA regulations related to labeling a product as low in sodium, which is useful for those wanting to limit sodium intake.

### Sugar Content

Sugar content of the selected foods was evaluated in 4 ways: (1) sugar concentration (milligrams per 100 g); (2) sugar per RACC; (3) percentage of calories from sugar; and (4) presence of added sugars. High sugar content was defined as >35% of total calories from sugar. However, products high in fat or protein may be lower in the relative calories from sugar. Thus, we also defined products of potential concern as including  $\geq 1$  added sugar in the ingredient list. In lieu of information on the amount of added versus naturally occurring sugars, the IOM recommendations for Nutrition Standards for Food in Schools was used.<sup>38</sup> These standards state that snacks, foods, and beverages should provide no more than 35% of calories from total sugars per portion as packaged. Exceptions are 100% fruits and fruit juices without added sugars, 100% vegetables and vegetable juices without added

sugars, and unflavored nonfat and low-fat milk and yogurt. Thus, we did not report the proportion of products high in sugar content (>35% of calories from total sugars) for categories including these foods. All but 1 of the dairy-based dessert products were flavored, and we therefore included this category in our analysis. In addition, we identified whether a product may be of concern because it contained added sugars. Ingredients qualifying as added sugars were identified by using lists from the *Dietary Guidelines for Americans, 2010*,<sup>11</sup> and USDA's MyPlate<sup>27</sup> recommendations and included sugar, sweetener, syrup, corn syrup, high-fructose corn syrup, honey, fructose, malt, maltose, molasses, dextrose, glucose, lactose, sucrose, turbinado, and trehalose. As other studies have done, the present study included “juice concentrate” or “cane” (juice, syrup, or sugar) as sources of added sugars.<sup>9,39</sup> If a food product included  $\geq 1$  source of added sugars (as identified earlier) in the ingredients list, it was categorized as including added sugars. Products with at least 1 source of added sugars and >35% of total calories from sugar were also examined.

### Statistical Analysis

For each food category, mean and 95% confidence intervals were calculated for sodium content. We also estimated the proportion of products within a specific food category with the following: (1) low sodium content; (2) high sodium content; (3) high sugar content; (4) with  $\geq 1$  added sugar; or (5) with both high sugar content and containing  $\geq 1$  added sugar. All statistical analyses were performed by using SAS version 9.3 (SAS Institute, Inc, Cary, NC).

## RESULTS

### Sodium Content

Regarding infant food products, all but 2 of the 657 infant vegetables,

**TABLE 1** Categorization of Commercial Infant and Toddler Food and Drink Products (*N* = 1074)

Food Product Category (Example)	RACC Category <sup>a</sup>	<i>N</i>	RACC, g <sup>b</sup>	Serving Size, g <sup>c</sup>
<b>Infant</b>				
Vegetables, stage 1 <sup>d</sup> (single vegetables [eg, pureed peas, pureed carrots])	Dinners, desserts, fruits, vegetables or soups, ready-to-serve, strained type	41	60	71
Dinners, soups, and vegetables, stages 2 and 3 <sup>e</sup> (eg, vegetables, or vegetable, meat, pasta, or soup-based mixed dishes)	Dinners, desserts, fruits, vegetables or soups, ready-to-serve, junior type	256	110	113
Fruit, stages 1–3 (pureed single or mixed fruits)	Dinners, desserts, fruits, vegetables or soups, ready-to-serve, strained or junior	239	60 or 110 <sup>f</sup>	113
Cereals, dry/instant (eg, dry rice cereal)	Cereals, dry/instant	47	15	15
Mixed grains and fruits, ready-to-serve (eg, oatmeal and fruit in a jar, ready-to-serve)	Cereals, prepared, ready-to-serve	79	110	113
<b>Toddler</b>				
Dinners or meals (vegetable, meat, <sup>g</sup> pasta, pizza-, or soup-based mixed dishes)	Dinners, stews, or soups for toddlers, ready-to-serve	73	170	170
Cereal bars and breakfast pastries (eg, cereal bars, cereal and fruit bars, cakes or bread)	Other cereal and grain products, dry ready-to-eat	34	20	19
Fruit (eg, pureed fruit mixtures)	Fruits for toddlers, ready-to-serve	30	125	118
Dry fruit–based snacks (eg, freeze-dried yogurt and/or fruit snacks, dehydrated fruit snacks)	Dinners, desserts, fruits, vegetables or soups, dry mix	56	15	10
<b>Infant or toddler</b>				
Savory snacks, sides <sup>h</sup> (eg, crackers, savory rice cakes, jarred mini hotdogs, toddler vegetables)	Dinners, desserts, fruits, vegetables or soups, dry mix	34	15	8
Dry grain-based desserts (eg, cookies, sweet biscuits or graham crackers, sweet rice cakes/puffs)	Other cereal and grain products, dry ready-to-eat (eg, ready-to-eat cereals, cookies, teething biscuits, toasts)	88	7	7
Dairy-based desserts (eg, yogurt with or without fruit)	Dinners, desserts, fruits, vegetables or soups, ready-to-serve, junior type	46	110	113
Juices/drinks (eg, single or mixed fruit juices/drinks)	Juices, all varieties	51	120	118

*N*, number of products with serving size information.

<sup>a</sup> Corresponding US FDA's food categories for infant and toddler foods used to set the RACC to help determine serving sizes for the Nutrition Facts labels.

<sup>b</sup> These values are used by the US FDA to represent the amount of the specified food consumed on average per eating occasion and "were primarily derived from the 1977–1978 and the 1987–1988 Nationwide Food Consumption Surveys conducted by the US Department of Agriculture." See <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcr/cfrsearch.cfm?fr=101.12>.

<sup>c</sup> The median manufacturer serving size as listed on the Nutrition Facts label of the products in the specified food category.

<sup>d</sup> Stage 1 foods are finely pureed solid foods meant for infants aged 4 to 6 months.

<sup>e</sup> Stage 2 foods are strained junior foods meant for infants aged from 7 to 8 months, and stage 3 foods are partially strained foods, with small, tender chunks meant for infants aged 9 to 12 months.

<sup>f</sup> The RACC varies based on whether it is a stage 1 food (60 g) or stage 2 or 3 food (110 g).

<sup>g</sup> Meat, poultry, or fish.

<sup>h</sup> Jarred mini-hot dogs and toddler vegetables were included in this category. In a separate analysis, these products were excluded.

dinners, fruits, dry cereals, and ready-to-serve mixed grains and fruits were low in sodium content ( $\leq 140$  mg/RACC) (Table 2), and none was high in sodium ( $>210$  mg/RACC). Seventy-two percent of toddler dinners were high in sodium content ( $>210$  mg/RACC). Toddler dinners contained an average of 2295 mg of sodium per 1000 kcal (sodium 212 mg/100 g). Savory infant/toddler snacks ( $n = 34$ ) contained an average of 1382 mg of sodium per 1000 kcal (sodium 486 mg/100 g); 1 was high sodium.

### Sugar Content

The majority of the infant vegetables, dinners, fruits, and dry/instant cereals did not contain added sugars.

However, 52% of infant ready-to-serve mixed grains and fruits contained  $\geq 1$  added sugar and 44% also contained  $>35\%$  calories from sugar. On average, infant mixed grains and fruits contained 9 g of sugar per 100 g, 10 g of sugar per RACC, and 47% of calories from total sugars (Table 3).

Thirty-two percent of toddler dinners and the majority of toddler cereal bars/breakfast pastries, fruit, and dry fruit-based snacks contained  $\geq 1$  added sugar. Thirty-five percent of cereal bars/breakfast pastries contained  $>35\%$  of calories from total sugars and  $\geq 1$  added sugar. On average, these products contained 29 g of sugar per 100 g, 6 g of sugar

per RACC, and 31% of total calories from total sugars. Eighty-eight percent of dry fruit-based snacks contained  $\geq 1$  added sugar and  $>35\%$  of calories from total sugars. On average dry fruit-based snacks contained 60 g sugar/100 g, 9 g sugar/RACC, and 66% of calories from total sugars (Table 3).

Most infant/toddler savory snacks, desserts, and juices/drinks contained  $\geq 1$  added sugars, and 61% of dairy-based desserts contained at least 1 added sugar and  $>35\%$  of calories from total sugars. Dairy-based desserts contained 12 g of sugar per 100 g, 12 g of sugar per RACC, and 51% of total calories from sugars (Table 3). The most commonly used

**TABLE 2** Sodium Content of Infant and Toddler Food and Drinks According to Product Category

Food Product Category	N	Sodium Density, mg/ 1000 kcal		Sodium Concentration, mg/100 g		Sodium per RACC, mg <sup>a</sup>		
		Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Median	≤140 n (%)	141–210 n (%)	>210 n (%)
<b>Infant</b>								
Vegetables, stage 1 <sup>b</sup>	41	501 (302–700)	20 (12–28)	12 (7–17)	4	41 (100)	0	0
Dinners, soups, and vegetables, stages 2 and 3 <sup>c</sup>	256	503 (428–578)	28 (25–31)	30 (27–34)	25	254 (99)	2 (1)	0
Fruit, stages 1–3	239	77 (59–96)	5 (4–5)	4 (3–5)	0	239 (100)	0	0
Cereals, dry/instant	47	31 (12–51)	12 (5–20)	2 (1–3)	0	47 (100)	0	0
Mixed grains and fruits, ready-to-serve	76	103 (61–146)	9 (5–13)	10 (5–14)	5	76 (100)	0	0
<b>Toddler</b>								
Dinners or meals	72	2295 (2007–2584)	212 (187–237)	361 (317–404)	340	3 (4)	17 (24)	52 (72)
Cereal bars and breakfast pastries	34	744 (558–930)	248 (199–298)	50 (40–60)	49	34 (100)	0	0
Fruit	30	82 (40–125)	6 (2–9)	7 (3–11)	5	30 (100)	0	0
Dry fruit-based snacks	56	383 (302–463)	138 (108–167)	21 (16–25)	26	56 (100)	0	0
<b>Infant or toddler</b>								
Savory snacks, sides	34	1382 (1114–1649)	486 (367–604)	73 (55–91)	63	31 (91)	2 (6)	1 (3)
Dry grain-based desserts	88	399 (301–496)	169 (125–214)	25 (19–32)	17	87 (99)	1 (1)	0
Dairy-based desserts	46	421 (357–484)	42 (31–53)	41 (34–47)	49	46 (100)	0	0
Juices/drinks	51	184 (150–218)	9 (7–10)	10 (9–12)	10	51 (100)	0	0
<b>Total</b>	<b>1070<sup>d</sup></b>	<b>470 (424–515)</b>	<b>71 (62–79)</b>	<b>43 (37–49)</b>	<b>10</b>	<b>995 (93)</b>	<b>22 (2)</b>	<b>53 (5)</b>

CI, confidence interval.

<sup>a</sup> The amount per RACC is considered low if sodium is ≤140 mg and high if >210 mg.

<sup>b</sup> Stage 1 foods are finely pureed solid foods meant for infants aged 4 to 6 months.

<sup>c</sup> Stage 2 foods are strained junior foods meant for infants aged from 7 to 8 months, and stage 3 foods are partially strained foods, with small, tender chunks meant for infants age 9 to 12 months.

<sup>d</sup> Sample sizes in some the categories do not add up to the total products with serving size information because of missing information on sodium content.

added sugars were fruit juice concentrate (56%), sugar (33%), cane (20%), syrup (15%), and malt (7%). High-fructose corn syrup, molasses, honey, dextrose, fructose, and glucose were listed as an ingredient in 2% to 4% of the products examined (data not shown). In products containing an added sugar, 74% included the added sugar among the first 4 ingredients listed on the product label.

## DISCUSSION

A substantial proportion of commercial toddler dinners or meals sold in the United States are high in sodium content. Although infant/toddler savory snacks or sides are not generally high in sodium content per standard serving, they have the highest sodium concentration (ie, “saltiness”). In addition, the majority of products in categories

with some toddler foods (ie, toddler cereal bars/breakfast pastries, fruits and dry fruit-based snacks, infant/toddler savory snacks, desserts, fruit drinks), contained ≥1 added sugar as an ingredient. In contrast, the majority of commercially prepared foods for infants only (ie, vegetables, dinners, fruit, dry/instant cereals) are generally low in sodium and total sugars and did not contain added sugars. The 1 exception was ready-to-serve, mixed grains and fruits, for which a substantial proportion of products were high in total sugars and contained at least 1 added sugar as an ingredient. Although “fruit juice concentrate” was the primary added sugar in the products evaluated in the present study, a substantial proportion of products also contained “sugar,” “cane,” or other types of sugars. These results are somewhat concerning, given the research suggesting that exposure to sodium

and added sugars in early life can affect taste preferences, intake, and health later in life.<sup>13–15,40</sup>

Our study is the most recent and comprehensive research on the sodium and sugar content of US commercial infant and toddler food products. Despite differences in thresholds used to identify excess nutrient content, food products, and food categories, our overall findings on sodium and total sugar content are similar to the Canadian studies indicating<sup>25,26</sup> many types of infant and toddler food products did not have low sugar or sodium content. In the present study, ~7 of 10 toddler dinners or meals were high in sodium content and sodium dense. The concentration of sodium in infant/toddler savory snacks was comparable with plain salted potato chips sold to the general population (450-mg sodium/100 g for plain salted potato chips).<sup>41</sup> The average

**TABLE 3** Sugar Content of Infant and Toddler Foods and Drinks According to Product Category

Food Product Category	N	Sugar, g/100 g		% of Total Calories From Sugar <sup>b</sup>			≥1 Added Sugar <sup>c</sup>	≥1 Added Sugar and >35%
		Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Median	>35%, n (%)	n (%)	n (%)
<b>Infant</b>								
Vegetables, stage 1 <sup>d</sup>	41	5 (4–5)	3 (2–3)	42 (36–48)	40	NA <sup>e</sup>	2 (5)	NA
Dinners, soups, and vegetables, stages 2 and 3 <sup>f</sup>	255	3 (3–4)	4 (3–4)	25 (22–27)	20	64 (25)	10 (4)	1 (<1)
Fruit, stages 1–3	239	12 (11–12)	11 (10–11)	71 (70–73)	73	NA	40 (17)	NA
Cereals, dry/instant	47	8 (6–9)	1 (1–1)	8 (6–10)	7	0	6 (13)	0
Mixed grains and fruits, ready-to serve	79	9 (8–9)	10 (9–10)	47 (44–50)	51	63 (80)	41 (52)	35 (44)
<b>Toddler</b>								
Dinners or meals	72	2 (2–2)	3 (3–4)	9 (8–11)	7	0	23 (32)	0
Cereal bars and breakfast pastries	34	29 (24–33)	6 (5–7)	31 (27–36)	29	13 (38)	33 (97)	12 (35)
Fruit	30	12 (11–13)	15 (13–16)	69 (65–73)	69	NA	16 (53)	NA
Dry fruit-based snacks	56	60 (56–64)	9 (8–10)	66 (62–70)	62	55 (98)	50 (89)	49 (88)
<b>Infant or toddler</b>								
Savory snacks, sides	34	6 (4–8)	1 (1–1)	9 (5–12)	9	1 (3)	24 (71)	0
Dry grain-based desserts	88	18 (17–20)	3 (3–3)	19 (17–20)	16	0	80 (91)	0
Dairy-based desserts	46	12 (9–15)	12 (11–13)	51 (46–55)	48	41 (89)	32 (70)	28 (61)
Juices/drinks	51	11 (10–11)	13 (12–14)	87 (85–88)	86	NA	45 (88)	NA
<b>Total</b>	<b>1071<sup>g</sup></b>	<b>12 (11–13)</b>	<b>7 (7–7)</b>	<b>42 (41–44)</b>	<b>40</b>	<b>NA</b>	<b>402 (37)</b>	<b>NA</b>

CI, confidence interval; NA, not applicable.

<sup>a</sup> The amount per RACC.

<sup>b</sup> Equals the total amount of sugar in calories (gram of sugar × 3.87 kcal/g) per serving divided by the total calories per serving × 100.

<sup>c</sup> Contains ≥1 of the following ingredients: sugar, sweetener, syrup, corn syrup, high-fructose corn syrup, honey, fructose, malt, maltose, molasses, dextrose, glucose, lactose, sucrose, turbinado, trehalose, fruit juice concentrate, and cane juice.

<sup>d</sup> Stage 1 foods are finely pureed solid foods meant for infants aged 4 to 6 months.

<sup>e</sup> IOM recommendations for Nutrition Standards for Food in Schools indicate snacks, foods, and beverages provide no more than 35% of calories from total sugars per portion as packaged. Exceptions are 100% fruits and fruit juices without added sugars, 100% vegetables and vegetable juices without added sugars, and unflavored nonfat and low-fat milk and yogurt. Food categories containing ≥2 of these products were considered not applicable.

<sup>f</sup> Stage 2 foods are strained junior foods meant for infants aged from 7 to 8 months and stage 3 foods are partially strained foods, with small, tender chunks meant for infants aged 9 to 12 months.

<sup>g</sup> Sample sizes in some of the categories do not add up to the total products with serving size information because of missing information on sugar content.

amount of calories from sugar in toddler dry fruit-based snacks and cereal bars and breakfast pastries also did not differ from similar products meant for older children and adults, such as fruit leather pieces (62% of calories from total sugars) and strawberry toaster pastries (32% of calories from total sugars).

A substantial proportion of products contained ≥1 added sugar in their ingredient list, even foods not typically thought of as sweet. Approximately 1 in 3 toddler dinners and meals and 7 of 10 infant/toddler savory snacks contained ≥1 added sugar. Sugars are known to elicit a positive response at birth, and research shows that at an early age, the addition of sugar, even in small amounts, may enhance liking for products that are high in sodium per

serving or high in sodium concentration (ie, salty).<sup>13</sup>

Our study is subject to limitations. First, sodium, sugar, and calorie content are based on the label, not laboratory analysis. According to FDA regulatory standards, the nutritional values on the label can vary from the actual value by as much as ±20%.<sup>42</sup> Second, the Nutrition Facts label does not include the amount of added sugars, separate from total sugar. We included qualitative data from the ingredient list on the presence of added sugars in the products but could not quantify the amount. In addition, fruit juice concentrate is considered an added sugar only if not diluted to 100% juice, and we were unable to consistently evaluate these details from the package information. Third, when comparing the ratio of

a nutrient to total calories, products high in total calories from sources other than those evaluated (eg, fat) may seemingly be lower in sugar and sodium and need to be interpreted with caution. Finally, we examined sales data to choose grocery stores and checked Web sites for top-selling brands of infant and toddler products, but our database lacks sales or market share data for individual food products, and it is possible we missed products.

## CONCLUSIONS

Parents can be reassured that commercial foods for infants (eg, vegetables, dinners, plain fruit [without grains], dry cereals) sold in the United States in 2012 were generally acceptable in sodium and

sugar content. However, the majority of snacks, desserts, or juice drinks for infants or toddlers, and many commercial foods meant for toddlers aged  $\geq 12$  months were either high in sodium content or contained  $\geq 1$  added sugar. Many types of commercial infant and toddler foods had higher or equivalent levels of sodium and sugars to products sold for older children or adults. As indicated in the American Academy of Pediatrics's 2014 Pediatric Nutrition Handbook, parents and caregivers can be advised to read labels and choose products or food types lower

in sodium.<sup>17</sup> The proposed changes to the nutrition label to include information on added sugars<sup>30</sup> may also help parents make better choices. Products high in naturally occurring sugars, such as plain pureed fruits are an important source of other required nutrients; however, some may be a significant source of added sugar. Key advice for parents includes limiting juice and avoiding sugar-sweetened beverages and energy-dense, nutrient-poor snacks; if purchasing commercial toddler foods, the labels should be checked for sodium and added sugar. Reducing

excessive sodium and added sugar intake from birth to 24 months can help set taste preferences and lead to better health for children now and as they grow.

## ACKNOWLEDGMENTS

The authors thank Jennifer Seymour, PhD, Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention, for her thorough review of the original draft of the article and Joyce Maalouf for her work creating the database and earlier work on this study.

Address correspondence to Mary E. Cogswell, DrPH, RN, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, Mailstop F72, Atlanta, GA 30341. E-mail: mec0@cdc.gov

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275); published in the public domain by the American Academy of Pediatrics

**FINANCIAL DISCLOSURE:** The authors have no financial relationships relevant to this article to disclose.

**FUNDING:** Supported by the Centers for Disease Control and Prevention.

**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

**COMPANION PAPER:** A companion to this article can be found on page 550, and online at [www.pediatrics.org/cgi/doi/10.1542/peds.2014-4028](http://www.pediatrics.org/cgi/doi/10.1542/peds.2014-4028).

## REFERENCES

- Centers for Disease Control and Prevention (CDC). Trends in the prevalence of excess dietary sodium intake - United States, 2003-2010. *MMWR Morb Mortal Wkly Rep*. 2013;62(50):1021-1025
- Institute of Medicine. *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate*. Washington, DC: National Academies Press; 2005
- Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*. 2014;311(8):806-814
- Yang Q, Zhang Z, Kuklina EV, et al. Sodium intake and blood pressure among US children and adolescents. *Pediatrics*. 2012;130(4):611-619
- Rosner B, Cook NR, Daniels S, Falkner B. Childhood blood pressure trends and risk factors for high blood pressure: the NHANES experience 1988-2008. *Hypertension*. 2013;62(2):247-254
- Aburto NJ, Ziolkovska A, Hooper L, Elliott P, Cappuccino FP, Meerpohl JJ. Effect of lower sodium intake on health: systematic review and meta-analyses. *BMJ*. 2013;346:f1326
- Li Z, Snieder H, Harshfield GA, Treiber FA, Wang X. A 15-year longitudinal study on ambulatory blood pressure tracking from childhood to early adulthood. *Hypertens Res*. 2009;32(5):404-410
- Chen X, Wang Y. Tracking of blood pressure from childhood to adulthood: a systematic review and meta-regression analysis. *Circulation*. 2008;117(25):3171-3180
- Welsh JA, Cunningham SA. The role of added sugars in pediatric obesity. *Pediatr Clin North Am*. 2011;58(6):1455-1466, xi
- Johnson RK, Appel LJ, Brands M, et al; American Heart Association Nutrition Committee of the Council on Nutrition, Physical Activity, and Metabolism and the Council on Epidemiology and Prevention. Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. *Circulation*. 2009;120(11):1011-1020
- US Department of Agriculture and US Department of Health and Human Services. *Dietary Guidelines for Americans, 2010. 7th Edition*, Washington, DC: US Government Printing Office, December 2010. Available at: [www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/PolicyDoc.pdf](http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/PolicyDoc.pdf). Accessed September 17, 2014
- Ervin R, Kit B, Carroll M, Ogden C. Consumption of added sugar among U.S. children and adolescents, 2005-2008. NCHS Data Brief. Number 87:1-8. Available at: [www.cdc.gov/nchs/data/databriefs/db87.pdf](http://www.cdc.gov/nchs/data/databriefs/db87.pdf). Accessed September 17, 2014
- Mennella JA. Ontogeny of taste preferences: basic biology and implications for health. *Am J Clin Nutr*. 2014;99(suppl 3):704S-711S
- Cornwell TB, McAlister AR. Alternative thinking about starting points of obesity. Development of child taste preferences. *Appetite*. 2011;56(2):428-439
- Beauchamp GK, Mennella JA. Early flavor learning and its impact on later feeding

- behavior. *J Pediatr Gastroenterol Nutr*. 2009;48(suppl 1):S25–S30
16. National Center for Health Statistics. Centers for Disease Control and Prevention. *Health*, United States, 2013: With Special Feature on Prescription Drugs. Hyattsville, MD: National Center for Health Statistics; 2014: 309. Available at: [www.cdc.gov/nchs/data/abus/abus13.pdf](http://www.cdc.gov/nchs/data/abus/abus13.pdf). Accessed October 3, 2014
  17. American Academy of Pediatrics. Committee on Nutrition. In: Kleinman RE, Greer FR, eds. *Pediatric Nutrition Handbook*. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2014
  18. Anderson TA. Commercial infant foods: content and composition. *Pediatr Clin North Am*. 1977;24(1):37–47
  19. Matthews RH, Workman MY. Nutrient content of selected baby foods. *J Am Diet Assoc*. 1978;72(1):27–30
  20. Anderson TA, Fomon SJ. Commercially prepared strained and junior foods for infants. *J Am Diet Assoc*. 1971;58(6):520–527
  21. Kerr CM Jr, Reisinger KS, Plankey FW. Sodium concentration of homemade baby foods. *Pediatrics*. 1978;62(3):331–335
  22. Zand N, Chowdhry BZ, Zotor FB, Wray DS, Amuna P, Pullen FS. Essential and trace elements content of commercial infant foods in the UK. *Food Chem*. 2011;128(1):123–128
  23. Melø R, Gellein K, Evje L, Syversen T. Minerals and trace elements in commercial infant food. *Food Chem Toxicol*. 2008;46(10):3339–3342
  24. García AL, Raza S, Parrett A, Wright CM. Nutritional content of infant commercial weaning foods in the UK. *Arch Dis Child*. 2013;98(10):793–797
  25. Elliott CD. Sweet and salty: nutritional content and analysis of baby and toddler foods. *J Public Health (Oxf)*. 2011;33(1):63–70
  26. Elliott CD, Conlon MJ. Toddler foods, children's foods: assessing sodium in packaged supermarket foods targeted at children. *Public Health Nutr*. 2011;14(3):490–498
  27. US Department of Agriculture. USDA ChooseMyPlate.gov. Available at: [www.choosemyplate.gov/](http://www.choosemyplate.gov/). Accessed September 17, 2014
  28. Health Canada. Eating well with Canada's food guide. Available at: [www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php](http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php). Accessed September 17, 2014
  29. Summer SS, Oilberding NJ, Guy T, Setchell KD, Brown N, Kalkwarf HJ. Cross-border use of food databases: equivalence of US and Australian databases for macronutrients. *J Acad Nutr Diet*. 2013;113(10):1340–1345
  30. US Food and Drug Administration. Proposed changes to the Nutrition Facts label. Available at: [www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm](http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm). Accessed September 8, 2014
  31. Guenther PM, Lyon JM, Appel LJ. Modeling dietary patterns to assess sodium recommendations for nutrient adequacy. *Am J Clin Nutr*. 2013;97(4):842–847
  32. Tian N, Zhang Z, Loustalot F, Yang Q, Cogswell ME. Sodium and potassium intakes among US infants and preschool children, 2003-2010. *Am J Clin Nutr*. 2013;98(4):1113–1122
  33. Gladson. Nutrition database. Available at: [www.gladson.com/SERVICES/NutritionDatabase/tabid/89/Default.aspx](http://www.gladson.com/SERVICES/NutritionDatabase/tabid/89/Default.aspx). Accessed September 17, 2014
  34. US Food and Drug Administration. Infant formula. Available at: [www.fda.gov/food/foodsafety/product-specificinformation/infantformula/default.htm](http://www.fda.gov/food/foodsafety/product-specificinformation/infantformula/default.htm). Accessed September 17, 2014
  35. Supermarket News. Top 75 retailers & wholesalers 2013. Available at: <http://supermarketnews.com/top-75-retailers-wholesalers-2013>. Accessed September 8, 2014
  36. US Food and Drug Administration. 21CFR101.12. Reference amounts customarily consumed per eating occasion. Revised as of April 1, 2014. Available at: [www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=101.12](http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=101.12). Accessed September 8, 2014
  37. US Food and Drug Administration. Guidance for industry: a food labeling guide (9. Appendix A: Definitions of Nutrient Content Claims). Revised January 2013. Available at: [www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/labelingnutrition/ucm064911.htm](http://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/labelingnutrition/ucm064911.htm). Accessed September 8, 2014
  38. Institute of Medicine. Nutrition Standards for Foods in Schools: Leading the Way Toward Healthier Youth. Washington, DC: The National Academies Press; 2007. Available at: [www.iom.edu/Reports/2007/Nutrition-Standards-for-Foods-in-Schools-Leading-the-Way-toward-Healthier-Youth.aspx](http://www.iom.edu/Reports/2007/Nutrition-Standards-for-Foods-in-Schools-Leading-the-Way-toward-Healthier-Youth.aspx). Accessed September 17, 2014
  39. Ng SW, Slining MM, Popkin BM. Use of caloric and noncaloric sweeteners in US consumer packaged foods, 2005-2009. *J Acad Nutr Diet*. 2012;112(11):1828–1834, e1–e6
  40. Stein LJ, Cowart BJ, Beauchamp GK. The development of salty taste acceptance is related to dietary experience in human infants: a prospective study. *Am J Clin Nutr*. 2012;95(1):123–129
  41. Agricultural Research Service. US Department of Agriculture, National Nutrient Database for Standard Reference, Release 27. Available at: <http://ndb.nal.usda.gov>. Accessed September 8, 2014
  42. US Department of Health and Human Services, Food and Drug Administration. 21CFR101.9. Available at: [www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=101.9](http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=101.9). Accessed September 17, 2014



## Sodium and Sugar in Complementary Infant and Toddler Foods Sold in the United States

Mary E. Cogswell, Janelle P. Gunn, Keming Yuan, Sohyun Park and Robert Merritt  
*Pediatrics* 2015;135;416

DOI: 10.1542/peds.2014-3251 originally published online February 2, 2015;

### Updated Information & Services

including high resolution figures, can be found at:  
<http://pediatrics.aappublications.org/content/135/3/416>

### References

This article cites 26 articles, 10 of which you can access for free at:  
<http://pediatrics.aappublications.org/content/135/3/416#BIBL>

### Subspecialty Collections

This article, along with others on similar topics, appears in the following collection(s):

#### Nutrition

[http://www.aappublications.org/cgi/collection/nutrition\\_sub](http://www.aappublications.org/cgi/collection/nutrition_sub)

### Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:

<http://www.aappublications.org/site/misc/Permissions.xhtml>

### Reprints

Information about ordering reprints can be found online:  
<http://www.aappublications.org/site/misc/reprints.xhtml>

# American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN®



# PEDIATRICS<sup>®</sup>

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **Sodium and Sugar in Complementary Infant and Toddler Foods Sold in the United States**

Mary E. Cogswell, Janelle P. Gunn, Keming Yuan, Sohyun Park and Robert Merritt  
*Pediatrics* 2015;135;416

DOI: 10.1542/peds.2014-3251 originally published online February 2, 2015;

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/135/3/416>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 345 Park Avenue, Itasca, Illinois, 60143. Copyright © 2015 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN<sup>®</sup>

