

# Feeding of Dietary Botanical Supplements and Teas to Infants in the United States



**WHAT'S KNOWN ON THIS SUBJECT:** Dietary botanical supplement and tea use among infants as a separate group from children has not been studied.



**WHAT THIS STUDY ADDS:** Our study is the first to examine prevalence of dietary botanical supplement and tea use among US infants. We found that ~9% of infants were given these supplements in their first year of life, although usually only for short periods.

## abstract

FREE

**OBJECTIVES:** To describe the use of dietary botanical supplements and teas among infants, the characteristics of mothers who give them the specific botanical supplements and teas used, reasons for use, and sources of information.

**METHODS:** We used data from the Infant Feeding Practices Study II, a longitudinal survey of women studied from late pregnancy through their infant's first year of life conducted by the US Food and Drug Administration and the Centers for Disease Control and Prevention between 2005 and 2007. The sample was drawn from a nationally distributed consumer opinion panel and was limited to healthy mothers with healthy term or near-term singleton infants. The final analytical sample included 2653 mothers. Statistical techniques include frequencies,  $\chi^2$  tests, and ordered logit models.

**RESULTS:** Nine percent of infants were given dietary botanical supplements or teas in their first year of life, including infants as young as 1 month. Maternal herbal use ( $P < .0001$ ), longer breastfeeding ( $P < .0001$ ), and being Hispanic ( $P = .016$ ) were significantly associated with giving infants dietary botanical supplements or teas in the multivariate model. Many supplements and teas used were marketed and sold specifically for infants. Commonly mentioned information sources included friends or family, health professionals, and the media.

**CONCLUSIONS:** A substantial proportion of infants in this sample was given a wide variety of supplements and teas. Because some supplements given to infants may pose health risks, health care providers need to recognize that infants under their care may be receiving supplements or teas. *Pediatrics* 2011;127:1060–1066

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### KEY WORDS

infant, dietary supplements, pediatric herbs, herbal teas

### ABBREVIATION

DBS—dietary botanical supplements

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Use of dietary botanical supplements (DBS) and herbal teas by infants is a concern for several reasons. Because the purity and potency of such supplements and teas are not regulated in the same way as pharmaceuticals, their administration concomitantly with medicines may cause drug interactions,<sup>1</sup> and they may contain heavy metals or other contaminants.<sup>2</sup> Infants may be more susceptible to adverse effects because of differences in physiology, metabolism, and dose per body weight.<sup>3–5</sup> Studies conducted in the United States have documented the adverse effects of feeding certain DBS to children, including seizures in previously healthy infants<sup>3</sup> and death.<sup>6</sup> A major brand of DBS marketed for infants was recalled for microbiologic contamination in 2007.<sup>7</sup> DBS and teas are sometimes preferred because they can be obtained without medical prescriptions, have been used traditionally in many countries, have been shown to be effective for some conditions, and are marketed as and considered to be more natural.<sup>5</sup> Even if the products given are benign, experts recommend that infants receive only human milk or infant formula for the first 4 to 6 months, with the addition of vitamins and medicines as needed.<sup>8</sup>

Although DBS and tea use has been studied in US children, no prevalence estimates exist for use in infants as a separate group. Three recent population-based estimates of DBS and tea use among US children have produced estimates of 0.8% from the 1999–2002 National Health and Nutrition Examination Survey,<sup>9</sup> 3.9% from the 2007 National Health Interview Survey,<sup>10</sup> and 5% in a North Carolina sample.<sup>11</sup> In addition, estimates of DBS and tea use range widely, from 7% of children visiting private pediatric offices<sup>12</sup> to 45% in a sample of children from a pediatric emergency department.<sup>13</sup> A study of children participating in the

Special Supplemental Program for Women, Infants, and Children in 2 states found a DBS and tea use prevalence of 36%.<sup>14</sup> DBS and tea use among infants was documented in 2 of the studies,<sup>13,14</sup> although detailed information for infants as a separate group from children was not given. In all of the above studies, except those based on the National Health and Nutrition Examination Survey and the National Health Interview Survey, the question that was asked specifically included herbal teas in addition to dietary supplements.

The purposes of this study are the following: (1) to describe the prevalence of DBS and tea use among infants in a nationally distributed sample by age and specific product; (2) to describe the characteristics of mothers who give their infants DBS and teas; and (3) to investigate the reasons mothers feed DBS and teas to their infants and their sources of information.

## METHODS

### Study Population

The Infant Feeding Practices Study II is a longitudinal survey of women studied from late pregnancy through their infant's first year of life conducted collaboratively by the US Food and Drug Administration and the Centers for Disease Control and Prevention between 2005 and 2007. The sample was drawn from a nationally distributed, but not representative, consumer opinion panel, with a sample size of ~3000 mothers aged 18 years and older for postnatal data. Questionnaires were sent by mail once prenatally and 10 times over the first year postpartum, and 94% of the postnatal sample returned at least 2 questionnaires. The sample was limited to healthy mothers with healthy term or near-term singleton infants and overrepresented older, white, middle-income, and higher-educated mothers. Detailed methods

and sample criteria are given in Fein et al 2008.<sup>15</sup> The final analytical sample was further restricted to 2653 mothers by removing those with missing values for any variables used in the regression model. All results are displayed for the analytical sample only (sample sizes may be smaller than 2653 because different variables are displayed).

### Dependent Variable

The dependent variable was the number of times mothers answered “yes” to a question asked on 10 postnatal surveys: “Was your baby given any herbal or botanical preparation or any kind of tea in the past 2 weeks? (Do not count preparations applied to the baby's skin or anything the baby may have received through breastfeeding after you took an herbal or botanical preparation).” The variable indicated whether the infant was given any preparation without regard to multiple preparations, number of doses, or amount fed. Botanical supplements include herbs (leaves) and any other part of the plant (roots, oils, seeds, etc). Tea could be any kind of tea, including tea that is not an herbal supplement. DBS and tea use was coded into 3 categories: 0 = never in infancy; 1 = reported in 1 questionnaire; 2 = reported in more than 1 questionnaire.

### Other Variables

Independent variables included maternal demographic characteristics and DBS use and breastfeeding duration. Breastfeeding duration was defined as the total number of weeks that infants were fed breast milk on the basis of the age of the infant in weeks when the mother completely stopped breastfeeding and pumping milk. If the mother was breastfeeding on the last questionnaire she returned, breastfeeding duration was estimated by the age when breastfeeding was last reported. Demographic characteristics

included parity, age, education, percentage of poverty level, race/ethnicity, marital status, region, and population density. Mother's age was treated as a 4-category variable because the effect was not linear. Percentage of poverty level was defined as the ratio of household income to the poverty thresholds by household size available from the US Census Bureau (2005). Because household income was collected in ranges, we used the midpoint of each category for estimating percentage of poverty. Race/ethnicity of the mother included non-Hispanic white, non-Hispanic black, non-Hispanic other, and Hispanic. Four regions were categorized using the Census Bureau definitions for West, Midwest, South, and Northeast regions.

Other variables used in this study were age at which infants were fed DBS and teas, the types of DBS and teas fed to infants, reasons for giving DBS and teas, and sources of information. Types of DBS and teas fed to the infant was an open-ended question because some mothers in pretest interviews assumed that the DBS and teas listed were recommended for infant consumption by the US Food and Drug Administration. Mothers were asked to list "all the kinds of herbal or botanical preparations or teas your baby was given in the past 2 weeks." If mothers listed a medicine or a nonbotanical supplement, their use was coded as "no." To evaluate reasons for giving DBS and teas, we asked a question that listed 8 conditions for which mothers might give DBS and teas and, in addition, accepted written-in responses. The question about sources of information on botanical supplements was asked of all mothers, not just those who fed DBS and teas to their infant. It was asked at infant ages 3 and 10 months, and responses were combined (for example, the mother was coded as receiving information from product la-

bels if she answered yes to that item in either month 3 or month 10).

### Statistical Analyses

We used SAS release 9.1<sup>16</sup> to conduct all analyses. Because our dependent variable consists of a categorical variable with 3 ordered levels, the ordered logistic model is more appropriate than ordinary least-squares or regular logistic regression. We used ordered logistic rather than multinomial mod-

els because the dependent variable is rank ordered in a low, medium, and high fashion (in our analysis, never fed DBS and teas to the infant; reported DBS and tea use on 1 questionnaire; reported DBS and teas use on more than 1 questionnaire), and the proportional odds assumption was met as indicated by the score test.<sup>17</sup> Ordered logistic models assume that the regressor effects are the same across

**TABLE 1** Description of the Analytical Sample and Percentage of Infants Who Were Given DBS or Teas ( $n = 2653$ )

	Percentage or Mean	SD	Percentage of Infants Given DBS and Teas
DBS and tea use during the first 12 months			
Never in infancy	90.7		
Reported once	5.7		
Reported more than once	3.6		
Mother's DBS use, $P < .0001$			
No	81.1		6.2
Yes	18.9		22.6
Parity, $P = .022$			
Primiparous	28.0		11.4
Multiparous	72.2		8.5
Breastfeeding duration, wk <sup>a</sup>	23.4	20.6	
Mother's age, y, $P = .006$			
18–24	20.2		6.2
25–29	34.0		10.7
30–34	29.4		8.5
≥35	16.4		11.9
Mother's education, $P = .044$			
High school or less	20.6		6.6
Some college	40.0		9.7
College graduate or more	39.4		10.3
Poverty level, $P = .016$			
Under 100	15.2		6.2
100–184	25.6		8.1
185–349	36.0		9.9
≥350	23.2		11.7
Race, $P = .158$			
Non-Hispanic white	85.3		9.0
Non-Hispanic black	4.2		8.9
Non-Hispanic other	4.4		9.4
Hispanic	6.0		14.4
Marital status, $P = .016$			
Married	80.0		10.0
Not married	20.0		6.6
Population density, $P = .589$			
Rural	18.6		8.1
Suburban	50.4		9.6
Urban	31.0		9.6
Region, $P = .001$			
Northeast	17.2		8.1
Midwest	30.2		7.0
South	31.7		9.5
West	20.9		13.4

Data were obtained from the Infant Feeding Practices Study II.  $P$  values are based on  $\chi^2$  tests.

<sup>a</sup> Range: 0–64.5.

all ordinal categories. Thus, all coefficients were constrained to be the same for the 2 equations (high versus medium and low, and high and medium versus low, respectively), but the intercepts differed. Intercepts 1 and 2 (constants) are the estimated ordered logits when the independent variables are evaluated at 0.

## RESULTS

Table 1 lists characteristics of the analytical sample and the percentage of infants who were given DBS and teas. Overall, ~9% of mothers in the sample reported giving DBS and teas to their infants on at least one of the questionnaires, and 4% of the mothers reported giving DBS and teas on more than one questionnaire. According to the bivariate statistics in Table 1, mothers were more likely to give their infants DBS and teas if they had used DBS themselves, were primiparous, were older, had higher education or higher income, and were married (using  $\alpha = 0.05$ ). Geographically, giving DBS and teas to infants was most common in the West and least common in the Midwest.

Results from ordered logit models are shown in Table 2. Controlling for all the other variables in the model, the adjusted odds ratios of giving an infant more DBS and teas were 3.69 times higher (adjusted odds ratio: 3.69,  $P < .0001$ ) among mothers who previously used DBS than among mothers who did not. Hispanic mothers (adjusted odds ratio: 1.85,  $P = .016$ ) were more likely to give DBS and teas than non-Hispanic white mothers. Longer breastfeeding duration was significantly associated with greater odds of feeding more DBS and teas ( $P < .0001$ ). Parity, age, education, poverty level, marital status, and region were not significantly associated with feeding DBS and teas to infants in the multivariate model.

**TABLE 2** Ordered Logit Models for Use of DBS and Teas Among Infants As a Function of Mother's Characteristics ( $n = 2653$ )

Variable	DBS and Teas Use, Adjusted Odds Ratio	<i>P</i>	95% Confidence Interval
Intercept 1		<.0001	
Intercept 2		<.0001	
Maternal herbal use before or during pregnancy	3.69	<.0001	2.78–4.89
Parity			
Primiparous <sup>a</sup>			
Multiparous	0.74	.084	0.53–1.04
Breastfeeding duration, wk	1.02	<.0001	1.01–1.02
Mother's age			
18–24 <sup>a</sup>			
25–29	1.44	.115	0.92–2.28
30–34	1.21	.455	0.73–1.99
≥35	1.52	.124	0.89–2.59
Mother's education			
High school or less <sup>a</sup>			
Some college	1.19	.417	0.78–1.82
College graduate or more	0.87	.542	0.55–1.38
Poverty level			
Under 100 <sup>a</sup>			
100–184	1.20	.494	0.71–2.01
185–349	1.50	.117	0.90–2.47
≥350	1.69	.066	0.97–2.97
Race			
Non-Hispanic white <sup>a</sup>			
Non-Hispanic black	1.19	.637	0.58–2.46
Non-Hispanic other	0.90	.747	0.46–1.74
Hispanic	1.85	.016	1.12–3.06
Married	1.30	.224	0.85–2.00
Population density			
Rural <sup>a</sup>			
Suburban	0.98	.917	0.66–1.45
Urban	1.02	.946	0.66–1.55
Region			
Northeast <sup>a</sup>			
Midwest	0.92	.699	0.58–1.44
South	1.22	.365	0.79–1.88
West	1.39	.143	0.89–2.16
Model $\chi^2$	161.46		
<i>df</i>	20		
Score test <sup>b</sup>	20.20		

Data were obtained from the Infant Feeding Practices Study II.

<sup>a</sup> Reference categories.

<sup>b</sup> The score test evaluates the null hypothesis of no difference in the regressor effects for the ordinal categories using a  $\chi^2$  distribution. A value of 20.20 with 20 degrees of freedom (*df*) fails to reject the null hypothesis, indicating that the proportional odds assumption is reasonable.

The percentage of infants given any DBS and teas varies only slightly by infant age, from 2.4% in month 1 to 4.4% in months 4 to 6 (Table 3). Infants were given a wide variety of different DBS and teas, the most common of which included gripe water, chamomile, teething tablets, and unspecified tea (Table 3).

The 4 most common reasons that mothers fed DBS and teas to their in-

fant were to help with fussiness, digestion, colic, and relaxation (Table 4). In general, reasons for use were consistent with usage indications for specific DBS and teas fed to the infants. Other reasons for giving DBS and teas are listed in Table 4. The percentage of mothers who used DBS and teas to treat an illness increased with infant age. In months 10 to 12 only, using DBS and teas “as a beverage” was the rea-

**TABLE 3** Percentage of Infants Given Each DBS or Tea by Age

Specific DBS and Teas	Month 1	Months 2–3	Months 4–6	Months 7–9	Months 10–12
<i>n</i>	1748	2437	2323	2001	1876
Any DBS and teas	2.4	4.3	4.4	3.1	3.4
Gripe water <sup>a</sup>	0.9	1.8	1.2	0.5	0.3
Chamomile	0.6	0.7	0.7	0.4	0.4
Teething tablets <sup>b</sup>	0.0	0.2	1.5	1.4	1.2
Tea, unspecified	0.0	0.2	0.2	0.1	0.5
Mint	0.1	0.1	0.2	0.1	0.1
Tummy soother <sup>c</sup>	0.1	0.4	0.1	0.0	0.0
Fennel	0.1	0.3	0.1	0.0	0.0
Anise	0.2	0.1	0.0	0.1	0.0
Echinacea	0.1	0.0	0.1	0.1	0.2
Catnip	0.1	0.0	0.0	0.0	0.0
Ginger	0.0	0.0	0.2	0.0	0.1
Baby tea	0.0	0.0	0.0	0.1	0.0
Herbal cold remedies	0.0	0.0	0.0	0.0	0.1
Other <sup>d</sup>	0.2	0.7	0.8	0.8	1.0

Data were obtained from the Infant Feeding Practices Study II. Infants could be given more than 1 supplement in each month.

<sup>a</sup> May contain ginger and fennel but ingredients vary by brand.

<sup>b</sup> May contain chamomile and calcium phosphate and other ingredients depending on brand.

<sup>c</sup> May contain ginger, chamomile, and fennel.

<sup>d</sup> Includes chrysanthemum tea, clove oil, codonopsis astragalus, comfrey, elderberry tea, flax seed oil, garlic oil, goldenseal extract, grape extract, horehound tea, lemon tea, orange oil, orange tea, red raspberry tea, rosemary leaf tea, sambucol, slippery elm, and white oak bark.

**TABLE 4** Percentage of Mothers Who Reported Each Reason for Giving Their Infant DBS and Teas by Infant Age (Among Mothers Who Gave These Preparations)

Reason	Months 2–3	Months 4–6	Months 7–9	Months 10–12
<i>n</i>	90	99	58	60
Fussiness	56.7	54.6	56.9	30.0
Digestion aid	51.1	28.3	13.8	13.3
Colic	41.1	19.2	3.5	1.7
Relaxation aid	26.7	25.3	29.3	26.7
Teething	4.4	28.3	37.9	35.0
Cold or respiratory symptoms	5.6	9.1	10.3	31.7
Gas	6.7	7.1	0.0	0.0
Immune system stimulant	2.2	6.1	6.9	16.7
Diaper rash	4.4	1.0	0.0	1.7
Illness other than respiratory symptoms	0.0	1.0	5.2	6.7
Reflux	1.1	1.0	0.0	0.0
As a beverage	0.0	0.0	0.0	3.3
Other	0.0	4.0	0.0	1.7

Data were obtained from the Infant Feeding Practices Study II. Reason for giving DBS and teas was not asked in Month 1.

son given by 3.3% of mothers, consistent with the rise in unspecified tea given to the infant.

According to Table 5, the most commonly reported sources of information about DBS and teas were friends and relatives (30%), health care professionals (27%), and the media (27.6%). Mothers who received information from friends or relatives, health care professionals, and sales clerks were 3 to 5 times more likely to give their infants DBS and teas than mothers who did not receive information from these sources.

## DISCUSSION

This is the first study to estimate the prevalence of DBS and tea use in a sample of US infants, in contrast to use by children. We found that ~9% of infants were fed DBS and teas in their first year of life, a figure much higher than the 0.8% from the National Health and Nutrition Examination Survey,<sup>9</sup> the 3.9% from the National Health Interview Survey,<sup>10</sup> and the 5% found in a state-based representative sample.<sup>11</sup> We believe that the true national prevalence rate of infant use is somewhere

between 3% and 10%. The National Health and Nutrition Examination Survey estimate probably underestimated DBS use in children because it asked about dietary supplements in the context of dietary intake rather than of medicinal use. Furthermore, the underestimation might be because both the National Health and Nutrition Examination Survey and the National Health Interview Survey defined herbal supplements to exclude herbal tea, a form likely to be used by infants. The state-based estimate might also underestimate DBS use because of its limited list of medicinal herb products included in the question. Our study may overestimate use because we included unspecified tea, which may have been ordinary tea. However, our recall period of 2 weeks should have increased validity compared with the 3 above-mentioned studies, which required a much longer (30 days to 1 year) recall period. Our sample overrepresents certain demographic groups that may use DBS and teas more often, although our estimate of mothers' DBS and tea use is very similar to that for all adults reported from the nationally representative data (18.9% vs 17.7%).<sup>9</sup>

Consistent with previous studies on children, the Infant Feeding Practices Study II found that mothers who fed their infants DBS and teas were more likely to have used DBS themselves.<sup>11,12</sup> Also consistent with other studies, we found that Hispanic mothers were more likely to give DBS and teas to their infants than white mothers in our study.<sup>14</sup> This result was not found in the nationally representative study of children's DBS use,<sup>10</sup> but it is consistent with the study of herb use by WIC (Women, Infants, and Children program) participants.<sup>14</sup> Other studies also have documented DBS and teas use by Hispanic parents. For example, Hispanic parents tend to use herbal remedies to treat their children's



**TABLE 5** Percentage of Infants Ever Given DBS and Teas by Sources of Information ( $n = 2226$ )

Source of Information	Percentage	Percentage Given DBS and Teas
Friends or relatives, $P < .0001$		
Yes	30.0	22.2
No	70.0	4.6
Health care professionals, $P < .0001$		
Yes	27.0	20.8
No	73.0	5.8
Media, $P = .0019$		
Yes	27.6	13.0
No	72.4	8.6
Web site, $P < .0001$		
Yes	20.5	17.5
No	79.5	7.9
Labels, $P < .0001$		
Yes	18.2	16.1
No	81.8	8.5
Sales clerks, $P < .0001$		
Yes	5.8	28.1
No	94.3	8.7

Data were obtained from the Infant Feeding Practices Study II.  $P$  values are based on  $\chi^2$  tests.

asthma<sup>18</sup> and to use oil and tea for common ailments.<sup>19,20</sup> We also found that longer breastfeeding, a characteristic that has not previously been studied, was related to giving the infant DBS and teas. Studies have shown that infants could receive lead from breast milk indirectly if mothers are regular Chinese herb consumers.<sup>21</sup>

Unlike previous studies, we asked all mothers, not only DBS users, for their sources of information about DBS and teas. We found that the most commonly listed sources were friends or relatives (30%), the media (28%), and the health care professionals (27%). Two other studies found that ~80% of mothers who gave DBS and teas to their children listed family or friends as a source of information,<sup>13,14</sup> and 1 study found that media (31%) and medical professionals (13%) were

much less frequently listed than were family and friends.<sup>14</sup>

This study has several limitations. The Infant Feeding Practices Study II did not have a nationally representative sampling frame and required that mothers be able to read and write English and have a stable mailing address. Because the respondents who participated in the study overrepresented non-Hispanic white, older mothers of higher socioeconomic status, the results cannot be generalized to the overall US population of mothers or infants. Our results might overestimate the rate of DBS and tea use because some of these maternal characteristics are associated with increased DBS and tea use. In addition, we have no specific data for subgroups such as Asians and certain immigrant groups who are frequent DBS users them-

selves<sup>22</sup> and tend to use DBS and teas for their infant care<sup>23</sup> because of culture and tradition. The Infant Feeding Practices Study II did not target these groups, and they are not represented in our sample, so we do not have information on their unique beliefs and practices. We also do not have information on doses or the amount of the supplement or tea given to the infant. In addition, the question about specific DBS and teas given to the infant was open-ended, so some responses were too general to be coded into a specific category (for example, “tea”), and some products listed have different ingredients depending on the manufacturer.

The study has several important strengths, 1 of which is the short recall period of 2 weeks. The sample, although not representative, has other positive characteristics. These characteristics include the large sample size and the national distribution of healthy mothers and infants instead of focusing on children with chronic conditions or those sampled at health care facilities.

## CONCLUSIONS

Our study is the first to examine the prevalence of DBS and tea use among a sample of US infants. We found that ~9% of infants were given DBS and teas in their first year of life, although usually only for a short period of time. The wide variety of DBS and teas given to infants increases the likelihood that some are unsafe. Health care providers should recognize that infants under their care may receive a wide variety of different supplements and teas.

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