



June 28, 2001

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Division of Nutrition Science and Policy
Office of Nutritional Products, Labeling, and Dietary Supplements (HFS-800)
Food and Drug Administration
200 C Street, SW
Washington, DC 20204

Re: Further information regarding FDAMA notification on nutrient content claims for choline

Dr. Larsen:

Central Soya Company, Inc. hereby submits additional information and comments concerning our FDAMA notification regarding nutrient content claims for foods that contain choline.

First, we acknowledge that the specific nutrient content claims for choline requested in the notification (listed on page 3) for use in labeling to characterize the level of choline in a food or dietary supplement are not authorized until 120 days after submission of the notification unless FDA modifies or denies these claims. Additionally, the specific nutrient content claims for choline requested in the notification are not to be used to label products made for children less than two years of age or in infant formula.

Second, in Appendix A we provide considerable information on intake levels of choline given certain foods may be fortified with choline at levels to qualify for certain claims in the notification. We conclude that fortification of yogurt, milk-based fluids, egg substitutes, meat substitutes, whole wheat breads, multigrain breads, muffins, bars, and salad dressings (regular and low-calorie) at either 55 mg/serving or 110 mg/serving results in intakes that are within the Tolerable Upper Intake Level (UL) of choline for all age groups, including children ages 4 to 8 years. We estimate that fortifying the foods mentioned above with 110 mg choline per serving results in an average per capita choline intake for children ages 4 to 8 years of 620 mg/day. The 95th and 99th percentile per capita intake estimates of choline for children ages 4 to 8 years are 768 and 918 mg choline/day, respectively. The estimates of average intake for users, ages 4 to 8 years, would be 661 mg choline/day and the 95th and 99th percentile intakes among these users would be 839 and 948 mg choline per day, respectively. Based on work in our applications laboratory, choline fortification above the qualifying level for an "excellent

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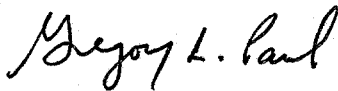
source of" claim (110 mg of choline per Reference Amount Customarily Consumed (RACC)) produces perceptible changes in flavor and texture characteristics that may be perceived by some manufacturers as undesirable. Thus, we feel that the 110 mg per RACC is a realistic representation of an upper level of fortification for the foods we project to be logical carriers for choline. However, since we cannot assure that the foods listed above will be the only foods fortified with choline, we suggest that when FDA finalizes its response to the FDAMA notification that FDA indicate that it plans to monitor choline fortification to ensure no safety issues arise.

Third, in the notification, we suggested that 550 mg/day be considered the "Reference Daily Intake" (RDI) for choline. We understand that an RDI for choline has yet to be established, and that a more appropriate term should be "Daily Consumption Value." Accordingly, it is more appropriate for manufacturers to use the term "Daily Consumption Value" in labeling when informing consumers about daily choline needs. In addition, manufacturers should also be aware that when an RDI for choline is established by FDA in the future, the amount of choline required per RACC to make a nutrient content claim could change from the "Daily Consumption Value" of 550 mg/day.

Finally, relative claims for choline will be used in accordance to § 101.54 (e). Manufacturers should be consistent with §§ 101.54 (e) (iii) (A), (B), and (B) (2) for use of accompanying information when relative claims are used in labeling individual foods, meal products, or main dish products.

If you have any questions on these comments or the information provided, please feel free to contact me. Thank you for consideration of this material.

Sincerely,



Gregory L. Paul, Ph.D.
Director Nutrition Science



Terrence E. Quinlan
Corporate Counsel

APPENDIX A. ESTIMATED CHOLINE INTAKE

INTRODUCTION

This document attempts to describe the impact of choline fortification on choline intake by Americans. Particular emphasis is placed on children 4-8 years of age, as this group has a narrow range between the Adequate Intake of 250 mg/day and a Tolerable Upper Intake Level (UL) of 1000 mg/day as reported by the Food and Nutrition Board (FNB) in Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B₆, Folate, Vitamin B₁₂, Pantothenic Acid, Biotin, and Choline.

To estimate the impact of fortification, various food/food groups were identified as logical carriers for choline. These food/food groups were yogurt, milk-based fluids, egg substitutes, meat substitutes, whole wheat breads, multigrain breads, muffins, bars, and salad dressings (regular and low-calorie). To model the impact of fortification, the food nutrient database was modified such that the above-mentioned foods contained either 55 mg choline per serving or 110 mg choline per serving. The intake profile (amount and frequency) by individuals in USDA's Continuing Survey of Food Intakes by Individuals (CSFII), 1994-1996 and 1998 was then used to calculate the additional choline intake from fortification of the above-mentioned foods with either 55 or 110 mg choline per serving.

We also estimated current choline intake (prior to fortification) in children ages 4 to 8 years. No data were provided for choline intake of children in the FNB report. Since CSFII and other databases do not contain choline content of foods, we needed to make a series of assumptions to generate an estimate of choline intake in children. Choline intake was estimated to be 730 to 1040 mg/day in adults consuming a typical U.S. diet according to the FNB report. We estimated choline intake in children by developing a ratio of choline intake between adults and children ages 4 to 8 years for four foods – total meats, eggs, nuts and table spreads. These foods were selected as they all had greater than 0.1 mg/g of choline as reported by Zeisel and Blusztajn (1994) and presented in our FDAMA notification.¹ We assumed all meats had 0.479 mg/g choline (even though the only meat reported by Zeisel and Blusztajn was beef steak). We also assumed all table spreads were butter (0.164 mg/g choline) and we used the peanut value (0.418 mg/g) to estimate choline from nuts. The adult intake (males and females 20 years and older) data came from USDA's CSFII 1994-1996, while the children (ages 9 and below) intake data came from USDA's CSFII 1998. The data used are shown in Table 1 and are described below.

¹ The only other foods with greater than 0.1 mg/g choline were cauliflower and organ meats. CSFII did not allow a clear distinction on the amount of cauliflower consumed by adults or children and organ meat consumption estimates were considered not statistically reliable.

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RESULTS

We first had to combine information from males and females into one adult value. This was done by multiplying the intake amounts for males and females by their respective percentage of the adult population and adding the products to create a value for all adults greater than 20 years of age.² We completed this for each of the four indicator foods and totaled the choline intake from these foods for both adults and children. We then calculated a ratio of choline intake from these indicator foods among adults and children (0.556). Thus, it appears children consume about 56% of the choline from these foods as adults. Applying the same logic across all foods, then total choline intake in children ranges from 406 to 578 mg/day.³

The impact on additional choline intake of fortification of the certain foods at two different levels, 55 or 110 mg/serving are presented in tables 2 through 5. While we provide the data for fortification of these foods at 55 mg/serving we will only be discussing tables 4 and 5, which contain estimates of additional choline intake from fortification of certain foods at 110 mg/serving. Also, for reasons mentioned above we will limit our discussion to the impact of choline fortification at 110 mg/serving on children 4 to 8 years of age. Table 4 presents the per capita intake estimates of additional choline intake for foods modified to contain 110 mg/serving. The average increase in intake for all the foods selected was 42.3 mg choline per day for children ages 4 to 8. The 95th and 99th percentile estimates of additional choline intake in these children were 189.7 and 340.1 mg/day, respectively. Table 5 shows estimates of additional choline intake for users of these products (eliminates non-users that are in the per capita estimates). The average increase in users, ages 4 to 8 years, from fortification of these foods with 110 mg choline per serving was 83.3 mg/day. The 95th and 99th percentile intake estimates for these children were 261.3 and 369.7 mg choline per day, respectively.

Combining the highest estimate of current intake of choline by children ages 4 to 8 years with the estimates of additional choline expected from fortifying certain foods with 110 mg choline per serving results in per capita choline intake estimates for children ages 4 to 8 years of 620 mg/day on average. The 95th and 99th percentile per capita intake estimates for these children would be 768 and 918 mg choline/day, respectively. The estimates of average intake for users, aged 4 to 8 years, would be 661 mg choline/day and the 95th and 99th percentile intakes among these users would be 839 and 948 mg choline per day, respectively. All of these intakes are below the UL established for children 4 to 8 years of age of 1000 mg/day.

² For example to calculate choline intake from total meats for all adults 20 years and older we multiplied the value for males of 269 g/day by 0.479 and added the result to the value for females of 166 g/day multiplied by 0.521.

³ Calculated as 730 mg/day * 0.556 = 405.7 mg/day and 1040 mg/day * 0.556 = 578.0 mg/day.

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DISCUSSION

To estimate choline intake for children ages 4 to 8 years we used a few indicator foods to create a ratio of choline intake among children and adults. We used this ratio (0.556) to adjust the average adult intake reported by FNB to estimate choline intake of children ages 4 to 8 years. While the ratio was developed using only a few foods, the ratio agrees with the ratio of Adequate Intakes of children and adults (adjusted for population percentages for males and females) reported by FNB, namely 0.516.⁴

Adding current estimates of choline intake to those suggested from fortification of certain foods show that the UL is not exceeded for any age group, including children ages 4 to 8. These estimates are also probably a worse case scenario. We assumed that 100% of the foods listed would be fortified with choline at 110 mg/serving. First, it is unlikely that all foods in any category would be fortified with choline. Some manufacturers would have no interest in adding choline. Second, it is not likely that all manufacturers of these foods would fortify with 110 mg/serving if they did decide to add choline to their products. Additionally, we assumed users consumed all the categories of foods in a day. Not all users of whole wheat bread will also consume multigrain bread in the same day. Also, users of regular salad dressing most likely will not be using a low-calorie dressing in the same day and vice versa. So again we have calculated a worse case scenario.

Finally, we cannot assure that the foods listed in the tables will be the only foods fortified with choline. Thus, we suggest that when FDA finalizes its response to the FDAMA notification that FDA indicate that it plans to monitor choline fortification to ensure no safety issues arise.

⁴ Calculated as the AI for children ages 4 to 8 years divided by the sum of the products of the adult AI values multiplied by their respective percentage of the population $[250/(550 * 0.479 + 425 * 0.521)]$.

**APPENDIX A.
ESTIMATED CHOLINE INTAKE**

Table 1. Estimate of Choline Intake in Children

ADULTS					
Estimated Choline intake, mg/d	730-1040				
Percent of Population		Percent of Adults			
Males, 20+ years	0.339	0.479			
Females, 20+ years	0.368	0.521			
Choline Intake of Indicator Foods					
	Males, 20+	Females, 20+	Total Adult Intake¹	Choline Content, mg/g	Choline Intake. mg/day
Total Meat, g/day	269	166	215.4	0.479	103.2
Eggs, g/day	24	16	19.8	3.967	78.7
Nuts, g/day	4	6	3.5	0.418	1.5
Table Fats, g/day	5	4	4.5	0.164	0.7
				TOTAL	184.0
CHILDREN					
Total Meat, g/day			110	0.479	52.7
Eggs, g/day			12	3.967	47.6
Nuts, g/day			4	0.418	1.7
Table Fats, g/day			2	0.164	0.3
				TOTAL	102.3
Ratio of choline intake	0.556				
Estimated choline intake in children, mg/day	405.7-578.0				

¹ From CSFII, 1994-1996 Tables 9.5 and 9.6 and CSFII, 1998 Tables 13B and 14A.

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**Table 2. Per Capita Daily Intake Estimates of Choline: Assuming Fortification Level of 55 mg Choline Per Serving
(mg choline/day)**

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Children 1 to 3											
Mean	3.0	0.0	0.1	0.3	6.2	0.9	0.8	1.6	2.4	0.3	15.5
25th Percentile	0.0	NA ⁵	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75th Percentile	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.6
90th Percentile	13.7	NA	NA	0.0	0.0	0.0	0.0	0.0	7.9	0.0	50.7
95th Percentile	23.6	NA	NA	0.0	53.5	0.0	0.0	10.5	15.4	0.0	79.2
99th Percentile	46.4	NA	NA	0.0	106.3	29.4	26.0	40.1	37.3	11.7	141.9
Children 4 to 8											
Mean	2.5	0.1	NRC ⁶	0.7	8.2	1.0	1.3	1.8	4.6	1.0	21.1
25th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
75th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	3.9	0.0	28.6
90th Percentile	3.9	0.0	NRC	0.0	30.6	0.0	0.0	0.0	16.7	0.0	66.0
95th Percentile	20.9	0.0	NRC	0.0	64.0	0.0	0.0	20.2	27.9	4.2	94.8
99th Percentile	46.0	0.0	NRC	25.6	125.8	45.7	36.1	43.2	45.8	32.7	170.0
Children 9 to 13											
Mean	2.0	0.1	NRC	1.1	7.2	0.8	2.0	2.4	7.5	1.5	24.5
25th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
75th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	6.8	0.0	33.7
90th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	27.5	0.0	74.6
95th Percentile	18.0	0.0	NRC	0.0	62.6	0.0	0.0	23.3	41.3	8.1	112.1
99th Percentile	42.8	0.0	NRC	46.5	136.0	32.8	48.0	54.7	92.8	49.6	184.7

⁵ NA= Not Applicable. The number of respondents is too small to calculate a distribution.

⁶ NRC= No Reported Consumption. No respondent reported consuming these foods.

APPENDIX A. ESTIMATED CHOLINE INTAKE

**Table 2. Per Capita Daily Intake Estimates of Choline: Assuming Fortification Level of 55 mg Choline Per Serving (Cont'd)
(mg choline/day)**

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Adolescents 14 to 18											
Mean	2.4	0.2	NRC	1.2	8.2	1.3	2.4	1.7	11.2	2.2	30.7
25th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	14.5	0.0	43.7
90th Percentile	0.0	0.0	NRC	0.0	14.0	0.0	0.0	0.0	33.3	0.0	96.7
95th Percentile	5.6	29.1	NRC	0.0	63.9	0.0	5.3	0.0	51.2	7.4	150.5
99th Percentile	67.5	77.3	NRC	45.4	144.9	41.3	68.2	47.7	116.3	68.6	224.4
Adults 19 and older											
Mean	3.7	0.33	0.05	1.1	12.8	2.8	2.2	1.4	14.1	3.8	42.3
25th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.8
75th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1	0.0	61.3
90th Percentile	0.0	0.0	0.0	0.0	58.0	0.0	0.0	0.0	49.5	8.1	122.6
95th Percentile	29.1	0.0	0.0	0.0	82.6	0.0	10.4	0.0	69.1	29.0	162.6
99th Percentile	77.3	0.0	0.0	44.5	183.7	85.5	57.4	49.2	119.2	77.2	275.8

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**Table 3. Per User Daily Intake Estimates of Choline: Assuming Fortification Level of 55 mg Choline Per Serving
(mg choline/day)**

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Children 1 to 3											
Mean	21.4	25.4	137.5	29.7	53.1	41.1	24.4	28.2	11.6	10.2	34.2
25th Percentile	13.4	NA	NA	16.7	28.3	18.1	14.1	18.7	4.3	3.4	9.6
50th Percentile	17.3	NA	NA	24.7	43.7	26.4	23.2	25.0	7.1	7.0	23.3
75th Percentile	28.0	NA	NA	27.9	66.5	53.3	27.0	30.6	14.9	13.9	45.4
90th Percentile	38.4	NA	NA	48.6	98.2	102.9	45.2	48.7	29.1	24.2	82.0
95th Percentile	52.7	NA	NA	80.1	126.0	111.0	53.5	56.5	36.0	28.3	110.1
99th Percentile	70.7	NA	NA	101.2	180.6	117.5	83.8	107.3	55.7	40.5	171.9
Children 4 to 8											
Mean	24.1	30.2	NRC	40.4	63.1	49.0	31.0	30.7	15.6	16.2	41.7
25th Percentile	14.1	11.6	NRC	20.0	31.7	25.2	22.4	23.4	4.9	4.7	13.5
50th Percentile	20.4	20.7	NRC	26.7	60.7	45.2	25.9	27.7	14.0	13.2	28.0
75th Percentile	29.5	33.1	NRC	51.8	68.9	56.2	35.9	33.9	23.1	23.0	57.2
90th Percentile	44.9	46.2	NRC	73.9	113.1	99.5	53.0	51.2	30.7	41.8	93.8
95th Percentile	59.1	50.6	NRC	88.6	140.7	110.0	69.3	54.6	37.9	47.5	130.7
99th Percentile	84.1	54.1	NRC	122.5	181.7	117.6	95.6	82.8	64.1	69.0	184.8
Children 9 to 13											
Mean	28.0	28.4	NRC	57.8	76.0	50.7	40.1	34.1	23.1	20.2	45.7
25th Percentile	16.3	16.7	NRC	37.9	52.0	22.0	25.3	21.8	7.7	5.9	13.9
50th Percentile	26.5	26.7	NRC	47.9	63.4	46.4	30.7	29.4	15.0	10.9	29.3
75th Percentile	37.1	29.3	NRC	76.7	86.7	58.6	43.7	44.0	29.7	26.7	60.6
90th Percentile	45.5	33.5	NRC	94.6	137.8	87.8	65.1	58.4	52.6	58.5	107.2
95th Percentile	57.7	35.0	NRC	100.5	162.4	98.8	73.1	63.3	69.4	69.1	143.2
99th Percentile	82.7	36.2	NRC	106.7	220.3	107.8	122.0	96.5	110.8	73.4	203.6

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**Table 3. Per User Daily Intake Estimates of Choline: Assuming Fortification Level of 55 mg Choline Per Serving (Cont'd)
(mg choline/day)**

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Adolescents 14 to 18											
Mean	45.4	61.6	NRC	45.7	78.3	63.1	45.7	33.4	28.7	33.9	58.3
25th Percentile	23.8	33.9	NRC	17.9	49.4	22.7	24.2	23.3	11.6	9.9	17.1
50th Percentile	37.0	61.3	NRC	37.0	63.1	40.3	27.4	29.0	19.9	16.6	39.8
75th Percentile	60.6	70.9	NRC	48.2	96.4	58.1	48.0	42.1	33.9	58.0	76.4
90th Percentile	84.8	72.2	NRC	88.1	142.6	106.7	98.1	56.5	55.6	78.1	147.6
95th Percentile	94.6	72.6	NRC	99.4	166.2	116.0	130.3	62.3	84.5	118.8	176.7
99th Percentile	141.2	72.9	NRC	152.6	246.2	132.5	161.7	78.2	174.5	135.1	253.6
Adults 19 and older											
Mean	39.6	48.5	54.3	53.6	82.3	69.5	41.7	41.2	34.4	31.6	66.9
25th Percentile	21.9	34.6	33.5	23.6	52.3	37.2	25.6	25.5	13.8	13.4	26.1
50th Percentile	29.7	38.8	50.1	43.6	63.7	54.8	33.6	30.4	26.9	27.3	53.5
75th Percentile	47.1	57.6	60.8	71.4	104.2	85.5	51.8	52.7	49.0	40.9	91.6
90th Percentile	78.8	76.1	70.6	97.8	156.4	116.7	72.1	77.7	73.8	68.7	143.0
95th Percentile	94.2	125.8	90.4	145.1	194.6	172.5	93.8	96.7	100.1	93.2	189.9
99th Percentile	166.0	140.8	128.1	204.9	321.7	258.4	137.6	123.1	150.0	147.1	300.0

APPENDIX A.
ESTIMATED CHOLINE INTAKE

**Table 4. Per Capita Daily Intake Estimates of Choline: Assuming Fortification Level of 110 mg Choline Per Serving
(mg choline/day)**

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Children 1 to 3											
Mean	5.9	0.1	0.1	0.5	12.4	1.7	1.5	3.1	4.9	0.6	31.0
25th Percentile	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75th Percentile	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.2
90th Percentile	27.4	NA	NA	0.0	41.6	0.0	0.0	0.0	15.8	0.0	101.5
95th Percentile	47.1	NA	NA	0.0	107.0	0.0	0.0	21.0	30.7	0.0	158.4
99th Percentile	92.9	NA	NA	0.0	212.6	58.9	52.0	80.1	74.7	23.3	283.8
Children 4 to 8											
Mean	5.0	0.1	0.0	1.4	16.4	2.0	2.5	3.7	9.2	1.9	42.3
25th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
75th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0	57.2
90th Percentile	7.9	0.0	0.0	0.0	61.3	0.0	0.0	0.0	33.4	0.0	131.9
95th Percentile	41.7	0.0	0.0	0.0	127.9	0.0	0.0	40.4	55.7	8.4	189.7
99th Percentile	91.9	0.0	0.0	51.2	251.5	91.4	72.2	86.4	91.5	65.3	340.1
Children 9 to 13											
Mean	3.9	0.1	NRC	2.2	14.3	1.6	3.9	4.8	15.1	3.1	49.1
25th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
75th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	13.6	0.0	67.3
90th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	55.1	0.0	149.1
95th Percentile	36.1	0.0	NRC	0.0	125.2	0.0	0.0	46.5	82.7	16.3	224.2
99th Percentile	85.6	0.0	NRC	93.1	271.9	65.7	96.0	109.5	185.7	99.3	369.3

APPENDIX A.
ESTIMATED CHOLINE INTAKE

Table 4. Per Capita Daily Intake Estimates of Choline: Assuming Fortification Level of 110 mg Choline Per Serving (Cont'd)
(mg choline/day)

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Adolescents 14 to 18											
Mean	4.7	0.4	NRC	2.5	16.5	2.6	4.7	3.3	22.3	4.4	61.4
25th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9
75th Percentile	0.0	0.0	NRC	0.0	0.0	0.0	0.0	0.0	29.0	0.0	87.4
90th Percentile	0.0	0.0	NRC	0.0	28.0	0.0	0.0	0.0	66.5	0.0	193.4
95th Percentile	11.2	0.0	NRC	0.0	127.8	0.0	10.7	0.0	102.4	14.7	301.1
99th Percentile	135.0	0.0	NRC	90.7	289.9	82.5	136.4	95.3	232.6	137.1	448.8
Adults 19 and older											
Mean	7.4	0.7	0.1	2.3	25.6	5.6	4.4	2.7	28.2	7.6	84.6
25th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.5
75th Percentile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.1	0.0	122.6
90th Percentile	0.0	0.0	0.0	0.0	115.9	0.0	0.0	0.0	98.9	16.2	245.3
95th Percentile	58.3	0.0	0.0	0.0	165.2	0.0	20.9	0.0	138.2	57.9	325.2
99th Percentile	154.5	0.0	0.0	88.9	367.4	171.0	114.9	98.4	238.4	154.4	551.6

**APPENDIX A.
ESTIMATED CHOLINE INTAKE**

**Table 5. Per User Daily Intake Estimates of Choline: Assuming Fortification Level of 110 mg Choline Per Serving
(mg choline/day)**

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Children 1 to 3											
Mean	42.8	50.7	275.0	59.5	106.1	82.2	48.7	56.4	23.1	20.4	68.5
25th Percentile	26.9	NA	NA	33.4	56.6	36.1	28.2	37.4	8.6	6.7	19.1
50th Percentile	34.6	NA	NA	49.3	87.3	52.7	46.3	50.0	14.3	14.0	46.7
75th Percentile	56.0	NA	NA	55.7	133.1	106.5	53.9	61.3	29.9	27.8	90.9
90th Percentile	76.8	NA	NA	97.3	196.3	205.9	90.4	97.4	58.3	48.5	164.1
95th Percentile	105.4	NA	NA	160.3	252.1	222.0	106.9	113.1	71.9	56.6	220.2
99th Percentile	141.5	NA	NA	202.5	361.1	234.9	167.5	214.6	111.4	81.0	343.7
Children 4 to 8											
Mean	48.2	60.5	0.0	80.8	126.1	97.9	62.0	61.3	31.2	32.3	83.3
25th Percentile	28.3	23.2	0.0	39.9	63.5	50.5	44.9	46.9	9.8	9.3	26.9
50th Percentile	40.8	41.4	0.0	53.3	121.4	90.5	51.8	55.3	28.0	26.5	56.1
75th Percentile	59.0	66.1	0.0	103.6	137.8	112.3	71.7	67.7	46.2	46.0	114.4
90th Percentile	89.7	92.4	0.0	147.7	226.2	199.0	106.0	102.4	61.4	83.6	187.6
95th Percentile	118.2	101.2	0.0	177.1	281.5	220.1	138.6	109.2	75.8	95.0	261.3
99th Percentile	168.2	108.2	0.0	245.0	363.4	235.3	191.3	165.7	128.1	138.0	369.7
Children 9 to 13											
Mean	56.1	56.9	NRC	115.5	152.1	101.4	80.1	68.3	46.2	40.4	91.4
25th Percentile	32.6	33.4	NRC	75.8	104.1	43.9	50.5	43.6	15.4	11.9	27.9
50th Percentile	53.1	53.4	NRC	95.9	126.8	92.7	61.3	58.9	29.9	21.9	58.7
75th Percentile	74.2	58.6	NRC	153.3	173.3	117.1	87.3	88.0	59.5	53.5	121.2
90th Percentile	91.1	67.1	NRC	189.1	275.6	175.6	130.2	116.9	105.1	117.1	214.4
95th Percentile	115.4	70.0	NRC	201.1	324.8	197.7	146.2	126.6	138.9	138.1	286.3
99th Percentile	165.4	72.4	NRC	213.4	440.5	215.5	244.0	192.9	221.6	146.9	407.2

APPENDIX A.
ESTIMATED CHOLINE INTAKE

Table 5. Per User Daily Intake Estimates of Choline: Assuming Fortification Level of 110 mg Choline Per Serving (Cont'd)
(mg choline/day)

	Yogurt	Milk Based Fluids	Egg Substitutes	Meat Substitutes	Whole Wheat Breads	Multigrain Breads	Other Muffins	Bars	Regular Salad Dressing	Low-Calorie Salad Dressing	Total
Adolescents 14 to 18											
Mean	90.8	123.2	NRC	91.4	156.7	126.1	91.4	66.9	57.3	67.8	116.5
25th Percentile	47.6	67.9	NRC	35.8	98.9	45.3	48.5	46.7	23.1	19.8	34.2
50th Percentile	73.9	122.6	NRC	73.9	126.2	80.6	54.7	58.1	39.8	33.2	79.6
75th Percentile	121.3	141.7	NRC	96.5	192.7	116.2	96.1	84.3	67.8	116.1	152.8
90th Percentile	169.5	144.3	NRC	176.2	285.2	213.4	196.2	113.0	111.2	156.3	295.1
95th Percentile	189.1	145.2	NRC	198.8	332.5	232.1	260.5	124.5	169.0	237.6	353.5
99th Percentile	282.4	145.9	NRC	305.3	492.5	265.0	323.4	156.3	349.0	270.3	507.1
Adults 19 and older											
Mean	79.2	97.0	108.5	107.1	164.5	139.0	83.4	82.4	68.8	63.2	133.9
25th Percentile	43.8	69.2	67.0	47.2	104.6	74.4	51.1	51.0	27.6	26.7	52.2
50th Percentile	59.4	77.6	100.2	87.2	127.3	109.7	67.2	60.9	53.8	54.6	107.0
75th Percentile	94.2	115.2	121.6	142.9	208.4	171.0	103.6	105.4	98.1	81.9	183.3
90th Percentile	157.6	152.3	141.2	195.6	312.9	233.4	144.2	155.4	147.5	137.3	286.1
95th Percentile	188.4	251.7	180.9	290.2	389.1	345.0	187.6	193.4	200.3	186.3	379.8
99th Percentile	332.1	281.7	256.2	409.9	643.4	516.9	275.1	246.1	300.1	294.2	600.0