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Technical Issue Paper

Age Group Recommendations for Assessing Childhood Exposure and the Adequacy of Existing Exposure Factors Data for Children

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EXECUTIVE SUMMARY

In keeping with initiatives such as the Food Quality Protection Act of 1996 and Executive Order 13045, EPA has been investigating ways to improve the assessment of childhood risks from exposure to environmental contaminants. In July 2000, a workshop was convened by EPA to explore how to consider age-related changes in behavior and anatomy when assessing risks to children. The discussions and findings of the workshop are presented in the document *Summary Report of the Technical Workshop on Issues Associated with Considering Developmental Changes in Behavior and Anatomy When Assessing Exposure to Children* (EPA/630/R-00/005). The current technical issue paper was prepared to provide additional expert input for issues raised during the July 2000 workshop. In particular, this issue paper explores whether existing exposure factors data can be used to address childhood age groups derived from the July 2000 discussions.

Typically, Agency assessors have classified individuals under the age of 21 years as youth or children. However, how to subdivide this group to capture important developmental milestones has been somewhat elusive. To that end, participants in the July 2000 workshop concluded that, although development occurs along a continuum, age groups (or bins) can be useful as a guide for the development of exposure scenarios for children. Because children's behavior, such as crawling and mouthing of hands and objects, changes during the early life stages, dermal and oral exposures vary. Similarly, physiological changes affect children's exposures and their susceptibility to certain health effects. Two workshop subgroups, one addressing behavioral development and the other addressing anatomical changes, presented recommendations for age groups. The age groups considered in this issue paper were derived from those recommendations and include:

Less than 1 month
1 through 2 months
3 through 5 months
6 through 11 months
1 through 2 years
3 through 5 years
6 through 10 years
11 through 15 years
16 through 17 years

Prenatal development was outside the scope of the workshop discussions and of this issue paper.

This issue paper explores whether existing child-specific exposure factors data can be fit to the proposed EPA age groupings. The authors evaluated the exposure factors — breast milk intake, food intake, drinking water and total fluid intake, soil ingestion and pica, non-dietary ingestion factors, inhalation factors, skin surface area and soil adherence to skin (dermal), activity factors, and body weight — against the exposure factors recommended in the draft *Child-Specific Exposure*

Factors Handbook (CSEFH). Where reevaluation of the underlying data was possible and productive, the authors recommended new exposure factors for the proposed age groups. The authors also discussed the quality of the data provided by the key studies used in developing the CSEFH. Where reevaluation of exposure factors data was not possible or would not support new recommendations for the proposed age groups, the authors addressed the uncertainties that would be introduced if the existing data were used. The authors evaluated the data (new and existing) using the same characterization criteria used in the CSEFH.

In each section the author evaluated existing data, described the studies he or she selected for analysis to obtain new recommendations, recommended exposure factors data for the proposed age bins based on new analysis or reanalysis, and recommended additional research and analysis needs. The availability of recommendations and the recommended values for the proposed age bins are presented in Tables 1 and 2, respectively.

Chapter 2: Breast Milk Intake, Nursing Duration, and Fat Composition of Human Milk

Breast milk is a potential source of exposure to toxic substances for nursing infants. Lipid-soluble chemical compounds may accumulate in body fat and may be transferred to breast-fed infants in the lipid portion of breast milk. Because nursing infants obtain most (if not all) of their dietary intake from breast milk, they are especially vulnerable to exposures to these compounds. Estimating the magnitude of the potential dose to infants and the duration of that exposure requires information on the milk intake rate (quantity of breast milk consumed per day) and the duration over which breast-feeding occurs. Information about the fat composition of breast milk is also needed to estimate the possible concentration of the chemical moieties in the milk. The delivered dose of toxic chemical can then be estimated from breast milk residue concentrations that have been indexed to lipid content.

The author evaluated several studies that were used in developing the CSEFH to determine those with data applicable to the EPA proposed age bins. Study designs varied, but they typically comprised fairly small cohorts. The most typical measurement tool used in the studies was the test weighing methodology, in which infant weights were recorded prior to and after feeding.

Table 1. Availability of Recommendations for the Proposed Age Bins

Considerations	Age Bins: <1 Month	1-2 Months	3-5 Months	6-11 Months	1-2 Years	3-5 Years	6-10 Years	11-15 Years	16-17 Years
Breast Milk Intake	✓[a]	✓	✓	✓	—[b]	—	—	—	—
Food Intake[c]	—	✓	✓	✓	✓	✓	✓	✓	✓
Drinking Water and Total Fluids	—	—	—	✓	✓	✓	✓	✓	✓
Soil Ingestion	—	—	—	—	✓	✓	✓	—	—
Pica	—	—	—	—	—	—	—	—	—
Non-Dietary Factors	—	—	—	—	—	—	—	—	—
Inhalation Route	—	—	—	—	—	✓	✓	✓	✓
Dermal Route									
Surface Area	—	—	—	—	—	—	—	—	—
Soil Adherence[d]	✓	✓	✓	✓	✓	✓	✓	✓	✓
Activity Factors	—	—	—	—	✓	✓	✓	—	—
Body Weight	✓	✓	✓	✓	✓	✓	✓	✓	✓

[a] ✓ = Recommendation is available.
[b] — = Recommendation not available.
[c] Note that the sample sizes are small for some of the age groups, most notably <1 month. Recommendations cannot be made for age groups <1 month. For most food categories, a recommendation cannot be made for age groups 1-2 months and 3-5 months.
[d] The same factor value is recommended for all age bins.

Table 2. Summary of Exposure Factor Recommendations

Breast Milk	Intake (g/day)	
<1 month	650	
1-2 months	680	
3-5 months	780	
6-11 months	740	
12 months	410	
Breast Milk Fat Intake		
All age bins	4% lipid content	
Food Intake	**Per Capita Intake**	**Consumer Only**
Total diet & major food groups	Tables 3-3 and 3-3a	
Individual foods	Table 3-4	
Various USDA food categories	Table 3-5	
Exposed/protected fruits/vegetables	Table 3-6	
Major food groups	Tables 3-7 and 3-7a	Tables 3-8 and 3-8a
Contribution of Major Food Group to Total Dietary Intake	Tables 3-9 through 3-14	
Drinking Water	**Mean**	**95th Percentile**
	Direct Ingestion (mL/person/day)	
6-11 months	96	–
1-2 years	184	677
3-5 years	274	880
6-10 years	317	1,030
11-15 years	414	1,531
16-17 years	531	2,618
	Indirect Ingestion (mL/person/day)	
6-11 months	316	–
1-2 years	129	432
3-5 years	145	458
6-10 years	136	482
11-15 years	180	629
16-17 years	531	2,618
	Direct and Indirect Ingestion (mL/person/day)	
6-11 months	412	–
1-2 years	313	942
3-5 years	420	1,165
6-10 years	453	1,219
11-15 years	594	1,722
16-17 years	760	2,062

Table 2. Summary of Exposure Factor Recommendations (continued)

Soil Ingestion	Ingestion Rate (mg/day)		
	Mean	Median	90^{th} Percentile
1-2 years	30	24	100
3-5 years	30	20	150
6-10 years	71	37	187

Inhalation	Mean Inhalation Rate (m^3/day)		
	Male	Female	Male and Female
3-5 years	–	–	14
6-10 years	14	12	–
11-15 years	14	13	–
16-17 years	16	12	–

Dermal Soil Adherence	
All age bins	Use same values recommended in CSEFH (Table 8-8)

Activity Factors	Time Spent (hrs/day)				
Microenvironment	Indoors at Home	Outdoors at home	Indoors at School	Outdoors at Park	In Vehicle
1-2 years	18.6	1.9	5.5	2.0	1.2
3-5 years	17.2	2.3	5.4	1.8	1.3
6-10 years	15.7	2.3	6.0	2.0	1.2

Macroactivity in Home Microenvironment	Eat	Sleep or Nap	Shower or Bathe	Play Games	Watch TV or Listen to Radio	Read, Write, Home-work	Think, Relax, Passive
1-2 years	1.4	11.8	0.5	3.2	2.0	0.6	1.8
3-5 years	1.1	10.9	0.5	2.5	2.5	0.8	1.1
6-10 years	1.0	9.9	0.4	1.9	2.8	1.1	0.8

Body Weight	Male: Mean at 50^{th} Percentile	Female: Mean at 50^{th} Percentile	Average Male/ Female Value
0-1 month	4.00	3.80	3.90
1-2 months	4.88	4.54	4.71
3-5 months	6.72	6.15	6.43
6-11 months	9.04	8.28	8.66
1-2 years	11.53	10.80	11.16
3-5 years	16.27	15.83	16.05
6-10 years	25.86	25.95	25.90
11-15 years	45.77	45.41	45.59
16-17 years	62.84	54.54	58.69

The author selected four studies (cross-sectional or longitudinal) for analysis and made recommendations for the proposed age bins birth to 1 month, 1 to 2 months, 3 to 5 months, 6 to 11 months, and 12 months on the basis of one or more of the studies. In general, the author expanded the results of studies of homogeneous populations with small cohorts to a large, diverse U.S. population, so exact time-weighted averages or statistical boundaries could not be calculated for those values. The author derived estimates of intake for various age groups by calculating averages across the findings in different studies or by deriving time-weighted averages across time periods. The author recommended data for breast milk fat concentrations using two studies with narrowly defined populations and different analysis methodologies, which made it difficult to extrapolate the values across the population for all age groups and durations.

Recommendations for further analysis and research needs included the need to (1) consider the major ethnic groups in the U.S. population to estimate the variability across the population for milk intake as a function of age and/or infant weight (new studies are needed on black, Asian, and Hispanic mother/infant groups); and (2) estimate the effect of nutrient status of the mother before and during lactation on the fat content of the milk. Data are needed on the types of lipids that may change because of these variables and the mobility of such lipids in the milk during lactation.

Chapter 3: Food Intake

Children's exposure from food ingestion may differ from that of adults because of differences in the types and amounts of food eaten. Exposure also may differ because the intake per unit body weight is greater for children than for adults. The author reevaluated the data used in the CSEFH to provide food intake rates for the proposed age groups of interest to the Risk Assessment Forum. The reevaluation included intake rates for various food groups and individual foods, as well as for the total dietary analysis. The chapter did not reevaluate some CSEFH data, including intake rates for home-produced foods, serving sizes, or fish intake.

The primary source used by the CSEFH for recent information on consumption rates of foods among children was the U.S. Department of Agriculture's (USDA) 1994-96 *Continuing Survey of Food Intakes by Individuals* (CSFII). The 1994-96 CSFII used a stratified statistical sampling technique designed to ensure that all seasons, geographic regions, and demographic and socioeconomic groups were represented. The survey included individuals of all ages living in selected households in the 50 States and Washington, D.C. Individual data was for 2 non-consecutive days, based on 24-hour recall (76 percent response rate). Approximately 15,000 individuals provided intake data over the 3 survey years. Because of the relatively large sample size in the 1994-96 CSFII data set, the author was able to reanalyze the CSFII data to generate intake rates for the proposed age groups. The resulting number of observations in some of the new age groups were lower than in the original CSEFH analysis.

The author addressed the uncertainties resulting from new exposure data values that have been generated from short-term data. Although the data are suitable for estimating mean average daily intake rates representative of both short-term and long-term consumption, the distribution of average daily intake rates generated using short-term data (e.g., 2-day) does not necessarily reflect the long-term distribution of average daily intake rates. Other variations occur that affect the applicability of the data, and the author noted that the small sample sizes used in the reanalysis affect the confidence ratings for data for children less than 1 year of age.

The author recommended that, although 1994-96 CSFII data were used for this reanalysis, the 1998 CFSII data that are now available would be a useful supplement in evaluating food intake for children. A similar analysis to that conducted here for this issue paper would increase the number of observations on which the child intake rates are based and improve the confidence level for intake rates generated by such an analysis.

Chapter 4: Drinking Water and Total Fluids

The CSEFH summarized two studies, the USDA 1994-96 *Continuing Survey of Food Intakes by Individuals* and *Estimated Per Capita Water Ingestion in the United States*, which reported intake rates for both direct and indirect ingestion of water. *Direct intake* is defined as direct consumption of water as a beverage, while *indirect intake* includes water added during food preparation but not water intrinsic to purchased foods. Both studies supported EPA's use of 1 L/day as the default drinking water intake rate for infants (10 kg body mass or less) and children, including drinking water consumed in the form of juices and other beverages containing tap water (direct intake). Because the use of total water intake to estimate exposure may overestimate the potential exposure to toxic substances present only in local water supplies, the two studies emphasized intake of tap water (community water), rather than total water intake. The two studies were selected for the new analysis for the proposed age bins.

To estimate per capita ingestion of plain drinking water (direct ingestion) and water ingested indirectly, the USDA study gathered responses to questionnaires in which respondents averaged quantities of water they ingested over 2 nonconsecutive days to generate a 2-day average. These daily averages comprised the empirical distributions from which mean and upper percentile per capita ingestion rates were developed from 2-day averages for more than 15,000 individuals in 50

States and the District of Columbia, which were then extrapolated to the population of the entire United States.

In the second study, EPA used the 1994-96 CSFII data to estimate the per capita drinking water ingestion rate for subpopulations segregated by (1) gender and age, and (2) by pregnant, lactating, and childbearing-age women. The study report, *Estimated Per Capita Water Ingestion in the United States*, estimated the 2-day average per capita ingestion of community water at 2.016 L/person/day, with estimates for infants less than 1 year of age and for children 1 to 10 years of age consistent with the standard 1-liter ingestion rate used in risk assessments for a 10 kg child.

The author conducted a new analysis using the CSFII data to obtain recommended values for the proposed age bins; however, the CSFII data set did not provide enough data for the proposed age groups of children up to 1 year of age. Also, the author noted that assessing exposure as volume of intake per unit body mass clearly indicates the greater potential for exposure of the young child. Fetuses, newborns, and toddlers up to 2 years of age are vulnerable as a result of their different renal function and fluid intake needs.

The author recommended that more research be conducted to collect data on intake rates for drinking water within the proposed age bins, noting that specific age data from the CSFII questionnaires might be used if the sample sizes for those age groups are adequate to extrapolate the data to the general children's population. Also, a new questionnaire should be developed that considers independent data validation, such as use of physiological parameters to gauge water balance and fluid intake values. The author also discussed assessment methods for children, including the greater potential for exposure of young children because of the ratio of body surface area to intake rates as well as their different renal function and fluid intake needs. Drinking water consumption and total fluid intake should be normalized by body surface area as well as by body weight. Fetuses, infants, and adults have distinct shape-weight relationships, and estimates of BSA are used frequently in the practice of anesthesiology and critical care medicine to reflect the body's metabolic functions, such as ventilation rate, fluid requirements, and extracorporeal circulation. A simple linear relationship between BSA and weight in infants and children weighing between 3 and 30 kg can be developed using linear regression analysis on published human BSA data.

Chapter 5: Soil Ingestion and Pica

To quantify the amount of toxic substance(s) ingested by a child over time, exposure parameters relevant for risk assessment need to be selected and computed. Although absorption of toxicants and toxic effects have obvious importance, this chapter limits its discussion to quantifying ingestion of toxic substances.

Two facts make quantifying ingestion of toxic substances in soil and/or dust difficult. First, it has not been possible to directly quantify the amount of a toxic substance ingested. Instead, several indirect strategies for constructing such estimates have been proposed, including a behavioral strategy, a mass-balance strategy, an estimation based on comparison of average blood lead of populations between areas with different soil lead concentrations, and a combined approach using behavioral data to develop a model for soil ingestion with age, and then applying this model to mass-balance soil ingestion estimates. Only the mass-balance method has been experimentally validated (among adults); therefore, the authors limited their discussion to mass-balance studies of soil ingestion using trace elements contained in soil. The second factor that made estimate of soil ingestion difficult was the design of the existing studies.

Although there is much literature on ingestion of nonfood items (which is also referred to as pica), the authors found limited information on soil pica, most of which was anecdotal or for special populations. The studies that do exist fall short of defining the amount of soil ingested in a pica event, but they provide insights that may help guide the design of studies that can quantify soil pica.

The authors focused on four primary studies (of seven reviewed) of soil ingestion and numerous manuscripts based on data from those studies. The common features of the studies were the use of mass-balance methodology, their conduct in the United States, and the use of the trace elements aluminum, silicon, and titanium. The authors also reviewed reports that directly discussed the relationship between soil ingestion and age. Because the studies were conducted on children 1-7 years of age, the authors made exposure factor recommendations for soil ingestion for only the age groups 1-2 years, 3-5 years, and 6-10 years.

According to the authors, interpretations of estimates of soil ingestion from the four studies have several limitations that affect their generalizability. However, they used three of the four mass-balance studies to develop recommendations for the proposed age bins. They reported the estimates first as ranges to indicate the extent of variability of individual studies, then combined the studies' trace-element-specific estimates to form single estimates. To more closely correspond to estimates based on a longer study design, they used long-term data from one of the studies, which provided recommended values with higher confidence levels for some age bins. The authors compared their recommendations for the mean and 90th percentile with those in the CSEFH and discussed the differences.

To highlight the difficulty of framing a recommendation concerning soil pica that has value for exposure assessment, the authors examined in detail a subject in one of the four studies who exhibited very high soil ingestion, presumed to be soil pica.

The authors concluded that there are many areas where little is known about soil ingestion. Even where they could provide recommendations, they said there is no evidence to support generalizing the estimates to other seasons of the year or to other parts of the country. It is unlikely that there are sufficient data available to reliably distinguish soil ingestion in different age ranges, although existing data could be used to improve on the estimates of soil ingestion for age groupings. They recommended using the multiple estimates of soil ingestion (using the multiple trace elements) to obtain a single estimate of soil ingestion and characterize the distribution. The main limitations to making recommendations for all the proposed age bins included the fact that soil ingestion studies are difficult to conduct and data collection and chemical processing are expensive.

According to the authors, the most critical need at this point is new data, which should be gathered in the context of a research program. Data are needed that span a broader age range, perhaps initially expanding the age range to extend from 3 months to 12 years. Data on children in future soil ingestion studies need to span the range of demographic variables such as geography, race, and economic status so that results can be more confidently applied to the general U.S. population. Estimates of soil ingestion need to reflect longer time periods. Seasonal effects and longitudinal studies (both over seasons and over years) are important to identify tracking that may lead to a broader or narrower soil ingestion distribution. Finally, soil ingestion studies need to be integrated with behavioral studies and made efficient. Much has been learned as a result of the conduct of soil ingestion studies in the past, and this needs to be taken advantage of in the future.

Chapter 6: Non-dietary Ingestion Exposure

For young children, mouthing activities offer one of the most common ways for the child to explore his or her environment. However, contamination of any object used in mouthing activities may lead to elevated exposure to a variety of chemical compounds, including metals, pesticides, and other potentially toxic compounds.

The authors evaluated the data from studies used in the CSEFH, all of which they consider to be lacking in some fundamental way, and then examined the literature since 1999 to assess the applicability of any studies not considered for the CSEFH, including several modeling efforts and monitoring studies. The authors determined that no studies provide definitive data for the age bins proposed by EPA. There have been no systematic, probability-based studies undertaken that would afford a reasonable assessment of such, nor have any studies been designed and implemented that would determine whether age-bin-specific factors differ from one another. Sample sizes in the studies outlined above were too small, and study designs were inconsistent and often spanned only part of the range (e.g., very little work has been done on children ages 10-20 years).

The authors stressed that the most important research need is a systematic method of data collection. Current meta-analysis is limited by inconsistencies in data and small sample sizes. One clear recommendation arising from the authors' assessment of existing data was that a new, comprehensive data collection effort to determine non-dietary ingestion exposure factors should be designed and undertaken.

Chapter 7: Exposure Factors for Inhalation

Three basic techniques are used for estimating inhalation rates: activity-based approach, using assigned breathing rates for various activities and calculating daily values; metabolic approach, which determines breathing rate as a function of oxygen demand; and a hybrid approach, in which a physiological measure of oxygen consumption, such as heart rate, is used along with activity data and a personal calibration curve of heart rate to inhalation to estimate how much air is inhaled during an individual's daily activities.

The studies reviewed by the authors used these approaches, or modifications of them, to develop inhalation estimates for different age groups. The authors focused on the data and methods that could best be used to develop recommendations for inhalation exposure factors for the proposed age groups, based on chronic or daily inhalation rates applicable to the proposed childhood age groups.

The data from the selected studies could not be reanalyzed to support recommendations for the new age bins, had a very limited data set on which to determine applicable multipliers for different age groups, or involved small test cohorts. However, the studies were used as the foundation for developing new recommendations for age-specific inhalation rates, followed by a review of more recent information to address data gaps pertaining to the calculation of breathing rates for children of different ages.

The authors recommended improving particular studies and methodologies that were discussed and identified several analyses that need to be performed. First, daily energy expenditures computed using CHAD should be compared with food-energy intakes obtained from USDA food consumption surveys for children in the different age bins. They also recommended developing expanded data sets of VQ measurements on children using the applied physiology literature together with new, direct measurements. Reanalysis of the raw data from selected studies could provide age-dependent distributions of VQ. Results of such analyses could be used to design experimental studies targeting children in selected age bins. Another related issue concerns the nature of the age-dependent decline in VQ as well as related gender differences (e.g., at what age should males and females be treated separately with respect to VQ?). In addition, Linn et al. (1991) noted that asthmatic children in their study had higher inhalation rates. Given those children's enhanced susceptibility to ozone, this also should be an area of special research.

In summary, until additional data on VQ values are obtained for children ages 5 years and younger, estimates of inhalation rates for this particular age cohort will have potentially significant uncertainties. The existing recommendations given in the *Child-Specific Exposure Factors Handbook* could underestimate actual inhalation rates by 50 percent or more, depending on the results of additional measurements of VQ values as well as the development of improved estimates of age-specific energy intakes and expenditures.

Chapter 8: Exposure Factors for the Dermal Route

Dermal exposure is estimated, in part, by the amount of body surface area available for contact with contaminated media. The amount of body surface area exposed during an event is influenced by age-specific behavioral factors. For children, such factors include playing and crawling on contaminated surfaces, and the amount of clothing worn during play activities. Surface area of the skin is determined via direct measurement or regression models that consider the dependence of surface area on such other body dimensions as height and weight. The CSEFH described various measurement techniques and reviewed pertinent surface area studies as a basis for recommending body surface areas for children that are representative of the subpopulation under consideration (i.e., age and sex-dependent).

The author conducted a thorough search of peer-reviewed literature back to 1997; however, no new studies were identified that have been performed relative to those factors. Also, total surface area could not be estimated from the NHANES II or III data sets, because height information, which is equally important to calculate surface area, was not included. Therefore, no recommendations for surface area values could be made with respect to the proposed age bins. The lack of NHANES II height data precluded estimating the recommended total surface area values for children less than 1 month of age, 1-2 months, 3-5 months, 6-11 months, or 1-2 years of age. Estimates of surface area values for the older age groups would require an extensive statistical reevaluation of the NHANES data that is beyond the scope of the current paper.

The most important research need is to compile appropriate height and weight data for children under 2 years of age. Because of their behavior patterns (e.g., playing and crawling on contaminated surfaces with fewer clothes for protection) and physical factors (i.e., higher surface area relative to body weight), children in this age group may have potentially higher exposure to environmental toxicants than other age groups.

With regard to dermal soil adherence, the CSEFH already recommended that more-detailed studies are necessary because the control experiments and field studies conducted to date were based on specific situations and a limited number of measurements. The results of those studies showed that soil adherence generally could be directly correlated with moisture content, inversely correlated with particle size, and independent of clay content or organic carbon. Additionally, the rate of soil adherence is higher for hands than for other parts of the body. Therefore, because soil adherence is more activity-specific than age-specific, the values recommended in the CSEFH can be used for any age group, depending on the activity considered.

Chapter 9: Activity Patterns

Chemical exposures of children are influenced by the types of activities in which they are engaged as well as the locations of the activities and the level of participation in those activities. Consequently, exposure to chemicals in the environment can vary among children of similar developmental stages because of the variability associated with their behavior. Additionally, seasonal and geographic differences among children of similar developmental stages influence the variability of exposure.

The CSEFH described various measurement techniques and reviewed pertinent activity studies as a basis for recommending activity factors for children that are representative of the subpopulations (i.e., age and sex-dependent) under consideration. No new pertinent studies have been performed relative to those factors since the development of that document.

The author reviewed five studies (four that were used in the CSEFH) and determined that, presently, no recommendations can be made with respect to activity factor values for children less than 1 month old, 1 to 2 months, 3 to 5 months, 6 to 11 months, 11 to 15 years, or 16 to 17 years. As stated in the CSEFH, the current database on children's macroactivities is sparse and data are insufficient to adequately assess exposures to environmental contaminants. However, data are sufficient to estimate values for time spent in various microenvironments and participation in certain macroactivities for children in age bins of 1-2 years, 3-5 years, and 6-10 years (see Tables 9-1 through 9-3). The author presents the recommended values for time spent in microenvironments and in macroactivities for children in age bins of 1-2 years, 3-5 years, and 6-10 years, as well as the level of confidence for the recommended activity factor values.

Overall, the present state of knowledge regarding children's exposures and activities are inadequate to assess exposures to environmental contaminants sufficiently. Research needs to be conducted in three specific areas in order to improve the database that is currently available to assess children's exposures. Methods for monitoring children's activities and exposures need to be improved. Additionally, physical activity data for children, but especially young children less than 4 years of age and in age bins 11-15 years and 16-17 years, need to be collected in order to assess exposure by all routes. In order to accomplish this, population-based data are required to improve the characterization of children's activities and exposures as a function of age, gender, environmental setting (residence, school, day care), socioeconomic status, race/ethnicity, location (urban, suburban, rural), region, and season.

Chapter 10: Body Weight

Exposure and risk assessments are frequently expressed as a function of dose normalized to the average body weight of the exposed population. Body weight is one of the parameters in the calculation of the body mass index, by which overall fitness is categorized and body fat content estimated. It also can serve as one parameter in estimating body surface area, which is a key factor in some exposure and risk scenarios.

Creating an average growth reference of the relationship between weight and age requires a database that is representative of the population under consideration, contains accurate measurements from the sample subjects, and uses a statistical process that appropriately fits smooth percentile curves to the data. The authors' evaluation of the data within the proposed age bins used those criteria.

The NHANES III database, distributed by NCHS, contains measured physical parameters on a representative population of more than 30,000 individuals between the ages of 2 months and 90 years, collected between 1988 and 1994. The NHANES III data support classification not only by age, but also by sex, race, and ethnicity, and reflects actual measurements under consistent conditions (as opposed to self-reported values), includes data on a large number of individuals collected as a representative sample of the U.S. population, and contains demographic data that have been confirmed by in-person interviews with survey respondents.

The authors selected NHANES III to develop recommendations for the proposed age bins because it provides data for constructing age-based bins of growth parameters, including age-to-weight, as well as provides data for which age-to-height measurements and age-to-body mass indices can be constructed. Therefore, the data sets and graphs are convenient for estimating exposure factors data for the proposed age bins. In their analysis, the authors selected the 50^{th} percentile values for each age grouping. For time periods over several months, they summed the values and computed an average (one value for males and one for females for each age bin).

Although the age-to-weight bins in the CDC growth charts are adequate for estimations of exposure and risk, normalized by averages of the population weights, that approach is only minimally adequate because many exposure and risk assessments use other body metrics as key components. Dermal exposure assessments use surface area factors and are usually related to some age groups and gender/age subpopulations. Increasingly, risk assessment considers pharmakokinetic and pharmacodynamic relationships. The NHANES III survey provides data for all of these situations. The NHANES III survey could be improved by presenting the age-to-weight estimates as gender-specific values, particularly values representing ages greater than 2 years. NHANES III data also could be used to conduct separate analyses for selected ethnic groups ethnic-specific exposure and risk assessments.

1.0 INTRODUCTION

1.1 BACKGROUND

The 1993 National Academy of Sciences (NAS) report "Pesticides in the Diets of Infants and Children" highlighted important differences between children and adults with respect to risks posed by pesticides. Some of the principles in the NAS report provided the foundation for the Food Quality Protection Act of 1996 (FQPA) and the President's Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risk." The FQPA requires that children's aggregate exposure be considered when establishing pesticide tolerances (legal limits for residues in food). Executive Order 13045 broadens consideration of impacts on children by stating that "each Federal agency: shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." Many of the comments the EPA received on the *Proposed Guidelines for Carcinogen Risk Assessment* relate to the implementation of Executive Order 13045. In response to these comments and regulatory initiatives, EPA has been investigating ways to improve Agency risk assessments for children.

An Agency workgroup convened under the auspices of the Risk Assessment Forum has been exploring children's exposure assessment issues. This workgroup has concluded that a major issue facing the Agency is how to consider age-related changes in behavior and physiology when assessing early lifestage exposure. This issue is critical for scientists involved in preparing exposure assessments applicable to children or for use in evaluating integrated lifetime exposure. Typically, Agency assessors have classified individuals under the age of 21 years as youth or children. However, how to subdivide this group in a consistent and scientifically supported manner has been somewhat elusive. Children's behavior changes over time in ways that can have an important impact on exposure. For example, crawling and mouthing of hands and objects during the toddler stage of life can lead to dermal and oral exposures that are appreciably higher than those of adults. Further, children's physiology changes over time in ways that can affect both their exposures and their susceptibility to certain health effects. The key issue is how to capture those changes in an assessment of risks from exposure to environmental contaminants.

In July 2000, a workshop was convened by EPA to explore how to consider age-related changes in anatomy and behavior when assessing risk to children. A summary of the workshop discussions is provided in the document *Summary Report of the Technical Workshop on Issues Associated with Considering Developmental Changes in Behavior and Anatomy When Assessing Exposure to Children* (U.S. EPA, 2000). Although viewing development as a continuum is considered the "ideal" approach, workshop participants concluded that age groupings (or bins) can be useful as a guide for the development of exposure scenarios. To that end, workshop participants offered some preliminary advice on possible age groups related to developmental change. The workshop subgroup addressing behavioral development recommended dividing the first year of life into three groups: 0 to 2 months, 3 to 5 months, and 6 to 11 months. After the first year of life, they recommended the following groups: 1 to 2 years, 2 to 5 years, 6 to 10 years, 11 to 15 years, and 16 to 20 years. The subgroup addressing anatomy/physiology changes recommended the following groupings: 0 to 1 month, 1 to 3 months, 3 to 6 months, 6 to 12 months, 1 to 3 years, 3 to 8 (female) or 9 (male) years, and 8 or 9 years to 16 (female) or 18 (male) years. Prenatal development was outside the scope of the workshop discussions, but both subgroups stressed the importance of including this lifestage in exposure and risk assessments.

On the basis of the workshop discussions, EPA is considering developing a minimum set of childhood age groups for exposure and risk assessment, as follows:

Prenatal	1 through 2 years
less than 1 month	3 through 5 years
1 through 2 months	6 through 10 years
3 through 5 months	11 through 15 years
6 through 11 months	16 through 17 years

At the workshop, in addition to defining the proposed age bins, factors that influence children's exposure were discussed and techniques currently used to assess their exposures were addressed. To that end, highlights of the Hubal et al. (2000) paper were discussed and are briefly summarized to follow. A child's exposure is greatly influenced by where the child is and what the child is doing. Characteristics of children that influence exposure are physical, behavioral, physical activities, diet and eating habits, gender, and demographic characteristics. For each exposure route (inhalation, dermal, ingestion), an exposure algorithm mathematically expresses exposure as a function of (1) chemical concentration in the exposure medium, (2) contact rate, (3) rate of transfer from the exposure medium to the portal of entry, and (4) the exposure duration. There are several key algorithms used when estimating exposure. Key terms used to develop these algorithms are as follows:

- **Microenvironment** — The location a child occupies for a specified period of time, such as indoors at home in the kitchen.

- **Macroactivity** — Activities that are part of what a child is doing over a specified period of time, such as watching TV, sleeping, or crawling.

- **Microactivity** — Detailed actions that occur within a general activity, such as hand-to-surface and hand-to-mouth behavior.

Microenvironmental data have been used for years to evaluate inhalation; however, in recent years, it became obvious that general activity descriptions do not provide enough information on specific contact with exposure media within a microenvironment to estimate dermal and non-dietary ingestion exposures. Activity pattern data requirements are demonstrated in the context of algorithms for inhalation, dermal contact, and ingestion. These are described in the following paragraphs (as presented in Hubal et al., 2000).

Inhalation exposure is estimated for each of the microenvironments where a child spends time and each macroactivity that would result in a different inhalation rate while engaging in that activity. Exposure over the 24-hour period is then the sum of all of the microenvironmental/macroactivity (me/ma) exposures. For each individual me/ma, inhalation exposure over the 24-hour period ($E_{ime/ma}$) is defined as:

$$E_{ime/ma} = T_{me/ma} \text{ x } C_{ame} \text{ x } IR_{ma} \quad (1)$$

where:

$E_{ime/ma}$	=	inhalation exposure over the 24-hour period for a single microenvironmental/macroactivity (mg/day)
$T_{me/ma}$	=	the time spent in that me/ma over the 24-hour period (h/24h)
C_{ame}	=	the air concentration measured in the microenvironment (mg/m^3)
IR_{ma}	=	the child's respiration rate representing his activity level for that macroactivity (m^3/h)

Two main approaches are currently used to assess dermal and non-dietary ingestion exposure. To estimate dermal exposure using the macroactivity approach, microenvironments are defined by location and surface type (e.g., indoors at home on carpet). The dermal exposure associated with a given macroactivity (e.g., actively playing in the yard) is measured and used to develop an activity- and microenvironment-specific transfer coefficient. Exposure can then be estimated individually for each of the microenvironments where a child spends time and each macroactivity that the child conducts within that microenvironment. Exposure over the 24-hour period is the sum of all of the microenvironment/macroactivity (me/ma) exposures. For each me/ma, dermal exposure over the 24-hour period ($E_{dme/ma}$) is defined as:

$$E_{dme/ma} = C_{surf} \text{ x } TC_{der} \text{ x } ED \quad (2)$$

where:

$E_{dme/ma}$	=	dermal exposure over the 24-hour period for each microenvironmental/macroactivity (mg/day)
C_{surf}	=	total contaminant loading on surface (mg/cm^2)
TC_{der}	=	dermal transfer coefficient for the me/ma (cm^2/hr)
ED	=	exposure duration that represents the time spent in the me/ma (hr/day)

To assess dermal exposure and non-dietary ingestion using the microactivity approach, exposure is estimated individually for each of the microactivities or events (e.g., each time a child touches a given object) from which dermal contact or non-dietary ingestion occurs. Exposure over the 24-hour period is then the sum of all of the individual exposures. For each microactivity, dermal exposure over the 24-hour period ($E_{der/mi}$) can be defined as:

$$E_{der/mi} = C_{surf} \text{ x } TE \text{ x } SA \text{ x } EF \quad (3)$$

where:

$E_{der/mi}$	=	dermal exposure for a given microactivity over a 24-hour period (mg/day)
C_{surf}	=	total contaminant loading on surface (mg/cm^2)
TE	=	transfer efficiency, fraction transferred from surface to skin (unitless)
SA	=	area of surface that is contacted (cm^2/event)
EF	=	frequency of contact event over a 24-hour period (events/day)

For each microactivity resulting in non-dietary ingestion, exposure over the 24-hour period ($E_{nding/mi}$) can be defined as:

$$E_{nding/mi} = C_x \text{ x } TE_{xm} \text{ x } SA_x \text{ x } EF \quad (4)$$

where:

$E_{nding/mi}$	=	non-dietary ingestion exposure for a given microactivity over a 24-hour period (mg/day)
x	=	hand or object that is mouthed
C_x	=	total contaminant loading on hand or object (mg/cm^2)
TE_{xm}	=	transfer efficiency, fraction transferred from object or hand to mouth (unitless)
SA_x	=	area of object or hand that is mouthed (cm^2/event)
EF	=	frequency of mouthing event over a 24-hour period (events/day)

Dietary exposures of young children are difficult to accurately assess or measure. Young children do not consume foods in a structured manner. While eating, their foods contact surfaces (hands, floors, eating surfaces, etc.) that may be contaminated. To assess dietary ingestion, exposure is estimated individually for each item of food consumed by the child. Total dietary exposure is then the sum of exposures for all food items consumed over a 24-hour period. The intake of a contaminant associated with one food item, the specific eating activities resulting in that food item's contact with contaminated surfaces (*i*), and specific activities resulting in the food item's contact with the child's hands before it is eaten (*j*) can be described as follows:

$$E_{diet} = \underbrace{C_{food}\ W_T}_{\text{Term 1}} + \underbrace{\sum_i [C_{surf}\ TE_{S/F}\ SA_{S/F}\ EF_{S/F}]}_{\text{Term 2}} + \underbrace{\sum_j [C_{hand}\ TE_{H/F}\ SA_{H/F}\ EF_{H/F}]}_{\text{Term 3}} \quad (5)$$

where:

E_{diet}	=	Total dietary exposure to the environmental contaminant for one food eaten (mg/food item)
C_{food}	=	Contaminant concentration of food item after preparation for consumption (µg/g food)
W_T	=	Total amount of the individual food consumed (g food/food item)
C_{surf}	=	Contaminant loading on a contacted surface (µg/cm^2)
$TE_{S/F}$	=	Surface to food contaminant transfer efficiency (where transfer efficiency is a function of duration of contact, surface type, moisture, etc.) (unitless)
$SA_{S/F}$	=	Area of contaminated surface that is contacted by the food item (cm^2/event)
$EF_{S/F}$	=	Frequency of surface to food contact events that occur during consumption of the food item (events/food item)
C_{hand}	=	Contaminant loading on child's hand (µg/cm^2)
THE/F	=	Hand to food contaminant transfer efficiency (unitless
$SA_{H/F}$	=	Area of the contaminated hand that is contacted by the food (cm^2/event)
$EF_{H/F}$	=	Frequency of hand to food contact events that occur during consumption of the food item (events/food item)

Hubal et al. (2000) concluded that, currently, data on children's exposures and activities are insufficient to adequately assess exposures to environmental contaminants. As a result, regulators use a series of default assumptions and exposures factors when conducting exposure assessments. the more uncertain the assumptions and exposure factors used, the more conservative they must be to protect children's health. Data to reduce uncertainty in the assumptions and exposure estimates are needed to ensure that chemicals are regulated appropriately. To improve the database available to assess children's exposures, three areas of research are required: identification of appropriate age/development benchmarks for categorizing children in exposure assessments, development and improvement of methods for monitoring children's exposures and activities, and collection of physical activity data for children (especially young children) required to assess exposure by all routes. Therefore, this issue paper addresses some of the concerns expressed in the conclusions of Hubal et al. (2000).

1.2 PURPOSE

The purpose of this issue paper is to explore whether existing scientific data support defensible child-specific exposure factor recommendations for the EPA proposed age groupings derived from the July 2000 workshop. To accomplish that task, a panel of experts was selected to present their individual views for particular exposure factors. The authors evaluated exposure factors for breast milk intake, food intake, drinking water and total fluid intake, soil ingestion and pica, non-dietary ingestion factors, inhalation factors, skin surface area, soil adherence to skin, body weight, and activity factors. In the preparation of this document, the authors reevaluated the data underlying the exposure factor recommendations in the draft *Child-Specific Exposure Factors Handbook* (CSEFH) (U.S. EPA, 2001). Where reevaluation of the underlying data was possible and productive, the authors recommended exposure factors for the proposed age groups. As part of the reevaluation, the authors discussed quality assurance issues, including the considerations used in selecting key studies for the CSEFH. These considerations included the level of peer review, accessibility, reproducibility, focus on the exposure factor of interest, data pertinent to the United States, primary data, current information, adequacy of the data collection period, validity of approach, representativeness of the population, variability in the population, minimal or defined bias in study design, and minimal or defined uncertainty in the data. In each area of exposure in which reevaluation of exposure factors data was not possible or would not support the development of recommendations for the proposed children's age groups, the authors addressed the uncertainties introduced by using the existing data to assess exposures for children.

1.3 ORGANIZATION

The exposure factors discussed in this issue paper are organized in the same sequence as in the CSEFH. In addition, the authors evaluated the data (new and existing) using the same characterization criteria used in the CSEFH. New recommendations for the exposure factors, when available, were provided for the proposed age bins. In addition, a table is provided in each chapter that describes the authors' confidence in their conclusions for providing new recommendations. The criteria used for describing the confidence are the same as those used in Table 1-1 of the CSEFH.

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2.0 BREAST MILK: INTAKE, NURSING DURATION, AND FAT COMPOSITION

2.1 INTRODUCTION

Breast milk is a potential source of exposure to toxic substances for nursing infants. Lipid-soluble chemical compounds may accumulate in body fat and may be transferred to breast-fed infants in the lipid portion of breast milk. Because nursing infants obtain most (if not all) of their dietary intake from breast milk, they are especially vulnerable to exposures to these compounds. Estimating the magnitude of the potential dose to infants and the duration of that exposure requires information on the milk intake rate (quantity of breast milk consumed per day) and the duration over which breast-feeding occurs. Information about the fat composition of breast milk is also needed to estimate the possible concentration of the chemical moieties in the milk. The delivered dose of toxic chemical can then be estimated from breast milk residue concentrations that have been indexed to lipid content.

Several studies have provided data applicable to the EPA proposed age bins. Breast milk intake has been studied in both cross-sectional and longitudinal studies with mother/infant pairs. Study designs varied, but typically comprised fairly small cohorts, given the sensitivity and technical complexities of such data collection. In order to minimize confounding factors in such studies, the participants were confined to very homogeneous demographic factors and anthropometrics. While these designs enhance the focus on the variable under study, it is difficult to know how the results can be extrapolated across a population that is far more diverse than the universe of test subjects. In the cross-sectional studies, a given period or a few periods in time postpartum were chosen as the points of data collection. This minimized variation introduced by changes in infant size and dietary choices, and permitted more samples over the shorter viewing period. Longitudinal studies may follow a smaller cohort across longer periods of time, but must account for the variables introduced over those time changes. In addition, studies may measure intake as a function of individual feeding events, as a summation of 24-hour periods, or as a mean of multiple 24-hour periods (approximately contiguous days).

The most typical measurement tool used in the studies was the test weighing methodology in which the freshly diapered infant was weighed before and after each feeding, with no diaper change between weighings. Corrections on this calculated weight were made to adjust for the possible loss of water during the period of feeding (insensible weight loss), and to convert to volume of milk intake using the density factor of the breast milk. The first factor was typically about 2 g/kg body weight per hour, and the second factor typically fell between 1.01 and 1.03 g/mL breast milk. The data were reported with one or both of these factors and in some cases included estimations of those factors from previously reported studies, or the data were independently determined within the study. The insensible weight loss was calculated using estimates of feeding durations or from daily diary records of the study participants. The resulting weight or volume measurements of breast milk intake was reported as discreet feeding events or summed over a 24-hour period. Means of multiple daily intakes may minimize the intra-individual variability.

The test weighing procedures employed by the study may be validated within the study design. To do this, the procedure is applied to bottle-fed infants and the milk weight is directly measured before and after feeding. The known weight of the consumed milk is compared with the measured change in the infant's weight between commencement and conclusion of feeding. This methodology has been shown to quite accurately measure the breast milk intake. Neville et al. (1988) estimated that the error was only about 2.5 grams per feeding. Note that this is not very different from the average value of the predicted insensible weight loss of 2.8 grams per feeding.

Results of these intake studies among "privileged infants," born to well-educated, healthy, nonsmoking parents in the middle to upper income range, showed a general intake level of 600 to 900 g/day. These studies reported rather significant inter-individual differences among the infants (10 to 20 percent), even with these homogeneous cohorts. This was true even when the cohort group began with infants with weights at birth or 1 month that are considered to be in the normal range for full-term, healthy infants. Intra-individual variation (day-to-day) also was high in most studies, though generally less than the inter-individual variation. Exploring the reasons for these differences was the objective of the Davis Area Research on Lactation, Infant Nutrition, and Growth (DARLING) study by Dewey et al. (1991a, 1991b). Results from this study suggest that we may be able to apply the findings from homogeneous populations of mothers and infants to a broader section of the population, where demographic, anthropometric, and physiological differences are surely greater than in the study cohorts. These results also suggest that older studies may be adequately representative of the current population, even though maternal characteristics may have changed with time.

Descriptions of several key studies on breast milk intake are presented in Section 2.2.1. Section 2.2.2 discusses the research on breast milk composition, particularly estimation of fat content.

2.2 EVALUATION OF EXISTING DATA

2.2.1 Studies on Breast Milk Intake

In *Milk Intakes and Feeding Patterns of Breast-fed Infants*, Pao et al. (1980) conducted a study of 22 healthy breast-fed infants to estimate breast milk intake rates. Infants were categorized as completely breast-fed or partially breast-fed. The goal of the study was to enroll infants as close to 1 month of age as possible and to obtain records near 1, 3, 6, and 9 months of age. Data were collected for these 22 infants using the test weighing method. Records were collected for three consecutive 24-hour periods at each test interval. The weighing methodology was tested for accuracy and determined to be accurate to 95 percent of reference tests using bottle-fed infants. Measurements were not corrected for insensible water loss. The weight of breast milk was converted to volume by assuming a density of 1.03 g/mL for all feeding periods and for both completely breast-fed (CBF) infants and partially breast-fed (PBF) infants. Daily intake rates were calculated for each infant based on the mean of the three 2-hour periods. Mean daily breast milk intake rates for the infants surveyed at each time interval are presented in Table 2-1 of the *Child-Specific Exposure Factors Handbook* (2001 CSEFH).

The study presented valuable information over multiple time periods, minimizing daily variability with the use of 3 contiguous days of measurement at each age interval. However, several issues compromise the quantitative conclusions. The utility of these data as nationally representative age-related breast milk intake values is questionable. The data are over 34 years old, raising issues about the possible changes in infant weights and trends of intake over the generations.

In *Milk and Nutrient Intakes of Breast-fed Infants from 1 to 6 months*, Dewey and Lonnerdal (1983) monitored the dietary intake of 20 breast-fed infants between the ages of 1 and 6 months. Most were completely breast-fed, five had been given some formula, and several were fed small amounts of solid foods after 3 months of age. A second objective of the study was to estimate nutrient intake and examine nutrient concentration and milk volume. This second objective provided data useful for the consideration of intake calculations and comparison with calculations made in other studies.

Dewey and Lonnerdal noted the very wide range of breast milk intake rates, even among this very homogeneous group for which reporting precision would be expected to be excellent (see Table 2-2 in the 2001 CSEFH). Variation over time was particularly pronounced; at 1 month, intake showed an almost threefold variation and at 6 months was twofold. The energy needs of the infants seemed to vary greatly, but no consistent relationship was found between breast milk intake volume and the concentrations of nutrients in the milk during the first 6 months.

Study of the energy intake parameters revealed interesting correlations. Weight gain was positively correlated with energy intake per kilogram body weight at 1-2 months. But by 5-6 months the correlation reversed. The fattest infants consumed less per unit weight at 5-6 months than the lean infants, but such correlations were not statistically significant. Mean intake rates ranged from 673 mL/day for a 1-month old infant to 896 mL/day for a 6-month old infant. The intake findings confirm the findings of previous studies, which placed breast milk consumption between 600 and 800 mL/day, with great variation between different infants. Breast milk intake was relatively constant between 2 and 5 months.

Application of these measurements to contemporary infants in the general U.S. population is compromised by the size of the measured cohort, lack of underweight or overweight infants, lack of premature births in the cohort, age of the study (18 years), and lack of multiple ethnic groups.

In *Human Milk Intake and Growth in Exclusively Breast-Fed Infants*, Butte et al. (1984) studied breast milk intake in exclusively breast-fed infants during the first 4 months of life. Breast-feeding mothers were recruited through the Baylor Milk Bank Program in Texas. These mothers were 18-36 years of age, predominantly white (41 white, 2 Hispanics, 1 Asian, and 1 West Indian), very well educated, healthy nonsmokers, and all were professionals or technicians. Their infants were full-term, the first or second child, healthy, and of normal weight. Infant growth progressed satisfactorily over the course of the study. The amount of milk ingested over a 24-hour period was determined using the test weighing procedure. The procedure was validated with bottle-fed infants for this study, with a 3.2- gram difference noted. For most participants, test weighing was conducted over single 2-hour periods monthly; however, in an attempt to capture information about intra-individual variation, Butte et al. weighed participants in 48- to 96-hour continuous test weighings. This study provided at least 37 infants per monthly measurement period.

Breast milk intake was relatively constant across time periods in this study (see Table 2-3 in the 2001 CSEFH). The mean intake was 733 g/day (712 mL/day) using a density factor of 1.03 g/mL. The range was small, with 723 g/day at 3 months to 751 g/day at 1 month for the means of the group at each time period. Inter-individual variation was found to be 17 percent, even within this homogeneous cohort. Intra-individual variation in daily intake was estimated to be 7.9 ± 3.6 percent. The conclusions of this study are consistent with the findings in the literature that report variability in intakes of infants of the same age to be 11 to 29 percent. Also, it agrees with literature that reports breast milk intake throughout the first 4 months of life at 600-900 g/day.

In *Studies on Human Lactation*, Neville et al. (1988) studied breast milk intake among 13 infants during the first year of life in a longitudinal study designed to characterize the temporal course of lactation. Such understanding could improve the use of breast milk intake data from mother/infant pairs in cross-sectional studies. The study design, as well as selection of subjects from a very homogeneous cohort, maximizes the opportunity to understand sources of intra-subject variation and possible relationship of intake to milk production and transfer parameters.

Daily milk intake was estimated by the test weighing method. Data were collected daily from birth to 14 days, weekly from weeks 3 through 8, and monthly until the study period ended at 1 year. Results from this study were analyzed for correlations between mean daily intake and birth weights, infant weight at 1 month, infant weight gain 1 month postpartum, and total milk intake at 1 month postpartum. There was little or no correlation with birth weight over the 5 months of intake measurement, but there was consistent correlation with infant weight gain at 1 month postpartum. The data also suggest that total milk intake through 5 months of age can be related to the total milk intake at 1 month postpartum. Thus, high-intake infants seem to remain high-intake infants, and vice versa.

This study is valuable for setting nationally representative breast milk intake values at various time periods, with some strong qualifying considerations. The measurement of breast milk intake during the first month postpartum is rare in a study design, and even with the limited number of subjects, one can see the rapid onset of significant intake and a steadily increasing slope of intake rate. The longitudinal study design suggests that, although there is the same inter-individual variability as we saw in all the cross-sectional studies, individuals tended to stay constant in terms of their position within that range over time. Mean intake quickly reached 600 g/day, with a maximum intake near 800 g/day by 5 months (see Table 2-4 in the 2001 CSEFH). This information is consistent with data from cross-sectional studies on similar types of subjects. As in other studies, the virtues of minimizing the variability during study observations by maintaining a strictly homogeneous cohort create problems when considering how to apply such information to the general population with vastly more opportunity for variation.

The DARLING Study was conducted by Dewey et al. in 1986 to evaluate growth patterns, nutrient intake, morbidity, and activity levels in infants who were exclusively breast-fed for at least the first 12 months of life (Dewey et al., 1991a, 1991b). The study used a 4-day test weighing procedure for 73 infants age 3 months. The study was designed to assess the factors that influence the very wide range in intake among normal infants and measured total volume of breast milk extracted.

The mean intake was estimated at 812 g/day, 769 g/day, 646 g/day, and 448 g/day for infants ages 3 months, 6 months, 9 months, and 12 months, respectively (see Table 2-5 in the 2001 CSEFH). Variability in residual milk volume was high. The average day-to-day coefficient of variation for all 73 subjects was 8.9 ± 5.4 percent, and inter-individual coefficient of variation was 16.3 percent. The mean intake for these infants was within the range of the 600 to 900 g/day reported in the literature. Intake measured from the same cohort at other intervals up to 12 months of age also showed patterns consistent with those described in other studies (Dewey et al., 1991b). Because there were more mother/infant pairs included in this study than in most similar studies reported in the literature, and because the study assessed contributors to the intake variability, the study is valuable for the determination of breast milk intake in the general U.S. population. Most studies employ a very homogeneous cohort in order to minimize confounding factors among the small number of participants. Results of this study also suggest that differences in many demographic and personal traits may not play an important role in the frequently observed large differences in breast milk intake by infants in any age group. Thus, the findings in these studies may be applicable to the overall U.S. population.

2.2.2 Studies on Lipid Content of Breast Milk and Fat Intake from Breast Milk

In *Human Milk Intake and Growth in Exclusively Breast-fed Infants*, Butte et al. (1984) studied breast milk intake in exclusively breast-fed infants during the first 4 months of life. Breast-feeding mothers were recruited through the Baylor Milk Bank Program in Texas. These mothers were 18-36 years of age, predominantly white (41 white, 2 Hispanics, 1 Asian, and 1 West Indian), very well educated, healthy nonsmokers, and all were professionals or technicians. Their infants were full-term, the first or second child, healthy, and of normal weight. Infant growth progressed satisfactorily over the course of the study. The amount of milk ingested over a 24-hour period was determined using the test weighing procedure. This study provided at least 37 infants per monthly measurement period.

Milk was collected for compositional studies within 3 days after the test weighing procedure for milk intake estimation. The breast milk was harvested with an Engnell electrical breast pump, and fat content was determined gravimetrically after methylene chloride extraction (modification of Roese-Gottlieb method). The fat concentration (mg fat/g milk) of the breast milk at each of the four monthly testing periods was 36.2, 34.4, 32.2, and 34.8 for infants ages 1 month, 2 months, 3 months, and 4 months, respectively (see Table 2-6 in the 2001 CSEFH). Fat concentration remained constant across these 4 months. Since intake of milk was constant in the study, intake changed only as a function of infant body weight. Because all of the women in the study were well nourished and had no compromising health problems or dietary restrictions, we could not tell from this study if it is reasonable to extrapolate these conclusions to populations of women who are nutritionally deprived for any reason.

In *Milk and Nutrient Intakes of Breast-fed Infants from 1 to 6 months*, Dewey and Lonnerdal (1983) monitored the intake of 20 breast-fed infants between the ages of 1 and 6 months. A key objective of the study was to estimate nutrient intake and examine nutrient concentration and milk volume. The participants were very well educated, well-nourished mothers 21 to 36 years of age who were recruited from Lamaze childbirth classes in California. Some were taking nutrient supplements. All but one infant remained well within the normal ranges of weight and growth during the study, and none was obese.

Milk samples were collected from each mother at the second feeding of the morning on the day after the two 2-hour weighing records. The second feeding was chosen in an attempt to minimize diurnal differences in fat concentration. Fat was measured as total lipids. Fat concentration (g/100 mL milk) remained constant across the 6 months of testing, with very little variation around the mean values. The slight decline in total lipid concentrations between 1 and 6 months was not statistically significant. These data are presented below in Table 2-1.

Table 2-1. Mean Fat Content of Breast Milk Intake Samples for Infants 1-6 Months

	Months					
	1	2	3	4	5	6
g/100 mL	4.92 (1.05)	4.58(0.97)	4.58 (1.65)	4.62 (1.86)	4.36 (1.67)	4.30 (1.96)
mg/gm[a]	47.4	44.1	44.1	44.6	42.0	41.5

[a] Assumes milk density of 1.037.
Source: Dewey and Lonnerdal (1983).

Again, data from the cohort used in this study do not permit extrapolation to the general population without concern as to the possible influence of maternal nutritional status.

2.3 STUDIES SELECTED FOR THE ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

2.3.1 Studies Selected for Estimating Breast Milk Intake

The studies of Neville et al. (1988), Pao et al. (1980), Dewey et al. (1991a, 1991b), and Butte et al. (1984) provide data on intake rates of breast milk at various ages, from which we could derive factors for the proposed age bins. Although only Neville et al. studied the infants' intake during the first few days of life, all four studies provided data relevant to some of the age bins up to 1 year. The four studies generally agreed that inter- and intra-individual variation is great and that there is a predictable variation of intake among the feeding times within a day. The pattern suggests that the early weeks after birth are a period of rapid increase in intake rates in infants. During months 3-7, the intake rate peaks, then levels off somewhere between 700 and 800 g/day. From 8 to 12 months, the intake rate drops off to approximately half of that value. On a g/kg body weight basis, the decrease appears even more precipitous.

2.3.2 Studies Selected for Estimating Breast Milk Fat Content

Studies by Butte et al. (1984) and Dewey and Lonnerdal (1983) presented data on the fat content of breast milk. However, these studies differ in their analytical approaches to measuring the lipid content, and even in their definition of a fat. Other variables may confound the use of these data, but they are adequate for estimating breast milk fat content.

2.4 RECOMMENDATIONS FOR PROPOSED AGE BINS

In this analysis, we expand the results of studies of homogeneous populations with small cohorts to a large, diverse U.S. population and, therefore, cannot calculate exact time-weighted averages or statistical boundaries for these values. We infer the variabilities and uncertainties shown in the four studies by rounding, which avoids the appearance of precision while providing reasonable estimations of the breast milk intake. Given these and other sources of variability, the estimates of intake for various age groups can be derived from these data by calculating averages across the findings in different studies or by deriving time-weighted averages across time periods. The average is then rounded up to the nearest 10. The recommended breast milk intake values for the proposed age bins are presented in Table 2-2. The confidence in ratings for the recommendations are shown in Table 2-3.

Table 2-2. Recommended Breast Milk Intake and Proposed Age Bins

Age Categories (Bins)	Intake (g/day)
< 1 month	650
1-2 months	680
3-5 months	780
6-11 months	740
12 months	410

Sources: Data adapted from Butte et al. (1984), Dewey et al. (1991b), Neville et al. (1988), and Pao et al. (1980).

2.4.1 Breast Milk

Birth Through 1 Month of Age

Only Neville et al. measured milk intake from the first day postpartum. The number of participants was low, but these are rare and valuable measurements. It is difficult to select a single value to represent this first month, as lactation appears to commence on the second or third day, and milk intake dramatically increases with each subsequent week during the first month. An average of daily consumption for days 3 to 7 is 480 g/day; for days 8 through 11 it is 591 g/day; at 14 days it is 653 g/day; at 21 days it is 651 g/day; and at 28 days it is 770 g/day. A simple weighted average intake over the month is 643 g/day.

We recommend that the weighted average from the Neville et al. study, 643 g/day, be used as only the basis of the estimate. This value may infer precision and conformity that is not realistic. Also, the value is derived from a cohort that is not representative of the total U.S. population and is averaged over time periods of great variability. Therefore, following the suggested procedure for rounding, the recommended value for the bin is 650 g/day.

Age Bin 1-2 Months

All four selected studies measured intake during the period 1-2 months. Pao et al. estimated intake at 1 month to be 600 g/day. Dewey et al. (1991b) measured intake at 1 month to be 673 g/day and at 2 months to be 756 g/day. Butte et al. measured intake at 1 and 2 months to be 751 and 725 g/day, respectively. Neville et al. estimated intake at 701 g/day by time-weighted averages of the reported values. These values, if averaged, suggest an intake of 677 g/day. Again, the value

Table 2-3. Confidence in Recommendations for Breast Milk Intake and Breast Milk Fat Content

	Rating (High, Medium, Low)								
	Age								
Considerations	<1 Month	1-2 Mos	3-5 Mos	6-11 Mos	1 Yr	2-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
Study Elements									
• Level of peer review	High	High	High	High	High	NA	NA	NA	NA
• Accessibility	High	High	High	High	High	NA	NA	NA	NA
• Reproducibility[a]	High/Low	High/Low	High/Low	High/Low	High/Low	NA	NA	NA	NA
• Focus on factor of interest	High	High	High	High	High	NA	NA	NA	NA
• Data pertinent to U.S.	Low	Low	Low	Low	Low	NA	NA	NA	NA
• Primary data	Med	Med	Med	Med	Med	NA	NA	NA	NA
• Currency	Med	Med	Med	Med	Med	NA	NA	NA	NA
• Adequacy of data collection period[b]	Med/Low	Med/Low	Med/Low	Med/Low	Med/Low	NA	NA	NA	NA
• Validity of approach	High	High	High	High	High	NA	NA	NA	NA
• Representativeness of the population	Low	Low	Low	Low	Low	NA	NA	NA	NA
• Characterization of variability in the population[b]	Med/Low	Med/Low	Med/Low	Med/Low	Med/Low	NA	NA	NA	NA
• Lack of bias in study design	High	High	High	High	High	NA	NA	NA	NA
• Measurement error[b]	Med/Low	Med/Low	Med/Low	Med/Low	Med/Low	NA	NA	NA	NA
Overall Rating	Med	Med	Med	Med	Med	NA	NA	NA	NA

[a] High for breast milk intake, low for breast milk fat content.
[b] Medium for breast milk intake, low for breast milk fat content.

suggests precision and conformity beyond the facts of these studies. Using the rounding convention, the intake for this bin is 680 g/day.

Age Bin 3-5 Months

For this age group, the mean intakes varied greatly, within studies and between studies, from 711 g/day to 833 g/day. In all four studies, the trend seems to indicate that this is a time of high intake per day. The average of values for this time period with these studies is 779 g/day. Using the rounding convention, the intake for this bin is 780 g/day.

Age Bin 6-11 Months

Three of the studies reported intake measurements within the period 6-11 months of age. Pao et al. estimated intake at 6 months to be 682 g/day for completely breast-fed infants. Dewey et al. (1991b) had a much higher estimate of 896 g/day for the same time point. Neville et al. reported intake for infants on a monthly basis for each month in this period. The average of those months is 638 g/day, but the data suggest a high intake period during months 6-7, similar to months 3-5. Thereafter, breast milk consumption decreases significantly with each succeeding month. This suggests that the binning period comprises two (perhaps even three) binning populations. If all studies are averaged and estimates at 6 months are extrapolated over the range of the binning period, the estimated intake would be 738 g/day. Thus, the rounded bin value is 740 g/day.

Age Bin 12 Months

Neville et al. reported intake at 1 year of age to be only 403 g/day. By this time many diets are supplemented with food and other fluids. Energy demand is high but is met by these additions to the breast milk intake. Rounding by our convention gives us a value of 410 g/day.

2.4.2 Recommendations for Breast Milk Fat Concentration

Two of the studies, Butte et al. and Dewey and Lonnerdal, measured fat content in breast milk within the narrowly defined populations. Analysis methodologies and the resulting definitions of fat and lipid content differed for these studies. Several issues make it difficult to extrapolate these values across the population for all age groups and for all measurement durations. Variables such as diurnal variability, nutritional and health status of the mother before and during lactation, and changes during periods of stress were addressed. Using the approximated averages in Butte et al. (1984) (Table 2-6 in the 2001 CSEFH) and Dewey and Lonnerdal (1983) (Table 2-1 in this report), we recommend that a value of 4 percent lipid content in breast milk at all ages of nursing (all age bins) be used for assessing exposures to toxic chemicals.

2.5 RECOMMENDATIONS FOR FURTHER ANALYSIS AND RESEARCH NEEDS

Key issues that need to be addressed include:

- Estimation of the variability across the population for milk intake as a function of age and/or infant weight, considering the major ethnic groups in the U.S. population. Studies on black, Asian, and Hispanic mother/infant groups are needed.

- Estimation of the effect of nutrient status of the mother before and during lactation on the fat content of the milk. Data are needed on the types of lipids that may change because of these variables and the mobility of such lipids in the milk during lactation.

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3.0 FOOD INTAKE

3.1 INTRODUCTION

Ingestion of contaminated foods is a potential pathway of exposure to toxic chemicals among children. Children's exposure from food ingestion may differ from that of adults because of differences in the types and amounts of food eaten. Also, for many foods, the intake per unit body weight is greater for children than for adults. The *Child-Specific Exposure Factors Handbook* provides information on food intake rates for children in the following age groups: <1 year, 1-2 years, 3-5 years, 6-11 years, and 12-19 years (U.S. EPA, 2001). The age groups that the EPA Risk Assessment Forum are interested in are as follows: < 1 month, 1-2 months, 3-5 months, 6-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and 16-17 years. This chapter addresses the reevaluation of the data used in the CSEFH to provide food intake rates in the age categories of interest to the Risk Assessment Forum. The reevaluation includes intake rates for various food groups and individual foods, as well as the total dietary analysis. Intake rates for home-produced foods were not evaluated here because the data required to conduct such analyses are not available in USDA's *1994-96 Continuing Survey of Food Intake among Individuals* (CSFII) data set (USDA, 1998). Earlier analyses of intake of home-produced food were based on the 1987-88 Nationwide Food Consumption Survey. These data are no longer readily accessible, but could be evaluated if adequate resources were available. The CSEFH also provides data on serving size from Pao et al. (1982). This chapter does not reevaluate serving size because the Pao et al. report provides data for only the age bins shown in the CSEFH and could not be reorganized into the age bins of interest to the Risk Assessment Forum. Finally, this chapter does not address fish intake because this exposure factor was outside the scope of this project.

3.2 EVALUATION OF EXISTING DATA

The primary source of recent information on consumption rates of foods among children is the U.S. Department of Agriculture's (USDA) Nationwide Food Consumption Survey (NFCS) and the USDA 1994-96 CSFII. Data from the1994-96 CSFII were used in the *Child-Specific Exposure Factors Handbook* to generate children's per capita intake rates for both individual foods and the major food groups. As stated in the CSEFH (U.S. EPA, 2001):

> USDA conducts the CSFII annually to "assess food consumption behavior and nutritional content of diets for policy implications relating to food production and marketing, food safety, food assistance, and nutrition education" (USDA, 1995). The survey uses a statistical sampling technique designed to ensure that all seasons, geographic regions of the

U.S., and demographic and socioeconomic groups are represented. Using a stratified sampling technique, individuals of all ages living in selected households in the 50 states and Washington, D.C., were surveyed. Individuals provided 2 non-consecutive days of data, based on 24-hour recall. The 2-day response rate for the 1994-96 CSFII was approximately 76 percent. Data from the 1994, 1995, and 1996 CFSII were combined into a single data set to increase the number of observations available for analysis. Approximately 15,000 individuals provided intake data over the 3 survey years (USDA, 1998).

Because of the relatively large sample size associated with this data set, it may be used to generate intake rates for major crop groups and commonly eaten foods for various age groups of the population. The CSEFH generated intake rates for the following age groups of children: <1 year, 1-2 years, 3-5 years, 6-11 years, and 12-19 years using the 1994-96 CSFII data (U.S. EPA, 2001). The sample size for each of these age groups is shown in Table 3-1. The age groups in the CSEFH differ from those of interest to the Risk Assessment Forum; thus, a reanalysis of the CSFII data is needed to generate intake rates for the age groups specified in this project. Although this type of analysis is possible, the number of observations in some of the new age groups will be lower than those used in the analysis for the CSEFH. Table 3-2 provides the number of observations in the 1994-96 CSFII data set that may be used for the selected age groups.

Table 3-1. Weighted and Unweighted Number of Observations used in the 1994-96 CSFII Analysis, for the *Child-Specific Exposure Factors Handbook* Age Groups

Age Group	Weighted Number of Observations	Unweighted Number of Observations
< 1 year	3,772,296	359
1-2 years	8,270,523	1,356
3-5 years	12,376,836	1,435
6-11 years	23,408,882	1,432
12-19 years	29,657,098	1,398

Table 3-2. Weighted and Unweighted Number of Observations Used in the Reanalysis of the 1994-96 CSFII for the Selected Age Bins

Age Group	Weighted Number of Observations	Unweighted Number of Observations
< 1 month	150,104	15
1-2 months	729,143	65
3-5 months	1,124,897	119
6-11 months	1,768,152	160
1-2 years	8,270,523	1,356
3-5 years	12,376,836	1,435
6-10 years	19,498,495	1,189
11-15 years	19,268,648	1,005
16-17	7,760,616	363

For the purposes of this paper the 1994-96 CSFII data were used. Because Versar used the 1994-96 CSFII data and analyses for the *Child-Specific Exposure Factors Handbook*, the data and programs were readily available for use in this reanalysis. It should be noted, however, that the 1998 CFSII data became available after the analysis of the 1994-96 CSFII data was conducted for the Exposure Factors Handbooks. The 1998 data set provides additional data for children and would be a useful supplement to the 1994-96 CSFII data set in evaluating food intake for children (it was not used in this reanalysis because a significant effort would be required to rewrite the statistical program to incorporate these new data). As stated in the documentation for the 1998 data set (USDA, 2000):

> The goal of the sample design for the CSFII 1998 was to obtain nationally representative samples of noninstitutionalized persons 9 years of age or younger residing in households in the United States for each of 28 analytic domains defined by sex, age (7 age groups), and income level (a "low-income" group and an "all-income" group). The age groups used were under 1 year, 1 year, 2 years, 3 years, 4 years, 5 to 6 years, and 7 to 9 years.

Section 3.3 of this document provides details on the methods used to generate intake rates for the selected age groups using the 1994-96 CSFII data. Two types of analyses were conducted: (1) individual intake rates, and (2) total diet analysis.

3.3 ANALYSES USED TO OBTAIN NEW FOOD INTAKE RECOMMENDATIONS FOR CHILDREN

3.3.1 Individual Intake Rates

The food groups selected for this analysis include the same food groups evaluated in the CSEFH. These include the major food groups including total fruits, total vegetables, total grains, total meats, and total dairy; and a variety of individual fruits, vegetables, grains, meats, and dairy products. Various USDA food categories (i.e., citrus and other fruits, and dark green, deep yellow, and other vegetables), and protected and exposed produce were also evaluated, as in the CSEFH. Intake rates of total vegetables, tomatoes, and white potatoes, total meats, fish, beef, pork, poultry, dairy, eggs, and total grains were adjusted to account for the amount of these food items eaten as meat and grain mixtures, as described in Appendix 3A of the CSEFH. Note that fish is included here because it is a component of total meats. If fish were excluded, the total meat value would not equal 100 percent. Food items/groups were identified in the CSFII database according to USDA-defined food codes. Appendix 3B of the CSEFH presents the codes and definitions used to determine the various food groups used in the analysis. Intake rates for these food items/groups represent intake of all forms of the product (i.e., home produced and commercially produced).

Individual identifiers in the database were used throughout the analysis to categorize populations according to demographics. These identifiers included identification number, age, body weight, weighting factor, and number of days that data were reported. Distributions of intake were determined for children who provided data for 2 days of the survey. Individuals who did not provide information on body weight, or for which identifying information was unavailable, were excluded from the analysis. Two-day average intake rates were calculated for all individuals in the database for each of the food items/groups. These average daily intake rates were divided by each individual's reported body weight to generate intake rates in units of g/kg/day. The data were also weighted according to the 2-day weights provided in the 1994-96 CSFII. USDA sample weights are calculated to account for inherent biases in the sample selection process and to adjust the sample population to reflect the national population. Summary statistics for individual intake rates were generated on a per capita basis. That is, both users and non-users of the food item were included in the analysis.

3.3.2 Total Diet Analysis

Using data from the 1994-96 CSFII, this reanalysis also evaluated total dietary intake. Total dietary intake was defined as intake of the sum of all foods in the following major food groups: dairy, eggs, meats, fish, fats, grains, vegetables, and fruits, using the same food codes and method for allocating mixtures as those described in Appendix 3B of the CSEFH. Beverages; sugar, candy, and sweets; and nuts and nut products were not included. Distributions of total dietary intake were generated for various age groups, as described previously for the major food groups. Means, standard errors, and percentiles of total dietary intake were estimated in units of g/kg/day, as well as g/day.

To evaluate variability in the contributions of the major food groups to total dietary intake, this reanalysis ranked individuals from lowest to highest, based on total dietary intake. Three subsets of individuals were defined, as follows: a group at the low end of the distribution of total intake (i.e., below the 10th percentile of total intake), a central group (i.e., the 45th to 55th percentile of total intake), and a group at the high end of the distribution of total intake (i.e., above the 90th percentile of total intake). Mean total dietary intake (in g/day and g/kg/day), mean intake of each of the major food groups (in g/day and g/kg/day), and the percentage of total dietary intake that each of these food groups represents were calculated for each of the three populations (i.e., individuals with low-end, central, and high-end total dietary intake). A similar analysis was conducted to estimate the contribution of the major food groups to total dietary intake for individuals at the low end, central, and high end of the distribution of total meat intake, total dairy intake, total meat and dairy intake, total fish intake, and fruit and vegetable intake. For example, to evaluate the variability in the diets of individuals at the low end, central range, and high end of the distribution of total meat intake, survey individuals were ranked according to their reported total meat intake. Three subsets of individuals were formed as described above. Mean total dietary intake, intake of the major food groups, and the percent of total dietary intake represented by each of the major food groups were tabulated. This analysis was conducted for the following age groups of the population: < 1 month, 1-2 months, 3-5 months, 6-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and 16-17 years. The data were tabulated in units of g/day and g/kg/day. Summary statistics include the number of weighted and unweighted observations, percentage of the population using the food item/group being analyzed, mean intake rate, standard error, and percentiles of the intake rate distribution (i.e., 0, 1, 5, 10, 25, 50, 75, 90, 95, 99, and 100th percentile or maximum observed in the survey). The food analysis was accomplished using the SAS statistical programming system (SAS Institute, 1990).

3.4 RECOMMENDATIONS FOR PROPOSED AGE BINS

3.4.1 Results of Reanalysis

Tables 3-3 through 3-14 (at the end of this chapter) present the results of the reanalysis. Table 3-3 provides per capita intake rates in units of g/kg/day for the total diet and major food groups. Table 3-3a provides the same information in units of g/day. Per capita intake rates for individual foods are provided in Table 3-4. As in the CSEFH, these tables do not provide full data distributions (i.e., only means, standard deviations, and percentage consuming), because the numbers of observations for individual foods are lower than for the major food groups and are not believed to be sufficient for generating distributions. Table 3-5 presents per capita intake rates for various USDA food categories, and Table 3-6 provides per capita intake rates for exposed/protected fruits and vegetables. Tables 3-7 and 3-7a present per capita intake rates in units of g/kg/day for the major food groups. These tables provide the same information as in Table 3-3 and 3-3a, except that the data are sorted in a slightly different way (i.e., these tables allow for easy comparisons between age groups). Tables 3-8 and 3-8a present consumer-only intake rates for the major food groups in g/kg/day and g/day, respectively. It should be noted that the terms consumer-only intake and per capita intake are used in the same way as in the CSEFH. Consumer-only intake is defined as the quantity of foods consumed only by children who ate these food items during the survey period. Per capita intake rates are generated by averaging consumer-only intakes over the entire population of children (i.e., both users and non-users). Also, the food ingestion rates are expressed as "as consumed," since this is the fashion in which data are reported by survey respondents.

Tables 3-9 through 3-14 present the contributions of the major food groups to total dietary intake for individuals (in the various age groups) at the low end, central, and high end of the distribution of total dietary intake, total meat intake, total meat and dairy intake, total fish intake, total fruit and vegetable intake, and total dairy intake in units of g/day and g/kg/day.

3.4.2 Uncertainties

As noted in the CSEFH, these exposure data have been generated from short-term data. Although the data are suitable for estimating mean average daily intake rates representative of both short-term and long-term consumption, the distribution of average daily intake rates generated using short-term data (e.g., 2-day) does not necessarily reflect the long-term distribution of average daily intake rates. Also, day-to-day variation in intake among individuals will be great for food item/groups that are highly seasonal and for items/groups that are eaten year-round but are not typically eaten every day (U.S. EPA, 2001). For these foods, the intake distribution generated from short-term data will not be a good reflection of the long-term distribution. On the other hand, for broad categories of foods (e.g., vegetables) that are eaten on a daily basis throughout the year with minimal seasonality, the short-term distribution may be a reasonable approximation of the true long-term distribution, although it will show somewhat more variability. It is also important to note that the sample sizes are small for some of the age groups used in the reanalysis (see Table 3-2). This is particularly true for children less than 1 year of age. Table 3-15 provides the confidence ratings for the results of this reanalysis.

3.5 RECOMMENDATION FOR FURTHER ANALYSIS AND RESEARCH NEEDS

As noted in Section 3.2, the 1998 CSFII data set provides additional data for children and would be a useful supplement to the 1994-96 CSFII data set in evaluating food intake for children. A similar analysis to that conducted here, using the 1998 CSFII data set, would increase the number of observations on which the child intake rates are based and improve the confidence level for intake rates generated by such an analysis. Table 3-16 illustrates the increase in the number of children surveyed in 1998 compared to 1994-96.

3.6 REFERENCES

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U.S. EPA (2001) Child-specific exposure factors handbook (external review draft). Prepared by Versar, Inc., for the Office of Research and Development, National Center for Environmental Assessment, under EPA contract no. 68-W-99-041.

Table 3-3. Per Capita Intake of the Major Food Groups (g/kg/day, as consumed)															
Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
							Total Dietary									
<1month	60.0%	*	*	*	*	*	*	*	*	*	*	*	*	9	15	150104
1-2 months	70.8%	1.6e+02	1.4e+01	0.0e+00	0.0e+00	6.9e+00	1.5e+02	1.8e+02	2.2e+02	2.4e+02	2.7e+02	3.1e+02	3.3e+02	46	65	729143
3-5 months	91.6%	1.3e+02	7.3e+00	0.0e+00	1.2e+00	1.8e+01	9.3e+01	1.4e+02	1.8e+02	2.3e+02	2.4e+02	2.9e+02	2.9e+02	109	119	1124897
6-11 months	95.0%	1.3e+02	4.3e+00	0.0e+00	2.3e+01	5.4e+01	1.0e+02	1.2e+02	1.6e+02	1.9e+02	2.0e+02	2.5e+02	3.1e+02	152	160	1768152
1-2 years	96.0%	8.4e+01	1.1e+00	0.0e+00	2.6e+01	3.9e+01	6.0e+01	8.1e+01	1.0e+02	1.3e+02	1.5e+02	1.9e+02	2.6e+02	1302	1356	8270523
3-5 years	93.2%	5.5e+01	7.3e-01	0.0e+00	0.0e+00	2.6e+01	3.8e+01	5.4e+01	7.0e+01	8.9e+01	1.0e+02	1.3e+02	1.9e+02	1337	1435	12376836
6-10 years	92.9%	3.8e+01	5.8e-01	0.0e+00	0.0e+00	1.5e+01	2.6e+01	3.6e+01	4.8e+01	6.1e+01	7.2e+01	9.1e+01	1.2e+02	1105	1189	19498495
11-15 years	97.0%	2.3e+01	3.9e-01	0.0e+00	7.3e+00	9.8e+00	1.5e+01	2.2e+01	3.0e+01	3.9e+01	4.6e+01	6.0e+01	8.1e+01	975	1005	19286648
16-17 years	99.2%	1.8e+01	5.1e-01	3.1e+00	6.2e+00	7.5e+00	1.1e+01	1.6e+01	2.2e+01	2.9e+01	3.4e+01	5.8e+01	6.4e+01	360	363	7760616
							Dairy									
<1month	60.0%	*	*	*	*	*	*	*	*	*	*	*	*	9	15	150104
1-2 months	69.2%	1.6e+02	1.4e+01	0.0e+00	0.0e+00	0.0e+00	1.5e+02	1.8e+02	2.2e+02	2.4e+02	2.7e+02	3.1e+02	3.3e+02	45	65	729143
3-5 months	84.0%	1.1e+02	7.4e+00	0.0e+00	0.0e+00	5.6e-01	6.2e+01	1.3e+02	1.7e+02	2.0e+02	2.3e+02	2.8e+02	2.8e+02	100	119	1124897
6-11 months	91.3%	8.3e+01	3.7e+00	0.0e+00	4.9e-02	1.0e+01	5.9e+01	8.3e+01	1.1e+02	1.3e+02	1.7e+02	1.9e+02	2.4e+02	146	160	1768152
1-2 years	95.7%	3.7e+01	7.8e-01	0.0e+00	4.1e-01	6.7e+00	1.8e+01	3.2e+01	5.1e+01	7.4e+01	9.0e+01	1.3e+02	1.8e+02	1298	1356	8270523
3-5 years	92.9%	2.1e+01	4.0e-01	0.0e+00	0.0e+00	3.5e+00	1.0e+01	1.9e+01	2.9e+01	4.1e+01	4.9e+01	6.6e+01	9.0e+01	1333	1435	12376836
6-10 years	92.8%	1.5e+01	3.2e-01	0.0e+00	0.0e+00	2.2e+00	7.2e+00	1.3e+01	2.1e+01	2.9e+01	3.5e+01	4.5e+01	8.1e+01	1103	1189	19498495
11-15 years	96.1%	7.7e+00	2.1e-01	0.0e+00	1.8e-01	6.1e-01	2.9e+00	6.4e+00	1.1e+01	1.6e+01	2.0e+01	3.2e+01	3.8e+01	966	1005	19286648
16-17 years	98.3%	5.3e+00	2.5e-01	0.0e+00	2.1e-01	4.1e-01	1.8e+00	4.1e+00	7.6e+00	1.2e+01	1.3e+01	2.0e+01	3.3e+01	357	363	7760616
							Meat									
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	10.1%	*	*	*	*	*	*	*	*	*	*	*	*	12	119	1124897
6-11 months	65.0%	2.3e+00	2.6e-01	0.0e+00	0.0e+00	0.0e+00	5.3e-02	1.4e+00	3.4e+00	6.0e+00	8.6e+00	1.2e+01	1.2e+01	104	160	1768152
1-2 years	94.0%	4.4e+00	9.4e-02	0.0e+00	0.0e+00	7.6e-01	1.9e+00	3.8e+00	6.2e+00	8.9e+00	1.0e+01	1.5e+01	2.4e+01	1274	1356	8270523
3-5 years	92.2%	4.1e+00	8.0e-02	0.0e+00	0.0e+00	7.7e-01	2.1e+00	3.8e+00	5.6e+00	7.8e+00	9.4e+00	1.3e+01	2.1e+01	1323	1435	12376836
6-10 years	91.7%	3.0e+00	6.9e-02	0.0e+00	0.0e+00	4.1e-01	1.4e+00	2.6e+00	4.1e+00	5.7e+00	7.1e+00	1.0e+01	1.8e+01	1090	1189	19498495
11-15 years	96.5%	2.3e+00	5.0e-02	0.0e+00	2.4e-01	5.5e-01	1.2e+00	2.0e+00	3.0e+00	4.2e+00	5.2e+00	7.8e+00	1.1e+01	970	1005	19286648
16-17 years	98.3%	1.9e+00	6.2e-02	0.0e+00	2.8e-01	4.9e-01	1.1e+00	1.7e+00	2.5e+00	3.6e+00	4.0e+00	5.5e+00	7.0e+00	357	363	7760616
							Egg									
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
6-11 months	58.1%	8.4e-01	2.1e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.0e-02	1.9e-01	3.3e+00	5.8e+00	8.3e+00	1.1e+01	93	160	1768152
1-2 years	88.8%	1.2e+00	5.5e-02	0.0e+00	0.0e+00	0.0e+00	5.3e-02	1.6e-01	1.8e+00	3.8e+00	5.1e+00	8.3e+00	1.4e+01	1204	1356	8270523
3-5 years	84.5%	6.5e-01	3.7e-02	0.0e+00	0.0e+00	0.0e+00	3.0e-02	8.8e-02	4.6e-01	2.1e+00	3.4e+00	6.1e+00	1.3e+01	1212	1435	12376836
6-10 years	84.8%	4.2e-01	2.8e-02	0.0e+00	0.0e+00	0.0e+00	2.3e-02	6.4e-02	1.9e-01	1.4e+00	2.3e+00	4.4e+00	9.3e+00	1008	1189	19498495
11-15 years	89.6%	3.0e-01	2.0e-02	0.0e+00	0.0e+00	3.0e-03	2.2e-02	5.6e-02	1.9e-01	1.1e+00	1.4e+00	3.0e+00	7.3e+00	900	1005	19286648
16-17 years	92.8%	2.4e-01	2.4e-02	0.0e+00	0.0e+00	7.0e-03	2.3e-02	4.9e-02	1.2e-01	8.7e-01	1.3e+00	2.1e+00	2.5e+00	337	363	7760616
							Fish									
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	8.4%	*	*	*	*	*	*	*	*	*	*	*	*	10	119	1124897
6-11 months	40.6%	2.2e-01	7.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.6e-01	5.3e-01	8.7e-01	4.7e+00	4.7e+00	65	160	1768152
1-2 years	58.2%	3.7e-01	3.7e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	8.0e-02	2.9e-01	7.8e-01	1.8e+00	4.7e+00	1.4e+01	789	1356	8270523
3-5 years	56.4%	3.2e-01	3.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.9e-02	2.4e-01	6.6e-01	1.7e+00	4.6e+00	9.6e+00	810	1435	12376836
6-10 years	57.4%	2.7e-01	2.8e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.9e-02	1.8e-01	4.8e-01	1.6e+00	4.2e+00	6.7e+00	682	1189	19498495
11-15 years	60.9%	2.2e-01	2.2e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.4e-02	1.8e-01	4.7e-01	1.2e+00	3.1e+00	5.9e+00	612	1005	19286648

Table 3-3. Per Capita Intake of the Major Food Groups (g/kg/day, as consumed)															
Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
16-17 years	62.0%	1.8e-01	3.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.7e-02	1.6e-01	3.5e-01	6.0e-01	2.0e+00	4.9e+00	225	363	7760616
Grain																
<1month	6.7%	*	*	*	*	*	*	*	*	*	*	*	*	1	15	150104
1-2 months	13.8%	2.1e-01	2.8e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.1e-01	1.6e+00	2.8e+00	9.0e+00	9	65	729143
3-5 months	64.7%	1.6e+00	3.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.4e-01	2.4e+00	4.4e+00	5.9e+00	1.1e+01	2.7e+01	77	119	1124897
6-11 months	91.3%	7.7e+00	6.2e-01	0.0e+00	2.3e-02	1.0e+00	2.4e+00	5.2e+00	1.0e+01	2.1e+01	2.4e+01	3.3e+01	4.0e+01	146	160	1768152
1-2 years	95.6%	1.1e+01	2.0e-01	0.0e+00	1.7e+00	3.6e+00	6.4e+00	9.8e+00	1.4e+01	2.1e+01	2.5e+01	3.5e+01	4.8e+01	1297	1356	8270523
3-5 years	93.1%	1.0e+01	2.0e-01	0.0e+00	0.0e+00	3.7e+00	6.3e+00	9.2e+00	1.3e+01	1.8e+01	2.1e+01	3.4e+01	1.2e+02	1336	1435	12376836
6-10 years	92.9%	7.5e+00	1.4e-01	0.0e+00	0.0e+00	2.5e+00	4.5e+00	7.0e+00	9.7e+00	1.3e+01	1.6e+01	2.0e+01	3.6e+01	1104	1189	19498495
11-15 years	97.0%	5.0e+00	9.7e-02	0.0e+00	1.3e+00	1.9e+00	2.9e+00	4.4e+00	6.5e+00	8.8e+00	1.1e+01	1.5e+01	2.1e+01	975	1005	19286648
16-17 years	99.2%	3.9e+00	1.4e-01	2.8e-01	1.2e+00	1.4e+00	2.1e+00	3.4e+00	4.9e+00	6.6e+00	8.3e+00	1.4e+01	2.1e+01	360	363	7760616
Vegetable																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	1.5%	*	*	*	*	*	*	*	*	*	*	*	*	1	65	729143
3-5 months	34.5%	4.1e+00	1.1e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.7e+00	1.7e+01	1.9e+01	3.0e+01	3.1e+01	41	119	1124897
6-11 months	86.3%	1.2e+01	9.1e-01	0.0e+00	0.0e+00	8.0e-01	5.9e+00	1.1e+01	1.5e+01	2.4e+01	2.9e+01	4.9e+01	1.0e+02	138	160	1768152
1-2 years	95.4%	9.5e+00	2.1e-01	0.0e+00	4.7e-01	1.9e+00	4.5e+00	8.0e+00	1.3e+01	1.9e+01	2.3e+01	3.3e+01	8.3e+01	1293	1356	8270523
3-5 years	92.7%	7.3e+00	1.6e-01	0.0e+00	0.0e+00	1.3e+00	3.4e+00	6.2e+00	9.7e+00	1.4e+01	1.8e+01	2.9e+01	4.6e+01	1330	1435	12376836
6-10 years	92.7%	5.5e+00	1.3e-01	0.0e+00	0.0e+00	1.0e+00	2.5e+00	4.5e+00	7.3e+00	1.1e+01	1.4e+01	2.1e+01	5.2e+01	1102	1189	19498495
11-15 years	96.8%	4.2e+00	9.9e-02	0.0e+00	5.8e-01	1.2e+00	2.3e+00	3.6e+00	5.5e+00	7.9e+00	9.8e+00	1.5e+01	3.6e+01	973	1005	19286648
16-17 years	98.3%	3.8e+00	1.7e-01	0.0e+00	6.0e-01	9.1e-01	1.8e+00	3.2e+00	4.7e+00	7.3e+00	9.6e+00	1.5e+01	2.5e+01	357	363	7760616
Fruit																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	7.7%	*	*	*	*	*	*	*	*	*	*	*	*	5	65	729143
3-5 months	54.6%	1.3e+01	2.2e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.1e+00	2.1e+01	4.0e+01	4.3e+01	6.3e+01	1.1e+02	65	119	1124897
6-11 months	83.8%	2.0e+01	1.2e+00	0.0e+00	0.0e+00	0.0e+00	8.6e+00	1.9e+01	2.6e+01	3.7e+01	4.4e+01	6.7e+01	7.1e+01	134	160	1768152
1-2 years	85.5%	1.9e+01	5.2e-01	0.0e+00	0.0e+00	0.0e+00	6.4e+00	1.6e+01	2.7e+01	4.2e+01	5.4e+01	7.7e+01	1.3e+02	1160	1356	8270523
3-5 years	79.0%	1.1e+01	3.4e-01	0.0e+00	0.0e+00	0.0e+00	2.3e+00	8.1e+00	1.6e+01	2.6e+01	3.3e+01	5.3e+01	1.1e+02	1134	1435	12376836
6-10 years	70.6%	5.7e+00	2.3e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.6e+00	8.6e+00	1.4e+01	1.9e+01	2.9e+01	4.5e+01	840	1189	19498495
11-15 years	67.8%	3.4e+00	1.6e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.0e+00	5.3e+00	9.3e+00	1.3e+01	1.8e+01	3.2e+01	681	1005	19286648
16-17 years	56.2%	2.3e+00	2.4e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.7e-01	3.5e+00	7.2e+00	9.5e+00	1.4e+01	2.4e+01	204	363	7760616
Fat																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
6-11 months	58.8%	1.7e-01	2.3e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.4e-01	2.5e-01	4.0e-01	4.9e-01	1.2e+00	1.7e+00	94	160	1768152
1-2 years	90.1%	4.2e-01	1.2e-02	0.0e+00	0.0e+00	1.0e-02	1.4e-01	3.1e-01	5.5e-01	9.1e-01	1.2e+00	2.2e+00	3.3e+00	1222	1356	8270523
3-5 years	89.2%	4.2e-01	1.2e-02	0.0e+00	0.0e+00	0.0e+00	1.3e-01	3.0e-01	5.9e-01	9.5e-01	1.3e+00	1.8e+00	3.1e+00	1280	1435	12376836
6-10 years	89.9%	3.5e-01	1.1e-02	0.0e+00	0.0e+00	1.8e-02	1.0e-01	2.4e-01	4.7e-01	8.3e-01	1.1e+00	1.6e+00	3.1e+00	1069	1189	19498495
11-15 years	93.2%	2.7e-01	9.0e-03	0.0e+00	0.0e+00	2.8e-02	8.5e-02	1.8e-01	3.4e-01	6.2e-01	8.2e-01	1.4e+00	1.8e+00	937	1005	19286648
16-17 years	97.5%	2.3e-01	1.3e-02	0.0e+00	1.3e-02	3.9e-02	7.7e-02	1.6e-01	3.0e-01	5.4e-01	7.2e-01	1.2e+00	1.6e+00	354	363	7760616

NOTES:
PC = Percent Consuming
SE = Standard Error
Ntotal = Number of Individuals Surveyed
Nwgt = Number of Observations Weighted to the US Population
Ncons = Number of Individuals Consuming in the 2-Day Survey Period
* = Data not provided for less than 20 observations.

Source: Based on analysis of 1994-1996 CSFII.
Similar data presented in Tables 3-16 and 3-33 of the CSEFH.

Table 3-3a. Per Capita Intake of the Major Food Groups (g/day, as consumed)

Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	N cons	N total	N pop
Total Dietary																
<1month	66.7%	*	*	*	*	*	*	*	*	*	*	*	*	10	15	150104
1-2 months	76.9%	8.6e+02	6.4e+01	3.0e+01	3.1e+01	1.1e+02	7.9e+02	9.2e+02	1.0e+03	1.2e+03	1.3e+03	2.0e+03	2.4e+03	50	65	729143
3-5 months	94.1%	9.4e+02	4.7e+01	5.6e+00	3.6e+01	1.6e+02	7.5e+02	9.7e+02	1.2e+03	1.5e+03	1.7e+03	2.1e+03	2.1e+03	112	119	1124897
6-11 months	99.4%	1.2e+03	3.4e+01	1.2e+02	2.1e+02	6.4e+02	9.8e+02	1.2e+03	1.4e+03	1.6e+03	1.8e+03	2.3e+03	2.5e+03	159	160	1768152
1-2 years	100.0%	1.1e+03	1.1e+01	3.2e+02	5.1e+02	6.2e+02	8.1e+02	1.1e+03	1.3e+03	1.6e+03	1.8e+03	2.2e+03	2.8e+03	1356	1356	8270523
3-5 years	100.0%	1.0e+03	9.9e+00	3.4e+02	5.0e+02	5.8e+02	7.6e+02	1.0e+03	1.2e+03	1.5e+03	1.7e+03	2.1e+03	2.6e+03	1435	1435	12376836
6-10 years	100.0%	1.1e+03	1.2e+01	3.9e+02	5.5e+02	6.5e+02	8.3e+02	1.1e+03	1.3e+03	1.7e+03	1.9e+03	2.3e+03	3.6e+03	1189	1189	19498495
11-15 years	100.0%	1.2e+03	1.7e+01	3.2e+02	5.4e+02	6.2e+02	8.3e+02	1.1e+03	1.5e+03	1.8e+03	2.2e+03	2.9e+03	4.8e+03	1005	1005	19286648
16-17 years	100.0%	1.2e+03	3.3e+01	3.0e+02	3.9e+02	4.9e+02	7.1e+02	1.0e+03	1.5e+03	2.0e+03	2.5e+03	3.2e+03	4.4e+03	363	363	7760616
Dairy																
<1month	66.7%	*	*	*	*	*	*	*	*	*	*	*	*	10	15	150104
1-2 months	75.4%	8.5e+02	6.3e+01	0.0e+00	0.0e+00	1.1e+02	7.9e+02	9.2e+02	1.0e+03	1.2e+03	1.3e+03	2.0e+03	2.0e+03	49	65	729143
3-5 months	86.6%	7.9e+02	4.8e+01	0.0e+00	3.1e+00	2.3e+01	5.7e+02	8.5e+02	1.1e+03	1.3e+03	1.5e+03	2.0e+03	2.1e+03	103	119	1124897
6-11 months	95.6%	7.7e+02	3.1e+01	0.0e+00	8.1e+00	2.1e+02	6.1e+02	7.5e+02	9.6e+02	1.3e+03	1.5e+03	1.9e+03	2.0e+03	153	160	1768152
1-2 years	99.7%	4.8e+02	8.3e+00	5.3e+00	7.0e+01	1.3e+02	2.6e+02	4.3e+02	6.5e+02	8.9e+02	1.1e+03	1.4e+03	2.0e+03	1352	1356	8270523
3-5 years	99.6%	3.9e+02	6.3e+00	7.8e+00	7.4e+01	1.2e+02	2.2e+02	3.6e+02	5.1e+02	7.2e+02	8.3e+02	1.2e+03	1.7e+03	1429	1435	12376836
6-10 years	99.7%	4.4e+02	7.5e+00	1.1e+01	7.6e+01	1.3e+02	2.6e+02	4.0e+02	5.9e+02	7.8e+02	8.8e+02	1.2e+03	2.7e+03	1185	1189	19498495
11-15 years	99.1%	3.9e+02	9.8e+00	1.8e+00	2.3e+01	5.0e+01	1.6e+02	3.3e+02	5.3e+02	7.9e+02	9.7e+02	1.5e+03	2.0e+03	996	1005	19286648
16-17 years	99.2%	3.5e+02	1.7e+01	3.2e+00	1.3e+01	2.9e+01	1.0e+02	2.7e+02	4.9e+02	7.4e+02	9.8e+02	1.4e+03	1.6e+03	360	363	7760616
Meat																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	10.1%	*	*	*	*	*	*	*	*	*	*	*	*	12	119	1124897
6-11 months	67.5%	2.1e+01	2.4e+00	0.0e+00	0.0e+00	0.0e+00	1.1e+00	1.3e+01	3.2e+01	5.7e+01	7.4e+01	1.2e+02	1.2e+02	108	160	1768152
1-2 years	97.8%	5.9e+01	1.2e+00	0.0e+00	6.2e+00	1.2e+01	2.7e+01	5.2e+01	8.2e+01	1.2e+02	1.4e+02	1.9e+02	3.2e+02	1326	1356	8270523
3-5 years	99.0%	7.9e+01	1.3e+00	0.0e+00	1.6e+01	2.4e+01	4.4e+01	7.2e+01	1.0e+02	1.4e+02	1.7e+02	2.4e+02	3.8e+02	1420	1435	12376836
6-10 years	98.7%	9.2e+01	1.7e+00	0.0e+00	1.7e+01	2.6e+01	4.9e+01	8.3e+01	1.2e+02	1.6e+02	2.0e+02	3.0e+02	4.1e+02	1174	1189	19498495
11-15 years	99.5%	1.2e+02	2.5e+00	5.0e+00	2.2e+01	3.6e+01	6.7e+01	1.1e+02	1.6e+02	2.2e+02	2.7e+02	3.7e+02	6.0e+02	1000	1005	19286648
16-17 years	99.2%	1.3e+02	4.3e+00	5.0e+00	2.0e+01	3.5e+01	7.0e+01	1.1e+02	1.7e+02	2.5e+02	2.9e+02	3.7e+02	4.3e+02	360	363	7760616
Egg																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
6-11 months	60.6%	8.1e+00	1.9e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.3e-01	1.6e+00	3.9e+01	5.8e+01	7.9e+01	8.9e+01	97	160	1768152
1-2 years	92.5%	1.6e+01	7.1e-01	0.0e+00	0.0e+00	1.7e-01	8.1e-01	2.3e+00	2.4e+01	4.9e+01	7.0e+01	1.1e+02	1.9e+02	1254	1356	8270523
3-5 years	90.8%	1.3e+01	7.0e-01	0.0e+00	0.0e+00	8.3e-02	7.3e-01	1.8e+00	2.0e+01	4.3e+01	6.3e+01	1.1e+02	2.5e+02	1303	1435	12376836
6-10 years	91.5%	1.3e+01	7.9e-01	0.0e+00	0.0e+00	2.4e-01	9.0e-01	2.1e+00	6.3e+00	4.5e+01	6.8e+01	1.3e+02	2.2e+02	1088	1189	19498495
11-15 years	92.4%	1.6e+01	1.0e+00	0.0e+00	0.0e+00	3.2e-01	1.4e+00	3.0e+00	1.5e+01	5.6e+01	8.2e+01	1.5e+02	3.1e+02	929	1005	19286648
16-17 years	93.7%	1.6e+01	1.6e+00	0.0e+00	0.0e+00	6.0e-01	1.5e+00	3.3e+00	8.0e+00	5.3e+01	8.1e+01	1.4e+02	1.8e+02	340	363	7760616
Fish																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	8.4%	*	*	*	*	*	*	*	*	*	*	*	*	10	119	1124897
6-11 months	40.6%	1.9e+00	6.3e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.5e+00	5.0e+00	7.5e+00	4.2e+01	4.2e+01	65	160	1768152
1-2 years	60.7%	4.9e+00	4.6e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.2e+00	3.9e+00	1.1e+01	2.4e+01	6.9e+01	1.7e+02	823	1356	8270523
3-5 years	61.0%	6.1e+00	5.4e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.7e+00	5.0e+00	1.4e+01	3.4e+01	8.0e+01	2.0e+02	875	1435	12376836
6-10 years	62.6%	8.9e+00	8.8e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.3e+00	5.7e+00	1.7e+01	4.4e+01	1.4e+02	2.1e+02	744	1189	19498495
11-15 years	63.3%	1.2e+01	1.1e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.9e+00	9.5e+00	2.6e+01	5.7e+01	1.4e+02	2.8e+02	636	1005	19286648
16-17 years	62.5%	1.2e+01	2.2e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.8e+00	1.1e+01	2.1e+01	4.8e+01	1.4e+02	3.7e+02	227	363	7760616
Grain																
<1month	6.7%	*	*	*	*	*	*	*	*	*	*	*	*	1	15	150104
1-2 months	15.4%	*	*	*	*	*	*	*	*	*	*	*	*	10	65	729143

Table 3-3a. Per Capita Intake of the Major Food Groups (g/day, as consumed)

Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
3-5 months	66.4%	1.1e+01	2.3e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.0e+00	1.7e+01	2.8e+01	4.0e+01	9.9e+01	1.8e+02	79	119	1124897
6-11 months	95.0%	7.0e+01	5.4e+00	0.0e+00	5.0e+00	1.0e+01	2.3e+01	4.7e+01	9.3e+01	1.8e+02	1.9e+02	2.7e+02	3.6e+02	152	160	1768152
1-2 years	99.6%	1.5e+02	2.4e+00	1.6e+01	3.9e+01	5.4e+01	8.7e+01	1.3e+02	1.9e+02	2.6e+02	3.2e+02	4.5e+02	6.5e+02	1351	1356	8270523
3-5 years	99.8%	1.9e+02	2.8e+00	4.7e+01	7.0e+01	8.8e+01	1.2e+02	1.7e+02	2.4e+02	3.1e+02	3.6e+02	5.3e+02	1.6e+03	1432	1435	12376836
6-10 years	99.9%	2.2e+02	3.1e+00	4.4e+01	8.5e+01	1.1e+02	1.5e+02	2.1e+02	2.7e+02	3.6e+02	4.1e+02	6.0e+02	7.8e+02	1188	1189	19498495
11-15 years	100.0%	2.6e+02	4.2e+00	5.3e+01	8.4e+01	1.1e+02	1.7e+02	2.3e+02	3.2e+02	4.4e+02	5.0e+02	6.6e+02	1.0e+03	1005	1005	19286648
16-17 years	100.0%	2.5e+02	8.4e+00	2.8e+01	7.2e+01	9.6e+01	1.4e+02	2.2e+02	3.3e+02	4.2e+02	5.2e+02	8.4e+02	1.4e+03	363	363	7760616
Vegetable																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	3.1%	*	*	*	*	*	*	*	*	*	*	*	*	2	65	729143
3-5 months	35.3%	3.0e+01	7.8e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.6e+01	1.1e+02	1.4e+02	2.0e+02	2.8e+02	42	119	1124897
6-11 months	90.0%	1.1e+02	6.8e+00	0.0e+00	0.0e+00	1.4e+01	5.7e+01	1.1e+02	1.4e+02	1.9e+02	2.3e+02	4.9e+02	7.0e+02	144	160	1768152
1-2 years	99.3%	1.3e+02	2.5e+00	3.9e+00	1.9e+01	3.4e+01	6.6e+01	1.1e+02	1.6e+02	2.4e+02	3.1e+02	4.4e+02	7.1e+02	1346	1356	8270523
3-5 years	99.4%	1.4e+02	2.5e+00	3.4e+00	2.4e+01	4.0e+01	7.4e+01	1.2e+02	1.8e+02	2.6e+02	3.2e+02	4.8e+02	7.6e+02	1427	1435	12376836
6-10 years	99.7%	1.7e+02	3.3e+00	9.7e+00	3.5e+01	5.4e+01	8.7e+01	1.4e+02	2.1e+02	3.0e+02	3.7e+02	5.8e+02	9.5e+02	1185	1189	19498495
11-15 years	99.7%	2.2e+02	4.6e+00	1.6e+01	4.8e+01	7.4e+01	1.2e+02	1.9e+02	2.9e+02	4.1e+02	4.8e+02	7.1e+02	1.5e+03	1002	1005	19286648
16-17 years	99.2%	2.5e+02	1.1e+01	1.3e+01	4.2e+01	6.1e+01	1.1e+02	2.1e+02	3.3e+02	5.0e+02	5.9e+02	1.1e+03	1.2e+03	360	363	7760616
Fruit																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	6	65	729143
3-5 months	54.6%	9.3e+01	1.6e+01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.1e+01	1.6e+02	2.9e+02	3.2e+02	5.5e+02	7.5e+02	65	119	1124897
6-11 months	87.5%	1.8e+02	1.1e+01	0.0e+00	0.0e+00	0.0e+00	8.6e+01	1.7e+02	2.3e+02	3.4e+02	4.2e+02	5.7e+02	6.1e+02	140	160	1768152
1-2 years	89.0%	2.5e+02	6.4e+00	0.0e+00	0.0e+00	0.0e+00	9.3e+01	2.0e+02	3.6e+02	5.4e+02	7.1e+02	9.2e+02	2.1e+03	1207	1356	8270523
3-5 years	84.4%	2.1e+02	5.5e+00	0.0e+00	0.0e+00	0.0e+00	6.2e+01	1.6e+02	3.1e+02	4.7e+02	5.6e+02	8.4e+02	1.9e+03	1211	1435	12376836
6-10 years	76.8%	1.7e+02	6.2e+00	0.0e+00	0.0e+00	0.0e+00	3.1e+01	1.2e+02	2.6e+02	4.3e+02	5.2e+02	8.7e+02	1.2e+03	913	1189	19498495
11-15 years	70.0%	1.7e+02	7.7e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.2e+02	2.5e+02	4.4e+02	6.0e+02	8.9e+02	1.5e+03	704	1005	19286648
16-17 years	56.7%	1.5e+02	1.6e+01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.0e+01	2.4e+02	4.2e+02	6.2e+02	9.0e+02	1.8e+03	206	363	7760616
Fat																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
6-11 months	60.6%	1.5e+00	2.0e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.3e+00	2.5e+00	3.6e+00	4.5e+00	1.1e+01	1.1e+01	97	160	1768152
1-2 years	93.9%	5.5e+00	1.5e-01	0.0e+00	0.0e+00	6.7e-01	1.9e+00	4.1e+00	7.2e+00	1.2e+01	1.6e+01	2.6e+01	5.0e+01	1273	1356	8270523
3-5 years	95.6%	7.8e+00	2.0e-01	0.0e+00	1.7e-01	1.0e+00	2.7e+00	5.6e+00	1.1e+01	1.8e+01	2.2e+01	3.7e+01	6.3e+01	1372	1435	12376836
6-10 years	96.7%	1.1e+01	3.0e-01	0.0e+00	7.3e-01	1.5e+00	3.7e+00	7.7e+00	1.4e+01	2.4e+01	3.0e+01	5.2e+01	8.2e+01	1150	1189	19498495
11-15 years	96.1%	1.4e+01	4.8e-01	0.0e+00	7.9e-01	2.0e+00	4.8e+00	9.7e+00	1.8e+01	3.3e+01	4.1e+01	7.4e+01	1.3e+02	966	1005	19286648
16-17 years	98.3%	1.6e+01	8.9e-01	0.0e+00	1.2e+00	2.4e+00	5.0e+00	1.0e+01	1.9e+01	3.8e+01	4.7e+01	1.0e+02	1.1e+02	357	363	7760616

NOTES:
PC = Percent Consuming
SE = Standard Error
Ntotal = Number of Individuals Surveyed
Nwgt = Number of Observations Weighted to the US Population
Ncons = Number of Individuals Consuming in the 2-Day Survey Period
* = Data not provided for less than 20 observations

Source: Based on analysis of 1994-1996 CSFII.
Similar data presented in Tables 3-16 in g/kg/day and 3-33 of the CSEFH.

Table 3-4. Per Capita Intake of Individual Foods (g/kg/day, as consumed)

	Apples			Asparagus			Bananas			Beets			Broccoli		
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	8.3e-01	1.5e+00	6.2%	0.0e+00	0.0e+00	0.0%	5.6e-02	3.7e-01	1.5%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
3-5 months	7.8e+00	2.2e+00	36.1%	0.0e+00	0.0e+00	0.0%	6.4e-01	4.4e-01	16.0%	2.0e-03	4.0e-02	0.8%	0.0e+00	0.0e+00	0.0%
6-11 months	9.7e+00	1.2e+00	63.1%	0.0e+00	0.0e+00	0.0%	2.0e+00	5.2e-01	35.6%	6.7e-02	5.1e-01	0.6%	3.6e-02	1.6e-01	2.5%
1-2 years	8.0e+00	4.5e-01	55.1%	1.4e-02	8.2e-02	0.7%	1.7e+00	1.4e-01	35.0%	4.0e-03	3.5e-02	0.4%	2.4e-01	9.5e-02	8.6%
3-5 years	4.1e+00	2.7e-01	47.7%	9.0e-03	4.1e-02	0.7%	7.1e-01	9.5e-02	20.8%	1.2e-02	5.1e-02	0.6%	1.4e-01	6.0e-02	7.8%
6-10 years	1.6e+00	1.6e-01	35.0%	1.6e-02	7.8e-02	0.8%	3.8e-01	8.5e-02	14.4%	4.0e-03	4.0e-02	0.3%	1.1e-01	6.1e-02	6.9%
11-15 years	7.0e-01	1.1e-01	23.1%	3.0e-03	2.7e-02	0.4%	1.5e-01	4.4e-02	11.0%	2.0e-03	2.0e-02	0.3%	7.1e-02	4.6e-02	6.5%
16-17 years	5.8e-01	1.8e-01	21.8%	5.0e-03	3.7e-02	0.6%	8.6e-02	5.5e-02	8.0%	1.0e-03	2.4e-02	0.3%	4.1e-02	6.0e-02	4.7%
	Cabbage			Carrots			Corn			Cucumbers			Lettuce		
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	0.0e+00	0.0e+00	0.0%	8.2e-02	9.2e-01	1.5%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
3-5 months	0.0e+00	0.0e+00	0.0%	1.2e+00	9.2e-01	10.9%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
6-11 months	4.9e-02	3.0e-01	1.3%	6.7e-01	3.5e-01	18.8%	3.5e-01	5.1e-01	5.0%	1.0e-03	1.7e-02	0.6%	0.0e+00	0.0e+00	0.0%
1-2 years	7.1e-02	7.0e-02	3.8%	3.4e-01	1.8e-01	14.5%	4.6e-01	9.7e-02	18.5%	8.9e-02	5.4e-02	6.9%	1.1e-01	3.5e-02	11.0%
3-5 years	9.9e-02	6.0e-02	5.7%	1.8e-01	4.3e-02	15.1%	4.3e-01	7.1e-02	19.2%	1.3e-01	5.9e-02	11.2%	1.7e-01	2.9e-02	18.9%
6-10 years	7.2e-02	4.3e-02	6.9%	1.5e-01	3.1e-02	18.8%	3.4e-01	5.1e-02	22.0%	1.2e-01	4.3e-02	14.6%	1.9e-01	3.2e-02	23.9%
11-15 years	3.9e-02	3.3e-02	5.6%	8.1e-02	3.4e-02	13.6%	1.8e-01	4.2e-02	16.0%	1.1e-01	4.9e-02	14.2%	1.6e-01	2.1e-02	32.0%
16-17 years	2.8e-02	4.2e-02	4.1%	2.9e-02	2.2e-02	9.4%	1.0e-01	5.8e-02	10.5%	8.3e-02	5.1e-02	16.8%	1.9e-01	3.9e-02	36.4%
	Lima Beans			Okra			Onions			Other Berries			Peaches		
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
3-5 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	5.0e-01	5.9e-01	7.6%
6-11 months	1.0e-03	1.2e-02	0.6%	0.0e+00	0.0e+00	0.0%	1.4e-02	2.0e-01	0.6%	1.1e-02	9.9e-02	0.6%	1.5e+00	5.8e-01	23.1%
1-2 years	3.7e-02	7.4e-02	1.6%	1.0e-02	4.1e-02	1.0%	1.9e-02	2.1e-02	4.1%	7.3e-02	2.3e-01	1.5%	4.5e-01	1.5e-01	9.7%
3-5 years	1.0e-02	4.4e-02	0.8%	6.0e-03	8.4e-02	0.3%	2.2e-02	2.1e-02	4.7%	3.4e-02	8.4e-02	1.7%	2.5e-01	1.2e-01	7.2%
6-10 years	2.0e-02	6.7e-02	1.1%	6.0e-03	3.6e-02	0.5%	2.6e-02	2.0e-02	6.7%	3.3e-02	6.8e-02	1.9%	1.3e-01	8.9e-02	5.6%
11-15 years	6.0e-03	4.7e-02	0.6%	4.0e-03	2.3e-02	0.9%	4.4e-02	2.3e-02	9.9%	1.8e-02	4.4e-02	1.8%	9.0e-02	6.9e-02	4.5%
16-17 years	1.0e-03	2.1e-02	0.3%	7.0e-03	4.5e-02	1.1%	4.4e-02	2.1e-02	15.4%	1.5e-02	1.3e-01	0.8%	3.8e-02	5.2e-02	4.4%
	Pears			Peas			Peppers			Pumpkins			Snap Beans		
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	5.1e-02	5.8e-01	1.5%
3-5 months	1.7e+00	8.6e-01	16.8%	4.9e-01	5.1e-01	8.4%	0.0e+00	0.0e+00	0.0%	5.0e-01	6.0e-01	8.4%	4.2e-01	5.8e-01	5.9%
6-11 months	1.8e+00	7.1e-01	20.6%	9.7e-01	4.6e-01	14.4%	2.0e-03	2.0e-02	0.6%	6.1e-01	6.0e-01	10.6%	1.0e+00	3.6e-01	21.3%
1-2 years	3.9e-01	1.6e-01	8.5%	2.6e-01	7.2e-02	12.3%	7.0e-03	1.5e-02	1.5%	5.4e-02	1.7e-01	1.0%	4.9e-01	8.6e-02	19.4%
3-5 years	1.8e-01	1.1e-01	5.0%	1.6e-01	5.4e-02	9.1%	1.8e-02	2.3e-02	3.1%	3.0e-03	3.4e-02	0.3%	2.4e-01	5.0e-02	15.3%
6-10 years	1.2e-01	8.1e-02	5.3%	1.3e-01	5.6e-02	8.3%	1.6e-02	1.5e-02	4.4%	1.0e-03	1.9e-02	0.2%	1.6e-01	6.6e-02	12.1%
11-15 years	3.8e-02	5.1e-02	2.5%	7.1e-02	4.5e-02	6.3%	2.1e-02	1.7e-02	6.3%	0.0e+00	1.6e-02	0.1%	9.8e-02	3.4e-02	10.4%
16-17 years	1.8e-02	6.0e-02	1.7%	3.3e-02	5.3e-02	4.1%	1.8e-02	1.7e-02	8.3%	5.0e-03	1.1e-01	0.3%	3.6e-02	3.2e-02	6.9%
	Strawberries			Tomatoes			White Potatoes			Breads			Breakfast Foods (Grains)		
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
3-5 months	0.0e+00	0.0e+00	0.0%	2.8e-01	4.7e-01	8.4%	2.2e-01	2.4e-01	11.8%	2.4e-02	1.1e-01	2.5%	0.0e+00	0.0e+00	0.0%
6-11 months	1.5e-02	1.2e-01	1.3%	9.3e-01	1.2e-01	58.1%	1.0e+00	2.1e-01	53.1%	5.3e-01	1.6e-01	31.9%	1.0e-01	2.4e-01	3.8%
1-2 years	1.2e-01	9.1e-02	4.4%	2.1e+00	7.6e-02	88.8%	2.2e+00	1.0e-01	77.4%	2.0e+00	6.3e-02	76.9%	4.3e-01	6.6e-02	19.5%
3-5 years	9.6e-02	8.1e-02	4.4%	1.7e+00	5.9e-02	87.7%	2.0e+00	8.5e-02	77.6%	2.3e+00	5.4e-02	85.6%	3.9e-01	5.5e-02	21.5%
6-10 years	6.6e-02	6.0e-02	4.5%	1.2e+00	4.2e-02	89.1%	1.6e+00	6.7e-02	78.2%	1.7e+00	4.5e-02	86.5%	4.0e-01	5.1e-02	22.8%
11-15 years	3.6e-02	3.8e-02	3.8%	9.9e-01	3.2e-02	92.6%	1.3e+00	5.1e-02	84.5%	1.2e+00	3.5e-02	88.4%	1.8e-01	3.9e-02	15.2%
16-17 years	3.0e-02	4.0e-02	4.1%	1.0e+00	5.2e-02	96.7%	1.3e+00	1.1e-01	81.5%	9.7e-01	5.0e-02	82.9%	1.1e-01	6.0e-02	11.6%
	Cereals (Baby)			Cereals (Cooked)			Cereals (Ready-to-Eat)			Pasta			Rice		
<1month	2.1e-02	9.5e-02	6.7%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	2.1e-01	2.8e-01	13.8%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%

Table 3-4. Per Capita Intake of Individual Foods (g/kg/day, as consumed)

3-5 months	1.3e+00	3.2e-01	60.5%	9.4e-02	7.2e-01	0.8%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	2.0e-02	3.2e-01	0.8%
6-11 months	2.5e+00	4.5e-01	67.5%	1.9e+00	1.2e+00	11.9%	1.3e-01	6.8e-02	19.4%	1.4e-01	2.2e-01	5.6%	3.4e-01	4.2e-01	8.1%
1-2 years	1.6e-01	9.5e-02	6.5%	1.6e+00	2.9e-01	16.6%	9.7e-01	3.9e-02	65.0%	8.0e-01	1.5e-01	16.2%	9.0e-01	1.7e-01	19.1%
3-5 years	4.0e-03	5.5e-02	0.3%	1.3e+00	2.8e-01	14.7%	1.1e+00	3.8e-02	68.5%	5.5e-01	1.3e-01	12.5%	8.0e-01	1.8e-01	16.3%
6-10 years	0.0e+00	2.0e-03	0.1%	5.2e-01	2.0e-01	9.1%	8.2e-01	3.5e-02	63.3%	4.9e-01	1.2e-01	12.4%	4.9e-01	1.1e-01	15.7%
11-15 years	0.0e+00	0.0e+00	0.0%	2.0e-01	1.1e-01	7.2%	4.9e-01	2.9e-02	53.6%	2.9e-01	9.5e-02	11.7%	5.1e-01	1.1e-01	18.0%
16-17 years	0.0e+00	0.0e+00	0.0%	6.5e-02	1.5e-01	3.3%	3.1e-01	4.1e-02	41.0%	2.1e-01	1.1e-01	11.3%	3.8e-01	2.2e-01	16.8%
	Snacks (Grains)			Sweets (Grains)			Beef			Eggs			Game		
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
3-5 months	2.9e-02	1.5e-01	3.4%	2.0e-02	4.7e-02	3.4%	1.2e-01	1.4e-01	9.2%	4.2e-02	8.6e-02	9.2%	0.0e+00	0.0e+00	0.0%
6-11 months	2.7e-01	8.4e-02	28.8%	3.2e-01	1.4e-01	21.3%	1.0e+00	1.5e-01	58.1%	8.4e-01	2.1e-01	58.1%	0.0e+00	0.0e+00	0.0%
1-2 years	7.4e-01	3.9e-02	57.5%	1.2e+00	6.6e-02	53.9%	1.4e+00	4.5e-02	88.9%	1.2e+00	5.5e-02	88.8%	9.0e-03	6.7e-02	0.5%
3-5 years	7.0e-01	4.2e-02	54.5%	1.3e+00	6.4e-02	62.1%	1.3e+00	4.2e-02	86.1%	6.5e-01	3.7e-02	84.5%	9.0e-03	5.4e-02	0.6%
6-10 years	4.9e-01	3.5e-02	50.8%	1.2e+00	6.3e-02	63.5%	1.1e+00	4.0e-02	87.2%	4.2e-01	2.8e-02	84.8%	1.6e-02	5.8e-02	1.2%
11-15 years	3.1e-01	2.6e-02	49.0%	7.2e-01	4.0e-02	58.9%	9.0e-01	3.1e-02	91.7%	3.0e-01	2.0e-02	89.6%	7.0e-03	3.3e-02	0.8%
16-17 years	3.1e-01	4.5e-02	46.3%	5.8e-01	6.6e-02	53.2%	8.1e-01	3.8e-02	94.5%	2.4e-01	2.4e-02	92.8%	2.0e-03	1.8e-02	0.3%
	Pork			Poultry			Butter			Margarine			Dressing		
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
1-2 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%
3-5 months	1.1e-02	1.4e-02	8.4%	4.4e-02	5.9e-02	8.4%	0.0e+00	0.0e+00	0.0%	3.0e-03	2.1e-02	0.8%	0.0e+00	0.0e+00	0.0%
6-11 months	9.2e-02	3.0e-02	29.0%	7.2e-01	1.5e-01	61.9%	3.0e-03	9.0e-03	2.5%	6.0e-03	1.6e-02	4.4%	6.0e-03	2.9e-02	1.9%
1-2 years	4.0e-01	2.5e-02	86.7%	1.4e+00	5.1e-02	89.7%	3.4e-02	1.0e-02	13.0%	7.3e-02	9.0e-03	30.1%	6.1e-02	2.1e-02	11.1%
3-5 years	3.8e-01	2.4e-02	84.5%	1.3e+00	4.7e-02	88.1%	4.2e-02	1.0e-02	14.2%	8.5e-02	9.0e-03	31.6%	8.4e-02	1.6e-02	18.3%
6-10 years	2.7e-01	1.8e-02	84.3%	8.6e-01	3.6e-02	87.2%	3.4e-02	9.0e-03	15.4%	6.6e-02	8.0e-03	32.2%	9.5e-02	1.5e-02	22.0%
11-15 years	2.3e-01	1.5e-02	89.4%	6.5e-01	2.9e-02	91.9%	2.0e-02	6.0e-03	13.6%	4.0e-02	6.0e-03	26.0%	7.4e-02	1.2e-02	23.9%
16-17 years	2.0e-01	2.2e-02	90.6%	5.6e-01	3.5e-02	94.5%	7.0e-03	5.0e-03	8.3%	2.7e-02	7.0e-03	22.9%	7.7e-02	2.3e-02	21.2%
	Mayonnaise			Sauce			Vegetable Oil			Animal Fat					
<1month	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%			
1-2 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%			
3-5 months	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%	0.0e+00	0.0e+00	0.0%			
6-11 months	1.0e-03	7.0e-03	1.3%	0.0e+00	0.0e+00	0.0%	1.0e-02	8.3e-02	1.3%	0.0e+00	0.0e+00	0.0%			
1-2 years	2.6e-02	1.0e-02	9.7%	4.0e-03	2.5e-02	0.4%	1.0e-03	1.4e-02	0.4%	0.0e+00	0.0e+00	0.0%			
3-5 years	3.7e-02	8.0e-03	15.0%	3.0e-03	1.6e-02	0.8%	2.0e-03	7.0e-03	0.7%	0.0e+00	0.0e+00	0.0%			
6-10 years	2.9e-02	6.0e-03	16.6%	3.0e-03	1.5e-02	0.8%	1.0e-03	8.0e-03	0.5%	0.0e+00	0.0e+00	0.0%			
11-15 years	3.4e-02	7.0e-03	19.9%	3.0e-03	1.8e-02	0.7%	0.0e+00	4.0e-03	0.4%	0.0e+00	0.0e+00	0.0%			
16-17 years	3.0e-02	8.0e-03	22.9%	2.0e-03	1.4e-02	0.8%	0.0e+00	1.0e-03	0.3%	0.0e+00	0.0e+00	0.0%			

NOTES:
PC = Percent Consuming
SE = Standard Error

Source: Based on analysis of 1994-1996 CSFII.

Table 3-5. Per Capita Intake of USDA Categories of Vegetables and Fruits (g/kg/day, as consumed)															
Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
								Dark Green Vegetables								
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	119	1124897
6-11 months	3.8%	*	*	*	*	*	*	*	*	*	*	*	*	6	160	1768152
1-2 years	12.5%	3.3e-01	9.8e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	8.4e-01	2.3e+00	6.5e+00	2.1e+01	170	1356	8270523
3-5 years	10.9%	2.0e-01	6.3e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.2e-01	1.5e+00	4.1e+00	1.3e+01	157	1435	12376836
6-10 years	9.4%	1.5e-01	6.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.1e-01	9.9e-01	3.7e+00	6.8e+00	112	1189	19498495
11-15 years	10.5%	1.4e-01	4.9e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.2e-01	1.1e+00	2.7e+00	6.2e+00	106	1005	19286648
16-17 years	8.8%	1.1e-01	8.9e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.4e-01	3.2e+00	4.3e+00	32	363	7760616
								Deep Yellow Vegetables								
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	1.7%	*	*	*	*	*	*	*	*	*	*	*	*	2	119	1124897
6-11 months	8.8%	*	*	*	*	*	*	*	*	*	*	*	*	14	160	1768152
1-2 years	15.2%	2.8e-01	6.5e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.3e-01	2.1e+00	4.2e+00	1.2e+01	206	1356	8270523
3-5 years	16.9%	2.4e-01	5.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.2e-01	1.7e+00	4.3e+00	8.3e+00	242	1435	12376836
6-10 years	20.3%	1.8e-01	3.5e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.7e-01	1.2e+00	2.4e+00	5.4e+00	241	1189	19498495
11-15 years	14.6%	9.5e-02	3.5e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.2e-01	6.8e-01	1.8e+00	1.1e+01	147	1005	19286648
16-17 years	10.5%	4.3e-02	3.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.7e-01	1.0e+00	2.1e+00	38	363	7760616
								Other Vegetables								
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	4.2%	*	*	*	*	*	*	*	*	*	*	*	*	5	119	1124897
6-11 months	21.3%	8.7e-01	4.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.7e+00	5.1e+00	1.1e+01	1.5e+01	34	160	1768152
1-2 years	62.4%	2.2e+00	1.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.5e-01	3.0e+00	6.4e+00	8.9e+00	1.6e+01	5.4e+01	846	1356	8270523
3-5 years	64.5%	1.7e+00	9.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.1e-01	2.2e+00	4.7e+00	7.2e+00	1.3e+01	2.2e+01	926	1435	12376836
6-10 years	66.3%	1.4e+00	7.8e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.3e-01	1.9e+00	3.7e+00	5.2e+00	1.0e+01	2.9e+01	788	1189	19498495
11-15 years	69.4%	9.0e-01	5.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.5e-01	1.3e+00	2.4e+00	3.5e+00	5.8e+00	1.2e+01	697	1005	19286648
16-17 years	65.0%	6.7e-01	7.3e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.5e-01	9.3e-01	1.6e+00	2.6e+00	6.8e+00	7.5e+00	236	363	7760616
								Citrus Fruits								
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	1.7%	*	*	*	*	*	*	*	*	*	*	*	*	2	119	1124897
6-11 months	8.8%	*	*	*	*	*	*	*	*	*	*	*	*	14	160	1768152
1-2 years	37.7%	4.0e+00	3.4e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.7e+00	1.3e+01	1.9e+01	3.7e+01	1.1e+02	511	1356	8270523
3-5 years	38.9%	2.9e+00	2.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.7e+00	9.3e+00	1.3e+01	2.1e+01	6.7e+01	558	1435	12376836
6-10 years	33.9%	1.9e+00	1.9e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.8e+00	6.4e+00	9.8e+00	1.7e+01	2.8e+01	403	1189	19498495

Table 3-5. Per Capita Intake of USDA Categories of Vegetables and Fruits (g/kg/day, as consumed)

Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
11-15 years	40.7%	1.7e+00	1.5e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.6e+00	5.5e+00	8.4e+00	1.4e+01	2.1e+01	409	1005	19286648
16-17 years	30.9%	1.1e+00	2.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	9.4e-01	3.7e+00	6.4e+00	1.1e+01	1.4e+01	112	363	7760616
Other Fruits																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	7.7%	*	*	*	*	*	*	*	*	*	*	*	*	5	65	729143
3-5 months	53.8%	1.3e+01	2.2e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.1e+00	2.1e+01	4.0e+01	4.3e+01	6.3e+01	1.1e+02	64	119	1124897
6-11 months	81.3%	1.9e+01	1.2e+00	0.0e+00	0.0e+00	0.0e+00	7.8e+00	1.8e+01	2.6e+01	3.7e+01	4.3e+01	6.4e+01	7.0e+01	130	160	1768152
1-2 years	79.6%	1.5e+01	5.0e-01	0.0e+00	0.0e+00	0.0e+00	2.8e+00	1.1e+01	2.3e+01	3.5e+01	4.8e+01	7.0e+01	1.1e+02	1079	1356	8270523
3-5 years	71.4%	8.1e+00	3.1e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.9e+00	1.2e+01	2.1e+01	2.7e+01	4.4e+01	8.5e+01	1024	1435	12376836
6-10 years	62.3%	3.7e+00	1.9e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.1e+00	5.4e+00	9.8e+00	1.4e+01	2.2e+01	3.8e+01	741	1189	19498495
11-15 years	49.8%	1.7e+00	1.3e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.9e-01	2.4e+00	5.3e+00	7.7e+00	1.3e+01	3.2e+01	500	1005	19286648
16-17 years	41.0%	1.2e+00	2.1e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.5e+00	4.0e+00	5.3e+00	9.8e+00	2.4e+01	149	363	7760616

NOTES:

PC = Percent Consuming
SE = Standard Error
Ntotal = Number of Individuals Surveyed
Nwgt = Number of Observations Weighted to the US Population
Ncons = Number of Individuals Consuming in the 2-Day Survey Period
* = Data not provided for less than 20 observations

Source: Based on analysis of 1994-1996 CSFII.

Table 3-6. Per Capita Intake of Exposed/Protected Fruit and Vegetable Categories (g/kg/day, as consumed)

Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
Exposed Fruits																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	6.2%	*	*	*	*	*	*	*	*	*	*	*	*	4	65	729143
3-5 months	46.2%	1.1e+01	2.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.4e+00	2.0e+01	3.8e+01	4.1e+01	6.3e+01	6.3e+01	55	119	1124897
6-11 months	75.0%	1.4e+01	1.2e+00	0.0e+00	0.0e+00	0.0e+00	4.4e+00	1.2e+01	1.9e+01	3.3e+01	3.7e+01	6.4e+01	7.0e+01	120	160	1768152
1-2 years	68.6%	1.1e+01	4.7e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.7e+00	1.6e+01	2.9e+01	3.9e+01	6.6e+01	1.0e+02	930	1356	8270523
3-5 years	60.7%	5.6e+00	2.8e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.7e+00	8.1e+00	1.6e+01	2.2e+01	3.5e+01	7.7e+01	871	1435	12376836
6-10 years	49.9%	2.4e+00	1.6e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.9e-02	3.4e+00	6.7e+00	9.3e+00	1.8e+01	3.2e+01	593	1189	19498495
11-15 years	37.2%	1.1e+00	1.1e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.5e+00	3.6e+00	5.9e+00	9.7e+00	1.4e+01	374	1005	19286648
16-17 years	32.2%	8.1e-01	1.7e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	9.1e-01	2.9e+00	4.4e+00	7.4e+00	1.5e+01	117	363	7760616
Protected Fruits																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	1.5%	*	*	*	*	*	*	*	*	*	*	*	*	1	65	729143
3-5 months	19.3%	8.5e-01	4.5e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.2e+00	6.1e+00	1.0e+01	1.2e+01	23	119	1124897
6-11 months	45.6%	3.1e+00	5.8e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.4e+00	8.3e+00	1.1e+01	2.7e+01	3.0e+01	73	160	1768152
1-2 years	62.1%	6.4e+00	3.1e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.6e+00	9.2e+00	1.8e+01	2.4e+01	3.9e+01	1.1e+02	842	1356	8270523
3-5 years	54.5%	4.4e+00	2.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.1e+00	6.7e+00	1.2e+01	1.7e+01	2.8e+01	6.7e+01	782	1435	12376836
6-10 years	48.6%	2.8e+00	1.9e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.5e-01	4.1e+00	8.6e+00	1.2e+01	2.0e+01	3.2e+01	578	1189	19498495
11-15 years	50.9%	2.1e+00	1.5e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.2e-01	3.1e+00	6.4e+00	9.5e+00	1.5e+01	2.7e+01	512	1005	19286648
16-17 years	40.8%	1.4e+00	2.3e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.0e+00	4.4e+00	8.3e+00	1.4e+01	2.4e+01	148	363	7760616
Exposed Vegetables																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	1.5%	*	*	*	*	*	*	*	*	*	*	*	*	1	65	729143
3-5 months	8.4%	*	*	*	*	*	*	*	*	*	*	*	*	10	119	1124897
6-11 months	33.8%	2.0e+00	4.9e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.1e+00	5.8e+00	1.0e+01	1.5e+01	1.9e+01	54	160	1768152
1-2 years	63.4%	2.0e+00	1.1e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.9e-01	2.7e+00	5.8e+00	8.6e+00	1.5e+01	4.5e+01	860	1356	8270523
3-5 years	68.2%	1.6e+00	8.3e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.7e-01	2.2e+00	4.4e+00	6.4e+00	1.3e+01	2.5e+01	978	1435	12376836
6-10 years	70.2%	1.2e+00	6.4e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.0e-01	1.6e+00	3.4e+00	4.8e+00	8.5e+00	2.0e+01	835	1189	19498495
11-15 years	74.9%	1.0e+00	5.4e-02	0.0e+00	0.0e+00	0.0e+00	3.7e-02	5.4e-01	1.4e+00	2.7e+00	3.7e+00	6.9e+00	1.3e+01	753	1005	19286648
16-17 years	74.7%	9.8e-01	8.2e-02	0.0e+00	0.0e+00	0.0e+00	4.3e-02	5.1e-01	1.3e+00	2.6e+00	4.0e+00	5.9e+00	1.0e+01	271	363	7760616
Protected Vegetables																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
3-5 months	16.0%	*	*	*	*	*	*	*	*	*	*	*	*	19	119	1124897
6-11 months	30.6%	2.2e+00	5.5e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.3e+00	7.3e+00	9.6e+00	2.0e+01	2.3e+01	49	160	1768152
1-2 years	41.4%	1.5e+00	1.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.9e+00	4.4e+00	7.0e+00	1.4e+01	2.8e+01	562	1356	8270523
3-5 years	38.8%	1.1e+00	9.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.4e+00	3.5e+00	5.4e+00	1.0e+01	1.8e+01	557	1435	12376836
6-10 years	39.4%	7.8e-01	7.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.1e+00	2.6e+00	3.9e+00	7.0e+00	2.7e+01	468	1189	19498495
11-15 years	35.5%	5.8e-01	7.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.5e-01	1.8e+00	2.9e+00	6.3e+00	2.2e+01	357	1005	19286648
16-17 years	26.7%	3.0e-01	7.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.5e-02	1.2e+00	1.7e+00	3.1e+00	5.8e+00	97	363	7760616
Root Vegetables																
<1month	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
1-2 months	1.5%	*	*	*	*	*	*	*	*	*	*	*	*	1	65	729143
3-5 months	19.3%	1.7e+00	7.9e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	8.2e+00	9.6e+00	2.1e+01	2.2e+01	23	119	1124897

Table 3-6. Per Capita Intake of Exposed/Protected Fruit and Vegetable Categories (g/kg/day, as consumed)

Age Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
6-11 months	53.1%	2.8e+00	4.5e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	8.0e-01	4.6e+00	8.0e+00	1.0e+01	1.7e+01	3.3e+01	85	160	1768152
1-2 years	68.2%	2.6e+00	1.3e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.4e+00	3.6e+00	6.8e+00	8.3e+00	1.7e+01	8.3e+01	925	1356	8270523
3-5 years	71.1%	2.2e+00	9.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.4e+00	3.2e+00	5.5e+00	7.1e+00	1.4e+01	3.2e+01	1020	1435	12376836
6-10 years	72.7%	1.7e+00	7.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.0e+00	2.4e+00	4.3e+00	5.6e+00	9.5e+00	2.1e+01	864	1189	19498495
11-15 years	77.5%	1.3e+00	5.6e-02	0.0e+00	0.0e+00	0.0e+00	1.7e-01	9.1e-01	1.8e+00	3.3e+00	4.3e+00	6.4e+00	1.8e+01	779	1005	19286648
16-17 years	73.8%	1.3e+00	1.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	8.2e-01	1.8e+00	3.0e+00	3.7e+00	1.1e+01	1.5e+01	268	363	7760616

NOTES:
PC = Percent Consuming
SE = Standard Error
Ntotal = Number of Individuals Surveyed
Nwgt = Number of Observations Weighted to the US Population
Ncons = Number of Individuals Consuming in the 2-Day Survey Period
* = Data not provided for less than 20 observations

Source: Based on analysis of 1994-1996 CSFII.

Table 3-7. Per Capita Intake of Major Food Groups (g/kg/day, as consumed)															
Food Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
Age <1month																
Total Dietary Intake	60.0%	*	*	*	*	*	*	*	*	*	*	*	*	9	15	150104
Total Dairy Intake	60.0%	*	*	*	*	*	*	*	*	*	*	*	*	9	15	150104
Total Meat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Egg Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Fish Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Grain Intake	6.7%	*	*	*	*	*	*	*	*	*	*	*	*	1	15	150104
Total Vegetable Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Fruit Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Fat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Age 1-2 months																
Total Dietary Intake	70.8%	1.6e+02	1.4e+01	0.0e+00	0.0e+00	6.9e+00	1.5e+02	1.8e+02	2.2e+02	2.4e+02	2.7e+02	3.1e+02	3.3e+02	46	65	729143
Total Dairy Intake	69.2%	1.6e+02	1.4e+01	0.0e+00	0.0e+00	0.0e+00	1.5e+02	1.8e+02	2.2e+02	2.4e+02	2.7e+02	3.1e+02	3.3e+02	45	65	729143
Total Meat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Total Egg Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Total Fish Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Total Grain Intake	13.8%	*	*	*	*	*	*	*	*	*	*	*	*	9	65	729143
Total Vegetable Intake	1.5%	*	*	*	*	*	*	*	*	*	*	*	*	1	65	729143
Total Fruit Intake	7.7%	*	*	*	*	*	*	*	*	*	*	*	*	5	65	729143
Total Fat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Age 3-5 months																
Total Dietary Intake	91.6%	1.3e+02	7.3e+00	0.0e+00	1.2e+00	1.8e+01	9.3e+01	1.4e+02	1.8e+02	2.3e+02	2.4e+02	2.9e+02	2.9e+02	109	119	1124897
Total Dairy Intake	84.0%	1.1e+02	7.4e+00	0.0e+00	0.0e+00	5.6e-01	6.2e+01	1.3e+02	1.7e+02	2.0e+02	2.3e+02	2.8e+02	2.8e+02	100	119	1124897
Total Meat Intake	10.1%	*	*	*	*	*	*	*	*	*	*	*	*	12	119	1124897
Total Egg Intake	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
Total Fish Intake	8.4%	*	*	*	*	*	*	*	*	*	*	*	*	10	119	1124897
Total Grain Intake	64.7%	1.6e+00	3.2e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.4e-01	2.4e+00	4.4e+00	5.9e+00	1.1e+01	2.7e+01	77	119	1124897
Total Vegetable Intake	34.5%	4.1e+00	1.1e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.7e+00	1.7e+01	1.9e+01	3.0e+01	3.1e+01	41	119	1124897
Total Fruit Intake	54.6%	1.3e+01	2.2e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.1e+00	2.1e+01	4.0e+01	4.3e+01	6.3e+01	1.1e+02	65	119	1124897
Total Fat Intake	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
Age 6-11 months																
Total Dietary Intake	95.0%	1.3e+02	4.3e+00	0.0e+00	2.3e+01	5.4e+01	1.0e+02	1.2e+02	1.6e+02	1.9e+02	2.0e+02	2.5e+02	3.1e+02	152	160	1768152
Total Dairy Intake	91.3%	8.3e+01	3.7e+00	0.0e+00	4.9e-02	1.0e+01	5.9e+01	8.3e+01	1.1e+02	1.3e+02	1.7e+02	1.9e+02	2.4e+02	146	160	1768152
Total Meat Intake	65.0%	2.3e+00	2.6e-01	0.0e+00	0.0e+00	0.0e+00	5.3e-02	1.4e+00	3.4e+00	6.0e+00	8.6e+00	1.2e+01	1.2e+01	104	160	1768152
Total Egg Intake	58.1%	8.4e-01	2.1e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.0e-02	1.9e-01	3.3e+00	5.8e+00	8.3e+00	1.1e+01	93	160	1768152
Total Fish Intake	40.6%	2.2e-01	7.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.6e-01	5.3e-01	8.7e-01	4.7e+00	4.7e+00	65	160	1768152
Total Grain Intake	91.3%	7.7e+00	6.2e-01	0.0e+00	2.3e-02	1.0e+00	2.4e+00	5.2e+00	1.0e+01	2.1e+01	2.4e+01	3.3e+01	4.0e+01	146	160	1768152
Total Vegetable Intake	86.3%	1.2e+01	9.1e-01	0.0e+00	0.0e+00	8.0e-01	5.9e+00	1.1e+01	1.5e+01	2.4e+01	2.9e+01	4.9e+01	1.0e+02	138	160	1768152
Total Fruit Intake	83.8%	2.0e+01	1.2e+00	0.0e+00	0.0e+00	0.0e+00	8.6e+00	1.9e+01	2.6e+01	3.7e+01	4.4e+01	6.7e+01	7.1e+01	134	160	1768152
Total Fat Intake	58.8%	1.7e-01	2.3e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.4e-01	2.5e-01	4.0e-01	4.9e-01	1.2e+00	1.7e+00	94	160	1768152
Age 1-2 years																
Total Dietary Intake	96.0%	8.4e+01	1.1e+00	0.0e+00	2.6e+01	3.9e+01	6.0e+01	8.1e+01	1.0e+02	1.3e+02	1.5e+02	1.9e+02	2.6e+02	1302	1356	8270523
Total Dairy Intake	95.7%	3.7e+01	7.8e-01	0.0e+00	4.1e-01	6.7e+00	1.8e+01	3.2e+01	5.1e+01	7.4e+01	9.0e+01	1.3e+02	1.8e+02	1298	1356	8270523
Total Meat Intake	94.0%	4.4e+00	9.4e-02	0.0e+00	0.0e+00	7.6e-01	1.9e+00	3.8e+00	6.2e+00	8.9e+00	1.0e+01	1.5e+01	2.4e+01	1274	1356	8270523
Total Egg Intake	88.8%	1.2e+00	5.5e-02	0.0e+00	0.0e+00	0.0e+00	5.3e-02	1.6e-01	1.8e+00	3.8e+00	5.1e+00	8.3e+00	1.4e+01	1204	1356	8270523
Total Fish Intake	58.2%	3.7e-01	3.7e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	8.0e-02	2.9e-01	7.8e-01	1.8e+00	4.7e+00	1.4e+01	789	1356	8270523
Total Grain Intake	95.6%	1.1e+01	2.0e-01	0.0e+00	1.7e+00	3.6e+00	6.4e+00	9.8e+00	1.4e+01	2.1e+01	2.5e+01	3.5e+01	4.8e+01	1297	1356	8270523
Total Vegetable Intake	95.4%	9.5e+00	2.1e-01	0.0e+00	4.7e-01	1.9e+00	4.5e+00	8.0e+00	1.3e+01	1.9e+01	2.3e+01	3.3e+01	8.3e+01	1293	1356	8270523

Table 3-7. Per Capita Intake of Major Food Groups (g/kg/day, as consumed)																
Food Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
Total Fruit Intake	85.5%	1.9e+01	5.2e-01	0.0e+00	0.0e+00	0.0e+00	6.4e+00	1.6e+01	2.7e+01	4.2e+01	5.4e+01	7.7e+01	1.3e+02	1160	1356	8270523
Total Fat Intake	90.1%	4.2e-01	1.2e-02	0.0e+00	0.0e+00	1.0e-02	1.4e-01	3.1e-01	5.5e-01	9.1e-01	1.2e+00	2.2e+00	3.3e+00	1222	1356	8270523
Age 3-5 years																
Total Dietary Intake	93.2%	5.5e+01	7.3e-01	0.0e+00	0.0e+00	2.6e+01	3.8e+01	5.4e+01	7.0e+01	8.9e+01	1.0e+02	1.3e+02	1.9e+02	1337	1435	12376836
Total Dairy Intake	92.9%	2.1e+01	4.0e-01	0.0e+00	0.0e+00	3.5e+00	1.0e+01	1.9e+01	2.9e+01	4.1e+01	4.9e+01	6.6e+01	9.0e+01	1333	1435	12376836
Total Meat Intake	92.2%	4.1e+00	8.0e-02	0.0e+00	0.0e+00	7.7e-01	2.1e+00	3.8e+00	5.6e+00	7.8e+00	9.4e+00	1.3e+01	2.1e+01	1323	1435	12376836
Total Egg Intake	84.5%	6.5e-01	3.7e-02	0.0e+00	0.0e+00	0.0e+00	3.0e-02	8.8e-02	4.6e-01	2.1e+00	3.4e+00	6.1e+00	1.3e+01	1212	1435	12376836
Total Fish Intake	56.4%	3.2e-01	3.0e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.9e-02	2.4e-01	6.6e-01	1.7e+00	4.6e+00	9.6e+00	810	1435	12376836
Total Grain Intake	93.1%	1.0e+01	2.0e-01	0.0e+00	0.0e+00	3.7e+00	6.3e+00	9.2e+00	1.3e+01	1.8e+01	2.1e+01	3.4e+01	1.2e+02	1336	1435	12376836
Total Vegetable Intake	92.7%	7.3e+00	1.6e-01	0.0e+00	0.0e+00	1.3e+00	3.4e+00	6.2e+00	9.7e+00	1.4e+01	1.8e+01	2.9e+01	4.6e+01	1330	1435	12376836
Total Fruit Intake	79.0%	1.1e+01	3.4e-01	0.0e+00	0.0e+00	0.0e+00	2.3e+00	8.1e+00	1.6e+01	2.6e+01	3.3e+01	5.3e+01	1.1e+02	1134	1435	12376836
Total Fat Intake	89.2%	4.2e-01	1.2e-02	0.0e+00	0.0e+00	0.0e+00	1.3e-01	3.0e-01	5.9e-01	9.5e-01	1.3e+00	1.8e+00	3.1e+00	1280	1435	12376836
Age 6-10 years																
Total Dietary Intake	92.9%	3.8e+01	5.8e-01	0.0e+00	0.0e+00	1.5e+01	2.6e+01	3.6e+01	4.8e+01	6.1e+01	7.2e+01	9.1e+01	1.2e+02	1105	1189	19498495
Total Dairy Intake	92.8%	1.5e+01	3.2e-01	0.0e+00	0.0e+00	2.2e+00	7.2e+00	1.3e+01	2.1e+01	2.9e+01	3.5e+01	4.5e+01	8.1e+01	1103	1189	19498495
Total Meat Intake	91.7%	3.0e+00	6.9e-02	0.0e+00	0.0e+00	4.1e-01	1.4e+00	2.6e+00	4.1e+00	5.7e+00	7.1e+00	1.0e+01	1.8e+01	1090	1189	19498495
Total Egg Intake	84.8%	4.2e-01	2.8e-02	0.0e+00	0.0e+00	0.0e+00	2.3e-02	6.4e-02	1.9e-01	1.4e+00	2.3e+00	4.4e+00	9.3e+00	1008	1189	19498495
Total Fish Intake	57.4%	2.7e-01	2.8e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.9e-02	1.8e-01	4.8e-01	1.6e+00	4.2e+00	6.7e+00	682	1189	19498495
Total Grain Intake	92.9%	7.5e+00	1.4e-01	0.0e+00	0.0e+00	2.5e+00	4.5e+00	7.0e+00	9.7e+00	1.3e+01	1.6e+01	2.0e+01	3.6e+01	1104	1189	19498495
Total Vegetable Intake	92.7%	5.5e+00	1.3e-01	0.0e+00	0.0e+00	1.0e+00	2.5e+00	4.5e+00	7.3e+00	1.1e+01	1.4e+01	2.1e+01	5.2e+01	1102	1189	19498495
Total Fruit Intake	70.6%	5.7e+00	2.3e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.6e+00	8.6e+00	1.4e+01	1.9e+01	2.9e+01	4.5e+01	840	1189	19498495
Total Fat Intake	89.9%	3.5e-01	1.1e-02	0.0e+00	0.0e+00	1.8e-02	1.0e-01	2.4e-01	4.7e-01	8.3e-01	1.1e+00	1.6e+00	3.1e+00	1069	1189	19498495
Age 11-15 years																
Total Dietary Intake	97.0%	2.3e+01	3.9e-01	0.0e+00	7.3e+00	9.8e+00	1.5e+01	2.2e+01	3.0e+01	3.9e+01	4.6e+01	6.0e+01	8.1e+01	975	1005	19286648
Total Dairy Intake	96.1%	7.7e+00	2.1e-01	0.0e+00	1.8e-01	6.1e-01	2.9e+00	6.4e+00	1.1e+01	1.6e+01	2.0e+01	3.2e+01	3.8e+01	966	1005	19286648
Total Meat Intake	96.5%	2.3e+00	5.0e-02	0.0e+00	2.4e-01	5.5e-01	1.2e+00	2.0e+00	3.0e+00	4.2e+00	5.2e+00	7.8e+00	1.1e+01	970	1005	19286648
Total Egg Intake	89.6%	3.0e-01	2.0e-02	0.0e+00	0.0e+00	3.0e-03	2.2e-02	5.6e-02	1.9e-01	1.1e+00	1.4e+00	3.0e+00	7.3e+00	900	1005	19286648
Total Fish Intake	60.9%	2.2e-01	2.2e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.4e-02	1.8e-01	4.7e-01	1.2e+00	3.1e+00	5.9e+00	612	1005	19286648
Total Grain Intake	97.0%	5.0e+00	9.7e-02	0.0e+00	1.3e+00	1.9e+00	2.9e+00	4.4e+00	6.5e+00	8.8e+00	1.1e+01	1.5e+01	2.1e+01	975	1005	19286648
Total Vegetable Intake	96.8%	4.2e+00	9.9e-02	0.0e+00	5.8e-01	1.2e+00	2.3e+00	3.6e+00	5.5e+00	7.9e+00	9.8e+00	1.5e+01	3.6e+01	973	1005	19286648
Total Fruit Intake	67.8%	3.4e+00	1.6e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.0e+00	5.3e+00	9.3e+00	1.3e+01	1.8e+01	3.2e+01	681	1005	19286648
Total Fat Intake	93.2%	2.7e-01	9.0e-03	0.0e+00	0.0e+00	2.8e-02	8.5e-02	1.8e-01	3.4e-01	6.2e-01	8.2e-01	1.4e+00	1.8e+00	937	1005	19286648
Age 16-17 years																
Total Dietary Intake	99.20%	1.8e+01	5.1e-01	3.1e+00	6.2e+00	7.5e+00	1.1e+01	1.6e+01	2.2e+01	2.9e+01	3.4e+01	5.8e+01	6.4e+01	360	363	7760616
Total Dairy Intake	98.30%	5.3e+00	2.5e-01	0.0e+00	2.1e-01	4.1e-01	1.8e+00	4.1e+00	7.6e+00	1.2e+01	1.3e+01	2.0e+01	3.3e+01	357	363	7760616
Total Meat Intake	98.30%	1.9e+00	6.2e-02	0.0e+00	2.8e-01	4.9e-01	1.1e+00	1.7e+00	2.5e+00	3.6e+00	4.0e+00	5.5e+00	7.0e+00	357	363	7760616
Total Egg Intake	92.80%	2.4e-01	2.4e-02	0.0e+00	0.0e+00	7.0e-03	2.3e-02	4.9e-02	1.2e-01	8.7e-01	1.3e+00	2.1e+00	2.5e+00	337	363	7760616
Total Fish Intake	62.00%	1.8e-01	3.1e-02	0.0e+00	0.0e+00	0.0e+00	0.0e+00	4.7e-02	1.6e-01	3.5e-01	6.0e-01	2.0e+00	4.9e+00	225	363	7760616
Total Grain Intake	99.20%	3.9e+00	1.4e-01	2.8e-01	1.2e+00	1.4e+00	2.1e+00	3.4e+00	4.9e+00	6.6e+00	8.3e+00	1.4e+01	2.1e+01	360	363	7760616
Total Vegetable Intake	98.30%	3.8e+00	1.7e-01	0.0e+00	6.0e-01	9.1e-01	1.8e+00	3.2e+00	4.7e+00	7.3e+00	9.6e+00	1.5e+01	2.5e+01	357	363	7760616
Total Fruit Intake	56.20%	2.3e+00	2.4e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	7.7e-01	3.5e+00	7.2e+00	9.5e+00	1.4e+01	2.4e+01	204	363	7760616
Total Fat Intake	97.50%	2.3e-01	1.3e-02	0.0e+00	1.3e-02	3.9e-02	7.7e-02	1.6e-01	3.0e-01	5.4e-01	7.2e-01	1.2e+00	1.6e+00	354	363	7760616

NOTES:
PC = Percent Consuming
SE = Standard Error
Ntotal = Number of Individuals Surveyed

Nwgt = Number of Observations Weighted to the US Population
Ncons = Number of Individuals Consuming in the 2-Day Survey Period
* = Data not provided for less than 20 observations

Table 3-7a. Per Capita Intake of Major Food Groups (g/day, as consumed)

Age <1month																
Total Dietary Intake	66.7%	*	*	*	*	*	*	*	*	*	*	*	*	10	15	150104
Total Dairy Intake	66.7%	*	*	*	*	*	*	*	*	*	*	*	*	10	15	150104
Total Meat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Egg Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Fish Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Grain Intake	6.7%	*	*	*	*	*	*	*	*	*	*	*	*	1	15	150104
Total Vegetable Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Fruit Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Total Fat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	15	150104
Age 1-2 months																
Total Dietary Intake	76.9%	8.6e+02	6.4e+01	3.0e+01	3.1e+01	1.1e+02	7.9e+02	9.2e+02	1.0e+03	1.2e+03	1.3e+03	2.0e+03	2.4e+03	50	65	729143
Total Dairy Intake	75.4%	8.5e+02	6.3e+01	0.0e+00	0.0e+00	1.1e+02	7.9e+02	9.2e+02	1.0e+03	1.2e+03	1.3e+03	2.0e+03	2.0e+03	49	65	729143
Total Meat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Total Egg Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Total Fish Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Total Grain Intake	15.4%	*	*	*	*	*	*	*	*	*	*	*	*	10	65	729143
Total Vegetable Intake	3.1%	*	*	*	*	*	*	*	*	*	*	*	*	2	65	729143
Total Fruit Intake	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	6	65	729143
Total Fat Intake	0.0%	*	*	*	*	*	*	*	*	*	*	*	*	0	65	729143
Age 3-5 months																
Total Dietary Intake	94.1%	9.4e+02	4.7e+01	5.6e+00	3.6e+01	1.6e+02	7.5e+02	9.7e+02	1.2e+03	1.5e+03	1.7e+03	2.1e+03	2.1e+03	112	119	1124897
Total Dairy Intake	86.6%	7.9e+02	4.8e+01	0.0e+00	3.1e+00	2.3e+01	5.7e+02	8.5e+02	1.1e+03	1.3e+03	1.5e+03	2.0e+03	2.1e+03	103	119	1124897
Total Meat Intake	10.1%	*	*	*	*	*	*	*	*	*	*	*	*	12	119	1124897
Total Egg Intake	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
Total Fish Intake	8.4%	*	*	*	*	*	*	*	*	*	*	*	*	10	119	1124897
Total Grain Intake	66.4%	1.1e+01	2.3e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.0e+00	1.7e+01	2.8e+01	4.0e+01	9.9e+01	1.8e+02	79	119	1124897
Total Vegetable Intake	35.3%	3.0e+01	7.8e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.6e+01	1.1e+02	1.4e+02	2.0e+02	2.8e+02	42	119	1124897
Total Fruit Intake	54.6%	9.3e+01	1.6e+01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	3.1e+01	1.6e+02	2.9e+02	3.2e+02	5.5e+02	7.5e+02	65	119	1124897
Total Fat Intake	9.2%	*	*	*	*	*	*	*	*	*	*	*	*	11	119	1124897
Age 6-11 months																
Total Dietary Intake	99.4%	1.2e+03	3.4e+01	1.2e+02	2.1e+02	6.4e+02	9.8e+02	1.2e+03	1.4e+03	1.6e+03	1.8e+03	2.3e+03	2.5e+03	159	160	1768152
Total Dairy Intake	95.6%	7.7e+02	3.1e+01	0.0e+00	8.1e+00	2.1e+02	6.1e+02	7.5e+02	9.6e+02	1.3e+03	1.5e+03	1.9e+03	2.0e+03	153	160	1768152
Total Meat Intake	67.5%	2.1e+01	2.4e+00	0.0e+00	0.0e+00	0.0e+00	1.1e+00	1.3e+01	3.2e+01	5.7e+01	7.4e+01	1.2e+02	1.2e+02	108	160	1768152
Total Egg Intake	60.6%	8.1e+00	1.9e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	6.3e-01	1.6e+00	3.9e+01	5.8e+01	7.9e+01	8.9e+01	97	160	1768152
Total Fish Intake	40.6%	1.9e+00	6.3e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.5e+00	5.0e+00	7.5e+00	4.2e+01	4.2e+01	65	160	1768152
Total Grain Intake	95.0%	7.0e+01	5.4e+00	0.0e+00	5.0e+00	1.0e+01	2.3e+01	4.7e+01	9.3e+01	1.8e+02	1.9e+02	2.7e+02	3.6e+02	152	160	1768152
Total Vegetable Intake	90.0%	1.1e+02	6.8e+00	0.0e+00	0.0e+00	1.4e+01	5.7e+01	1.1e+02	1.4e+02	1.9e+02	2.3e+02	4.9e+02	7.0e+02	144	160	1768152
Total Fruit Intake	87.5%	1.8e+02	1.1e+01	0.0e+00	0.0e+00	0.0e+00	8.6e+01	1.7e+02	2.3e+02	3.4e+02	4.2e+02	5.7e+02	6.1e+02	140	160	1768152
Total Fat Intake	60.6%	1.5e+00	2.0e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.3e+00	2.5e+00	3.6e+00	4.5e+00	1.1e+01	1.1e+01	97	160	1768152
Age 1-2 years																
Total Dietary Intake	100.0%	1.1e+03	1.1e+01	3.2e+02	5.1e+02	6.2e+02	8.1e+02	1.1e+03	1.3e+03	1.6e+03	1.8e+03	2.2e+03	2.8e+03	1356	1356	8270523
Total Dairy Intake	99.7%	4.8e+02	8.3e+00	5.3e+00	7.0e+01	1.3e+02	2.6e+02	4.3e+02	6.5e+02	8.9e+02	1.1e+03	1.4e+03	2.0e+03	1352	1356	8270523
Total Meat Intake	97.8%	5.9e+01	1.2e+00	0.0e+00	6.2e+00	1.2e+01	2.7e+01	5.2e+01	8.2e+01	1.2e+02	1.4e+02	1.9e+02	3.2e+02	1326	1356	8270523
Total Egg Intake	92.5%	1.6e+01	7.1e-01	0.0e+00	0.0e+00	1.7e-01	8.1e-01	2.3e+00	2.4e+01	4.9e+01	7.0e+01	1.1e+02	1.9e+02	1254	1356	8270523
Total Fish Intake	60.7%	4.9e+00	4.6e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.2e+00	3.9e+00	1.1e+01	2.4e+01	6.9e+01	1.7e+02	823	1356	8270523
Total Grain Intake	99.6%	1.5e+02	2.4e+00	1.6e+01	3.9e+01	5.4e+01	8.7e+01	1.3e+02	1.9e+02	2.6e+02	3.2e+02	4.5e+02	6.5e+02	1351	1356	8270523
Total Vegetable Intake	99.3%	1.3e+02	2.5e+00	3.9e+00	1.9e+01	3.4e+01	6.6e+01	1.1e+02	1.6e+02	2.4e+02	3.1e+02	4.4e+02	7.1e+02	1346	1356	8270523
Total Fruit Intake	89.0%	2.5e+02	6.4e+00	0.0e+00	0.0e+00	0.0e+00	9.3e+01	2.0e+02	3.6e+02	5.4e+02	7.1e+02	9.2e+02	2.1e+03	1207	1356	8270523
Total Fat Intake	93.9%	5.5e+00	1.5e-01	0.0e+00	0.0e+00	6.7e-01	1.9e+00	4.1e+00	7.2e+00	1.2e+01	1.6e+01	2.6e+01	5.0e+01	1273	1356	8270523
Age 3-5 years																
Total Dietary Intake	100.0%	1.0e+03	9.9e+00	3.4e+02	5.0e+02	5.8e+02	7.6e+02	1.0e+03	1.2e+03	1.5e+03	1.7e+03	2.1e+03	2.6e+03	1435	1435	12376836

Table 3-7a. Per Capita Intake of Major Food Groups (g/day, as consumed)

Food Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	Ncons	Ntotal	Nwgt
Total Dairy Intake	99.6%	3.9e+02	6.3e+00	7.8e+00	7.4e+01	1.2e+02	2.2e+02	3.6e+02	5.1e+02	7.2e+02	8.3e+02	1.2e+03	1.7e+03	1429	1435	12376836
Total Meat Intake	99.0%	7.9e+01	1.3e+00	0.0e+00	1.6e+01	2.4e+01	4.4e+01	7.2e+01	1.0e+02	1.4e+02	1.7e+02	2.4e+02	3.8e+02	1420	1435	12376836
Total Egg Intake	90.8%	1.3e+01	7.0e-01	0.0e+00	0.0e+00	8.3e-02	7.3e-01	1.8e+00	2.0e+01	4.3e+01	6.3e+01	1.1e+02	2.5e+02	1303	1435	12376836
Total Fish Intake	61.0%	6.1e+00	5.4e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.7e+00	5.0e+00	1.4e+01	3.4e+01	8.0e+01	2.0e+02	875	1435	12376836
Total Grain Intake	99.8%	1.9e+02	2.8e+00	4.7e+01	7.0e+01	8.8e+01	1.2e+02	1.7e+02	2.4e+02	3.1e+02	3.6e+02	5.3e+02	1.6e+03	1432	1435	12376836
Total Vegetable Intake	99.4%	1.4e+02	2.5e+00	3.4e+00	2.4e+01	4.0e+01	7.4e+01	1.2e+02	1.8e+02	2.6e+02	3.2e+02	4.8e+02	7.6e+02	1427	1435	12376836
Total Fruit Intake	84.4%	2.1e+02	5.5e+00	0.0e+00	0.0e+00	0.0e+00	6.2e+01	1.6e+02	3.1e+02	4.7e+02	5.6e+02	8.4e+02	1.9e+03	1211	1435	12376836
Total Fat Intake	95.6%	7.8e+00	2.0e-01	0.0e+00	1.7e-01	1.0e+00	2.7e+00	5.6e+00	1.1e+01	1.8e+01	2.2e+01	3.7e+01	6.3e+01	1372	1435	12376836
Age 6-10 years																
Total Dietary Intake	100.0%	1.1e+03	1.2e+01	3.9e+02	5.5e+02	6.5e+02	8.3e+02	1.1e+03	1.3e+03	1.7e+03	1.9e+03	2.3e+03	3.6e+03	1189	1189	19498495
Total Dairy Intake	99.7%	4.4e+02	7.5e+00	1.1e+01	7.6e+01	1.3e+02	2.6e+02	4.0e+02	5.9e+02	7.8e+02	8.8e+02	1.2e+03	2.7e+03	1185	1189	19498495
Total Meat Intake	98.7%	9.2e+01	1.7e+00	0.0e+00	1.7e+01	2.6e+01	4.9e+01	8.3e+01	1.2e+02	1.6e+02	2.0e+02	3.0e+02	4.1e+02	1174	1189	19498495
Total Egg Intake	91.5%	1.3e+01	7.9e-01	0.0e+00	0.0e+00	2.4e-01	9.0e-01	2.1e+00	6.3e+00	4.5e+01	6.8e+01	1.3e+02	2.2e+02	1088	1189	19498495
Total Fish Intake	62.6%	8.9e+00	8.8e-01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.3e+00	5.7e+00	1.7e+01	4.4e+01	1.4e+02	2.1e+02	744	1189	19498495
Total Grain Intake	99.9%	2.2e+02	3.1e+00	4.4e+01	8.5e+01	1.1e+02	1.5e+02	2.1e+02	2.7e+02	3.6e+02	4.1e+02	6.0e+02	7.8e+02	1188	1189	19498495
Total Vegetable Intake	99.7%	1.7e+02	3.3e+00	9.7e+00	3.5e+01	5.4e+01	8.7e+01	1.4e+02	2.1e+02	3.0e+02	3.7e+02	5.8e+02	9.5e+02	1185	1189	19498495
Total Fruit Intake	76.8%	1.7e+02	6.2e+00	0.0e+00	0.0e+00	0.0e+00	3.1e+01	1.2e+02	2.6e+02	4.3e+02	5.2e+02	8.7e+02	1.2e+03	913	1189	19498495
Total Fat Intake	96.7%	1.1e+01	3.0e-01	0.0e+00	7.3e-01	1.5e+00	3.7e+00	7.7e+00	1.4e+01	2.4e+01	3.0e+01	5.2e+01	8.2e+01	1150	1189	19498495
Age 11-15 years																
Total Dietary Intake	100.0%	1.2e+03	1.7e+01	3.2e+02	5.4e+02	6.2e+02	8.3e+02	1.1e+03	1.5e+03	1.8e+03	2.2e+03	2.9e+03	4.8e+03	1005	1005	19286648
Total Dairy Intake	99.1%	3.9e+02	9.8e+00	1.8e+00	2.3e+01	5.0e+01	1.6e+02	3.3e+02	5.3e+02	7.9e+02	9.7e+02	1.5e+03	2.0e+03	996	1005	19286648
Total Meat Intake	99.5%	1.2e+02	2.5e+00	5.0e+00	2.2e+01	3.6e+01	6.7e+01	1.1e+02	1.6e+02	2.2e+02	2.7e+02	3.7e+02	6.0e+02	1000	1005	19286648
Total Egg Intake	92.4%	1.6e+01	1.0e+00	0.0e+00	0.0e+00	3.2e-01	1.4e+00	3.0e+00	1.5e+01	5.6e+01	8.2e+01	1.5e+02	3.1e+02	929	1005	19286648
Total Fish Intake	63.3%	1.2e+01	1.1e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.9e+00	9.5e+00	2.6e+01	5.7e+01	1.4e+02	2.8e+02	636	1005	19286648
Total Grain Intake	100.0%	2.6e+02	4.2e+00	5.3e+01	8.4e+01	1.1e+02	1.7e+02	2.3e+02	3.2e+02	4.4e+02	5.0e+02	6.6e+02	1.0e+03	1005	1005	19286648
Total Vegetable Intake	99.7%	2.2e+02	4.6e+00	1.6e+01	4.8e+01	7.4e+01	1.2e+02	1.9e+02	2.9e+02	4.1e+02	4.8e+02	7.1e+02	1.5e+03	1002	1005	19286648
Total Fruit Intake	70.0%	1.7e+02	7.7e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	1.2e+02	2.5e+02	4.4e+02	6.0e+02	8.9e+02	1.5e+03	704	1005	19286648
Total Fat Intake	96.1%	1.4e+01	4.8e-01	0.0e+00	7.9e-01	2.0e+00	4.8e+00	9.7e+00	1.8e+01	3.3e+01	4.1e+01	7.4e+01	1.3e+02	966	1005	19286648
Age 16-17 years																
Total Dietary Intake	100.0%	1.2e+03	3.3e+01	3.0e+02	3.9e+02	4.9e+02	7.1e+02	1.0e+03	1.5e+03	2.0e+03	2.5e+03	3.2e+03	4.4e+03	363	363	7760616
Total Dairy Intake	99.2%	3.5e+02	1.7e+01	3.2e+00	1.3e+01	2.9e+01	1.0e+02	2.7e+02	4.9e+02	7.4e+02	9.8e+02	1.4e+03	1.6e+03	360	363	7760616
Total Meat Intake	99.2%	1.3e+02	4.3e+00	5.0e+00	2.0e+01	3.5e+01	7.0e+01	1.1e+02	1.7e+02	2.5e+02	2.9e+02	3.7e+02	4.3e+02	360	363	7760616
Total Egg Intake	93.7%	1.6e+01	1.6e+00	0.0e+00	0.0e+00	6.0e-01	1.5e+00	3.3e+00	8.0e+00	5.3e+01	8.1e+01	1.4e+02	1.8e+02	340	363	7760616
Total Fish Intake	62.5%	1.2e+01	2.2e+00	0.0e+00	0.0e+00	0.0e+00	0.0e+00	2.8e+00	1.1e+01	2.1e+01	4.8e+01	1.4e+02	3.7e+02	227	363	7760616
Total Grain Intake	100.0%	2.5e+02	8.4e+00	2.8e+01	7.2e+01	9.6e+01	1.4e+02	2.2e+02	3.3e+02	4.2e+02	5.2e+02	8.4e+02	1.4e+03	363	363	7760616
Total Vegetable Intake	99.2%	2.5e+02	1.1e+01	1.3e+01	4.2e+01	6.1e+01	1.1e+02	2.1e+02	3.3e+02	5.0e+02	5.9e+02	1.1e+03	1.2e+03	360	363	7760616
Total Fruit Intake	56.7%	1.5e+02	1.6e+01	0.0e+00	0.0e+00	0.0e+00	0.0e+00	5.0e+01	2.4e+02	4.2e+02	6.2e+02	9.0e+02	1.8e+03	206	363	7760616
Total Fat Intake	98.3%	1.6e+01	8.9e-01	0.0e+00	1.2e+00	2.4e+00	5.0e+00	1.0e+01	1.9e+01	3.8e+01	4.7e+01	1.0e+02	1.1e+02	357	363	7760616

NOTES:
PC = Percent Consuming
SE = Standard Error
Ntotal = Number of Individuals Surveyed
Nwgt = Number of Observations Weighted to the US Population
Ncons = Number of Individuals Consuming in the 2-Day Survey Period
* = Data not provided for less than 20 observations

Source: Based on analysis of 1994-1996 CSFII.

Table 3-8. Consumer Intake of Major Food Groups (g/kg/day, as consumed)

Food Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	N	Nwgt
Age <1 month															
Total Dietary Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	9	111979
Total Dairy Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	9	111979
Total Meat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Egg Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fish Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Grain Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	1	6716
Total Vegetable Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fruit Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Age 1-2 months															
Total Dietary Intake	100%	1.7e+02	1.1e+01	6.9e+00	6.9e+00	2.4e+01	1.6e+02	1.9e+02	2.2e+02	2.4e+02	2.7e+02	3.1e+02	3.3e+02	46	513246
Total Dairy Intake	100%	1.9e+02	8.4e+00	4.8e+00	6.0e+01	1.4e+02	1.6e+02	1.9e+02	2.3e+02	2.5e+02	2.8e+02	3.1e+02	3.3e+02	45	470798
Total Meat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Egg Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fish Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Grain Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	9	92996
Total Vegetable Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	1	5728
Total Fruit Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	5	79948
Total Fat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Age 3-5 months															
Total Dietary Intake	100%	1.4e+02	6.8e+00	8.1e-01	5.7e+00	2.2e+01	9.5e+01	1.4e+02	1.8e+02	2.3e+02	2.4e+02	2.9e+02	2.9e+02	109	1020261
Total Dairy Intake	100%	1.2e+02	6.6e+00	4.1e-01	2.5e+00	1.8e+01	8.1e+01	1.3e+02	1.7e+02	2.0e+02	2.3e+02	2.8e+02	2.8e+02	100	970465
Total Meat Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	12	111057
Total Egg Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	11	110853
Total Fish Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	10	92820
Total Grain Intake	100%	2.4e+00	3.6e-01	1.2e-01	2.3e-01	3.2e-01	7.4e-01	1.5e+00	2.8e+00	5.6e+00	6.2e+00	2.7e+01	2.7e+01	77	759909
Total Vegetable Intake	100%	1.0e+01	1.1e+00	6.1e-01	1.4e+00	1.4e+00	3.9e+00	9.6e+00	1.7e+01	1.9e+01	2.5e+01	3.0e+01	3.1e+01	41	440422
Total Fruit Intake	100%	2.3e+01	2.3e+00	4.6e-01	2.4e+00	3.4e+00	7.6e+00	2.0e+01	3.7e+01	4.1e+01	6.3e+01	1.1e+02	1.1e+02	65	641787
Total Fat Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	11	111807
Age 6-11 months															
Total Dietary Intake	100%	1.3e+02	4.1e+00	1.6e+01	2.4e+01	6.0e+01	1.0e+02	1.3e+02	1.7e+02	1.9e+02	2.0e+02	2.5e+02	3.1e+02	152	1720660
Total Dairy Intake	100%	8.8e+01	3.5e+00	4.9e-02	1.0e+01	3.1e+01	6.8e+01	8.7e+01	1.1e+02	1.3e+02	1.7e+02	1.9e+02	2.4e+02	146	1683509
Total Meat Intake	100%	3.0e+00	2.6e-01	8.7e-02	2.7e-01	5.0e-01	9.4e-01	2.3e+00	4.1e+00	6.5e+00	8.6e+00	1.2e+01	1.2e+01	104	1329670
Total Egg Intake	100%	1.3e+00	2.4e-01	4.0e-03	1.0e-02	4.3e-02	7.0e-02	1.2e-01	1.0e+00	5.0e+00	8.3e+00	8.3e+00	1.1e+01	93	1177183
Total Fish Intake	100%	4.7e-01	9.4e-02	8.0e-03	3.0e-02	3.9e-02	1.4e-01	2.9e-01	4.6e-01	8.7e-01	1.6e+00	4.7e+00	4.7e+00	65	812655
Total Grain Intake	100%	8.1e+00	6.2e-01	1.9e-01	9.6e-01	1.4e+00	2.9e+00	5.5e+00	1.2e+01	2.1e+01	2.4e+01	3.3e+01	4.0e+01	146	1684880
Total Vegetable Intake	100%	1.3e+01	8.9e-01	6.1e-01	1.7e+00	3.1e+00	7.2e+00	1.2e+01	1.6e+01	2.4e+01	2.9e+01	4.9e+01	1.0e+02	138	1617520
Total Fruit Intake	100%	2.2e+01	1.1e+00	2.3e+00	5.2e+00	7.4e+00	1.5e+01	2.0e+01	2.8e+01	4.0e+01	5.1e+01	6.7e+01	7.1e+01	134	1538726
Total Fat Intake	100%	2.5e-01	2.4e-02	9.0e-03	2.0e-02	5.1e-02	1.4e-01	2.0e-01	3.2e-01	4.3e-01	5.5e-01	1.2e+00	1.7e+00	94	1178873
Age 1-2 years															
Total Dietary Intake	100%	8.7e+01	9.8e-01	2.5e+01	3.7e+01	4.5e+01	6.2e+01	8.3e+01	1.1e+02	1.3e+02	1.6e+02	1.9e+02	2.6e+02	1302	7943041
Total Dairy Intake	100%	3.9e+01	7.6e-01	5.1e-01	5.8e+00	1.0e+01	1.9e+01	3.3e+01	5.3e+01	7.5e+01	9.2e+01	1.3e+02	1.8e+02	1298	7918065
Total Meat Intake	100%	4.7e+00	9.1e-02	1.9e-01	8.2e-01	1.2e+00	2.2e+00	4.1e+00	6.4e+00	8.9e+00	1.0e+01	1.5e+01	2.4e+01	1274	7769335
Total Egg Intake	100%	1.3e+00	5.7e-02	7.0e-03	2.4e-02	3.5e-02	8.3e-02	2.2e-01	2.1e+00	4.1e+00	5.3e+00	8.8e+00	1.4e+01	1204	7325394
Total Fish Intake	100%	6.4e-01	4.6e-02	9.0e-03	3.4e-02	6.1e-02	1.2e-01	2.3e-01	5.0e-01	1.5e+00	2.8e+00	6.3e+00	1.4e+01	789	4790345
Total Grain Intake	100%	1.2e+01	2.0e-01	1.9e+00	3.4e+00	4.6e+00	7.0e+00	1.0e+01	1.5e+01	2.1e+01	2.5e+01	3.5e+01	4.8e+01	1297	7912242
Total Vegetable Intake	100%	1.0e+01	2.1e-01	8.0e-01	1.7e+00	3.0e+00	5.1e+00	8.2e+00	1.3e+01	1.9e+01	2.4e+01	3.3e+01	8.3e+01	1293	7885022

Table 3-8. Consumer Intake of Major Food Groups (g/kg/day, as consumed)														
Food Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	N	Nwgt
Total Fruit Intake	100%	2.2e+01	5.0e-01	1.3e+00	3.5e+00	5.5e+00	1.0e+01	1.8e+01	3.0e+01	4.4e+01	5.8e+01	8.3e+01	1.3e+02	1160	7112706
Total Fat Intake	100%	4.6e-01	1.2e-02	1.9e-02	6.1e-02	8.9e-02	1.8e-01	3.4e-01	5.9e-01	9.7e-01	1.3e+00	2.3e+00	3.3e+00	1222	7481895
Age 3-5 years															
Total Dietary Intake	100%	5.9e+01	6.3e-01	2.0e+01	2.7e+01	3.2e+01	4.1e+01	5.6e+01	7.2e+01	9.0e+01	1.0e+02	1.3e+02	1.9e+02	1337	11598922
Total Dairy Intake	100%	2.2e+01	3.9e-01	1.5e+00	4.5e+00	6.7e+00	1.2e+01	2.0e+01	3.0e+01	4.2e+01	4.9e+01	6.8e+01	9.0e+01	1333	11551343
Total Meat Intake	100%	4.5e+00	7.6e-02	4.1e-01	9.7e-01	1.5e+00	2.5e+00	4.0e+00	5.7e+00	8.0e+00	9.7e+00	1.3e+01	2.1e+01	1323	11479245
Total Egg Intake	100%	7.7e-01	3.9e-02	5.0e-03	1.6e-02	2.7e-02	5.6e-02	1.2e-01	1.1e+00	2.5e+00	3.6e+00	6.1e+00	1.3e+01	1212	10495709
Total Fish Intake	100%	5.5e-01	3.7e-02	1.2e-02	2.8e-02	5.7e-02	1.1e-01	2.0e-01	3.8e-01	1.5e+00	2.4e+00	5.7e+00	9.6e+00	810	7127866
Total Grain Intake	100%	1.1e+01	1.9e-01	2.5e+00	3.9e+00	5.0e+00	6.9e+00	9.6e+00	1.3e+01	1.8e+01	2.1e+01	3.4e+01	1.2e+02	1336	11594549
Total Vegetable Intake	100%	7.8e+00	1.6e-01	4.9e-01	1.5e+00	2.1e+00	4.1e+00	6.6e+00	1.0e+01	1.4e+01	1.9e+01	2.9e+01	4.6e+01	1330	11552278
Total Fruit Intake	100%	1.4e+01	3.3e-01	8.9e-01	2.2e+00	3.4e+00	6.0e+00	1.1e+01	1.9e+01	2.8e+01	3.5e+01	5.6e+01	1.1e+02	1134	9812013
Total Fat Intake	100%	4.7e-01	1.2e-02	1.6e-02	5.4e-02	8.3e-02	1.7e-01	3.4e-01	6.2e-01	9.9e-01	1.3e+00	1.9e+00	3.1e+00	1280	11089608
Age 6-10 years															
Total Dietary Intake	100%	4.0e+01	5.2e-01	1.0e+01	1.6e+01	2.0e+01	2.8e+01	3.8e+01	4.9e+01	6.2e+01	7.2e+01	9.3e+01	1.2e+02	1105	18263131
Total Dairy Intake	100%	1.6e+01	3.0e-01	4.7e-01	2.5e+00	4.3e+00	8.3e+00	1.4e+01	2.1e+01	2.9e+01	3.6e+01	4.7e+01	8.1e+01	1103	18235617
Total Meat Intake	100%	3.2e+00	6.6e-02	2.0e-01	6.8e-01	9.7e-01	1.7e+00	2.8e+00	4.4e+00	5.8e+00	7.3e+00	1.1e+01	1.8e+01	1090	18042272
Total Egg Intake	100%	4.9e-01	3.0e-02	7.0e-03	1.6e-02	2.1e-02	3.9e-02	8.5e-02	4.2e-01	1.7e+00	2.5e+00	4.6e+00	9.3e+00	1008	16689310
Total Fish Intake	100%	4.6e-01	3.6e-02	1.3e-02	3.2e-02	5.1e-02	8.5e-02	1.5e-01	3.2e-01	1.2e+00	2.1e+00	4.8e+00	6.7e+00	682	11363938
Total Grain Intake	100%	8.0e+00	1.3e-01	1.3e+00	2.7e+00	3.5e+00	5.0e+00	7.3e+00	1.0e+01	1.4e+01	1.6e+01	2.0e+01	3.6e+01	1104	18252467
Total Vegetable Intake	100%	5.8e+00	1.3e-01	4.7e-01	1.3e+00	1.9e+00	2.9e+00	4.8e+00	7.5e+00	1.1e+01	1.4e+01	2.1e+01	5.2e+01	1102	18222862
Total Fruit Intake	100%	7.9e+00	2.3e-01	4.4e-01	1.4e+00	2.0e+00	3.0e+00	6.0e+00	1.1e+01	1.7e+01	2.1e+01	3.1e+01	4.5e+01	840	14000258
Total Fat Intake	100%	3.9e-01	1.1e-02	2.0e-02	4.3e-02	6.4e-02	1.4e-01	2.7e-01	5.2e-01	8.8e-01	1.1e+00	1.6e+00	3.1e+00	1069	17708968
Age 11-15 years															
Total Dietary Intake	100%	2.4e+01	3.8e-01	5.2e+00	8.1e+00	1.1e+01	1.6e+01	2.2e+01	3.1e+01	3.9e+01	4.7e+01	6.0e+01	8.1e+01	975	18818601
Total Dairy Intake	100%	7.9e+00	2.1e-01	1.5e-01	4.2e-01	9.3e-01	3.2e+00	6.7e+00	1.1e+01	1.6e+01	2.1e+01	3.2e+01	3.8e+01	966	18682741
Total Meat Intake	100%	2.4e+00	4.9e-02	1.4e-01	4.2e-01	6.9e-01	1.3e+00	2.1e+00	3.0e+00	4.3e+00	5.4e+00	8.1e+00	1.1e+01	970	18725557
Total Egg Intake	100%	3.3e-01	2.1e-02	4.0e-03	9.0e-03	1.6e-02	3.1e-02	6.3e-02	3.7e-01	1.1e+00	1.4e+00	3.0e+00	7.3e+00	900	17432491
Total Fish Intake	100%	3.5e-01	2.6e-02	5.0e-03	1.6e-02	2.7e-02	6.3e-02	1.3e-01	2.6e-01	9.3e-01	1.6e+00	3.2e+00	5.9e+00	612	12076053
Total Grain Intake	100%	5.1e+00	9.5e-02	9.3e-01	1.5e+00	2.1e+00	3.0e+00	4.4e+00	6.6e+00	8.8e+00	1.1e+01	1.5e+01	2.1e+01	975	18818601
Total Vegetable Intake	100%	4.4e+00	9.7e-02	3.8e-01	9.2e-01	1.4e+00	2.3e+00	3.7e+00	5.6e+00	7.9e+00	9.8e+00	1.5e+01	3.6e+01	973	18777586
Total Fruit Intake	100%	4.9e+00	1.7e-01	6.6e-02	6.0e-01	1.0e+00	1.8e+00	3.4e+00	6.5e+00	1.1e+01	1.4e+01	1.8e+01	3.2e+01	681	13550269
Total Fat Intake	100%	2.8e-01	9.0e-03	1.2e-02	2.9e-02	5.2e-02	9.6e-02	1.9e-01	3.6e-01	6.6e-01	8.3e-01	1.4e+00	1.8e+00	937	18231526
Age 16-17 years															
Total Dietary Intake	100%	1.8e+01	5.1e-01	4.2e+00	6.2e+00	7.6e+00	1.1e+01	1.6e+01	2.2e+01	2.9e+01	3.4e+01	5.8e+01	6.4e+01	360	7718155
Total Dairy Intake	100%	5.4e+00	2.5e-01	8.8e-02	2.6e-01	4.6e-01	1.8e+00	4.3e+00	7.7e+00	1.2e+01	1.3e+01	2.0e+01	3.3e+01	357	7644914
Total Meat Intake	100%	1.9e+00	6.2e-02	1.6e-01	3.6e-01	5.2e-01	1.1e+00	1.7e+00	2.5e+00	3.6e+00	4.0e+00	5.5e+00	7.0e+00	357	7640988
Total Egg Intake	100%	2.5e-01	2.4e-02	5.0e-03	1.1e-02	1.7e-02	2.9e-02	5.2e-02	1.6e-01	9.1e-01	1.3e+00	2.1e+00	2.5e+00	337	7212757
Total Fish Intake	100%	2.8e-01	3.8e-02	1.0e-02	1.2e-02	2.5e-02	5.4e-02	1.1e-01	2.5e-01	4.9e-01	1.4e+00	3.0e+00	4.9e+00	225	4843926
Total Grain Intake	100%	3.9e+00	1.4e-01	3.5e-01	1.2e+00	1.4e+00	2.1e+00	3.4e+00	5.0e+00	6.6e+00	8.6e+00	1.4e+01	2.1e+01	360	7718155
Total Vegetable Intake	100%	3.8e+00	1.7e-01	2.1e-01	6.4e-01	9.9e-01	1.8e+00	3.2e+00	4.7e+00	7.3e+00	9.6e+00	1.5e+01	2.5e+01	357	7674724
Total Fruit Intake	100%	4.2e+00	2.5e-01	1.2e-01	5.6e-01	8.7e-01	1.5e+00	3.0e+00	5.6e+00	9.2e+00	1.1e+01	1.5e+01	2.4e+01	204	4231840
Total Fat Intake	100%	2.4e-01	1.3e-02	1.1e-02	2.4e-02	4.2e-02	8.5e-02	1.7e-01	3.1e-01	5.4e-01	7.3e-01	1.2e+00	1.6e+00	354	7576804

NOTES:
PC = Percent Consuming
SE = Standard Error

N = Number of Individuals Surveyed and Consuming in the 2-Day Survey Period
Nwgt = Number of Observations Weighted to the US Population
* = Data not provided for less than 20 observations

Source: Based on analysis of 1994-1996 CSFII.

Table 3-8a. Consumer Intake of Major Food Groups (g/day, as consumed)														
Food Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	N	Nwgt
Age <1 month															
Total Dietary Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	10	117552
Total Dairy Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	10	117552
Total Meat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Egg Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fish Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Grain Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	1	6716
Total Vegetable Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fruit Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Age 1-2 months															
Total Dietary Intake	100%	8.7e+02	5.4e+01	3.1e+01	3.1e+01	1.1e+02	7.9e+02	9.2e+02	1.0e+03	1.2e+03	1.3e+03	2.0e+03	2.4e+03	50	541289
Total Dairy Intake	100%	9.3e+02	4.2e+01	1.1e+02	2.4e+02	7.3e+02	8.1e+02	9.2e+02	1.0e+03	1.2e+03	1.3e+03	2.0e+03	2.0e+03	49	498841
Total Meat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Egg Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Fish Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Total Grain Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	10	97159
Total Vegetable Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	2	9891
Total Fruit Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	6	84111
Total Fat Intake	0%	*	*	*	*	*	*	*	*	*	*	*	*	0	0
Age 3-5 months															
Total Dietary Intake	100%	9.4e+02	4.5e+01	5.6e+00	3.6e+01	1.6e+02	7.5e+02	9.7e+02	1.2e+03	1.5e+03	1.7e+03	2.1e+03	2.1e+03	112	1038478
Total Dairy Intake	100%	8.3e+02	4.3e+01	3.1e+00	2.3e+01	1.3e+02	6.1e+02	8.5e+02	1.1e+03	1.3e+03	1.5e+03	2.0e+03	2.1e+03	103	988682
Total Meat Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	12	111057
Total Egg Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	11	110853
Total Fish Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	10	92820
Total Grain Intake	100%	1.7e+01	2.5e+00	6.2e-01	1.2e+00	2.0e+00	4.0e+00	1.0e+01	1.9e+01	3.8e+01	4.6e+01	1.8e+02	1.8e+02	79	774229
Total Vegetable Intake	100%	7.6e+01	8.4e+00	4.7e+00	1.0e+01	1.3e+01	2.8e+01	7.1e+01	1.1e+02	1.4e+02	1.7e+02	2.0e+02	2.8e+02	42	443879
Total Fruit Intake	100%	1.6e+02	1.6e+01	3.2e+00	1.6e+01	3.1e+01	5.5e+01	1.4e+02	2.3e+02	3.2e+02	3.7e+02	7.5e+02	7.5e+02	65	641787
Total Fat Intake	100%	*	*	*	*	*	*	*	*	*	*	*	*	11	111807
Age 6-11 months															
Total Dietary Intake	100%	1.2e+03	3.4e+01	1.2e+02	2.1e+02	6.4e+02	9.8e+02	1.2e+03	1.4e+03	1.6e+03	1.8e+03	2.3e+03	2.5e+03	159	1765230
Total Dairy Intake	100%	7.8e+02	3.0e+01	4.5e-01	9.8e+01	2.9e+02	6.1e+02	7.5e+02	9.7e+02	1.3e+03	1.5e+03	1.9e+03	2.0e+03	153	1728079
Total Meat Intake	100%	2.8e+01	2.4e+00	7.1e-01	2.5e+00	4.5e+00	8.9e+00	1.9e+01	3.9e+01	6.2e+01	8.1e+01	1.2e+02	1.2e+02	108	1348432
Total Egg Intake	100%	1.2e+01	2.2e+00	4.3e-02	1.0e-01	3.9e-01	6.3e-01	1.2e+00	9.1e+00	4.7e+01	7.5e+01	7.9e+01	8.9e+01	97	1197037
Total Fish Intake	100%	4.2e+00	8.4e-01	5.5e-02	3.6e-01	3.7e-01	1.4e+00	2.5e+00	4.1e+00	7.5e+00	1.3e+01	4.2e+01	4.2e+01	65	812655
Total Grain Intake	100%	7.2e+01	5.3e+00	2.0e+00	9.2e+00	1.4e+01	2.5e+01	4.8e+01	9.9e+01	1.8e+02	1.9e+02	2.7e+02	3.6e+02	152	1725930
Total Vegetable Intake	100%	1.2e+02	6.6e+00	6.6e+00	1.6e+01	3.3e+01	6.3e+01	1.1e+02	1.5e+02	1.9e+02	2.3e+02	4.9e+02	7.0e+02	144	1658570
Total Fruit Intake	100%	2.0e+02	9.9e+00	2.8e+01	4.3e+01	6.6e+01	1.2e+02	1.8e+02	2.4e+02	3.4e+02	4.6e+02	5.7e+02	6.1e+02	140	1579776
Total Fat Intake	100%	2.3e+00	2.0e-01	8.6e-02	1.8e-01	6.3e-01	1.3e+00	1.7e+00	2.8e+00	4.4e+00	5.9e+00	1.1e+01	1.1e+01	97	1190398
Age 1-2 years															
Total Dietary Intake	100%	1.1e+03	1.1e+01	3.2e+02	5.1e+02	6.2e+02	8.1e+02	1.1e+03	1.3e+03	1.6e+03	1.8e+03	2.2e+03	2.8e+03	1356	8270523
Total Dairy Intake	100%	4.8e+02	8.3e+00	5.9e+00	7.5e+01	1.3e+02	2.6e+02	4.3e+02	6.5e+02	8.9e+02	1.1e+03	1.4e+03	2.0e+03	1352	8245547
Total Meat Intake	100%	6.1e+01	1.2e+00	2.0e+00	9.0e+00	1.5e+01	2.9e+01	5.3e+01	8.3e+01	1.2e+02	1.4e+02	1.9e+02	3.2e+02	1326	8074322
Total Egg Intake	100%	1.7e+01	7.2e-01	8.3e-02	3.0e-01	4.8e-01	1.0e+00	2.7e+00	2.6e+01	5.2e+01	7.2e+01	1.1e+02	1.9e+02	1254	7617210
Total Fish Intake	100%	8.2e+00	5.7e-01	1.1e-01	3.8e-01	7.0e-01	1.4e+00	2.8e+00	6.2e+00	2.1e+01	3.4e+01	8.0e+01	1.7e+02	823	4995891

Table 3-8a. Consumer Intake of Major Food Groups (g/day, as consumed)														
Food Group	PC	MEAN	SE	P1	P5	P10	P25	P50	P75	P90	P95	P99	P100	N	Nwgt
Total Grain Intake	100%	1.5e+02	2.4e+00	2.1e+01	4.1e+01	5.4e+01	8.7e+01	1.3e+02	1.9e+02	2.6e+02	3.2e+02	4.5e+02	6.5e+02	1351	8239724
Total Vegetable Intake	100%	1.3e+02	2.5e+00	9.2e+00	2.1e+01	3.6e+01	6.7e+01	1.1e+02	1.6e+02	2.4e+02	3.1e+02	4.4e+02	7.1e+02	1346	8205531
Total Fruit Intake	100%	2.8e+02	6.2e+00	1.7e+01	4.7e+01	6.2e+01	1.2e+02	2.4e+02	3.8e+02	5.6e+02	7.2e+02	9.4e+02	2.1e+03	1207	7397569
Total Fat Intake	100%	5.8e+00	1.5e-01	3.0e-01	7.0e-01	1.2e+00	2.3e+00	4.4e+00	7.5e+00	1.2e+01	1.6e+01	2.6e+01	5.0e+01	1273	7777189

Age 3-5 years															
Total Dietary Intake	100%	1.0e+03	9.9e+00	3.4e+02	5.0e+02	5.8e+02	7.6e+02	1.0e+03	1.2e+03	1.5e+03	1.7e+03	2.1e+03	2.6e+03	1435	12376836
Total Dairy Intake	100%	3.9e+02	6.3e+00	2.5e+01	8.0e+01	1.2e+02	2.2e+02	3.6e+02	5.1e+02	7.2e+02	8.3e+02	1.2e+03	1.7e+03	1429	12315247
Total Meat Intake	100%	8.0e+01	1.3e+00	7.5e+00	1.8e+01	2.5e+01	4.4e+01	7.2e+01	1.0e+02	1.4e+02	1.7e+02	2.4e+02	3.8e+02	1420	12250062
Total Egg Intake	100%	1.5e+01	7.3e-01	8.8e-02	3.2e-01	5.0e-01	1.0e+00	2.2e+00	2.2e+01	4.6e+01	7.0e+01	1.1e+02	2.5e+02	1303	11226264
Total Fish Intake	100%	9.9e+00	6.5e-01	2.9e-01	5.8e-01	1.0e+00	2.1e+00	3.6e+00	7.1e+00	2.8e+01	4.3e+01	8.7e+01	2.0e+02	875	7650706
Total Grain Intake	100%	1.9e+02	2.8e+00	4.8e+01	7.0e+01	8.9e+01	1.2e+02	1.7e+02	2.4e+02	3.1e+02	3.7e+02	5.3e+02	1.6e+03	1432	12364194
Total Vegetable Intake	100%	1.4e+02	2.5e+00	9.1e+00	2.5e+01	4.1e+01	7.5e+01	1.2e+02	1.8e+02	2.6e+02	3.2e+02	4.8e+02	7.6e+02	1427	12322456
Total Fruit Intake	100%	2.4e+02	5.3e+00	1.6e+01	4.2e+01	6.2e+01	1.1e+02	2.0e+02	3.4e+02	4.9e+02	5.9e+02	8.4e+02	1.9e+03	1211	10456390
Total Fat Intake	100%	8.2e+00	2.0e-01	3.0e-01	9.8e-01	1.5e+00	2.8e+00	6.0e+00	1.1e+01	1.8e+01	2.2e+01	3.7e+01	6.3e+01	1372	11817319
Age 6-10 years															
Total Dietary Intake	100%	1.1e+03	1.2e+01	3.9e+02	5.5e+02	6.5e+02	8.3e+02	1.1e+03	1.3e+03	1.7e+03	1.9e+03	2.3e+03	3.6e+03	1189	19498495
Total Dairy Intake	100%	4.4e+02	7.5e+00	1.4e+01	7.7e+01	1.4e+02	2.6e+02	4.0e+02	5.9e+02	7.8e+02	8.8e+02	1.2e+03	2.7e+03	1185	19434190
Total Meat Intake	100%	9.3e+01	1.7e+00	4.9e+00	1.8e+01	2.8e+01	5.0e+01	8.5e+01	1.2e+02	1.6e+02	2.0e+02	3.0e+02	4.1e+02	1174	19277636
Total Egg Intake	100%	1.4e+01	8.2e-01	1.9e-01	4.5e-01	6.2e-01	1.2e+00	2.4e+00	1.2e+01	4.7e+01	6.9e+01	1.3e+02	2.2e+02	1088	17844042
Total Fish Intake	100%	1.4e+01	1.1e+00	3.2e-01	9.4e-01	1.5e+00	2.5e+00	4.8e+00	9.2e+00	4.2e+01	6.7e+01	1.6e+02	2.1e+02	744	12323312
Total Grain Intake	100%	2.2e+02	3.1e+00	4.5e+01	8.5e+01	1.1e+02	1.5e+02	2.1e+02	2.7e+02	3.6e+02	4.1e+02	6.0e+02	7.8e+02	1188	19487831
Total Vegetable Intake	100%	1.7e+02	3.3e+00	1.1e+01	3.7e+01	5.4e+01	8.7e+01	1.4e+02	2.1e+02	3.0e+02	3.7e+02	5.8e+02	9.5e+02	1185	19448939
Total Fruit Intake	100%	2.3e+02	6.1e+00	1.6e+01	3.8e+01	6.0e+01	9.4e+01	1.7e+02	3.0e+02	4.7e+02	5.6e+02	9.4e+02	1.2e+03	913	15073955
Total Fat Intake	100%	1.1e+01	3.0e-01	5.2e-01	1.2e+00	2.1e+00	4.0e+00	7.9e+00	1.4e+01	2.5e+01	3.0e+01	5.2e+01	8.2e+01	1150	18872345
Age 11-15 years															
Total Dietary Intake	100%	1.2e+03	1.7e+01	3.2e+02	5.4e+02	6.2e+02	8.3e+02	1.1e+03	1.5e+03	1.8e+03	2.2e+03	2.9e+03	4.8e+03	1005	19286648
Total Dairy Intake	100%	3.9e+02	9.8e+00	8.0e+00	2.5e+01	5.5e+01	1.6e+02	3.4e+02	5.4e+02	7.9e+02	9.7e+02	1.5e+03	2.0e+03	996	19150788
Total Meat Intake	100%	1.2e+02	2.5e+00	7.4e+00	2.3e+01	3.6e+01	6.8e+01	1.1e+02	1.6e+02	2.2e+02	2.7e+02	3.7e+02	6.0e+02	1000	19193604
Total Egg Intake	100%	1.8e+01	1.0e+00	1.7e-01	4.5e-01	7.9e-01	1.6e+00	3.3e+00	2.3e+01	6.0e+01	8.4e+01	1.5e+02	3.1e+02	929	17858105
Total Fish Intake	100%	1.8e+01	1.3e+00	3.2e-01	7.0e-01	1.4e+00	3.6e+00	6.9e+00	1.5e+01	4.7e+01	8.5e+01	1.5e+02	2.8e+02	636	12432961
Total Grain Intake	100%	2.6e+02	4.2e+00	5.3e+01	8.4e+01	1.1e+02	1.7e+02	2.3e+02	3.2e+02	4.4e+02	5.0e+02	6.6e+02	1.0e+03	1005	19286648
Total Vegetable Intake	100%	2.2e+02	4.6e+00	2.0e+01	5.1e+01	7.6e+01	1.2e+02	2.0e+02	2.9e+02	4.1e+02	4.8e+02	7.1e+02	1.5e+03	1002	19203200
Total Fruit Intake	100%	2.4e+02	7.7e+00	3.5e+00	3.2e+01	5.9e+01	9.4e+01	1.9e+02	3.2e+02	5.4e+02	6.8e+02	9.4e+02	1.5e+03	704	13897901
Total Fat Intake	100%	1.5e+01	4.8e-01	6.0e-01	1.6e+00	2.6e+00	5.2e+00	1.0e+01	1.8e+01	3.4e+01	4.2e+01	7.4e+01	1.3e+02	966	18657140
Age 16-17 years															
Total Dietary Intake	100%	1.2e+03	3.3e+01	3.0e+02	3.9e+02	4.9e+02	7.1e+02	1.0e+03	1.5e+03	2.0e+03	2.5e+03	3.2e+03	4.4e+03	363	7760616
Total Dairy Intake	100%	3.5e+02	1.6e+01	5.9e+00	1.6e+01	3.0e+01	1.1e+02	2.7e+02	5.0e+02	7.4e+02	9.8e+02	1.4e+03	1.6e+03	360	7687375
Total Meat Intake	100%	1.3e+02	4.3e+00	9.5e+00	2.4e+01	3.9e+01	7.1e+01	1.1e+02	1.7e+02	2.5e+02	2.9e+02	3.7e+02	4.3e+02	360	7683449
Total Egg Intake	100%	1.7e+01	1.7e+00	3.4e-01	6.5e-01	9.5e-01	1.9e+00	3.6e+00	9.1e+00	6.3e+01	8.1e+01	1.4e+02	1.8e+02	340	7255218
Total Fish Intake	100%	1.9e+01	2.7e+00	6.5e-01	1.3e+00	1.6e+00	3.4e+00	6.8e+00	1.6e+01	3.4e+01	8.8e+01	2.4e+02	3.7e+02	227	4880609
Total Grain Intake	100%	2.5e+02	8.4e+00	2.8e+01	7.2e+01	9.6e+01	1.4e+02	2.2e+02	3.3e+02	4.2e+02	5.2e+02	8.4e+02	1.4e+03	363	7760616
Total Vegetable Intake	100%	2.5e+02	1.0e+01	1.8e+01	4.4e+01	6.4e+01	1.2e+02	2.1e+02	3.4e+02	5.0e+02	5.9e+02	1.1e+03	1.2e+03	360	7717185
Total Fruit Intake	100%	2.7e+02	1.7e+01	7.5e+00	3.6e+01	5.3e+01	1.1e+02	1.9e+02	3.7e+02	6.2e+02	7.5e+02	1.1e+03	1.8e+03	206	4255549
Total Fat Intake	100%	1.6e+01	8.9e-01	5.8e-01	1.6e+00	2.7e+00	5.2e+00	1.1e+01	1.9e+01	3.8e+01	4.7e+01	1.0e+02	1.1e+02	357	7619265

NOTES:
PC = Percent Consuming
SE = Standard Error
N = Number of Individuals Surveyed and Consuming in the 2-Day Survey Period
Nwgt = Number of Observations Weighted to the US Population
* = Data not provided for less than 20 observations

Source: Based on analysis of 1994-1996 CSFII.

Table 3-9. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Food Intake

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
	Age <1 month (g/day, as consumed)					
Total Foods	0.0E+00	0.0%	4.8E+02	100.0%	1.5E+03	100.0%
Total Dairy	0.0E+00	0.0%	4.8E+02	100.0%	1.5E+03	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/day, as consumed)					
Total Foods	0.0E+00	0.0%	8.2E+02	100.0%	1.6E+03	100.0%
Total Dairy	0.0E+00	0.0%	8.2E+02	99.7%	1.5E+03	95.8%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	7.1E-01	0.1%	4.0E+00	0.3%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	4.6E+01	2.9%
Total Fruits	0.0E+00	0.0%	1.7E+00	0.2%	1.7E+01	1.1%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/day, as consumed)					
Total Foods	1.5E+00	100.0%	9.2E+02	100.0%	1.8E+03	100.0%
Total Dairy	0.0E+00	0.0%	8.4E+02	91.2%	1.5E+03	87.7%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	1.1E+00	0.1%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	1.6E-01	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	4.1E-02	0.0%
Total Grains	1.5E+00	100.0%	6.6E+00	0.7%	2.7E+01	1.6%
Total Vegetables	0.0E+00	0.0%	1.8E+00	0.2%	5.9E+01	3.3%
Total Fruits	0.0E+00	0.0%	7.3E+01	7.9%	1.3E+02	7.3%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	1.8E-01	0.0%
	Age 6-11 months (g/day, as consumed)					
Total Foods	2.3E+02	100.0%	1.2E+03	100.0%	1.8E+03	100.0%
Total Dairy	3.7E+01	16.1%	8.3E+02	72.2%	1.3E+03	74.0%
Total Meats	2.7E+00	1.2%	1.6E+01	1.4%	1.2E+01	0.7%
Total Fish	1.1E+00	0.5%	1.1E+00	0.1%	9.1E-01	0.1%
Total Eggs	1.1E+00	0.5%	1.5E+01	1.3%	9.1E-01	0.1%
Total Grains	3.2E+01	14.1%	3.8E+01	3.3%	9.0E+01	5.0%
Total Vegetables	5.8E+01	25.5%	9.3E+01	8.1%	1.5E+02	8.5%
Total Fruits	9.6E+01	42.0%	1.6E+02	13.6%	2.1E+02	11.7%
Total Fats [a]	2.7E-01	0.1%	1.5E+00	0.1%	8.5E-01	0.0%
	Age 1-2 years (g/day, as consumed)					
Total Foods	4.8E+02	100.0%	1.1E+03	100.0%	1.9E+03	100.0%
Total Dairy	1.6E+02	33.3%	4.5E+02	42.5%	9.2E+02	49.1%
Total Meats	4.8E+01	10.0%	5.9E+01	5.6%	7.0E+01	3.7%
Total Fish	2.4E+00	0.5%	5.6E+00	0.5%	6.9E+00	0.4%
Total Eggs	1.2E+01	2.5%	1.5E+01	1.5%	2.3E+01	1.2%
Total Grains	1.0E+02	21.0%	1.5E+02	14.5%	1.8E+02	9.8%
Total Vegetables	7.4E+01	15.3%	1.2E+02	11.5%	1.9E+02	10.0%
Total Fruits	8.0E+01	16.7%	2.5E+02	23.3%	4.7E+02	25.3%
Total Fats [a]	3.7E+00	0.8%	5.7E+00	0.5%	7.5E+00	0.4%
	Age 3-5 years (g/day, as consumed)					
Total Foods	4.7E+02	100.0%	1.0E+03	100.0%	1.8E+03	100.0%
Total Dairy	1.5E+02	31.0%	4.0E+02	40.0%	7.2E+02	39.9%

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
	Age <1 month (g/kg/day, as consumed)					
Total Foods	0.0E+00	0.0%	1.4E+02	100.0%	4.5E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.4E+02	100.0%	4.5E+02	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/kg/day, as consumed)					
Total Foods	0.0E+00	0.0%	1.6E+02	100.0%	2.8E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.6E+02	98.9%	2.8E+02	99.1%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	1.8E+00	1.1%	2.5E-01	0.1%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	2.4E+00	0.9%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/kg/day, as consumed)					
Total Foods	2.3E-02	100.0%	1.3E+02	100.0%	2.5E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.2E+02	89.9%	2.2E+02	88.6%
Total Meats	0.0E+00	0.0%	5.4E-01	0.4%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	7.7E-02	0.1%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	1.9E-02	0.0%	0.0E+00	0.0%
Total Grains	2.3E-02	100.0%	1.5E+00	1.1%	4.0E+00	1.6%
Total Vegetables	0.0E+00	0.0%	3.3E+00	2.5%	6.8E+00	2.8%
Total Fruits	0.0E+00	0.0%	7.9E+00	6.0%	1.7E+01	7.0%
Total Fats [a]	0.0E+00	0.0%	3.8E-02	0.0%	1.4E-02	0.0%
	Age 6-11 months (g/kg/day, as consumed)					
Total Foods	7.2E+00	100.0%	1.2E+02	100.0%	2.1E+02	100.0%
Total Dairy	3.2E-01	4.4%	8.0E+01	65.7%	1.5E+02	72.3%
Total Meats	3.5E-02	0.5%	2.5E+00	2.1%	2.6E+00	1.2%
Total Fish	9.7E-02	1.4%	9.8E-02	0.1%	2.2E-01	0.1%
Total Eggs	1.2E-01	1.7%	8.8E-01	0.7%	1.8E-01	0.1%
Total Grains	1.7E+00	23.6%	6.6E+00	5.5%	1.3E+01	6.1%
Total Vegetables	2.2E+00	30.2%	1.2E+01	9.8%	1.9E+01	8.9%
Total Fruits	2.7E+00	38.2%	1.9E+01	16.0%	2.4E+01	11.1%
Total Fats [a]	2.5E-03	0.0%	1.5E-01	0.1%	1.7E-01	0.1%
	Age 1-2 years (g/kg/day, as consumed)					
Total Foods	1.9E+01	100.0%	8.1E+01	100.0%	1.6E+02	100.0%
Total Dairy	6.0E+00	31.4%	3.4E+01	42.5%	8.3E+01	52.3%
Total Meats	2.0E+00	10.5%	4.8E+00	5.9%	5.6E+00	3.5%
Total Fish	8.9E-02	0.5%	5.5E-01	0.7%	5.0E-01	0.3%
Total Eggs	6.7E-01	3.5%	1.4E+00	1.7%	1.6E+00	1.0%
Total Grains	4.2E+00	22.2%	1.1E+01	13.6%	1.5E+01	9.2%
Total Vegetables	3.2E+00	16.7%	1.0E+01	12.5%	1.5E+01	9.6%
Total Fruits	2.8E+00	14.4%	1.8E+01	22.6%	3.8E+01	23.7%
Total Fats [a]	1.6E-01	0.8%	4.4E-01	0.5%	5.7E-01	0.4%
	Age 3-5 years (g/kg/day, as consumed)					
Total Foods	6.8E+00	100.0%	5.4E+01	100.0%	1.1E+02	100.0%
Total Dairy	1.8E+00	27.1%	2.2E+01	40.6%	4.1E+01	37.9%

Table 3-9. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Food Intake

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
Total Meats	6.1E+01	12.9%	7.8E+01	7.9%	1.0E+02	5.8%
Total Fish	4.1E+00	0.9%	6.5E+00	0.7%	1.0E+01	0.6%
Total Eggs	1.0E+01	2.1%	1.1E+01	1.1%	2.5E+01	1.4%
Total Grains	1.1E+02	24.0%	1.9E+02	18.6%	2.8E+02	15.5%
Total Vegetables	8.1E+01	17.0%	1.3E+02	13.2%	2.1E+02	11.9%
Total Fruits	5.3E+01	11.1%	1.8E+02	17.9%	4.4E+02	24.4%
Total Fats [a]	4.7E+00	1.0%	7.0E+00	0.7%	1.2E+01	0.7%
Age 6-10 years (g/day, as consumed)						
Total Foods	5.3E+02	100.0%	1.1E+03	100.0%	2.0E+03	100.0%
Total Dairy	1.6E+02	29.9%	3.9E+02	37.2%	7.9E+02	40.6%
Total Meats	7.5E+01	14.2%	9.7E+01	9.2%	1.2E+02	6.1%
Total Fish	8.9E+00	1.7%	7.6E+00	0.7%	1.2E+01	0.6%
Total Eggs	7.8E+00	1.5%	1.3E+01	1.2%	2.2E+01	1.1%
Total Grains	1.4E+02	26.1%	2.1E+02	19.9%	3.3E+02	17.1%
Total Vegetables	9.2E+01	17.5%	1.7E+02	16.1%	2.7E+02	13.8%
Total Fruits	4.2E+01	8.0%	1.6E+02	14.8%	3.9E+02	19.8%
Total Fats [a]	6.0E+00	1.1%	9.9E+00	0.9%	1.4E+01	0.7%
Age 11-15 years (g/day, as consumed)						
Total Foods	4.8E+02	100.0%	1.1E+03	100.0%	2.3E+03	100.0%
Total Dairy	8.2E+01	17.1%	3.5E+02	32.0%	8.3E+02	36.6%
Total Meats	7.7E+01	16.1%	1.2E+02	10.6%	1.8E+02	7.8%
Total Fish	5.3E+00	1.1%	5.6E+00	0.5%	1.9E+01	0.8%
Total Eggs	9.2E+00	1.9%	1.5E+01	1.4%	2.1E+01	0.9%
Total Grains	1.4E+02	29.3%	2.4E+02	22.1%	4.0E+02	17.5%
Total Vegetables	1.2E+02	25.3%	2.0E+02	18.6%	4.0E+02	17.5%
Total Fruits	3.6E+01	7.5%	1.5E+02	13.7%	4.0E+02	17.7%
Total Fats [a]	8.0E+00	1.7%	1.1E+01	1.0%	2.3E+01	1.0%
Age 16-17 years (g/day, as consumed)						
Total Foods	3.9E+02	100.0%	1.0E+03	100.0%	2.4E+03	100.0%
Total Dairy	7.3E+01	18.9%	2.6E+02	25.1%	8.4E+02	35.4%
Total Meats	6.6E+01	17.1%	1.2E+02	11.9%	1.7E+02	7.2%
Total Fish	6.1E+00	1.6%	1.3E+01	1.3%	2.0E+01	0.8%
Total Eggs	7.3E+00	1.9%	1.8E+01	1.8%	1.7E+01	0.7%
Total Grains	1.0E+02	26.7%	2.3E+02	22.4%	4.5E+02	18.8%
Total Vegetables	1.0E+02	26.5%	2.5E+02	24.0%	4.3E+02	18.0%
Total Fruits	2.2E+01	5.6%	1.2E+02	11.9%	4.3E+02	18.0%
Total Fats [a]	6.9E+00	1.8%	1.7E+01	1.6%	2.5E+01	1.1%

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
Total Meats	9.5E-01	14.0%	4.5E+00	8.3%	6.3E+00	5.9%
Total Fish	4.1E-02	0.6%	3.1E-01	0.6%	4.6E-01	0.4%
Total Eggs	2.0E-01	2.9%	6.4E-01	1.2%	1.1E+00	1.0%
Total Grains	1.8E+00	27.0%	1.0E+01	18.6%	1.8E+01	16.9%
Total Vegetables	1.2E+00	17.2%	7.1E+00	13.1%	1.3E+01	12.0%
Total Fruits	6.9E-01	10.1%	9.1E+00	16.9%	2.7E+01	25.2%
Total Fats [a]	8.3E-02	1.2%	4.5E-01	0.8%	6.5E-01	0.6%
Age 6-10 years (g/kg/day, as consumed)						
Total Foods	3.3E+00	100.0%	3.6E+01	100.0%	7.4E+01	100.0%
Total Dairy	7.7E-01	23.7%	1.5E+01	43.0%	3.1E+01	41.6%
Total Meats	5.1E-01	15.7%	3.1E+00	8.7%	4.9E+00	6.6%
Total Fish	3.9E-02	1.2%	2.4E-01	0.7%	4.0E-01	0.5%
Total Eggs	9.2E-02	2.8%	3.6E-01	1.0%	9.0E-01	1.2%
Total Grains	9.8E-01	29.9%	7.4E+00	20.9%	1.3E+01	17.9%
Total Vegetables	6.6E-01	20.3%	4.7E+00	13.1%	1.0E+01	13.6%
Total Fruits	1.5E-01	4.6%	4.1E+00	11.6%	1.3E+01	17.8%
Total Fats [a]	5.5E-02	1.7%	3.6E-01	1.0%	5.9E-01	0.8%
Age 11-15 years (g/kg/day, as consumed)						
Total Foods	4.9E+00	100.0%	2.1E+01	100.0%	4.8E+01	100.0%
Total Dairy	7.3E-01	14.7%	6.5E+00	30.7%	1.8E+01	37.4%
Total Meats	8.6E-01	17.3%	2.6E+00	12.5%	3.5E+00	7.2%
Total Fish	6.5E-02	1.3%	1.5E-01	0.7%	4.7E-01	1.0%
Total Eggs	9.4E-02	1.9%	3.3E-01	1.6%	4.4E-01	0.9%
Total Grains	1.5E+00	30.3%	4.8E+00	22.5%	9.0E+00	18.8%
Total Vegetables	1.3E+00	27.1%	3.9E+00	18.2%	8.1E+00	17.0%
Total Fruits	2.7E-01	5.4%	2.7E+00	12.8%	8.1E+00	16.8%
Total Fats [a]	9.7E-02	2.0%	2.2E-01	1.0%	4.3E-01	0.9%
Age 16-17 years (g/kg/day, as consumed)						
Total Foods	5.5E+00	100.0%	1.6E+01	100.0%	3.6E+01	100.0%
Total Dairy	1.0E+00	18.8%	3.7E+00	23.1%	1.2E+01	32.3%
Total Meats	1.0E+00	18.5%	2.2E+00	13.4%	2.8E+00	7.6%
Total Fish	1.3E-01	2.4%	6.8E-02	0.4%	3.5E-01	1.0%
Total Eggs	1.1E-01	2.1%	2.2E-01	1.3%	3.8E-01	1.0%
Total Grains	1.5E+00	28.1%	4.0E+00	24.6%	8.1E+00	22.2%
Total Vegetables	1.2E+00	21.9%	3.7E+00	23.0%	7.0E+00	19.3%
Total Fruits	3.7E-01	6.9%	2.0E+00	12.6%	5.7E+00	15.6%
Total Fats [a]	6.9E-02	1.3%	2.5E-01	1.5%	4.2E-01	1.1%

[a] Includes added fats such as butter, margarine, dressings and sauces, vegetable oil, etc.; does not include fats eaten as components of other foods such as meats.

Source: Based on analysis of 1994-1996 CSFII.

Table 3-10. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Intake

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
	Age <1 month (g/day, as consumed)					
Total Foods	7.3E+02	100.0%	5.8E+02	100.0%	1.7E+02	100.0%
Total Dairy	7.3E+02	100.0%	5.8E+02	100.0%	1.7E+02	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/day, as consumed)					
Total Foods	8.1E+02	100.0%	8.3E+02	100.0%	8.5E+02	100.0%
Total Dairy	8.0E+02	98.6%	8.3E+02	99.8%	8.3E+02	97.9%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	1.2E+00	0.1%	1.7E+00	0.2%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	1.0E+01	1.3%	0.0E+00	0.0%	1.8E+01	2.1%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/day, as consumed)					
Total Foods	8.1E+02	100.0%	1.1E+03	100.0%	1.0E+03	100.0%
Total Dairy	7.0E+02	86.2%	9.9E+02	94.0%	7.5E+02	73.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	2.1E+01	2.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	2.0E+00	0.2%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	4.4E+00	0.4%
Total Grains	4.6E+00	0.6%	1.9E+01	1.8%	2.8E+01	2.7%
Total Vegetables	1.2E+01	1.5%	2.9E+01	2.7%	6.5E+01	6.3%
Total Fruits	9.5E+01	11.7%	1.6E+01	1.5%	1.6E+02	15.2%
Total Fats [a]	0.0E+00	0.0%	9.8E-02	0.0%	1.1E+00	0.1%
	Age 6-11 months (g/day, as consumed)					
Total Foods	1.0E+03	100.0%	1.2E+03	100.0%	1.3E+03	100.0%
Total Dairy	6.8E+02	66.0%	8.6E+02	73.8%	8.5E+02	63.6%
Total Meats	0.0E+00	0.0%	1.1E+01	1.0%	7.5E+01	5.7%
Total Fish	0.0E+00	0.0%	6.0E-01	0.1%	1.7E+00	0.1%
Total Eggs	0.0E+00	0.0%	1.5E+01	1.3%	1.9E+01	1.5%
Total Grains	2.7E+01	2.6%	7.2E+01	6.2%	1.1E+02	8.5%
Total Vegetables	9.2E+01	8.9%	8.6E+01	7.4%	1.2E+02	9.1%
Total Fruits	2.3E+02	22.5%	1.2E+02	10.2%	1.5E+02	11.3%
Total Fats [a]	0.0E+00	0.0%	1.8E+00	0.2%	2.8E+00	0.2%
	Age 1-2 years (g/day, as consumed)					
Total Foods	1.0E+03	100.0%	1.0E+03	100.0%	1.2E+03	100.0%
Total Dairy	5.9E+02	56.9%	4.8E+02	45.8%	4.3E+02	35.6%
Total Meats	5.9E+00	0.6%	5.2E+01	5.0%	1.5E+02	12.5%
Total Fish	3.3E+00	0.3%	5.5E+00	0.5%	7.9E+00	0.6%
Total Eggs	1.0E+01	1.0%	1.5E+01	1.4%	2.2E+01	1.8%
Total Grains	1.0E+02	9.7%	1.4E+02	13.6%	1.7E+02	14.3%
Total Vegetables	1.0E+02	9.8%	1.1E+02	10.8%	1.7E+02	13.7%
Total Fruits	2.2E+02	21.6%	2.3E+02	22.4%	2.5E+02	20.8%
Total Fats [a]	2.4E+00	0.2%	5.4E+00	0.5%	7.9E+00	0.7%

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
	Age <1 month (g/kg/day, as consumed)					
Total Foods	2.3E+02	100.0%	1.6E+02	100.0%	0.0E+00	0.0%
Total Dairy	2.3E+02	100.0%	1.6E+02	100.0%	0.0E+00	0.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/kg/day, as consumed)					
Total Foods	1.8E+02	100.0%	1.1E+02	100.0%	2.0E+02	100.0%
Total Dairy	1.7E+02	98.6%	1.1E+02	99.8%	1.9E+02	98.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	2.7E-01	0.2%	2.6E-01	0.2%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	2.2E+00	1.2%	0.0E+00	0.0%	3.9E+00	2.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/kg/day, as consumed)					
Total Foods	1.3E+02	100.0%	1.4E+02	100.0%	1.3E+02	100.0%
Total Dairy	1.1E+02	87.7%	1.3E+02	94.6%	9.4E+01	74.2%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	2.5E+00	1.9%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	2.4E-01	0.2%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	3.7E-01	0.3%
Total Grains	6.5E-01	0.5%	2.3E+00	1.6%	3.0E+00	2.3%
Total Vegetables	1.6E+00	1.3%	2.8E+00	2.0%	8.3E+00	6.5%
Total Fruits	1.3E+01	10.5%	2.4E+00	1.7%	1.8E+01	14.4%
Total Fats [a]	0.0E+00	0.0%	1.4E-02	0.0%	1.3E-01	0.1%
	Age 6-11 months (g/kg/day, as consumed)					
Total Foods	1.3E+02	100.0%	1.3E+02	100.0%	1.5E+02	100.0%
Total Dairy	8.3E+01	66.2%	9.3E+01	73.3%	8.8E+01	58.8%
Total Meats	0.0E+00	0.0%	1.1E+00	0.9%	7.9E+00	5.3%
Total Fish	0.0E+00	0.0%	6.0E-02	0.0%	3.6E-01	0.2%
Total Eggs	0.0E+00	0.0%	1.0E+00	0.8%	1.6E+00	1.1%
Total Grains	3.6E+00	2.9%	7.1E+00	5.6%	1.3E+01	8.7%
Total Vegetables	1.1E+01	9.0%	1.1E+01	8.3%	2.0E+01	13.3%
Total Fruits	2.8E+01	22.0%	1.4E+01	11.0%	1.9E+01	12.3%
Total Fats [a]	0.0E+00	0.0%	1.8E-01	0.1%	3.5E-01	0.2%
	Age 1-2 years (g/kg/day, as consumed)					
Total Foods	5.6E+01	100.0%	8.4E+01	100.0%	1.0E+02	100.0%
Total Dairy	3.2E+01	57.4%	3.6E+01	42.9%	3.9E+01	38.9%
Total Meats	1.6E-01	0.3%	3.9E+00	4.7%	1.1E+01	11.3%
Total Fish	9.8E-02	0.2%	4.0E-01	0.5%	7.0E-01	0.7%
Total Eggs	4.0E-01	0.7%	1.4E+00	1.7%	1.4E+00	1.4%
Total Grains	4.7E+00	8.3%	1.1E+01	13.4%	1.4E+01	13.8%
Total Vegetables	6.1E+00	10.9%	9.7E+00	11.5%	1.3E+01	13.4%
Total Fruits	1.2E+01	22.1%	2.1E+01	24.7%	2.0E+01	19.9%
Total Fats [a]	8.4E-02	0.1%	4.3E-01	0.5%	6.1E-01	0.6%

Table 3-10. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age 3-5 years (g/day, as consumed)					
Total Foods	9.7E+02	100.0%	9.6E+02	100.0%	1.3E+03	100.0%
Total Dairy	4.0E+02	41.3%	3.7E+02	38.8%	3.7E+02	29.9%
Total Meats	1.3E+01	1.4%	7.0E+01	7.3%	1.9E+02	14.9%
Total Fish	6.5E+00	0.7%	4.6E+00	0.5%	7.7E+00	0.6%
Total Eggs	1.2E+01	1.2%	1.6E+01	1.6%	1.9E+01	1.5%
Total Grains	1.9E+02	19.6%	1.7E+02	17.8%	2.3E+02	18.7%
Total Vegetables	1.1E+02	10.9%	1.4E+02	14.5%	1.9E+02	14.9%
Total Fruits	2.4E+02	24.4%	1.8E+02	18.7%	2.3E+02	18.7%
Total Fats [a]	4.8E+00	0.5%	7.2E+00	0.7%	1.1E+01	0.9%
	Age 6-10 years (g/day, as consumed)					
Total Foods	1.0E+03	100.0%	1.1E+03	100.0%	1.4E+03	100.0%
Total Dairy	4.4E+02	43.4%	4.5E+02	41.0%	4.4E+02	32.5%
Total Meats	1.4E+01	1.4%	8.6E+01	7.9%	2.2E+02	16.2%
Total Fish	4.1E+00	0.4%	8.7E+00	0.8%	9.0E+00	0.7%
Total Eggs	1.0E+01	1.0%	1.0E+01	0.9%	1.7E+01	1.2%
Total Grains	2.2E+02	21.6%	2.1E+02	19.3%	2.5E+02	18.4%
Total Vegetables	1.3E+02	13.3%	1.7E+02	15.5%	2.4E+02	17.7%
Total Fruits	1.8E+02	18.1%	1.5E+02	13.6%	1.7E+02	12.4%
Total Fats [a]	8.0E+00	0.8%	1.2E+01	1.1%	1.2E+01	0.9%
	Age 11-15 years (g/day, as consumed)					
Total Foods	1.0E+03	100.0%	1.1E+03	100.0%	1.5E+03	100.0%
Total Dairy	3.7E+02	36.2%	3.2E+02	29.9%	3.9E+02	25.4%
Total Meats	2.0E+01	2.0%	1.1E+02	10.0%	2.9E+02	18.8%
Total Fish	7.5E+00	0.7%	1.3E+01	1.2%	1.6E+01	1.0%
Total Eggs	1.4E+01	1.4%	1.2E+01	1.1%	2.5E+01	1.6%
Total Grains	2.3E+02	22.3%	2.4E+02	22.6%	3.1E+02	19.8%
Total Vegetables	1.8E+02	17.4%	2.0E+02	18.2%	3.3E+02	21.1%
Total Fruits	1.9E+02	19.0%	1.7E+02	16.0%	1.7E+02	11.1%
Total Fats [a]	1.1E+01	1.1%	1.2E+01	1.1%	1.8E+01	1.2%
	Age 16-17 years (g/day, as consumed)					
Total Foods	7.5E+02	100.0%	1.1E+03	100.0%	1.6E+03	100.0%
Total Dairy	2.1E+02	28.3%	3.9E+02	34.8%	3.7E+02	23.4%
Total Meats	1.9E+01	2.5%	1.2E+02	10.5%	3.1E+02	19.4%
Total Fish	1.2E+01	1.6%	8.5E+00	0.8%	1.4E+01	0.9%
Total Eggs	1.4E+01	1.9%	5.7E+00	0.5%	2.6E+01	1.6%
Total Grains	1.8E+02	24.4%	2.6E+02	23.5%	3.4E+02	21.6%
Total Vegetables	1.6E+02	21.2%	1.8E+02	16.2%	3.8E+02	24.1%
Total Fruits	1.4E+02	18.6%	1.4E+02	12.7%	1.2E+02	7.6%
Total Fats [a]	1.2E+01	1.5%	1.3E+01	1.2%	2.4E+01	1.5%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age 3-5 years (g/kg/day, as consumed)					
Total Foods	1.8E+01	100.0%	5.8E+01	100.0%	7.5E+01	100.0%
Total Dairy	7.9E+00	44.6%	2.3E+01	40.2%	2.4E+01	31.7%
Total Meats	7.8E-02	0.4%	3.8E+00	6.5%	1.0E+01	13.9%
Total Fish	1.2E-01	0.7%	4.0E-01	0.7%	2.8E-01	0.4%
Total Eggs	1.4E-01	0.8%	6.6E-01	1.1%	1.0E+00	1.4%
Total Grains	3.2E+00	17.7%	9.9E+00	17.1%	1.4E+01	18.5%
Total Vegetables	1.6E+00	9.0%	7.5E+00	13.0%	1.1E+01	15.3%
Total Fruits	4.7E+00	26.5%	1.2E+01	20.7%	1.3E+01	18.1%
Total Fats [a]	6.3E-02	0.4%	4.1E-01	0.7%	6.1E-01	0.8%
	Age 6-10 years (g/kg/day, as consumed)					
Total Foods	1.2E+01	100.0%	3.6E+01	100.0%	5.3E+01	100.0%
Total Dairy	4.9E+00	41.8%	1.4E+01	39.0%	1.8E+01	34.5%
Total Meats	2.9E-02	0.3%	2.7E+00	7.5%	8.0E+00	15.0%
Total Fish	1.0E-01	0.9%	3.2E-01	0.9%	3.0E-01	0.6%
Total Eggs	1.1E-01	0.9%	4.2E-01	1.2%	7.1E-01	1.3%
Total Grains	2.5E+00	21.2%	7.2E+00	20.2%	1.0E+01	18.8%
Total Vegetables	1.7E+00	14.7%	5.5E+00	15.3%	8.8E+00	16.6%
Total Fruits	2.3E+00	19.5%	5.4E+00	15.0%	6.5E+00	12.3%
Total Fats [a]	7.2E-02	0.6%	3.4E-01	1.0%	4.7E-01	0.9%
	Age 11-15 years (g/kg/day, as consumed)					
Total Foods	1.3E+01	100.0%	2.1E+01	100.0%	3.3E+01	100.0%
Total Dairy	4.5E+00	35.8%	6.6E+00	31.3%	9.3E+00	28.3%
Total Meats	2.0E-01	1.6%	2.0E+00	9.5%	5.8E+00	17.6%
Total Fish	5.7E-02	0.5%	1.5E-01	0.7%	2.6E-01	0.8%
Total Eggs	1.8E-01	1.4%	3.0E-01	1.4%	4.2E-01	1.3%
Total Grains	3.0E+00	23.8%	4.7E+00	22.3%	6.7E+00	20.4%
Total Vegetables	2.3E+00	18.3%	3.7E+00	17.5%	6.4E+00	19.4%
Total Fruits	2.2E+00	17.6%	3.4E+00	16.0%	3.7E+00	11.2%
Total Fats [a]	1.4E-01	1.1%	2.4E-01	1.1%	3.8E-01	1.2%
	Age 16-17 years (g/kg/day, as consumed)					
Total Foods	5.5E+00	100.0%	1.6E+01	100.0%	3.6E+01	100.0%
Total Dairy	1.0E+00	18.8%	3.7E+00	23.1%	1.2E+01	32.3%
Total Meats	1.0E+00	18.5%	2.2E+00	13.4%	2.8E+00	7.6%
Total Fish	1.3E-01	2.4%	6.8E-02	0.4%	3.5E-01	1.0%
Total Eggs	1.1E-01	2.1%	2.2E-01	1.3%	3.8E-01	1.0%
Total Grains	1.5E+00	28.1%	4.0E+00	24.6%	8.1E+00	22.2%
Total Vegetables	1.2E+00	21.9%	3.7E+00	23.0%	7.0E+00	19.3%
Total Fruits	3.7E-01	6.9%	2.0E+00	12.6%	5.7E+00	15.6%
Total Fats [a]	6.9E-02	1.3%	2.5E-01	1.5%	4.2E-01	1.1%

[a] Includes added fats such as butter, margarine, dressings and sauces, vegetable oil, etc.; does not include fats eaten as components of other foods such as meats.

Source: Based on analysis of 1994-1996 CSFII.

Table 3-11. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Meat and Dairy Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age <1 month (g/day, as consumed)					
Total Foods	0.0E+00	0.0%	4.8E+02	100.0%	1.5E+03	100.0%
Total Dairy	0.0E+00	0.0%	4.8E+02	100.0%	1.5E+03	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/day, as consumed)					
Total Foods	5.2E+00	100.0%	8.2E+02	100.0%	1.6E+03	100.0%
Total Dairy	0.0E+00	0.0%	8.2E+02	99.7%	1.5E+03	95.8%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	7.1E-01	0.1%	4.0E+00	0.3%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	4.6E+01	2.9%
Total Fruits	5.2E+00	100.0%	1.7E+00	0.2%	1.7E+01	1.1%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/day, as consumed)					
Total Foods	3.7E+00	100.0%	9.3E+02	100.0%	1.7E+03	100.0%
Total Dairy	0.0E+00	0.0%	8.1E+02	86.7%	1.6E+03	94.8%
Total Meats	0.0E+00	0.0%	1.5E+00	0.2%	1.1E+00	0.1%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	1.6E-01	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	4.1E-02	0.0%
Total Grains	1.7E+00	46.1%	8.6E+00	0.9%	1.3E+01	0.8%
Total Vegetables	1.3E+00	34.3%	2.2E+01	2.3%	4.0E+01	2.4%
Total Fruits	7.2E-01	19.6%	9.2E+01	9.9%	3.3E+01	2.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	1.8E-01	0.0%
	Age 6-11 months (g/day, as consumed)					
Total Foods	2.8E+02	100.0%	1.2E+03	100.0%	1.8E+03	100.0%
Total Dairy	2.1E+01	7.5%	7.7E+02	66.4%	1.4E+03	80.8%
Total Meats	6.9E+00	2.5%	2.0E+01	1.7%	1.8E+01	1.0%
Total Fish	1.5E+00	0.5%	1.7E+00	0.1%	6.6E-01	0.0%
Total Eggs	3.9E+00	1.4%	1.3E+01	1.1%	2.3E+00	0.1%
Total Grains	4.3E+01	15.6%	8.7E+01	7.5%	6.7E+01	3.8%
Total Vegetables	6.9E+01	24.9%	1.1E+02	9.9%	9.0E+01	5.1%
Total Fruits	1.3E+02	47.4%	1.5E+02	13.2%	1.6E+02	9.1%
Total Fats [a]	4.4E-01	0.2%	2.0E+00	0.2%	9.4E-01	0.1%
	Age 1-2 years (g/day, as consumed)					
Total Foods	7.2E+02	100.0%	1.1E+03	100.0%	1.7E+03	100.0%
Total Dairy	7.4E+01	10.3%	4.2E+02	39.6%	1.1E+03	66.4%
Total Meats	4.9E+01	6.7%	6.2E+01	5.8%	5.9E+01	3.5%
Total Fish	3.7E+00	0.5%	5.7E+00	0.5%	4.4E+00	0.3%
Total Eggs	2.0E+01	2.8%	1.6E+01	1.5%	1.5E+01	0.9%
Total Grains	1.6E+02	22.8%	1.6E+02	14.8%	1.3E+02	7.9%
Total Vegetables	1.2E+02	16.9%	1.2E+02	11.0%	1.3E+02	7.6%
Total Fruits	2.8E+02	39.3%	2.8E+02	26.2%	2.2E+02	13.0%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age <1 month (g/kg/day, as consumed)					
Total Foods	0.0E+00	0.0%	1.4E+02	100.0%	4.5E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.4E+02	100.0%	4.5E+02	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/kg/day, as consumed)					
Total Foods	1.1E+00	100.0%	1.6E+02	100.0%	2.8E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.6E+02	98.9%	2.8E+02	99.1%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	1.8E+00	1.1%	2.5E-01	0.1%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	2.4E+00	0.9%
Total Fruits	1.1E+00	100.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/kg/day, as consumed)					
Total Foods	3.7E-01	100.0%	1.3E+02	100.0%	2.3E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.1E+02	88.8%	2.2E+02	96.7%
Total Meats	0.0E+00	0.0%	5.4E-01	0.4%	9.0E-02	0.0%
Total Fish	0.0E+00	0.0%	7.7E-02	0.1%	1.3E-02	0.0%
Total Eggs	0.0E+00	0.0%	1.9E-02	0.0%	3.2E-03	0.0%
Total Grains	1.8E-01	49.3%	9.1E-01	0.7%	1.8E+00	0.8%
Total Vegetables	1.9E-01	50.7%	1.4E+00	1.1%	4.1E+00	1.8%
Total Fruits	0.0E+00	0.0%	1.2E+01	8.9%	1.6E+00	0.7%
Total Fats [a]	0.0E+00	0.0%	3.8E-02	0.0%	2.0E-02	0.0%
	Age 6-11 months (g/kg/day, as consumed)					
Total Foods	1.4E+01	100.0%	1.3E+02	100.0%	2.0E+02	100.0%
Total Dairy	2.7E-02	0.2%	8.1E+01	62.1%	1.6E+02	81.1%
Total Meats	1.7E-02	0.1%	2.9E+00	2.2%	2.5E+00	1.3%
Total Fish	2.4E-03	0.0%	1.1E-01	0.1%	2.0E-01	0.1%
Total Eggs	6.1E-04	0.0%	1.9E+00	1.4%	5.9E-01	0.3%
Total Grains	1.6E+00	11.5%	9.4E+00	7.2%	8.5E+00	4.2%
Total Vegetables	4.1E+00	29.7%	1.6E+01	12.5%	9.6E+00	4.8%
Total Fruits	8.1E+00	58.4%	1.9E+01	14.4%	1.6E+01	8.1%
Total Fats [a]	1.2E-03	0.0%	1.5E-01	0.1%	2.4E-01	0.1%
	Age 1-2 years (g/kg/day, as consumed)					
Total Foods	3.2E+01	100.0%	8.3E+01	100.0%	1.5E+02	100.0%
Total Dairy	2.4E+00	7.4%	3.2E+01	38.3%	9.7E+01	66.7%
Total Meats	1.9E+00	6.1%	5.0E+00	6.0%	4.9E+00	3.4%
Total Fish	7.6E-02	0.2%	3.5E-01	0.4%	4.0E-01	0.3%
Total Eggs	1.1E+00	3.3%	1.3E+00	1.6%	1.3E+00	0.9%
Total Grains	7.5E+00	23.8%	1.2E+01	14.3%	1.1E+01	7.7%
Total Vegetables	5.5E+00	17.3%	1.1E+01	12.7%	1.2E+01	8.0%
Total Fruits	1.3E+01	41.1%	2.2E+01	26.2%	1.9E+01	12.7%

Table 3-11. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Meat and Dairy Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
Total Fats [a]	4.6E+00	0.6%	5.8E+00	0.5%	5.3E+00	0.3%
	Age 3-5 years (g/day, as consumed)					
Total Foods	7.0E+02	100.0%	9.8E+02	100.0%	1.6E+03	100.0%
Total Dairy	7.8E+01	11.2%	3.6E+02	37.1%	8.9E+02	55.4%
Total Meats	5.9E+01	8.4%	7.5E+01	7.6%	8.7E+01	5.4%
Total Fish	5.9E+00	0.8%	7.5E+00	0.8%	6.7E+00	0.4%
Total Eggs	1.4E+01	2.0%	1.5E+01	1.5%	1.7E+01	1.1%
Total Grains	1.8E+02	26.1%	1.8E+02	18.4%	2.2E+02	13.5%
Total Vegetables	1.3E+02	17.9%	1.3E+02	13.3%	1.5E+02	9.4%
Total Fruits	2.3E+02	32.6%	2.0E+02	20.5%	2.3E+02	14.2%
Total Fats [a]	6.6E+00	0.9%	7.5E+00	0.8%	8.9E+00	0.6%
	Age 6-10 years (g/day, as consumed)					
Total Foods	6.9E+02	100.0%	1.1E+03	100.0%	1.8E+03	100.0%
Total Dairy	8.3E+01	12.0%	3.9E+02	37.4%	9.2E+02	51.7%
Total Meats	7.2E+01	10.3%	9.3E+01	8.9%	1.2E+02	6.8%
Total Fish	1.1E+01	1.6%	7.8E+00	0.7%	8.3E+00	0.5%
Total Eggs	1.2E+01	1.8%	1.4E+01	1.3%	1.4E+01	0.8%
Total Grains	1.8E+02	26.2%	2.2E+02	21.1%	2.8E+02	16.0%
Total Vegetables	1.5E+02	22.2%	1.6E+02	15.4%	2.0E+02	11.2%
Total Fruits	1.7E+02	24.5%	1.5E+02	14.3%	2.2E+02	12.2%
Total Fats [a]	9.5E+00	1.4%	9.2E+00	0.9%	1.3E+01	0.8%
	Age 11-15 years (g/day, as consumed)					
Total Foods	6.8E+02	100.0%	1.1E+03	100.0%	2.0E+03	100.0%
Total Dairy	3.6E+01	5.3%	3.3E+02	30.5%	1.0E+03	50.2%
Total Meats	6.7E+01	9.8%	1.2E+02	11.4%	1.7E+02	8.2%
Total Fish	8.4E+00	1.2%	1.1E+01	1.0%	1.2E+01	0.6%
Total Eggs	1.9E+01	2.7%	1.3E+01	1.2%	1.9E+01	0.9%
Total Grains	2.0E+02	29.3%	2.4E+02	22.6%	3.3E+02	16.2%
Total Vegetables	1.9E+02	27.3%	2.1E+02	19.7%	2.9E+02	14.1%
Total Fruits	1.6E+02	22.8%	1.4E+02	12.5%	1.8E+02	8.8%
Total Fats [a]	1.0E+01	1.5%	1.2E+01	1.1%	1.9E+01	1.0%
	Age 16-17 years (g/day, as consumed)					
Total Foods	5.5E+02	100.0%	1.0E+03	100.0%	2.1E+03	100.0%
Total Dairy	3.4E+01	6.2%	2.4E+02	23.4%	9.8E+02	45.8%
Total Meats	4.7E+01	8.5%	1.6E+02	15.1%	1.7E+02	8.1%
Total Fish	1.4E+01	2.6%	1.4E+01	1.4%	8.6E+00	0.4%
Total Eggs	1.5E+01	2.6%	1.3E+01	1.2%	1.9E+01	0.9%
Total Grains	1.6E+02	30.0%	3.0E+02	29.5%	4.1E+02	19.0%
Total Vegetables	1.5E+02	26.7%	2.2E+02	21.8%	3.2E+02	15.1%
Total Fruits	1.2E+02	21.8%	6.5E+01	6.3%	2.0E+02	9.5%
Total Fats [a]	8.7E+00	1.6%	1.4E+01	1.3%	2.5E+01	1.2%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
Total Fats [a]	2.1E-01	0.6%	4.7E-01	0.6%	4.1E-01	0.3%
	Age 3-5 years (g/kg/day, as consumed)					
Total Foods	1.3E+01	100.0%	5.5E+01	100.0%	9.5E+01	100.0%
Total Dairy	7.9E-01	6.2%	1.9E+01	34.3%	5.2E+01	54.9%
Total Meats	8.4E-01	6.6%	4.6E+00	8.4%	5.5E+00	5.9%
Total Fish	6.8E-02	0.5%	3.5E-01	0.6%	3.2E-01	0.3%
Total Eggs	2.9E-01	2.3%	7.6E-01	1.4%	8.3E-01	0.9%
Total Grains	3.2E+00	25.7%	1.1E+01	19.4%	1.3E+01	14.1%
Total Vegetables	2.4E+00	18.9%	7.8E+00	14.3%	9.2E+00	9.8%
Total Fruits	4.9E+00	38.6%	1.1E+01	20.9%	1.3E+01	13.7%
Total Fats [a]	1.5E-01	1.1%	4.1E-01	0.8%	4.5E-01	0.5%
	Age 6-10 years (g/kg/day, as consumed)					
Total Foods	5.0E+00	100.0%	3.8E+01	100.0%	6.9E+01	100.0%
Total Dairy	3.5E-01	7.1%	1.3E+01	33.7%	3.6E+01	51.6%
Total Meats	5.1E-01	10.1%	3.6E+00	9.5%	4.7E+00	6.7%
Total Fish	3.7E-02	0.7%	2.7E-01	0.7%	2.9E-01	0.4%
Total Eggs	1.3E-01	2.5%	4.8E-01	1.2%	6.3E-01	0.9%
Total Grains	1.4E+00	27.7%	7.8E+00	20.5%	1.2E+01	16.7%
Total Vegetables	1.3E+00	26.1%	5.6E+00	14.7%	8.4E+00	12.1%
Total Fruits	1.2E+00	24.0%	7.2E+00	18.8%	7.5E+00	10.9%
Total Fats [a]	8.0E-02	1.6%	3.5E-01	0.9%	5.1E-01	0.7%
	Age 11-15 years (g/kg/day, as consumed)					
Total Foods	7.7E+00	100.0%	2.2E+01	100.0%	4.4E+01	100.0%
Total Dairy	3.4E-01	4.4%	6.2E+00	28.5%	2.1E+01	48.8%
Total Meats	6.6E-01	8.5%	2.6E+00	11.8%	3.3E+00	7.5%
Total Fish	8.4E-02	1.1%	2.1E-01	1.0%	3.4E-01	0.8%
Total Eggs	2.2E-01	2.9%	3.4E-01	1.5%	3.6E-01	0.8%
Total Grains	2.4E+00	31.2%	4.9E+00	22.8%	7.4E+00	16.9%
Total Vegetables	2.1E+00	27.8%	4.1E+00	18.8%	6.2E+00	14.2%
Total Fruits	1.7E+00	22.3%	3.1E+00	14.3%	4.4E+00	10.1%
Total Fats [a]	1.3E-01	1.7%	2.8E-01	1.3%	4.1E-01	0.9%
	Age 16-17 years (g/kg/day, as consumed)					
Total Foods	8.0E+00	100.0%	1.6E+01	100.0%	3.1E+01	100.0%
Total Dairy	4.1E-01	5.2%	3.8E+00	23.2%	1.5E+01	47.2%
Total Meats	7.3E-01	9.2%	2.3E+00	13.8%	2.4E+00	7.9%
Total Fish	1.9E-01	2.4%	1.2E-01	0.7%	1.2E-01	0.4%
Total Eggs	1.9E-01	2.4%	2.4E-01	1.5%	2.5E-01	0.8%
Total Grains	2.4E+00	29.7%	4.1E+00	24.7%	5.8E+00	18.9%
Total Vegetables	2.0E+00	24.8%	3.8E+00	23.1%	4.5E+00	14.5%
Total Fruits	2.0E+00	25.0%	2.0E+00	11.9%	2.8E+00	9.2%
Total Fats [a]	1.2E-01	1.4%	1.8E-01	1.1%	3.4E-01	1.1%

[a] Includes added fats such as butter, margarine, dressings and sauces, vegetable oil, etc.; does not include fats eaten as components of other foods such as meats.

Source: Based on analysis of 1994-1996 CSFII.

Table 3-12. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Fish Intake

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
	Age <1 month (g/day, as consumed)					
Total Foods	7.3E+02	100.0%	5.8E+02	100.0%	1.7E+02	100.0%
Total Dairy	7.3E+02	100.0%	5.8E+02	100.0%	1.7E+02	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/day, as consumed)					
Total Foods	8.1E+02	100.0%	8.3E+02	100.0%	8.5E+02	100.0%
Total Dairy	8.0E+02	98.6%	8.3E+02	99.8%	8.3E+02	97.9%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	1.2E+00	0.1%	1.7E+00	0.2%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	1.0E+01	1.3%	0.0E+00	0.0%	1.8E+01	2.1%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/day, as consumed)					
Total Foods	9.3E+02	100.0%	9.7E+02	100.0%	9.7E+02	100.0%
Total Dairy	8.0E+02	86.1%	8.8E+02	90.0%	7.0E+02	71.7%
Total Meats	3.2E+00	0.3%	0.0E+00	0.0%	1.6E+01	1.7%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	2.0E+00	0.2%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	4.4E+00	0.5%
Total Grains	4.4E+00	0.5%	1.8E+01	1.9%	2.8E+01	2.8%
Total Vegetables	1.2E+01	1.3%	3.5E+01	3.6%	7.8E+01	8.0%
Total Fruits	1.1E+02	11.8%	4.4E+01	4.6%	1.5E+02	15.1%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	1.1E+00	0.1%
	Age 6-11 months (g/day, as consumed)					
Total Foods	1.1E+03	100.0%	9.8E+02	100.0%	1.2E+03	100.0%
Total Dairy	6.9E+02	64.6%	7.0E+02	71.4%	6.9E+02	55.5%
Total Meats	9.6E+00	0.9%	1.6E+01	1.6%	4.1E+01	3.3%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	1.0E+01	0.8%
Total Eggs	2.4E+00	0.2%	1.2E+01	1.3%	9.6E+00	0.8%
Total Grains	3.8E+01	3.6%	5.2E+01	5.3%	1.1E+02	9.0%
Total Vegetables	1.1E+02	9.9%	7.0E+01	7.1%	1.7E+02	14.1%
Total Fruits	2.2E+02	20.8%	1.3E+02	13.1%	2.0E+02	16.3%
Total Fats [a]	4.1E-01	0.0%	7.1E-01	0.1%	3.4E+00	0.3%
	Age 1-2 years (g/day, as consumed)					
Total Foods	1.1E+03	100.0%	9.5E+02	100.0%	1.2E+03	100.0%
Total Dairy	4.5E+02	41.1%	4.5E+02	48.0%	4.6E+02	39.1%
Total Meats	5.5E+01	5.0%	4.7E+01	5.0%	7.4E+01	6.3%
Total Fish	0.0E+00	0.0%	1.2E+00	0.1%	3.7E+01	3.1%
Total Eggs	1.6E+01	1.4%	1.2E+01	1.3%	1.6E+01	1.4%
Total Grains	1.6E+02	14.4%	1.3E+02	13.7%	1.6E+02	13.5%
Total Vegetables	1.2E+02	10.6%	1.1E+02	11.4%	1.4E+02	12.0%
Total Fruits	3.0E+02	27.0%	1.9E+02	20.0%	2.8E+02	24.0%
Total Fats [a]	5.2E+00	0.5%	4.5E+00	0.5%	6.7E+00	0.6%

Food Group	Low-end Consumers Intake	Low-end Consumers Percent	Mid-range Consumers Intake	Mid-range Consumers Percent	High-end Consumers Intake	High-end Consumers Percent
	Age <1 month (g/kg/day, as consumed)					
Total Foods	2.3E+02	100.0%	1.6E+02	100.0%	0.0E+00	0.0%
Total Dairy	2.3E+02	100.0%	1.6E+02	100.0%	0.0E+00	0.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/kg/day, as consumed)					
Total Foods	1.8E+02	100.0%	1.1E+02	100.0%	2.0E+02	100.0%
Total Dairy	1.7E+02	98.6%	1.1E+02	99.8%	1.9E+02	98.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	2.7E-01	0.2%	2.6E-01	0.2%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	2.2E+00	1.2%	0.0E+00	0.0%	3.9E+00	2.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/kg/day, as consumed)					
Total Foods	1.4E+02	100.0%	1.3E+02	100.0%	1.2E+02	100.0%
Total Dairy	1.2E+02	87.4%	1.1E+02	90.4%	8.8E+01	72.5%
Total Meats	4.7E-01	0.3%	0.0E+00	0.0%	1.9E+00	1.5%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	2.4E-01	0.2%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	3.7E-01	0.3%
Total Grains	6.4E-01	0.4%	2.2E+00	1.7%	3.0E+00	2.5%
Total Vegetables	1.6E+00	1.1%	3.7E+00	3.0%	1.0E+01	8.6%
Total Fruits	1.5E+01	10.7%	6.2E+00	4.9%	1.7E+01	14.2%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	1.3E-01	0.1%
	Age 6-11 months (g/kg/day, as consumed)					
Total Foods	1.3E+02	100.0%	9.8E+01	100.0%	1.4E+02	100.0%
Total Dairy	8.1E+01	64.8%	7.0E+01	71.8%	8.2E+01	57.1%
Total Meats	9.6E-01	0.8%	1.8E+00	1.8%	4.6E+00	3.2%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	1.2E+00	0.8%
Total Eggs	2.9E-01	0.2%	8.8E-01	0.9%	6.0E-01	0.4%
Total Grains	4.2E+00	3.3%	5.6E+00	5.7%	1.2E+01	8.0%
Total Vegetables	1.3E+01	10.4%	6.4E+00	6.5%	2.1E+01	14.3%
Total Fruits	2.6E+01	20.4%	1.3E+01	13.2%	2.3E+01	16.0%
Total Fats [a]	5.1E-02	0.0%	6.9E-02	0.1%	3.3E-01	0.2%
	Age 1-2 years (g/kg/day, as consumed)					
Total Foods	8.4E+01	100.0%	7.8E+01	100.0%	9.4E+01	100.0%
Total Dairy	3.6E+01	42.8%	3.8E+01	48.7%	3.7E+01	40.0%
Total Meats	4.0E+00	4.8%	3.8E+00	4.9%	6.1E+00	6.5%
Total Fish	0.0E+00	0.0%	7.9E-02	0.1%	2.8E+00	2.9%
Total Eggs	1.1E+00	1.2%	9.2E-01	1.2%	1.3E+00	1.3%
Total Grains	1.2E+01	13.9%	1.0E+01	12.9%	1.3E+01	13.5%
Total Vegetables	8.5E+00	10.0%	8.7E+00	11.2%	1.1E+01	12.1%
Total Fruits	2.3E+01	26.7%	1.6E+01	20.7%	2.2E+01	23.1%
Total Fats [a]	3.8E-01	0.5%	3.4E-01	0.4%	5.5E-01	0.6%

Table 3-12. Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Fish Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age 3-5 years (g/day, as consumed)					
Total Foods	1.1E+03	100.0%	9.4E+02	100.0%	1.1E+03	100.0%
Total Dairy	4.1E+02	38.7%	3.5E+02	37.7%	4.0E+02	35.7%
Total Meats	6.5E+01	6.1%	7.4E+01	7.9%	8.4E+01	7.4%
Total Fish	0.0E+00	0.0%	1.6E+00	0.2%	4.2E+01	3.7%
Total Eggs	1.0E+01	1.0%	1.2E+01	1.3%	1.4E+01	1.3%
Total Grains	2.2E+02	20.6%	1.7E+02	18.4%	2.0E+02	17.6%
Total Vegetables	1.3E+02	11.7%	1.3E+02	14.3%	1.6E+02	14.4%
Total Fruits	2.3E+02	21.2%	1.8E+02	19.5%	2.2E+02	19.2%
Total Fats [a]	7.1E+00	0.7%	6.9E+00	0.7%	9.9E+00	0.9%
	Age 6-10 years (g/day, as consumed)					
Total Foods	1.1E+03	100.0%	1.1E+03	100.0%	1.2E+03	100.0%
Total Dairy	4.6E+02	41.4%	4.4E+02	41.4%	4.3E+02	35.4%
Total Meats	8.8E+01	8.0%	8.1E+01	7.7%	1.0E+02	8.5%
Total Fish	0.0E+00	0.0%	2.2E+00	0.2%	5.8E+01	4.7%
Total Eggs	1.0E+01	0.9%	1.2E+01	1.2%	1.6E+01	1.3%
Total Grains	2.1E+02	18.9%	2.1E+02	20.1%	2.3E+02	18.4%
Total Vegetables	1.2E+02	11.1%	1.5E+02	14.6%	1.7E+02	13.9%
Total Fruits	2.1E+02	18.7%	1.5E+02	14.0%	2.1E+02	16.8%
Total Fats [a]	9.8E+00	0.9%	8.5E+00	0.8%	1.0E+01	0.8%
	Age 11-15 years (g/day, as consumed)					
Total Foods	1.2E+03	100.0%	1.2E+03	100.0%	1.4E+03	100.0%
Total Dairy	4.7E+02	40.2%	3.7E+02	32.0%	3.7E+02	26.4%
Total Meats	1.0E+02	8.8%	1.0E+02	8.8%	1.5E+02	11.1%
Total Fish	0.0E+00	0.0%	2.8E+00	0.2%	6.7E+01	4.8%
Total Eggs	1.2E+01	1.1%	1.3E+01	1.2%	2.0E+01	1.4%
Total Grains	2.4E+02	20.3%	2.6E+02	22.6%	2.8E+02	20.5%
Total Vegetables	1.8E+02	15.8%	2.1E+02	17.9%	2.7E+02	19.8%
Total Fruits	1.5E+02	12.8%	1.9E+02	16.2%	2.0E+02	14.5%
Total Fats [a]	1.2E+01	1.0%	1.2E+01	1.0%	2.0E+01	1.4%
	Age 16-17 years (g/day, as consumed)					
Total Foods	1.2E+03	100.0%	9.8E+02	100.0%	1.3E+03	100.0%
Total Dairy	4.1E+02	35.4%	3.4E+02	35.3%	2.9E+02	23.2%
Total Meats	1.1E+02	9.6%	1.2E+02	12.4%	1.4E+02	11.5%
Total Fish	0.0E+00	0.0%	3.1E+00	0.3%	7.8E+01	6.2%
Total Eggs	1.9E+01	1.6%	1.0E+01	1.1%	2.2E+01	1.7%
Total Grains	2.2E+02	19.3%	1.9E+02	19.3%	2.3E+02	18.3%
Total Vegetables	2.2E+02	19.4%	2.1E+02	21.6%	2.9E+02	22.9%
Total Fruits	1.5E+02	13.3%	8.6E+01	8.8%	1.9E+02	14.8%
Total Fats [a]	1.6E+01	1.4%	1.2E+01	1.2%	1.8E+01	1.4%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age 3-5 years (g/kg/day, as consumed)					
Total Foods	5.9E+01	100.0%	5.5E+01	100.0%	6.4E+01	100.0%
Total Dairy	2.2E+01	38.2%	2.1E+01	38.2%	2.4E+01	36.6%
Total Meats	3.5E+00	6.0%	4.3E+00	7.8%	4.6E+00	7.2%
Total Fish	0.0E+00	0.0%	6.2E-02	0.1%	2.2E+00	3.5%
Total Eggs	5.6E-01	1.0%	5.5E-01	1.0%	7.7E-01	1.2%
Total Grains	1.2E+01	21.3%	1.0E+01	18.6%	1.1E+01	17.3%
Total Vegetables	6.9E+00	11.8%	6.9E+00	12.6%	9.3E+00	14.5%
Total Fruits	1.2E+01	21.0%	1.1E+01	20.9%	1.2E+01	18.9%
Total Fats [a]	3.9E-01	0.7%	3.8E-01	0.7%	5.5E-01	0.9%
	Age 6-10 years (g/kg/day, as consumed)					
Total Foods	3.9E+01	100.0%	3.3E+01	100.0%	4.6E+01	100.0%
Total Dairy	1.6E+01	41.3%	1.3E+01	38.3%	1.7E+01	36.8%
Total Meats	3.0E+00	7.9%	2.7E+00	8.0%	4.0E+00	8.8%
Total Fish	0.0E+00	0.0%	5.6E-02	0.2%	1.8E+00	3.8%
Total Eggs	3.8E-01	1.0%	3.8E-01	1.1%	5.5E-01	1.2%
Total Grains	7.2E+00	18.8%	7.2E+00	21.4%	8.4E+00	18.2%
Total Vegetables	4.2E+00	11.0%	5.5E+00	16.5%	6.7E+00	14.5%
Total Fruits	7.4E+00	19.2%	4.6E+00	13.6%	7.3E+00	15.9%
Total Fats [a]	3.4E-01	0.9%	2.8E-01	0.8%	4.0E-01	0.9%
	Age 11-15 years (g/kg/day, as consumed)					
Total Foods	2.4E+01	100.0%	2.2E+01	100.0%	2.8E+01	100.0%
Total Dairy	9.6E+00	40.5%	7.3E+00	32.9%	8.2E+00	29.0%
Total Meats	2.1E+00	8.9%	2.0E+00	8.9%	2.9E+00	10.2%
Total Fish	0.0E+00	0.0%	4.7E-02	0.2%	1.3E+00	4.6%
Total Eggs	2.5E-01	1.1%	2.7E-01	1.2%	4.0E-01	1.4%
Total Grains	4.8E+00	20.2%	4.8E+00	21.6%	5.9E+00	20.8%
Total Vegetables	3.7E+00	15.5%	4.0E+00	18.0%	5.1E+00	18.2%
Total Fruits	3.0E+00	12.9%	3.6E+00	16.0%	4.0E+00	14.3%
Total Fats [a]	2.4E-01	1.0%	2.5E-01	1.1%	3.8E-01	1.4%
	Age 16-17 years (g/kg/day, as consumed)					
Total Foods	1.7E+01	100.0%	1.6E+01	100.0%	2.0E+01	100.0%
Total Dairy	5.9E+00	34.8%	6.2E+00	38.6%	4.7E+00	23.3%
Total Meats	1.7E+00	9.8%	1.6E+00	10.1%	2.1E+00	10.7%
Total Fish	0.0E+00	0.0%	4.8E-02	0.3%	1.1E+00	5.6%
Total Eggs	2.7E-01	1.6%	1.6E-01	1.0%	2.9E-01	1.5%
Total Grains	3.3E+00	19.6%	3.2E+00	19.6%	4.1E+00	20.5%
Total Vegetables	3.4E+00	19.9%	3.4E+00	21.0%	4.5E+00	22.5%
Total Fruits	2.2E+00	12.9%	1.3E+00	7.9%	2.9E+00	14.5%
Total Fats [a]	2.4E-01	1.4%	2.5E-01	1.5%	2.6E-01	1.3%

[a] Includes added fats such as butter, margarine, dressings and sauces, vegetable oil, etc.; does not include fats eaten as components of other foods such as meats.

Source: Based on analysis of 1994-1996 CSFII.

Table 3-13. Per Capita Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Fruit & Vegetable Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
		Age <1 month (g/day, as consumed)				
Total Foods	7.3E+02	100.0%	5.8E+02	100.0%	1.7E+02	100.0%
Total Dairy	7.3E+02	100.0%	5.8E+02	100.0%	1.7E+02	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
		Age 1-2 months (g/day, as consumed)				
Total Foods	8.2E+02	100.0%	7.1E+02	100.0%	1.1E+03	100.0%
Total Dairy	8.1E+02	99.9%	7.1E+02	100.0%	9.7E+02	91.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	5.7E-01	0.1%	0.0E+00	0.0%	3.5E+00	0.3%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	4.6E+01	4.4%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	4.5E+01	4.3%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
		Age 3-5 months (g/day, as consumed)				
Total Foods	7.0E+02	100.0%	7.5E+02	100.0%	1.1E+03	100.0%
Total Dairy	7.0E+02	99.3%	7.1E+02	94.2%	6.5E+02	59.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	5.2E+00	0.5%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	7.4E-01	0.1%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	1.8E-01	0.0%
Total Grains	4.7E+00	0.7%	9.7E+00	1.3%	2.7E+01	2.5%
Total Vegetables	0.0E+00	0.0%	4.9E+00	0.6%	9.2E+01	8.3%
Total Fruits	0.0E+00	0.0%	2.9E+01	3.9%	3.3E+02	29.7%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	3.7E-01	0.0%
		Age 6-11 months (g/day, as consumed)				
Total Foods	9.5E+02	100.0%	1.1E+03	100.0%	1.5E+03	100.0%
Total Dairy	8.5E+02	90.0%	7.1E+02	65.2%	7.3E+02	49.2%
Total Meats	1.7E+01	1.7%	2.2E+01	2.0%	2.6E+01	1.7%
Total Fish	5.1E-01	0.1%	1.1E+00	0.1%	1.7E+00	0.1%
Total Eggs	5.0E+00	0.5%	2.9E+00	0.3%	1.9E+00	0.1%
Total Grains	4.3E+01	4.6%	9.4E+01	8.6%	8.8E+01	5.9%
Total Vegetables	1.7E+01	1.8%	8.2E+01	7.5%	2.1E+02	14.1%
Total Fruits	1.0E+01	1.1%	1.7E+02	16.1%	4.3E+02	28.7%
Total Fats [a]	1.6E+00	0.2%	1.4E+00	0.1%	1.4E+00	0.1%
		Age 1-2 years (g/day, as consumed)				
Total Foods	7.5E+02	100.0%	1.0E+03	100.0%	1.6E+03	100.0%
Total Dairy	4.7E+02	63.5%	4.6E+02	44.3%	4.4E+02	27.8%
Total Meats	5.4E+01	7.3%	6.4E+01	6.1%	6.4E+01	4.0%
Total Fish	4.1E+00	0.5%	7.5E+00	0.7%	7.8E+00	0.5%
Total Eggs	1.5E+01	2.0%	1.3E+01	1.3%	2.1E+01	1.3%
Total Grains	1.2E+02	16.3%	1.6E+02	15.0%	1.5E+02	9.5%
Total Vegetables	5.7E+01	7.6%	1.2E+02	11.5%	2.0E+02	12.7%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
		Age <1 month (g/kg/day, as consumed)				
Total Foods	2.3E+02	100.0%	1.6E+02	100.0%	0.0E+00	0.0%
Total Dairy	2.3E+02	100.0%	1.6E+02	100.0%	0.0E+00	0.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
		Age 1-2 months (g/kg/day, as consumed)				
Total Foods	1.7E+02	100.0%	1.2E+02	100.0%	1.9E+02	100.0%
Total Dairy	1.7E+02	99.9%	1.2E+02	100.0%	1.8E+02	95.5%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	1.4E-01	0.1%	0.0E+00	0.0%	1.4E-01	0.1%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	2.4E+00	1.3%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	6.1E+00	3.2%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
		Age 3-5 months (g/kg/day, as consumed)				
Total Foods	1.1E+02	100.0%	9.8E+01	100.0%	1.6E+02	100.0%
Total Dairy	1.1E+02	99.4%	9.3E+01	94.2%	1.0E+02	61.5%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	5.6E-01	0.3%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	8.0E-02	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	2.0E-02	0.0%
Total Grains	6.8E-01	0.6%	1.1E+00	1.1%	3.9E+00	2.4%
Total Vegetables	0.0E+00	0.0%	1.7E-01	0.2%	1.2E+01	7.1%
Total Fruits	0.0E+00	0.0%	4.5E+00	4.5%	4.7E+01	28.5%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	4.0E-02	0.0%
		Age 6-11 months (g/kg/day, as consumed)				
Total Foods	5.6E+01	100.0%	1.2E+02	100.0%	1.6E+02	100.0%
Total Dairy	5.1E+01	90.2%	8.4E+01	68.8%	7.4E+01	46.0%
Total Meats	7.9E-01	1.4%	1.7E+00	1.4%	2.9E+00	1.8%
Total Fish	2.5E-02	0.0%	1.2E-01	0.1%	3.2E-01	0.2%
Total Eggs	3.9E-01	0.7%	9.3E-01	0.8%	3.6E-01	0.2%
Total Grains	3.5E+00	6.2%	7.4E+00	6.0%	1.0E+01	6.3%
Total Vegetables	5.6E-01	1.0%	8.9E+00	7.2%	2.6E+01	16.3%
Total Fruits	1.0E-01	0.2%	1.9E+01	15.6%	4.7E+01	29.0%
Total Fats [a]	1.7E-01	0.3%	1.8E-01	0.1%	1.9E-01	0.1%
		Age 1-2 years (g/kg/day, as consumed)				
Total Foods	3.4E+01	100.0%	8.3E+01	100.0%	1.3E+02	100.0%
Total Dairy	2.3E+01	66.1%	3.8E+01	45.5%	3.8E+01	29.1%
Total Meats	2.5E+00	7.2%	5.2E+00	6.2%	5.1E+00	3.9%
Total Fish	1.5E-01	0.4%	6.1E-01	0.7%	4.3E-01	0.3%
Total Eggs	7.4E-01	2.2%	1.2E+00	1.5%	1.8E+00	1.4%
Total Grains	5.6E+00	16.3%	1.2E+01	14.7%	1.3E+01	9.9%
Total Vegetables	2.1E+00	6.2%	9.5E+00	11.4%	1.7E+01	12.9%

Table 3-13. Per Capita Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Fruit & Vegetable Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
Total Fruits	1.7E+01	2.3%	2.1E+02	20.6%	6.9E+02	43.7%
Total Fats [a]	3.9E+00	0.5%	5.5E+00	0.5%	6.4E+00	0.4%
	Age 3-5 years (g/day, as consumed)					
Total Foods	7.0E+02	100.0%	1.0E+03	100.0%	1.6E+03	100.0%
Total Dairy	3.9E+02	56.3%	3.9E+02	39.4%	4.1E+02	26.2%
Total Meats	6.5E+01	9.3%	8.2E+01	8.3%	8.4E+01	5.4%
Total Fish	5.2E+00	0.7%	7.5E+00	0.8%	8.7E+00	0.6%
Total Eggs	1.1E+01	1.5%	1.2E+01	1.2%	2.3E+01	1.4%
Total Grains	1.5E+02	22.1%	1.9E+02	19.4%	2.1E+02	13.4%
Total Vegetables	5.4E+01	7.8%	1.5E+02	14.7%	2.2E+02	14.3%
Total Fruits	1.0E+01	1.5%	1.5E+02	15.5%	6.0E+02	38.0%
Total Fats [a]	4.9E+00	0.7%	8.1E+00	0.8%	1.1E+01	0.7%
	Age 6-10 years (g/day, as consumed)					
Total Foods	7.3E+02	100.0%	1.1E+03	100.0%	1.7E+03	
Total Dairy	3.7E+02	51.5%	4.5E+02	40.6%	4.6E+02	
Total Meats	7.3E+01	10.1%	1.0E+02	9.1%	1.0E+02	
Total Fish	1.0E+01	1.4%	8.5E+00	0.8%	1.2E+01	
Total Eggs	1.1E+01	1.5%	1.2E+01	1.0%	1.9E+01	
Total Grains	1.8E+02	25.3%	2.4E+02	21.3%	2.4E+02	
Total Vegetables	6.0E+01	8.3%	1.7E+02	15.2%	2.8E+02	
Total Fruits	8.4E+00	1.2%	1.2E+02	11.1%	5.4E+02	
Total Fats [a]	5.2E+00	0.7%	1.1E+01	0.9%	1.3E+01	
	Age 11-15 years (g/day, as consumed)					
Total Foods	7.7E+02	100.0%	1.1E+03	100.0%	2.0E+03	100.0%
Total Dairy	3.6E+02	46.3%	3.9E+02	34.3%	5.0E+02	24.7%
Total Meats	1.0E+02	13.1%	1.2E+02	10.5%	1.6E+02	8.1%
Total Fish	4.3E+00	0.6%	1.4E+01	1.2%	2.0E+01	1.0%
Total Eggs	9.9E+00	1.3%	1.4E+01	1.3%	2.1E+01	1.1%
Total Grains	2.1E+02	27.9%	2.6E+02	23.2%	3.3E+02	16.3%
Total Vegetables	7.3E+01	9.5%	2.1E+02	18.4%	4.1E+02	20.5%
Total Fruits	4.3E+00	0.6%	1.1E+02	10.0%	5.5E+02	27.2%
Total Fats [a]	6.7E+00	0.9%	1.2E+01	1.1%	2.3E+01	1.1%
	Age 16-17 years (g/day, as consumed)					
Total Foods	6.0E+02	100.0%	1.0E+03	100.0%	2.1E+03	100.0%
Total Dairy	2.5E+02	42.1%	3.5E+02	33.6%	4.9E+02	23.0%
Total Meats	9.0E+01	15.0%	1.1E+02	10.5%	1.6E+02	7.3%
Total Fish	5.0E+00	0.8%	5.5E+00	0.5%	1.8E+01	0.9%
Total Eggs	1.1E+01	1.9%	1.3E+01	1.3%	1.0E+01	0.5%
Total Grains	1.8E+02	30.3%	2.4E+02	23.0%	3.8E+02	17.8%
Total Vegetables	4.9E+01	8.1%	2.3E+02	22.3%	4.6E+02	21.9%
Total Fruits	1.3E+00	0.2%	7.8E+01	7.5%	5.8E+02	27.5%
Total Fats [a]	9.5E+00	1.6%	1.4E+01	1.3%	2.4E+01	1.1%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
Total Fruits	4.1E-01	1.2%	1.6E+01	19.5%	5.6E+01	42.2%
Total Fats [a]	1.5E-01	0.5%	3.8E-01	0.5%	5.2E-01	0.4%
	Age 3-5 years (g/kg/day, as consumed)					
Total Foods	1.2E+01	100.0%	5.4E+01	100.0%	9.6E+01	100.0%
Total Dairy	7.1E+00	57.5%	2.2E+01	40.9%	2.6E+01	26.9%
Total Meats	1.1E+00	9.2%	4.7E+00	8.7%	5.0E+00	5.3%
Total Fish	9.6E-02	0.8%	3.5E-01	0.6%	4.8E-01	0.5%
Total Eggs	1.9E-01	1.5%	5.0E-01	0.9%	1.1E+00	1.2%
Total Grains	3.1E+00	25.1%	1.0E+01	19.0%	1.3E+01	13.9%
Total Vegetables	6.0E-01	4.9%	7.1E+00	13.1%	1.3E+01	14.0%
Total Fruits	3.0E-02	0.2%	8.6E+00	15.9%	3.6E+01	37.7%
Total Fats [a]	8.2E-02	0.7%	4.5E-01	0.8%	6.0E-01	0.6%
	Age 6-10 years (g/kg/day, as consumed)					
Total Foods	5.9E+00	100.0%	3.7E+01	100.0%	6.4E+01	100.0%
Total Dairy	2.9E+00	50.1%	1.6E+01	43.1%	1.9E+01	29.7%
Total Meats	6.0E-01	10.2%	3.4E+00	9.4%	3.7E+00	5.8%
Total Fish	1.9E-02	0.3%	2.2E-01	0.6%	3.9E-01	0.6%
Total Eggs	1.4E-01	2.4%	3.0E-01	0.8%	7.3E-01	1.1%
Total Grains	1.8E+00	30.5%	7.6E+00	20.7%	9.7E+00	15.3%
Total Vegetables	3.3E-01	5.6%	5.0E+00	13.7%	1.1E+01	16.9%
Total Fruits	2.5E-02	0.4%	4.0E+00	10.9%	1.9E+01	29.7%
Total Fats [a]	3.8E-02	0.6%	3.2E-01	0.9%	4.8E-01	0.8%
	Age 11-15 years (g/kg/day, as consumed)					
Total Foods	8.3E+00	100.0%	2.2E+01	100.0%	4.2E+01	100.0%
Total Dairy	3.4E+00	41.4%	8.4E+00	37.5%	1.1E+01	25.2%
Total Meats	1.2E+00	14.7%	2.2E+00	9.9%	3.1E+00	7.3%
Total Fish	5.5E-02	0.7%	1.6E-01	0.7%	3.9E-01	0.9%
Total Eggs	1.4E-01	1.7%	3.4E-01	1.5%	5.1E-01	1.2%
Total Grains	2.6E+00	31.1%	5.2E+00	23.0%	7.3E+00	17.2%
Total Vegetables	7.4E-01	8.9%	3.9E+00	17.6%	8.3E+00	19.7%
Total Fruits	5.5E-02	0.7%	2.0E+00	8.7%	1.2E+01	27.4%
Total Fats [a]	7.4E-02	0.9%	2.6E-01	1.1%	4.4E-01	1.0%
	Age 16-17 years (g/kg/day, as consumed)					
Total Foods	8.4E+00	100.0%	1.6E+01	100.0%	3.2E+01	100.0%
Total Dairy	3.6E+00	43.1%	5.1E+00	31.4%	6.7E+00	20.9%
Total Meats	1.3E+00	15.4%	2.0E+00	12.4%	2.2E+00	6.9%
Total Fish	7.8E-02	0.9%	1.4E-01	0.9%	2.7E-01	0.9%
Total Eggs	1.5E-01	1.8%	2.7E-01	1.7%	1.5E-01	0.5%
Total Grains	2.5E+00	29.4%	3.7E+00	22.8%	6.4E+00	19.9%
Total Vegetables	6.5E-01	7.7%	3.9E+00	24.1%	7.5E+00	23.2%
Total Fruits	1.9E-02	0.2%	8.9E-01	5.4%	8.6E+00	26.6%
Total Fats [a]	1.1E-01	1.4%	2.1E-01	1.3%	3.7E-01	1.1%

[a] Includes added fats such as butter, margarine, dressings and sauces, vegetable oil, etc.; does not include fats eaten as components of other foods such as meats.

Source: Based on analysis of 1994-1996 CSFII.

Table 3-14. Per Capita Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Dairy Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age <1 month (g/day, as consumed)					
Total Foods	0.0E+00	0.0%	4.8E+02	100.0%	1.5E+03	100.0%
Total Dairy	0.0E+00	0.0%	4.8E+02	100.0%	1.5E+03	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/day, as consumed)					
Total Foods	0.0E+00	0.0%	8.2E+02	100.0%	1.6E+03	100.0%
Total Dairy	0.0E+00	0.0%	8.2E+02	99.7%	1.5E+03	95.8%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	7.1E-01	0.1%	4.0E+00	0.3%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	4.6E+01	2.9%
Total Fruits	0.0E+00	0.0%	1.7E+00	0.2%	1.7E+01	1.1%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/day, as consumed)					
Total Foods	3.3E+00	100.0%	9.3E+02	100.0%	1.7E+03	100.0%
Total Dairy	0.0E+00	0.0%	8.1E+02	86.7%	1.6E+03	94.8%
Total Meats	0.0E+00	0.0%	1.5E+00	0.2%	1.1E+00	0.1%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	1.6E-01	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	4.1E-02	0.0%
Total Grains	1.3E+00	39.6%	8.6E+00	0.9%	1.3E+01	0.8%
Total Vegetables	1.3E+00	38.5%	2.2E+01	2.3%	4.0E+01	2.4%
Total Fruits	7.2E-01	21.9%	9.2E+01	9.9%	3.3E+01	2.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	1.8E-01	0.0%
	Age 6-11 months (g/day, as consumed)					
Total Foods	2.8E+02	100.0%	1.2E+03	100.0%	1.8E+03	100.0%
Total Dairy	2.1E+01	7.5%	7.6E+02	64.3%	1.4E+03	80.9%
Total Meats	6.9E+00	2.5%	2.4E+01	2.0%	1.2E+01	0.7%
Total Fish	1.5E+00	0.5%	1.2E+00	0.1%	4.3E-01	0.0%
Total Eggs	3.9E+00	1.4%	9.2E+00	0.8%	2.3E+00	0.1%
Total Grains	4.3E+01	15.6%	9.3E+01	7.9%	7.5E+01	4.3%
Total Vegetables	6.9E+01	24.9%	1.1E+02	8.9%	8.6E+01	4.9%
Total Fruits	1.3E+02	47.4%	1.9E+02	15.8%	1.6E+02	9.0%
Total Fats [a]	4.4E-01	0.2%	1.9E+00	0.2%	8.2E-01	0.0%
	Age 1-2 years (g/day, as consumed)					
Total Foods	7.4E+02	100.0%	1.1E+03	100.0%	1.6E+03	100.0%
Total Dairy	6.5E+01	8.8%	4.2E+02	39.7%	1.1E+03	67.2%
Total Meats	6.8E+01	9.1%	6.5E+01	6.1%	5.0E+01	3.1%
Total Fish	4.3E+00	0.6%	6.5E+00	0.6%	4.5E+00	0.3%
Total Eggs	2.4E+01	3.2%	1.7E+01	1.6%	1.5E+01	0.9%
Total Grains	1.7E+02	22.8%	1.5E+02	14.3%	1.3E+02	7.8%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
	Age <1 month (g/kg/day, as consumed)					
Total Foods	0.0E+00	0.0%	1.4E+02	100.0%	4.5E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.4E+02	100.0%	4.5E+02	100.0%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 1-2 months (g/kg/day, as consumed)					
Total Foods	0.0E+00	0.0%	1.6E+02	100.0%	2.8E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.6E+02	98.9%	2.8E+02	99.1%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Grains	0.0E+00	0.0%	1.8E+00	1.1%	2.5E-01	0.1%
Total Vegetables	0.0E+00	0.0%	0.0E+00	0.0%	2.4E+00	0.9%
Total Fruits	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	0.0E+00	0.0%
	Age 3-5 months (g/kg/day, as consumed)					
Total Foods	1.5E-01	100.0%	1.3E+02	100.0%	2.3E+02	100.0%
Total Dairy	0.0E+00	0.0%	1.1E+02	88.2%	2.2E+02	96.7%
Total Meats	0.0E+00	0.0%	0.0E+00	0.0%	9.0E-02	0.0%
Total Fish	0.0E+00	0.0%	0.0E+00	0.0%	1.3E-02	0.0%
Total Eggs	0.0E+00	0.0%	0.0E+00	0.0%	3.2E-03	0.0%
Total Grains	1.5E-01	100.0%	1.1E+00	0.8%	1.8E+00	0.8%
Total Vegetables	0.0E+00	0.0%	6.9E-01	0.5%	4.1E+00	1.8%
Total Fruits	0.0E+00	0.0%	1.4E+01	10.4%	1.6E+00	0.7%
Total Fats [a]	0.0E+00	0.0%	0.0E+00	0.0%	2.0E-02	0.0%
	Age 6-11 months (g/kg/day, as consumed)					
Total Foods	1.4E+01	100.0%	1.2E+02	100.0%	2.0E+02	100.0%
Total Dairy	2.7E-02	0.2%	8.1E+01	66.3%	1.6E+02	81.0%
Total Meats	1.7E-02	0.1%	2.9E+00	2.4%	2.2E+00	1.1%
Total Fish	2.4E-03	0.0%	4.2E-01	0.3%	1.4E-01	0.1%
Total Eggs	6.1E-04	0.0%	2.1E+00	1.7%	5.8E-01	0.3%
Total Grains	1.6E+00	11.5%	7.6E+00	6.2%	9.5E+00	4.7%
Total Vegetables	4.1E+00	29.7%	1.1E+01	9.4%	8.8E+00	4.4%
Total Fruits	8.1E+00	58.4%	1.7E+01	13.6%	1.7E+01	8.4%
Total Fats [a]	1.2E-03	0.0%	1.3E-01	0.1%	2.1E-01	0.1%
	Age 1-2 years (g/kg/day, as consumed)					
Total Foods	3.3E+01	100.0%	8.2E+01	100.0%	1.4E+02	100.0%
Total Dairy	1.9E+00	5.6%	3.2E+01	38.7%	9.8E+01	67.6%
Total Meats	2.8E+00	8.4%	4.8E+00	5.9%	4.1E+00	2.8%
Total Fish	7.4E-02	0.2%	5.3E-01	0.7%	3.2E-01	0.2%
Total Eggs	1.2E+00	3.5%	1.1E+00	1.3%	1.2E+00	0.9%
Total Grains	8.0E+00	23.8%	1.2E+01	14.6%	1.1E+01	7.6%

Table 3-14. Per Capita Intake of Total Foods and Major Food Groups, and Percent of Total Food Intake for Individuals with Low-end, Mid-range, and High-end Total Dairy Intake

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
Total Vegetables	1.4E+02	18.4%	1.1E+02	10.4%	1.2E+02	7.4%
Total Fruits	2.7E+02	36.4%	2.8E+02	26.6%	2.1E+02	13.0%
Total Fats [a]	5.8E+00	0.8%	5.6E+00	0.5%	5.2E+00	0.3%
Age 3-5 years (g/day, as consumed)						
Total Foods	7.0E+02	100.0%	9.8E+02	100.0%	1.6E+03	100.0%
Total Dairy	6.6E+01	9.4%	3.6E+02	36.7%	9.0E+02	56.8%
Total Meats	8.3E+01	11.9%	8.6E+01	8.8%	7.5E+01	4.7%
Total Fish	5.3E+00	0.8%	5.9E+00	0.6%	6.2E+00	0.4%
Total Eggs	1.6E+01	2.2%	9.5E+00	1.0%	1.6E+01	1.0%
Total Grains	1.8E+02	25.8%	1.8E+02	18.8%	2.1E+02	13.2%
Total Vegetables	1.3E+02	18.4%	1.4E+02	14.7%	1.5E+02	9.2%
Total Fruits	2.2E+02	30.7%	1.8E+02	18.7%	2.2E+02	14.1%
Total Fats [a]	6.7E+00	1.0%	7.1E+00	0.7%	8.5E+00	0.5%
Age 6-10 years (g/day, as consumed)						
Total Foods	7.2E+02	100.0%	9.9E+02	100.0%	1.8E+03	100.0%
Total Dairy	7.1E+01	9.8%	3.9E+02	39.6%	9.3E+02	52.5%
Total Meats	1.0E+02	14.2%	8.2E+01	8.3%	1.0E+02	5.6%
Total Fish	1.1E+01	1.5%	7.0E+00	0.7%	7.4E+00	0.4%
Total Eggs	1.4E+01	2.0%	1.1E+01	1.2%	1.4E+01	0.8%
Total Grains	1.9E+02	26.1%	2.0E+02	20.3%	2.9E+02	16.1%
Total Vegetables	1.6E+02	21.9%	1.4E+02	14.2%	2.0E+02	11.1%
Total Fruits	1.6E+02	22.9%	1.4E+02	14.6%	2.3E+02	12.8%
Total Fats [a]	1.1E+01	1.5%	1.1E+01	1.1%	1.2E+01	0.7%
Age 11-15 years (g/day, as consumed)						
Total Foods	7.4E+02	100.0%	1.1E+03	100.0%	2.0E+03	100.0%
Total Dairy	2.1E+01	2.8%	3.3E+02	31.3%	1.0E+03	52.3%
Total Meats	1.1E+02	15.0%	1.1E+02	10.5%	1.4E+02	6.8%
Total Fish	9.6E+00	1.3%	8.7E+00	0.8%	1.1E+01	0.6%
Total Eggs	2.0E+01	2.7%	1.5E+01	1.4%	1.9E+01	0.9%
Total Grains	2.1E+02	29.0%	2.4E+02	22.9%	3.2E+02	16.3%
Total Vegetables	1.9E+02	25.9%	2.0E+02	18.8%	2.7E+02	13.5%
Total Fruits	1.6E+02	21.7%	1.4E+02	13.1%	1.8E+02	8.8%
Total Fats [a]	1.2E+01	1.6%	1.2E+01	1.1%	1.8E+01	0.9%
Age 16-17 years (g/day, as consumed)						
Total Foods	6.0E+02	100.0%	1.0E+03	100.0%	2.1E+03	100.0%
Total Dairy	1.3E+01	2.2%	2.5E+02	24.3%	9.9E+02	48.1%
Total Meats	1.2E+02	19.3%	1.6E+02	15.3%	1.5E+02	7.1%
Total Fish	2.1E+01	3.5%	8.2E+00	0.8%	9.4E+00	0.5%
Total Eggs	1.4E+01	2.3%	1.8E+01	1.7%	1.9E+01	0.9%
Total Grains	1.5E+02	25.2%	2.6E+02	24.9%	3.8E+02	18.7%
Total Vegetables	1.5E+02	24.7%	2.2E+02	20.7%	2.8E+02	13.5%
Total Fruits	1.3E+02	21.6%	1.2E+02	11.2%	2.1E+02	10.3%
Total Fats [a]	7.5E+00	1.2%	1.3E+01	1.3%	2.0E+01	1.0%

Food Group	Low-end Consumers		Mid-range Consumers		High-end Consumers	
	Intake	Percent	Intake	Percent	Intake	Percent
Total Vegetables	6.3E+00	18.9%	1.0E+01	12.4%	1.1E+01	7.8%
Total Fruits	1.3E+01	38.7%	2.1E+01	26.0%	1.9E+01	12.9%
Total Fats [a]	2.5E-01	0.8%	4.1E-01	0.5%	3.8E-01	0.3%
Age 3-5 years (g/kg/day, as consumed)						
Total Foods	1.3E+01	100.0%	5.3E+01	100.0%	9.4E+01	100.0%
Total Dairy	4.8E-01	3.7%	1.9E+01	35.5%	5.2E+01	55.4%
Total Meats	1.6E+00	12.1%	4.1E+00	7.8%	4.7E+00	5.0%
Total Fish	1.0E-01	0.8%	2.9E-01	0.5%	3.4E-01	0.4%
Total Eggs	3.3E-01	2.5%	5.9E-01	1.1%	8.9E-01	0.9%
Total Grains	3.4E+00	25.5%	9.5E+00	17.9%	1.3E+01	13.9%
Total Vegetables	2.6E+00	19.9%	7.8E+00	14.7%	9.3E+00	9.9%
Total Fruits	4.5E+00	34.4%	1.1E+01	21.6%	1.3E+01	13.9%
Total Fats [a]	1.6E-01	1.2%	4.1E-01	0.8%	4.5E-01	0.5%
Age 6-10 years (g/kg/day, as consumed)						
Total Foods	6.4E+00	100.0%	3.7E+01	100.0%	6.8E+01	100.0%
Total Dairy	1.7E-01	2.7%	1.3E+01	35.4%	3.6E+01	52.8%
Total Meats	1.0E+00	16.4%	3.1E+00	8.4%	3.8E+00	5.6%
Total Fish	3.8E-02	0.6%	2.7E-01	0.7%	2.9E-01	0.4%
Total Eggs	7.7E-02	1.2%	4.9E-01	1.3%	6.0E-01	0.9%
Total Grains	1.8E+00	27.5%	7.7E+00	20.8%	1.1E+01	16.3%
Total Vegetables	1.6E+00	24.9%	5.6E+00	15.2%	8.3E+00	12.1%
Total Fruits	1.6E+00	25.1%	6.4E+00	17.2%	7.7E+00	11.2%
Total Fats [a]	9.9E-02	1.6%	3.5E-01	1.0%	4.7E-01	0.7%
Age 11-15 years (g/kg/day, as consumed)						
Total Foods	8.7E+00	100.0%	2.2E+01	100.0%	4.3E+01	100.0%
Total Dairy	1.6E-01	1.9%	6.3E+00	28.6%	2.2E+01	51.1%
Total Meats	1.4E+00	15.6%	2.3E+00	10.3%	2.6E+00	6.0%
Total Fish	8.2E-02	0.9%	2.7E-01	1.2%	3.3E-01	0.8%
Total Eggs	2.2E-01	2.5%	3.2E-01	1.5%	3.8E-01	0.9%
Total Grains	2.7E+00	30.4%	4.9E+00	22.2%	7.0E+00	16.5%
Total Vegetables	2.3E+00	26.5%	4.2E+00	18.8%	5.5E+00	12.9%
Total Fruits	1.8E+00	20.9%	3.6E+00	16.3%	4.7E+00	10.9%
Total Fats [a]	1.1E-01	1.3%	2.3E-01	1.1%	3.5E-01	0.8%
Age 16-17 years (g/kg/day, as consumed)						
Total Foods	8.5E+00	100.0%	1.6E+01	100.0%	3.0E+01	100.0%
Total Dairy	1.8E-01	2.1%	3.9E+00	24.7%	1.5E+01	48.6%
Total Meats	1.5E+00	18.1%	2.3E+00	14.7%	2.1E+00	7.0%
Total Fish	3.0E-01	3.5%	1.2E-01	0.7%	1.3E-01	0.4%
Total Eggs	2.0E-01	2.4%	2.7E-01	1.7%	2.4E-01	0.8%
Total Grains	2.2E+00	25.5%	3.9E+00	24.3%	5.8E+00	19.1%
Total Vegetables	2.2E+00	26.0%	3.0E+00	19.1%	4.0E+00	13.0%
Total Fruits	1.8E+00	21.2%	2.1E+00	13.4%	3.0E+00	10.0%
Total Fats [a]	1.1E-01	1.3%	2.3E-01	1.4%	3.1E-01	1.0%

[a] Includes added fats such as butter, margarine, dressings and sauces, vegetable oil, etc.; does not include fats eaten as components of other foods such as meats.
Source: Bsaed on analysis of 1994-1996 CSFII.

Table 3-15. Confidence in Recommendations for Food Intake

Considerations	Rating (High, Medium, Low) Age								
	<1 Month	1-2 Mos	3-5 Mos	6-11 Mos	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
Study Elements.									
• Level of Peer Review	High	High	High	High	High	High	High	High	High
• Accessibility	High	High	High	High	High	High	High	High	High
• Reproducibility	High	High	High	High	High	High	High	High	High
• Focus on factor of interest	High	High	High	High	High	High	High	High	High
• Data pertinent to U.S.	High	High	High	High	High	High	High	High	High
• Primary data	High	High	High	High	High	High	High	High	High
• Currency	High	High	High	High	High	High	High	High	High
• Adequacy of data collection period	Med. High	Med. High	Med. High	Med. High	Med. High	Med. High	Med. High	Med. High	Med. High
• Validity of approach	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution	High confidence for coverage values; low confidence for long-term percentile distribution
• Representativeness of the population	Low	Low	Med	Med	High	High	High	High	High
• Characterization of variability in the Population	Low	Low	Low	Low	Med	Med	Med	Med	Med
• Lack of bias in study design	High	High	High	High	High	High	High	High	High
• Measurement error					N/A	N/A	N/A	NA	NA
Overall Rating	Low	Low	Med confidence in the average; low confidence in the long-term upper percentiles		High confidence in the average; low confidence in the long-term upper percentiles	High confidence in the average; low confidence in the long-term upper percentiles	High confidence in the average; low confidence in the long-term upper percentiles	High confidence in the average; low confidence in the long-term upper percentiles	High confidence in the average; low confidence in the long-term upper percentiles

Table 3-16. Number of Children Providing Intake Data in CSFII 1994-96 and CSFII 1998

Years of Age	1994-96	1998	Total
<1	376	1,175	1,551
1	711	373	1,084
2	705	402	1,107
3	492	1,344	1,836
4	511	1,348	1,859
5	475	409	884
6	256	343	599
7	233	71	304
8	236	53	289
9	258	41	299
0 - 9	4,253	5,559	9,812

4.0 DRINKING WATER AND TOTAL FLUIDS

4.1 INTRODUCTION

The legislative mandates found in the Safe Drinking Water Act (SDWA) Amendments of 1996 require EPA to gather up-to-date information on water ingestion and to identify subpopulations that may be at elevated risk of health effects from exposure to contaminants in drinking water. To fulfill its SDWA charge, EPA (2000) used current estimates of per capita water ingestion found in the dietary and demographic data from the combined 1994, 1995, and 1996 *Continuing Survey of Food Intakes by Individuals* (CSFII), conducted by the U.S. Department of Agriculture (USDA, 1998).

In its report to Congress, EPA noted that considerable progress has been made in the development of improved methods for evaluating toxicity of drinking water contaminants, assessing exposures of populations of special concern (lactating mothers, infants and children, the elderly, and individuals whose health status has been compromised), and conducting risk assessments. One critical issue in preparing exposure assessments for these subgroups is how to better consider age-related changes in levels of exposure in a consistent and scientifically sound manner, especially with regard to children. Exposure routes such as breast milk, food consumption, drinking water and total fluid intake, ingestion of soil and other non-dietary materials, pica, and inhalation, and factors such as body surface area, dermal soil adherence, body weight, and activity patterns, all have been identified as important variables in these assessments. The purpose of this chapter is to describe key published studies that provide information on drinking water consumption among children and to provide recommendations of consumption rates that should be used in exposure assessments for the EPA proposed age bins (<1 month, 1-2 months, 3-5 months, 6-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and 16-17 years).

4.2 EVALUATION OF EXISTING DATA

Currently, EPA uses the quantity of 1 L/day as a default drinking water intake rate for infants (10 kg body mass or less) and children (U.S. EPA, 1980, 1991). This rate includes drinking water consumed in the form of juices and other beverages containing tap water. The National Academy of Sciences estimated that daily consumption of water may vary with levels of physical activity and fluctuations in temperature and humidity (NAS, 1977). It is reasonable to assume that some individuals in physically demanding occupations or living in warmer regions may have high levels of water intake.

Two studies, the USDA 1994-96 *Continuing Survey of Food Intakes by Individuals* (1998) and *Estimated Per Capita Water Ingestion in the United States* (U.S. EPA, 2000), have generated the most recent data on drinking water intake rates. These studies were summarized in the CSEFH. These two studies reported intake rates for both direct and indirect ingestion of water, and in general, support EPA's use of 1 L/day as an upper percentile rate for children under 10 years of age. *Direct intake* is defined as direct consumption of water as a beverage, while *indirect intake* includes water added during food preparation but not water intrinsic to purchased foods. Data for consumption of various sources (i.e., the community water supply, bottled water, and other sources) are also presented. EPA (2000) assumed that bottled water, and other purchased foods and beverages, are widely distributed and therefore less likely to contain source-specific water. As a result, the use of total water intake to estimate exposure may overestimate the potential exposure to toxic substances present only in local water supplies; therefore, intake of tap water (community water), rather than total water intake, was emphasized in the two studies.

The USDA study was carried out over 2 nonconsecutive days. Estimates of per capita ingestion of plain drinking water (direct ingestion) and water ingested indirectly were derived from responses to questionnaires provided by the USDA. Water used in the final preparation of foods and beverages at home or by food service establishments such as school cafeterias or restaurants was defined as indirect water. Quantities of ingested water were averaged by participant to generate a 2-day average. These daily averages comprise the empirical distributions from which mean and upper percentile per capita ingestion rates were developed from 2-day averages for more than 15,000 individuals in 50 States and the District of Columbia, which were then extrapolated to the population of the entire United States.

Using the CSFII data, EPA estimated the per capita drinking water ingestion rate for subpopulations segregated by (1) gender and age, and (2) by pregnant, lactating, and childbearing-age women. These estimates are found in the EPA report *Estimated Per Capita Water Ingestion in the United States* (U.S. EPA, 2000). EPA noted that the CSFII does not support estimates of water intake levels for subpopulations with traditional lifestyles (Native Americans and recent immigrants), those who live in hot climates, those with health conditions that affect water ingestion, and those who consume large amounts of water because of physical activity.

In general, EPA estimated that the 90th percentile of the empirical distribution of 2-day average per capita ingestion of community water was 2.016 L/person/day, approximately equal to the 2 L/person/day estimate used as a standard ingestion value by many Federal agencies. EPA also estimated that the mean water ingestion for women of childbearing age (15 to 44 years) was similar to the general population and that lactating women had the highest community water ingestion rate of any subpopulation (2.872 L/person/day 90th percentile; 3.434 L/person/day at the 95th percentile), For infants less than 1 year of age, the estimated mean community water ingestion rate was 878 mL/person/day (90th percentile) and 1,040 mL/person/day (95th percentile). For children 1 to 10 years of age, the mean community water ingestion was estimated to be 400 mL/person/day (90th percentile) and 905 mL/person/day (95th percentile), consistent with the standard 1-liter ingestion rate used in risk assessments for a 10 kg child.

4.3 STUDIES SELECTED FOR ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

The two studies discussed in the previous section were selected for the new analysis. In its study *Estimated Per Capita Water Ingestion in the United States* (U.S. EPA, 2000), EPA reported that community water (i.e., tap water from the public water supply) accounts for 75 percent of the mean ingested water in the United States. Total water consumption consists of community water supply, bottled water, and other sources, plus missing sources. "Other sources" include household wells, cisterns, or a spring (either household or community). The data also distinguish between direct and indirect water consumption. Table 4-1 provides the 1994-96 CSFII estimates, combined for all ages, for the mean total direct and indirect water consumption, by water source, per person. The estimates also include consumption rates for the 90th and 95th percentiles.

Table 4-1. Estimated Direct and Indirect Total Water Ingestion by Source for U.S. Population (mL/person/day)[a]

Water Source	Sample Size	Mean	90th Percentile	95th Percentile
Community Water	15,303	927	2,016	2,544
Bottled Water	15,303	161	591	1,036
Other Sources	15,303	128	343	1,007
Missing Sources	15,303	16	NA[b]	NA
All Sources	15,303	1,232	2,341	2,908

[a] Estimates are based on 2-day averages for nonconsecutive days.
[b] NA = Not available.
Source: USDA (1998).

Table 4-2 presents EPA's estimated total direct and indirect water ingestion rates and percentiles for children, from all sources, by broad age groups (i.e., <1 year, 1-10 years, 11-19 years).

Table 4-2. Estimate of Total Direct and Indirect Water Ingestion, All Sources, by Broad Age Category for U.S. Children (mL/person/day)[a]

Direct Water Ingestion				
Age (Years)	Sample Size	Mean	90th Percentile	95th Percentile
< 1	359	484	949	1,182
1 – 10	3,980	528	1,001	1,242
11 – 19	1,641	907	1,780	2,185
Indirect Water Ingestion				
< 1	359	67	156	170
1 – 10	3,980	25	49	64
11 – 19	1,641	16	30	39

[a] Estimates are based on 2-day averages for nonconsecutive days.
Sources: U.S. EPA (2000), USDA (1998).

EPA (2000a) used the drinking water ingestion data to derive estimates of water consumption rates by age group, gender, water source, and potentially more highly exposed subgroups of the population. To better present these data for use in risk assessments, ingestion rates were expressed in both volume per person per day (mL/person/day) and volume per body weight per day (mL/kg/day). As shown in Table 4-3, younger children consume more water in terms of volume per body weight and therefore are a potentially more highly exposed subgroup of the general population.

The data in the CSFII study have both strengths and limitations. The strengths of the data set lie in the design of the survey. First, it was intended to collect a statistically representative sample of the U.S. population. Second, the survey was sufficiently specific in detailing types of food and drink. The large sample size (>15,000 people, including 6,000 children) enhances the precision and accuracy of the estimates. Furthermore, the survey was conducted over nonconsecutive days, which improves the variance over consecutive days of consumption. In addition, the survey was administered in such a manner that an interviewer went through the data collection process for the initial day to show participants how to properly respond to the questionnaire. The second day of the survey was reported by the participant alone. Finally, the survey uses parameters that enable differentiation of water sources, ages, gender, weight, and potentially vulnerable populations and represents the most up-to-date data on water consumption.

Table 4-3. Estimate of Total Direct and Indirect Water Ingestion, All Sources, by Fine Age Category for U.S. Children[a]

Age (Years)	Sample Size	Mean	90th Percentile	95th Percentile
		mL/person-day		
< 0.5	199	280	861	945[b]
0.5-0.9	160	412	884	1,101[b]
1-3	1834	313	691	942
4-6	1,203	420	917	1,165
7-10	943	453	978	1,219
11-14	816	594	1,365	1,722
15-19	825	760	1,610	2,062
		mL/kg/day		
< 0.5	191	47	139	170[b]
0.5-0.9	153	45	103	122[b]
1-3	1,752	23	51	67
4-6	1,113	21	44	64
7-10	879	15	32	39
11-14	790	12	26	34
15-19	816	12	25	32

[a] Estimates are based on 2-day averages for nonconsecutive days.
[b] Sample size was insufficient for minimum reporting requirements according to *Third Report on Nutritional Monitoring in the U.S. (1994-1996)*.
Sources: U.S. EPA (2000), USDA (1998).

The limitations of the CSFII include the short duration of the study, which diminishes the precision of the individual water ingestion rate, and some of the data reporting methods. The large sample population might have contributed to greater accuracy, but the precision could still be low. The mean for an individual can easily be skewed. Also, the data reporting did not always support variance estimation for some reported population subsets. As such, the differences in mean could not always be statistically tested except for the larger population subsets. Therefore, the reported differences were derived empirically instead of statistically. Also, no effort was made to verify estimated water consumption rates. Available data on urinary volume rates (see Table 4-4), or body composition data that include water values, could have been used. Most importantly, the CSFII data set does not appear to contain data to gauge the water intake for the potentially more highly exposed members of the subpopulation of children (those in the early age bins as proposed by EPA: <1, 1-2, 3-5, and 6-11 months).

Table 4-4. Urinary Volume Rates (mL/kg/day)

Age	Sample Size	Mean	Std. Dev.
Newborns – 1st day	9	8.5	3.5
Newborns 7th day (Breast Fed)	16	76	17
0-6 months	8	34	6
6-12 months	19	29	12
1-2 years	14	25	7
2-3 years	6	33	9
3-4 years	8	34	7
4-5 years	10	29	10
5-7 years	8	25	7
7-11 years	12	25	7
11-14 years	8	19	3
Young males	11	20	3.2

Source: Lentner, C. (1981).

Basically, the younger the child, the more sensitive that child is to the adverse effects of any contaminants that may be present in the drinking water (Fomon, 1967). Apart from the toxic properties of the contaminants, there are substantial differences between the renal function of children and adults that affect water intake and fluid balance in their bodies. During this period of rapid growth, substantial changes in body composition occur and can appear contradictory to the stable composition normally observed in adults (Fomon, 1967). For example, the mineral, protein, water, and lipid contents of the body increase with age during early life, each at markedly different rates (Figure 4-1).

The single molecule that constitutes the highest fraction of body mass is water. In healthy adults, total body water (TBW) constitutes 60 percent of body weight for non-obese subjects. These fractional contents, however, are not constant across the life span, nor are they invariant with diseases. At full-term birth, a healthy infant's total body water decreases rapidly over the next 3 to 5 years until the hydration fraction reaches that observed for adults. The change in hydration reflects a change in the ratio of water between the intracellular and extracellular compartments. In some clinical conditions and with certain drugs, the body can retain or lose significant amounts of water. In the healthy state, total body water tends to be well regulated, although a loss of only 15 percent, such as in dehydration, can be significantly life threatening. Data have shown that even with significant changes in the extracellular:intracellular ratio, the normally fixed hydration constant remains relatively firm. The kidney, the primary organ involved in maintaining water balance, is physiologically vastly different in the fetus, newborn, and child up to at least 2 years of age (Rhoades, 1992). The fetal kidney is not subject to the influence of antidiuretic hormone, which also influences thirst in the adult[1] and is only able to produce hypotonic urine. The fetal glomeruli are not completely developed until the 35th week of gestation; however, in premature infants maturation takes place immediately after delivery.

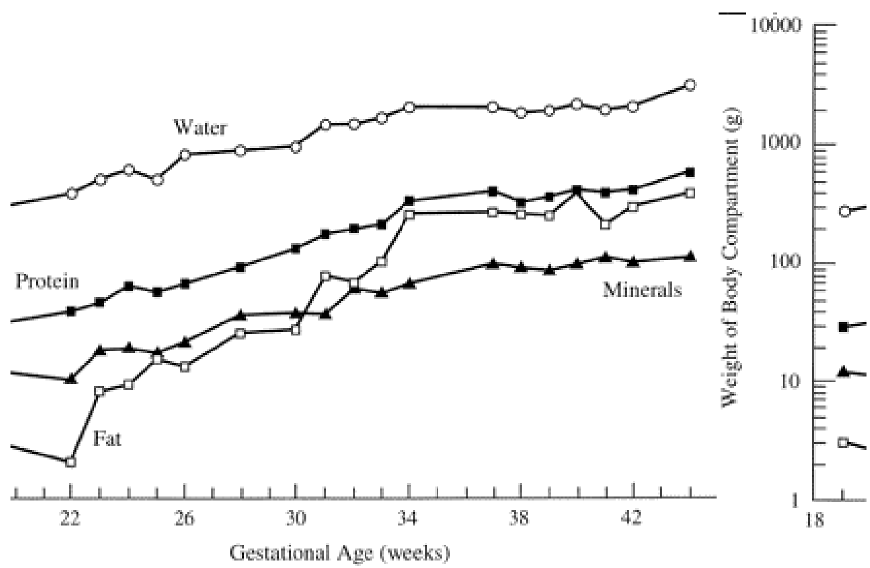

Figure 4-1. Changes in human body composition during fetal development and early life. These data often serve as a reference standard for assessing growth in the preterm infant.

Source: Fomon (1967).

Once the body weight of the fetus has reached 0.2 to 0.25 kg, the formation of new glomeruli stops. Given the number of glomeruli present at birth, the glomerular filtration rate is initially inhibited due to the presence of the fetal cuboid epithelium. During the first 2 years of life, this epithelium is slowly replaced by the final thin epithelial layer from the juxtamedullary to the cortical region. At term, the proximal tubules of the fetus are still primitive. The length of the Loops of Henle is important for the production of concentrated urine. At birth, the Loops of Henle are very short compared with the adult. It is not until postnatal months 5 and 6 that the glomerular filtration

1 Thirst is a sensation aroused by a need for water. Although it is desirable that we restrict the word *thirst* to the sensation aroused by a lack of water, in general usage it incorporates both an idea of appetite for water as well as a drive toward relief of a need.

rate in relation to body surface area approaches adult values; glomerular filtration rate and kidney mass increase uniformly. After the first 6 months the other renal functions mature more slowly. With normal development, children's tubular functions do not reach full maturity until they are at least 2 years of age.

4.4 RECOMMENDATIONS FOR PROPOSED AGE BINS

A new analysis was conducted on the CSFII data to obtain recommended values for the proposed age bins. Table 4-5 provides the recommended drinking water ingestion estimates for the U.S. populations within the selected age bins using the data adapted from the CSFII data as presented in the EPA water ingestion report (U.S. EPA, 2000). Note that the CSFII data set does not provide enough data for the proposed age groups of children up to 1 year of age. Confidence ratings for the recommended data to support recommendations presented in Table 4-5 are shown in Table 4-6.

4.5 RECOMMENDATIONS FOR FURTHER ANALYSIS AND RESEARCH NEEDS

Assessing exposure as volume of intake per unit body mass clearly indicates the greater potential for exposure of the young child. Fetuses, newborns, and toddlers up to 2 years of age are vulnerable as a result of their different renal function and fluid intake needs.

More research is needed to collect data on intake rates for drinking water within the proposed age bins. It is recommended that EPA determine if responses to the questionnaires used in the CSFII would allow researchers to derive drinking water ingestion data based on the proposed age bins through reanalysis of the data. Also, if CSFII data are available on the very young, it should be determined if the sample size is adequate to extrapolate this data to provide estimates of drinking water ingestion rates for the general children's population.

According to McPherson et al. (2000), assessing the diets of children presents unique methodological challenges. Validity and reliability studies of recall, records, food frequency questionnaires (FFQs), diet histories, water intake, and other observations among children are difficult. McPherson et al. evaluated the dietary assessment methods among school-aged children for 47 studies published in peer-reviewed English journals between January 1970 and April 1999. Each study for children 5-18 years of age had at least 30 samples. Most of the 24-hour recall validation studies assessed only a portion of the day, not a 24-hour period, and had higher agreements for meal versus complete day intake (McPherson et al., 2000). Food records underestimated energy intake when compared with intake of doubly labeled water. Few studies evaluated children's ability to complete records alone or to record an entire day. FFQs overestimated

Table 4-5. Recommended Values for Direct, Indirect, and Both Direct and Indirect Water Ingestion Excluding Commercial and Bottled Water

Direct Ingestion (mL/person/day)				
Age Group	Sample Size	Population	Mean	95th Percentile
< 1 month	NA[a]	NA	NA	NA
1-2 months	NA	NA	NA	NA
3-5 months	NA	NA	NA	NA
6-11 months	160	1,768,152	96	--[b]
1-2 years	1,834	12,262,345	184	677
3-5 years	1,203	12,531,561	274	880
6-10 years	943	15,351,948	317	1,030
11-15 years	816	15,578,741	414	1,531
16-17 years	825	17,988,744	531	2,618
Indirect Ingestion (mL/person/day)				
< 1 month	NA	NA	NA	NA
1-2 months	NA	NA	NA	NA
3-5 months	NA	NA	NA	NA
6-11 months	160	1,768,152	316	--[b]
1-2 years	1,834	12,262,345	129	432
3-5 years	1,203	12,531,561	145	458
6-10 years	943	15,351,948	136	482
11-15 years	816	15,578,741	180	629
16-17 years	825	17,988,744	531	2,618
Direct and Indirect Ingestion (mL/person/day)				
< 1 month	NA	NA	NA	NA
1-2 months	NA	NA	NA	NA
3-5 months	NA	NA	NA	NA
6-11 months	160	1,768,152	412	--[b]
1-2 years	1,834	12,262,345	313	942
3-5 years	1,203	12,531,561	420	1,165
6-10 years	943	15,351,948	453	1,219
11-15 years	816	15,578,741	594	1,722
16-17 years	825	17,988,744	760	2,062

[a] NA = Not available

[b] The sample size does not meet minimum reporting requirements, as described in the *Third Report on Nutrition Monitoring in the United States, 1994-96.*

Source: Adapted from U.S. EPA (2000), Part I, Table A2.

Table 4-6. Confidences in Recommendations for Drinking Water Ingestion

Considerations	Rating (High, Medium, Low) Age <1 Mo	1-2 Mos	3-5 Mos	6-11 Mos	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
Study Elements									
• Level of peer review	NA	NA	NA	NA	Low	Low	Low	Medium	Medium
• Accessibility	NA	NA	NA	NA	Low	Low	Low	Medium	Medium
• Reproducibility	NA	NA	NA	NA	Low	Low	Medium	Medium	High
• Focus on factor of interest	NA	NA	NA	NA	Low	Low	Low	Medium	High
• Data pertinent to U.S.	NA	NA	NA	NA	Low	High	High	High	High
• Primary data	NA	NA	NA	NA	Low	Low	Low	Medium	Medium
• Currency	NA	NA	NA	NA	Low	High	High	High	High
• Adequacy of data collection period	NA	NA	NA	NA	Low	Low	Low	Low	Low
• Validity of approach	NA	NA	NA	NA	Low	Low	Low	Medium	Medium
• Representativeness of the population	NA	NA	NA	NA	Low	Low	Medium	Medium	Medium
• Characterization of variability in the population	NA	NA	NA	NA	Low	High	High	High	High
• Lack of bias in study design	NA	NA	NA	NA	Low	High	High	Medium	Medium
• Measurement error	NA	NA	NA	NA	Low	Medium	Medium	Medium	Medium
Overall Rating	NA	NA	NA	NA	Low	Low	Medium	Medium	Medium

NA = No data available or data are not suitable for use in the age bin specified.

energy intake; however, validation standards may have over- or underestimated intake or used different referent periods. Results of reliability studies for FFQs and diet history showed higher energy intake at first, compared with subsequent administrations. Limited data were available on age, ethnicity, and gender effects. Correlations between the validation standard and dietary method were generally higher for recalls and records than FFQs. It was difficult to generalize the validity and reliability results of dietary assessment methods because of discrepancies in study design, referent periods, and validation standards. Given the experience of McPherson et al. (2000), new research should consider not only the matrix used to rate the confidence in recommended values presented in Table 1-1 of the *Child-Specific Exposure Factors Handbook*, but also data validity and data reliability. A new questionnaire should be developed that considers independent data validation, such as use of physiological parameters to gauge water balance and fluid intake values.

It is a frequent practice in anesthesiology and critical care medicine to use estimates of human body surface area (BSA) to reflect the body's metabolic functions, such as ventilation rate, fluid requirements, and extracorporeal circulation. Fetuses, infants, and adults have distinct shape-weight relationships. Examination of published human BSA data, although complex, yields a simple linear relationship between BSA and weight in infants and children weighing between 3 and 30 kg. Application of linear regression analysis to published data results in a formula relating BSA in square centimeters and weight in grams.

$$BSA = 1321 + 0.3433 * Wt$$

Drinking water consumption and total fluid intake should be normalized by BSA as well as by body weight using linear regression analysis (Current, 1998).

4.6 REFERENCES

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5.0 SOIL INGESTION AND PICA

5.1 INTRODUCTION

Children's exposure to toxicants via ingestion of contaminated soil and/or dust is of potential concern. Ideally, the toxic substance(s) ingested by a child can be quantified over time. Using the exposure profile, exposure parameters (such as the average daily quantity of a toxin ingested over a 2-year period, or the maximum quantity ingested in a 24-hour period) relevant for risk assessment can be selected and computed. These parameters, linked with knowledge of absorption and the ultimate toxic effect, can inform the assessment of risks due to ingestion of toxic substances. Although absorption of toxicants and toxic effects have obvious importance, the following discussion is limited to quantifying ingestion of toxic substances.

The purpose of this chapter is to determine if soil ingestion and pica recommendations can be made from existing data for the following proposed age groups: <1 month, 1-2 months, 3-5 months, 6-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and 16-17 years.

Two facts make quantifying ingestion of toxic substances in soil and/or dust difficult. First, it has not been possible to directly quantify the amount of a toxic substance ingested. Instead, several indirect strategies for constructing such estimates have been proposed, including a behavioral strategy (Lepow et al., 1974; National Research Council, 1980; Day et al., 1975; Kimbrough et al. 1984); a mass-balance strategy (Binder et al., 1986; Clausing et al., 1987; Calabrese et al., 1989a, b; Davis et al., 1990; van Wijnen et al., 1990; Thompson and Burmaster, 1991; Calabrese et al., 1997a); an implicit estimation approach based on average blood lead population comparisons between areas with different soil lead concentrations (de Silva, 1994); and a combined approach using behavioral data to develop a model for soil ingestion with age, and then applying this model to mass-balance soil ingestion estimates (Sedman, 1989; Sedman and Mahmood, 1994).

Each of the methods has its strengths and limitations. A key consideration in comparing the various methods is the ability to experimentally validate the approach. Only one method, the mass-balance method, has been experimentally validated and only among adults (Calabrese et al.,1990, 1991a, 1997a). Since the validation offers an objective point of reference, we limit this discussion to mass-balance studies of soil ingestion. In a mass-balance soil ingestion study, the amount of soil ingested is estimated using a trace element that is contained in soil. By quantifying the trace element excreted, after subtracting the amount of the element ingested from other sources and assuming minimal bioavailability of the element, the amount of soil ingested is back-calculated.

A second fact makes estimation of soil ingestion confusing, and hence difficult. The confusion occurs because the time period relevant for soil ingestion exposure assessment is usually different from the duration of soil ingestion studies; soil ingestion studies are limited in size; the day-to-day variability as well as the uncertainty in daily soil ingestion estimates appear to be large; and for a given subject, the distribution of soil ingestion over days is often highly skewed. As a result of these factors, simple tabulations and summaries of study data do not directly provide appropriate soil ingestion distribution estimates. These factors are addressed in more recent evaluations of soil ingestion and are particularly relevant when evaluating age-specific soil ingestion.

Pica, defined as deliberate soil ingestion, is discussed at the end of each section in this chapter. Quantifying pica in terms of the amount of soil ingested on a pica day is particularly difficult because the behavior is episodic. Since soil ingestion was quantified on a limited number of days, and deliberate ingestion was not self-reported, quantifying the amount of soil ingested on a pica day is difficult. We address these difficulties in the context of the relevant literature.

5.2 EVALUATION OF EXISTING DATA

5.2.1 Soil Ingestion

In this review, we focus on four primary studies and numerous manuscripts developed to estimate soil ingestion based on the data in those studies. The studies include the study in Helena, Montana (Binder et al., 1986); the Amherst, Massachusetts, study (Calabrese et al., 1989a); the Washington State study (Davis et al., 1990); and the Anaconda, Montana, study (Calabrese et al., 1997a). Common features of these studies are the mass-balance methodology, their conduct in the United States, and the use of the trace elements aluminum (Al), silicon (Si), and titanium (Ti).

We briefly review other mass-balance studies that have appeared in the peer reviewed literature, along with what we consider to be significant limitations of the other studies. Other reviews have been given by Calabrese et al. (1993a) and Calabrese and Stanek (1994, 1998). Since the focus of this report is on the relationship between age and soil ingestion, we also review reports that directly discuss the relationship between soil ingestion and age.

Three other mass-balance studies have been reported in the literature in addition to the four primary studies. One study was conducted on a limited number of subjects in an attempt to document soil pica behavior (Calabrese et al., 1997b). Since the subjects in this study were selected to be non-representative of the general population, we do not discuss this study further. The other two studies were conducted in the summer with Dutch children (Clausing et al., 1987, and van Wijnen et al., 1990). In each study, Al, Ti, and acid-insoluble residue (AIR) was used to quantify soil ingestion, with the estimate based on the minimum of the three estimates considered to be the best estimate. The Clausing study included 18 children ages 2-4, and collected fecal samples over a 5-day period. A concern in the study was the completeness of sample collection (only 27 samples were collected), leading the investigators to inflate fecal dry weights to a constant 10 g/day. These factors, plus the estimation of trace element intake from food from an independent hospital control group of subjects, are principal study limitations. Biases are possible both as a result of use of the limiting tracer method, and as a result of the hospital food controls.

The van Wijnen study included 292 children between the ages of 1 and 5, and used similar methods as Clausing's study. Children were recruited from day-care centers (n=199), camps (n=78), and hospitals (n=15). No attempt was made to collect complete fecal samples, with one sample considered adequate for a child. To compensate for the missing fecal samples, all dry fecal weights were assumed to be 15 g. As in the Clausing study, the fecal sampling protocol is a limitation. Collection of a small fecal sample for one child, and a large fecal sample for a second child, given that both children ingest the same amount of soil, will result in very different estimates. The choice of 15 g dry weight (versus 10 g dry weight) will alter soil ingestion estimates by 50 percent. Other concerns for the Clausing study are shared by the van Wijnen study. These limitations, along with the possibility of different cultural practices between Dutch and U.S. child rearing that may affect behavior and soil ingestion, resulted in exclusion of these studies from further consideration.

The relationship between age and soil ingestion is directly discussed in two publications. Sedman (1989) discusses the relationship between blood lead levels and age, and uses this, plus the Helena, Montana, data (Binder et al., 1986), to construct age specific soil ingestion estimates. Citing results given by Annest and Mahaffey (1984) from the Second National Health and Nutrition Examination Survey (1976-1980), average blood lead levels decline from 16.3 mg/dL for children between the ages of 6 months and 3 years to 11.4 mg/dL for children ages 12-14 years. Noting the decline in blood lead levels, Sedman expressed the blood lead for older age groups as a percentage of the blood lead levels for children in the 2-year-old group, and then fit a simple exponential model with age (x) to the percent of blood lead (y), giving the expression $y = 1.0594 \exp\{-0.0305x\}$. Similar models were fit to other blood lead data, and to mouthing prevalence data, resulting in different age coefficients. Sedman assumed that some combination of the age coefficients would be applicable to represent soil ingestion by age and chose an average of the blood lead and mouthing coefficients, resulting in an age coefficient of –0.112. Assuming a soil ingestion rate of 590 mg/d for children aged 1-3 years (obtained by taking the mean of five estimates, plus one standard deviation) age-specific soil ingestion values were calculated. The five estimates used to construct the soil ingestion rate came from two estimates using lead as a tracer in a study of 18 children by

Ter Haar and Aronow (1974) (8 of whom were hospitalized for high levels of lead and pica like behavior), while three of the estimates were based on the Helena, Montana, study (Binder et al., 1986) using the tracers Al, Si, and Ti. Using the exponential age model with a slope coefficient of –0.112, Sedman tabulated age specific soil ingestion values. In a subsequent publication, Sedman and Mahmood (1994) used soil ingestion estimates from Davis et al. (1990) and Calabrese et al. (1989a) studies, but retained the same basic exponential model and age slope to compute age specific soil ingestion.

We consider the assumptions underlying Sedman's approach to be arbitrary. Although the blood lead continues to decline with age based on the Third National Health and Nutrition Examination Survey (NHANES III), 1991-94 (CDC, 1997), a cross-sectional decline in blood lead may not imply a decline in soil ingestion. Many changes occur during this age range, including weight and height gains and hormonal changes. Mouthing behavior is reported to decline with age, but is not strongly related to soil ingestion (Davis et al., 1990). The limited rationale for the choice of the age slope results in little confidence in the age-specific soil ingestion results.

A second publication that addresses age directly uses the Amherst, Massachusetts, data (Stanek et al., 1991). Assuming a linear relationship between age and soil ingestion, estimates were given for linear regression slopes of soil ingestion for four trace elements (Al, Si, Ti, and zirconium [Zr]) with age (in months) for 59 of the study children separately. The estimated slope was positive with age (but substantially different) for each trace element, and statistically significant for Si. Nevertheless, the proportion of the variance explained by age (the R-square) was small (14.5 percent for Si and less than 6 percent for other trace elements). Further discussion of the relationship between age and soil ingestion in these data was given by Calabrese and Stanek (1991, 1994) and Calabrese et al. (1993a), who cautioned that the positive slope with age for Si and Al may be due to increased ingestion of toothpaste by older children, a factor not controlled in the Amherst study. In light of these observations, Calabrese et al. (1993a) concludes that the Amherst study data are insufficient to quantify an age effect. For this reason, we consider the results of Stanek et al. (1991) to offer limited insight into the age relationship.

Additional discussion of age and soil ingestion was given in Calabrese et al. (1993a). The authors postulated that children age 6-12 years ingest 25 percent of the soil ingested by a child age 1-6 years, while those greater than age 12 ingest 10 percent of that ingested by a child age 1-6 years. The authors noted that these estimates were not based on data. We do not consider this assertion to have a sufficient foundation for their use as a basis for a recommendation.

5.2.2 Soil Pica

For purposes of the discussion in this section, we defined pica as the deliberate ingestion of soil. Although there is much literature on ingestion of non-food items (which is also referred to as pica), there is limited information on soil pica. Most of this information is anecdotal or for special populations (see Wong, 1986, and Calabrese and Stanek, 1993b). Some effort has been made to quantify the frequency of soil pica in children using retrospective parental questionnaires (Stanek et al., 1998b), with mass-balance study follow-up on children reported to display soil pica (Calabrese et al., 1997b). Such efforts fall short of defining the amount of soil ingested in a pica event, but they provide insights that may help guide the design of studies that can quantify soil pica.

Nevertheless, very high soil ingestion, presumed to be soil pica, was observed in one subject in the Amherst study (Calabrese et al., 1991b). We discuss this subject in detail, in an effort to highlight the difficulty in framing a recommendation concerning soil pica that has value for exposure assessment.

5.3 STUDIES SELECTED FOR ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

5.3.1 Soil Ingestion

Recommendations for soil ingestion are based on four mass-balance studies conducted in the United States. The studies include the Helena, Montana, study (Binder et al. 1986); the Amherst, Massachusetts, study (Calabrese et al., 1989a); the Washington State study (Davis et al., 1990); and the Anaconda, Montana, study (Calabrese et al., 1997a). These studies were conducted on children 1-7 years of age. As a result, recommendations for soil ingestion are made only for the age groups 1-2 years, 3-5 years, and 6-10 years.

The four studies have been reviewed in many places; we describe them briefly here. The studies share the advantage that they include multiple trace elements, attempt to collect complete food (except for the Helena study) (Binder et al., 1986) and fecal samples over a defined study time period, and follow similar protocols. All the studies use the trace elements Al, Si, and Ti. In all four studies, estimates based on Ti are markedly different from other trace elements (for reasons not related to soil ingestion) (Stanek and Calabrese, 2000, Table IV), and hence will not be presented. It is important to note that these differences are considered the result of source error, that is, ingestion of trace elements is a result of nonfood/nonsoil ingestion. Although there are important differences between the studies, the common features support combining results to form a recommendation. We summarize the studies in chronological order.

The first mass-balance soil ingestion study used aluminum, silicon and titanium as tracers to estimate soil ingestion for 59 1- to 3-year-old children in diapers, from East Helena, Montana, for 3 days in the summer of 1984 (Binder et al., 1986). Food was not collected, and soil ingestion estimates were constructed by dividing the average daily trace element totals in fecal samples (assuming 15 g dry fecal weight/day) by trace element concentrations in soil from pooled one-inch deep samples in the children's yards. Adjustments were not made for food, toothpaste, and medicine ingestion, nor was urine collected. Data were reanalyzed by Thompson and Burmaster (1991) using actual dry stool weights (assuming complete fecal sample collection) yielding average soil ingestion estimates about one half as large as the soil ingestion estimates reported by Binder et al. (1986). We judge Thompson and Burmaster's estimates to be more appropriate in light of subsequent studies results (Calabrese et al., 1989a, 1997a) that obtained similar dry fecal weights for a similar age group of children. Estimates of average soil ingestion over three days given by Thompson and Burmaster were 97 mg/d and 85 mg/d based on Al and Si, respectively.

Soil ingestion estimates provided by Thompson and Burmaster did not adjust for trace element intake from food. Lacking adjustment for food intake of trace elements, estimates of average soil ingestion are positively biased, and estimates of the distribution of soil ingestion are artificially spread out. For this reason, we consider estimates from the study only for the mean and median soil ingestion. Average daily trace element ingestion from food in other studies with similar age children range from 1.87 to 6.3 mg/d for Al, and from 15.4 to 18 mg/d for Si (Calabrese et al., 1989b (Table 10); Calabrese et al., 1997a (Table 3); Sedman, 1989). Using Binder's geometric mean trace element concentrations in soil, the average trace element ingestion from food is equivalent to between 28-95 mg soil/d for Al, and between 51-60 mg/d for Si. Applying these adjustments for food, estimates of the average (over 3 days) soil ingestion for children ages 1-3 from Al and Si in the Helena, Montana, study range from 2 to 69 mg/d.

The second mass-balance soil ingestion study used eight trace elements (including Al and Si) to estimate soil ingestion for 64 children ages 1-3 from Amherst, Massachusetts, for 4 days in each of 2 consecutive weeks in late September/early October 1986 (Calabrese et al., 1989a, b). Subjects were recruited from day-care centers, and were eligible regardless of whether or not they wore diapers. Duplicate food samples and medicines were collected corresponding to three of the four fecal sample days (lagged by 12 hours), and used to estimate trace element intake from food over 4 days. Measures were made daily. Trace element amounts from food were subtracted from fecal totals, and divided by soil concentrations from composite 3-inch-deep home soil samples to estimate soil ingestion. Adjustments were not made for toothpaste ingestion, nor was urine collected. One child in the study ingested particularly large amounts of soil (~20 g) on 2 days in 1 week (Calabrese et al., 1991b, 1993c). Excluding this child, the study resulted in soil ingestion estimates corresponding to an average over 6-8 days. Soil ingestion estimates can be calculated on 48 children age 1-2 years and 15 children age 3 years.

The third mass-balance study used three trace elements (including Al and Si) to estimate soil ingestion for 101 children age 2-7 years from Washington State on 4 consecutive days in July and August 1987 (Davis et al., 1990). All subjects were out of diapers. Subjects were recruited via random digit dialing; 73 percent of households with eligible children participated. Duplicate food samples, medicines, fecal samples, and some urine were collected on 4 consecutive days. Collected quantities were pooled over days for each subject, and used to estimate trace element intake. These amounts were subtracted from fecal and urine totals and divided by soil concentrations from composite 1-inch-deep home soil samples to estimate average daily soil ingestion. The study resulted in soil ingestion estimates corresponding to average (over 4 days) soil ingestion for 11 children age 2 years, 54 children age 3-5 years, and 36 children age 6-7 years. The impact of toothpaste ingestion on soil ingestion estimates was discussed and estimated to reduce soil ingestion estimates by 1.8 mg/d for Al, and 45.4 mg/d for Si.

The fourth mass-balance study used eight trace elements (including Al and Si) to estimate soil ingestion for 64 children aged 1-3 from Anaconda, Montana, on seven consecutive days in September/October 1992 (Calabrese et al., 1997a). Subjects were selected via a stratified simple random sample of subjects in the area, balancing for geographic area, gender, and age. Duplicate food samples and medicines were collected (lagging fecal collections by 1 day) for 7 consecutive days, and used to estimate trace element intake from food. Low silicon/aluminum toothpaste was used. Measures were made daily. Trace element amounts from food were subtracted from fecal amounts and divided by soil concentrations from composite 3-inch-deep home soil samples to estimate soil ingestion. Adjustments were not made for toothpaste ingestion, nor was urine collected. The study resulted in soil ingestion estimates corresponding to the average (over 5-7 days) ingestion for soil calculated on 44 children age 1-2 years and 20 children age 3 years.

Interpretations of estimates of soil ingestion from these studies have several limitations. Two of the studies (in Montana) were conducted on children in areas with contaminated soil. All studies were conducted in the north in the summer or early fall. In one study (in Amherst), children were predominantly from two-parent, highly educated households. These factors serve to limit generalizability.

Other limitations were noted. Adjustments for medicine were not made in the Helena, Montana, study. Adjustments for toothpaste were only made in the Washington State and Anaconda studies. In light of the magnitude of the adjustment cited by Davis et al. (1990), estimates of soil ingestion based on Si in the Amherst and Helena studies are positively biased. Urine was partially collected only in the Washington State study, and hence soil ingestion in other studies is underestimated unless absorption of trace elements is 0 percent. Finally, the short time periods used in the study designs, along with the presumed skewed nature of the daily soil ingestion distribution, implies that simple estimates are likely to be positively biased when used to estimate longer-term average soil ingestion (such as over a 2-year period) (Stanek et al., 1998a; Stanek and Calabrese, 2000).

5.3.2 Pica

We discuss soil pica with reference to the child identified as displaying pica in the Amherst soil ingestion study (Calabrese et al., 1993c). This child, a 3.5-year-old female, had fecal samples collected for four days in each of two consecutive weeks. The amount of Al and Si ingested on each day from food was less than 100 mg of equivalent soil for each day of food sampling. Using the home soil concentrations of 44 and 354 mg/g for Al and Si, respectively, and Table 2 in Calabrese et al. (1993c), the amount of soil ingested on each day for the subject (not accounting for food) is presented in Table 5-1.

Table 5-1. Soil Equivalent Amount in Fecal Samples for Pica Subject, by Week (mg/day) (not subtracting amounts of trace elements from food)

Week	Tracer	Day 1	Day 2	Day 3	Day 4
1	A1	168	28	51	155
1	Si	249	220	49	178
2	A1	6	18,789	4	35,662
2	Si	16	19,961	8	23,976

Source: Data adapted from Calabrese et al., 1993b.

Note that minimal soil ingestion appears to have occurred during the first study week, and in fact no soil ingestion appears to have occurred on days 1 and 3 of the second week. Nevertheless, on the second day of week 2, the child appears to have ingested over 18 g of soil, while on day 4, the child appears to have ingested over 23 g of soil. For this child, using 18 g and 23 g as soil ingestion levels for these days, and assuming soil was ingested only on these 2 days during the 1,095-day period that the child was between the age of 3 and 5 years, the child's average daily soil ingestion would be 37 mg/day, not an unusual quantity. However, if the high soil ingestion behavior was repeated over this time period, average soil ingestion could be much higher. Distinguishing between the dramatically different conclusions requires long-term data on soil ingestion. Such data are lacking. Efforts to link parental reported soil pica in children may be reproducible (see Stanek et al., 1998b). However, follow-up soil ingestion studies on such children (Calabrese et al., 1997b) have not successfully characterized the apparently observed soil pica behavior. In the absence of knowledge of the longer-term frequency and magnitude of pica behavior in a child, we do not consider a recommendation possible for soil pica based on available data.

5.4 RECOMMENDATIONS FOR PROPOSED AGE BINS

5.4.1 Soil Ingestion

Recommendations for soil ingestion are summarized in Table 5-2. The recommendations are based principally on three of the four primary mass-balance soil ingestion studies previously discussed (omitting the Helena, Montana, study). The estimates were constructed in the following manner. First, for each study, trace element (Al and Si), and age group, an estimate of mean, median, and 90th percentile was made in each study based on children that fell within that age range. The trace elements Al and Si were used since they were included in all studies. Estimates based on Ti were not included because of the likelihood of nonfood, nonsoil sources of ingestion. The range of these estimates is reported. Note that this range is not a confidence interval. It simply indicates the extent of variability of the individual study estimates. Next, three strategies were used to combine the study's trace-element-specific estimates and form a single estimate. The strategies corresponded to taking the median of the six estimates and the weighted (by sample size) mean of the estimates, with negative estimates replaced by zero. In most cases, the combined estimates differed among themselves by less than 10 mg/day. By way of comparison, we also tabulated the long-term soil ingestion estimates using results from the Anaconda, Montana, study (Stanek et al., 2001). Our inclusion of the long-term estimates is based on basic methodological considerations. Simple percentile estimates using short-term study data result in estimates on both ends of the distribution being too extreme in comparison to what would be expected if a longer study period were employed (Stanek et al., 1998a). The combined estimates suffer from this limitation. We used the results of Stanek et al. (2001) to provide a reference for the extent of this bias. For the age groups 1-2 and 3-5 years, the recommended values attempt to more closely correspond to what we would expect from estimates based on a longer study design. No long-term estimates were available for the age group 6-10 years, and hence, recommended values are based solely on the short-term study data. Results from the Helena, Montana, study were not available as age specific, and so they have not been explicitly used. Nevertheless, the range of estimates reported is consistent with the Helena estimates (if a correction is made for toothpaste ingestion).

Table 5-2. Recommended Values for Soil Ingestion

Age Group	Mean value (mg/day)	Median (mg/day)	90^{th} Percentile
< 1 month	NA[a]	NA	NA
1-2 months	NA	NA	NA
3-5 months	NA	NA	NA
6-11 months	NA	NA	NA
1-2 years	30 (0-47)[b]	24 (0-86)	100 (42-257)
3-5 years	30 (0-76)	20 (0-41)	150 (54-258)
6-10 years	71 (65-77)	37 (35-40)	187 (164-211)
11-15 Years	NA	NA	NA
16-17 Years	NA	NA	NA

[a] NA = Not available
[b] The range accompanying an estimate describes estimates from different studies, not confidence intervals.

Primary data were available for each of the other studies, with the exception of toothpaste data from the Washington State study. Using the primary data, simple soil ingestion estimates for the mean, median, and 90^{th} percentile were tabulated for each of three age groups. An adjustment (subtraction of 1.8 mg/day for Al and 45.4 mg/day for Si) was made for toothpaste ingestion based on the average difference reported by Davis et al. (1990) (see Section 5.3) for the mean and median estimates for the age groups 1-2 and 3-5 years in the Washington State study. A similar adjustment (subtraction of 2.2 mg/day for Al and 42.7 mg/day for Si, with the difference due to the different average concentrations of the trace elements in soil) was made for the mean and median estimates for the age groups 1-2 years and 3-5 years in the Amherst study. No adjustment for toothpaste ingestion was made for the age group 6-10 years in the Washington State study, since ingestion of toothpaste at this age is reported to be low (Barnhart et al., 1974). Estimates for the age group 6-10 years are based solely on 36 subjects ages 6-7 years in the Washington State study. The recommended estimates for the age group 6-10 years are based simply on the midpoint of the Al and Si estimates for these 36 subjects.

We briefly provide details of the combined estimates. For reference, among 64 children ages 1-4 from Anaconda, Montana, the long-term estimate of the mean was 31 mg/day; the median, 25 mg/day; and the 90^{th} percentile, 75 mg/day (Stanek et al., 2001). A total of 103 children contributed to the estimate for 1-2 year olds. The three combined estimates of the mean ranged from 10 to 15 mg/day, and the three combined estimates of the median ranged from 4 to 11 mg/day. There were two combined estimates of the 90^{th} percentile, which ranged from 161 to 171 mg/day. A total of 89 children contributed to the estimate for 3-5 year olds. The three combined estimates of the mean ranged from 31 to 39 mg/day and for the median from 14 to 16 mg/day. The two estimates of the

90th percentile ranged from 168 to 198 mg/day. A total of 36 children were in the age range of 6-10 years from the Washington State study. Estimates for these children correspond to estimates for Al and Si for the study time period for these children.

Recommendations for the mean and 90th percentile soil ingestion that are provided in Table 5-2 differ from recommendations provided in Table 5-19 of the draft *Child Specific Exposure Factors Handbook*. The CSEFH estimates the mean as 100 mg/day (as compared with 30-71 mg/day in Table 5-2) and an upper percentile as 400 mg/day (as opposed to 100-187 mg/day in Table 5-2). The estimates differ by up to fourfold, even though data used in forming the estimates are the same for four of the six studies, and both reports base estimates principally on the trace elements of Al and Si. Inclusion of the two additional studies by the CSEFH is not the principal source of the difference, since estimates from these two studies overlap the estimates from the other four studies. Instead, the difference is attributable to differences in how soil ingestion is determined. There are differences in the way the soil ingestion estimate is determined for three of the four studies. For the Helena, Montana, study (Binder et al., 1986), the differences result from using actual reported fecal sample weights, subtracting an estimate of trace element intake from food, and subtracting an estimate of trace element intake from toothpaste. For the Amherst, Massachusetts, study (Calabrese et al., 1989), the differences result from excluding the pica subject and subtracting an estimate of trace element intake from toothpaste. For the Washington State study (Davis et al., 1990), the difference is due to the subtraction of trace element intake from toothpaste. It should be noted that the adjustment for toothpaste principally affected estimates based on Si for children in the categories 1-2 and 3-5 years. As a result of these differences, the estimate of mean (and median) soil ingestion in Table 5-2 is lower than the estimate given in Table 5-19 in the CSEFH. Differences are also evident between the recommended estimates for the 90th percentile, and the estimates given in Table 5-19 in the CSEFH. No adjustments to the data used were made when forming the estimates presented in Table 5-2. Differences are likely due to the use of a different percentile in Table 5-19 in the CSEFH, and the inclusion of the Dutch studies.

Table 5-3 (at the end of this section) summarizes a measure of confidence in the estimates. It should be noted that confidence in the 90th percentile estimates is much lower than confidence in estimates of the mean or median.

5.4.2 Pica

As previously mentioned, in the absence of knowledge of the longer-term frequency and magnitude of pica behavior in a child, we do not consider a recommendation possible for soil pica based on available data.

5.5 RECOMMENDATIONS FOR FURTHER ANALYSIS AND RESEARCH NEEDS

As is clear from Table 5-2, there are many areas where little is known about soil ingestion. Even for the few cells in which recommendations have been provided, there is no evidence to support generalizing the estimates to other seasons of the year or to other parts of the country. It is unlikely that there are sufficient data available to reliably distinguish soil ingestion in different age ranges. While such a distinction may in fact exist, we consider it yet to be uncovered.

It is possible using existing data to improve on the estimates of soil ingestion for age groupings. Such estimation can be accomplished by taking advantage of the multiple estimates of soil ingestion (using the multiple trace elements) for a subject. This strategy is particularly effective for removing effects of source errors (such as toothpaste, or other nonfood/nonsoil ingestion) that occur for individual elements. Using such a strategy (similar to that in Stanek et al., 2001), a single estimate of soil ingestion can be obtained and the distribution characterized. Such a strategy would help focus and possibly narrow the range of estimates provided and would have higher reliability.

The main limitation in completing the cells in Table 5-2 is the lack of adequate data. Soil ingestion studies are difficult to conduct. Data collection and chemical processing are expensive. Nevertheless, new soil ingestion data are needed. The last soil ingestion study data were collected in 1992. Although much has been learned about the conduct of such studies and analysis of the data, the most critical need at this point is new data. The agenda for new data is large and will not be accomplished with a single large study. Instead, our understanding of soil ingestion needs to be pursued in the context of a research program.

Data are needed that span a broader age range, perhaps initially expanding the age range to extend from 3 months to 12 years. Data on children in future soil ingestion studies need to span the range of demographic variables such as geography, race, and economic status so that results can be more confidently applied to the general U.S. population. Estimates of soil ingestion need to reflect longer time periods. Seasonal effects and longitudinal studies (both over seasons and over years) are important to identify tracking that may lead to a broader or narrower soil ingestion distribution. Finally, soil ingestion studies need to be integrated with behavioral studies and made efficient. Much has been learned as a result of the conduct of soil ingestion studies in the past, and this needs to be taken advantage of in the future.

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Table 5-3. Confidence in Recommendations for Soil Ingestion and Pica

Considerations	Rating (High, Medium, Low)								
	Age								
	<1 Month	1-2 Mos	3-5 Mos	6-11 Mos	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
Study Elements									
• Level of Peer Review	NA	NA	NA	NA	High	High	High	NA	NA
• Accessibility	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Reproducibility	NA	NA	NA	NA	High	High	High	NA	NA
• Focus on factor of interest	NA	NA	NA	NA	High	High	High	NA	NA
• Data pertinent to U.S.	NA	NA	NA	NA	High	High	High	NA	NA
• Primary data	NA	NA	NA	NA	High	High	High	NA	NA
• Currency	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Adequacy of data collection period	NA	NA	NA	NA	Low	Low	Low	NA	NA
• Validity of approach	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Representativeness of the population	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Characterization of variability in the population	NA	NA	NA	NA	Low	Low	Low	NA	NA
• Lack of bias in study design	NA	NA	NA	NA	Medium	Medium	Low	NA	NA
• Measurement error	NA	NA	NA	NA	Low	Low	Low	NA	NA
Overall Rating	NA	NA	NA	NA	Medium	Medium	Low	NA	NA

6.0 NON-DIETARY INGESTION EXPOSURE

6.1 INTRODUCTION

Non-dietary ingestion pathways of exposure are simultaneously one of the most important pathways for exposure in children and one of the least studied. For young children, mouthing activities offer one of the most common ways for the child to explore his or her environment. However, contamination of any object used in mouthing activities may lead to elevated exposure to a variety of chemical compounds, including metals, pesticides, and other potentially toxic compounds.

The purpose of this document is to identify sources of data on the non-dietary pathway of exposure for children and to assess the utility of that data in EPA's proposed age bins for the purposes of exposure assessment. The *Child-Specific Exposure Factors Handbook*, Chapter 6, identified a number of studies related to non-dietary exposure (U.S. EPA, 2001). In this paper, we evaluate those data that pertain to non-dietary ingestion exposure, identify other data of interest on this topic, discuss strengths and weaknesses of the data, and suggest new research activities to identify important factors related to children's non-dietary exposure.

Gurunathan et al., (1998) sum up the literature on non-dietary exposure factors: "There is a paucity of data available for making an accurate assessment of the relative importance of oral (non-dietary), dermal, and inhalation exposures to household pesticides." In the work of Gurunathan et al., as well as that of others, the difficulty of gathering high-quality, representative data for this important pathway is evident. Only a few studies are available that provide these type of data effectively. It is safe to say that no systematic, representative study of any large population exists in the current literature.

In the next section, we review the studies used to develop the CSEFH for their applicability to age categories suggested by EPA. All of the studies are lacking in some fundamental way. We then examine the literature since 1999 to assess the applicability of any studies not considered by the authors of the CSEFH.

6.2 EVALUATION OF EXISTING DATA

As part of the development of the draft CSEFH, EPA researchers selected several studies to use as the basis for proposed factors in non-dietary exposures. The specific works include Davis, 1995; Zartarian et al., 1997; Groot et al., 1998; Stanek et al., 1998; and Reed et al., 1999. Each is discussed below with emphasis on the question of age-group categorization.

The Davis (1995) study, as described in the draft CSEFH, observed mouthing activities of a total of 92 children ranging in age from birth to 48 months. The study relied on observations made by the child's parent and invoked the so-called interval method of observing the child for a certain interval every hour. Presumably, age data were available on the children so that activities could be placed in the proposed age bins. However, with only 92 children in the study, the number in each age bin is likely to be small.

Zartarian et al. (1997) presented results of a four-child pilot investigation designed to assess the use of a videotaping methodology to help assess activities that could result in non-dietary exposure. The children monitored were two girls ages 2 years 5 months and 4 years 2 months, and two boys ages 2 years 10 months and 3 years 9 months. The data were collected in September 1993 and comprise a total of 33 hours of activity. Activities were coded using a coding program called VideoTraq, which allows coding of specific events. Coders watched the videotaped activities of each child and coded activities such as "right hand touching hard toy," as well as the location and activity level of each child. The Dermal Exposure Reduction Model (DERM) software totaled the number of seconds in the monitoring period that the child was in contact with the object. For each of the four children, Zartarian et al. reported the total amount of time each hand was in contact with each of 19 different items, as well as summary statistics regarding the central tendency of contact time for each hand of each child.

The study was well designed and well executed given its initial intent, which was to show the efficacy of a videotaping methodology. Given that only four children were studied, two from each gender, and that they were the children of farm workers in Salinas, California, the representativeness of the data set is certainly in question. However, the technique showed merit and precipitated the Reed et al. (1999) work discussed later in this section. The data were presented in both tabular and graphical format and thus were readily available.

The Groot et al. (1998) study is an observational study focusing on mouthing activities of 42 Dutch children, with data collected in the summer of 1998. The children ranged in age from 3 months to 36 months. The researchers placed the children in four age categories: 3 to 6 months, 6 to 12 months, 12 to 18 months, and 18 to 36 months, with age categories selected by expected behavioral (not physiological) characteristics. The number of children in each category was small: 15, 14, 12, and 11, respectively. No differences were found between boys and girls with regard to activities, while large differences were found between age groups. Further, within an age group, variability, as measured by standard deviation in duration of mouthing activities, often exceeded the mean value.

The Groot et al. investigation was quite well designed, with a number of good quality assurance procedures. Most interesting among these is the attempt to validate observations using shadow observations and studies of inter- and intraobserver variability. In each case it was found that observers gave like estimates of total mouthing time during the observing intervals. The children were placed in age categories fairly closely aligned with the proposed age bins, so if the data could be obtained from the authors (likelihood unknown), they could be applied to the 3- to 36-month categories. The study suffers in at least two respects. First, the sample size was small, especially in light of the large variability in results observed. Second, the study was done in the Netherlands and on a population of children of well-educated parents. Thus the applicability to U.S. populations is unknown.

Stanek et al. (1998) is a study of the activities of 533 children, focusing on activities that are thought to affect non-dietary exposure. The study was conducted using face-to-face interviews with the parent or guardian of the child, with questions regarding frequency of 28 mouthing behaviors for the children. The children ranged in age from 1 to 6 years. Responses were given as "daily, at least weekly, at least monthly, and never."

Although the study had the largest number of participants, it had many limitations that most likely would preclude the use of its data for the proposed age bins. In many ways, the Stanek et al. data are not comparable to the other studies. Rather than reporting the frequency of events per day or per hour, the results were presented in events per week, and the frequencies reported are much lower than those reported in other studies. For example, outdoor ingestion rates were estimated to be 4.73 times per week compared with an estimate of approximately 9 times per hour for indoor mouthing activities reported by both Reed et al. (1999) and Zartarian et al. (1997). This discrepancy is most likely due to the nature of the data collection, which was through recall of activities occurring in the past. Also, there was no sensitization of the adults to the required observations before the data were collected. Unlike the videotaping or observational studies, these data were collected "cold." Other studies have suggested that untrained observers need time to develop their understanding of what is meant by a mouthing activity.

The data in the Stanek et al. study were collected in detail. Age categories were blocked by year of age, but the actual ages may be available from the authors, allowing finer resolution to be gleaned from the data. In general, the younger children (1-year-olds) participated in most activities of interest far more frequently than older children (e.g., 6-year-olds). Although the number of children evaluated in the Stanek et al. study is greater than in all the other studies combined, the difference in study design and reporting preclude its use because its data are not comparable.

Reed et al. (1999) reported the results of a study for mouthing activities collected using a videotaping methodology. The sample of children monitored included 20 at a day-care center and 10 in private residences. Children at the day-care center ranged in age from 3 to 6 years, with a mean age of 56.8 ± 9.7 months. The children in the private residences ranged in age from 2 to 5 years, with a mean of 43.2 ± 12.6 months. The coding of videotaped activities focused on different types of mouthing activities including directly mouthing surfaces and objects and placing objects in the mouth. A significant effort was made toward maintaining quality assurance of the coding activities; training programs were implemented to ensure inter- and intracoder reliability. Thus, the data can be considered of high quality. The paper presented hourly frequency data for hand and mouthing activities for each child observed. Data presented include the range, mean, and median frequencies for each of four activities, grouped by those in day-care settings and those in residential settings. The authors also presented two figures, in sufficient detail to assess inter- and intra-individual variability in these activities, which was substantial.

With regard to the study's applicability to the proposed age bins, no age group data can be fit to the bins. Although the authors gave the age ranges for the groups as a whole, no data were supplied on the individual ages of the children, so age-specific contact rates cannot be ascertained. Such data could presumably be obtained from the authors and would prove useful for the needs of EPA; however, we present two cautions. First, the overall age span of the individuals studied was limited. Second, the small numbers of individuals and the lack of representativeness of the sample (20 children drawn from a single university-affiliated day-care center and 10 individuals from two cities in New Jersey) make generalization of the data suspect.

It should be noted that authors of the Reed et al. (1999) study reported a much higher value for mouthing frequency, approximately 9.5 contacts per hour versus the value of 1.5 contacts per hour reported in the CSEFH. The value reported by Reed et al. is in agreement with that found by Zartarian et al. (1997) in their pilot investigation.

6.3 NEW STUDIES

A literature search performed using both Medline and Science Citation Index (using the identifiers "children" and "non-dietary exposure") identified 13 references, dated 1999 and later, to be of interest. None of these affords a better analysis of the age-specific components of non-dietary exposure. However, the data and models identified may be of use in further characterizations of these parameters. Several of these (Kissel and Fenske, 2000; Oliver et al., 2000; Buck et al., 2001; Lunchick, 2001; and Youngren et al., 2001) are modeling efforts geared toward understanding exposures experienced by not only children, but adults as well. Several papers discuss specific monitoring studies. These include Fenske et al. (2000), Lu et al. (2000), Wilson et al. (2000), Wong et al. (2000), and Moschandreas et al. (2001). Still others (Faustman et al., 2000, and Hubal et al., 2000) discuss other aspects of non-dietary exposure effects, some of which are specific to children. The following sections briefly discuss these modeling efforts and monitoring studies.

6.3.1 Modeling Efforts

Oliver et al. (2000) discussed the need for using probabilistic techniques in all assessments of exposure under the Food Quality Protection Act. Although not specifically geared toward understanding children's exposure, their work suggests the need for more relevant data collection efforts.

The work of Kissel and Fenske at the University of Washington has pushed the field of dermal and non-dietary exposure for children forward in the past 10 years. In an effort to model the effects of dermal transfer rates, these two authors have combined talents to estimate dermal exposure doses (Kissel and Fenske, 2000). Although the major application of the model is to an occupationally exposed cohort, such efforts should be applied to children's exposure with an eye toward both physiological and behavioral differences in children that would improve understanding of the effects of the contact exposure and inadvertent ingestion.

Buck et al. (2001) developed a probabilistic, multimedia, multipathway exposure model and assessment for chlorpyrifos as part of the National Human Exposure Assessment Survey (NHEXAS). The model was developed using data on the general population, collected in Arizona, and on children ages 3-12 in Minneapolis-St. Paul. Such a model, especially using the Minneapolis-St. Paul data, could prove useful in identifying the importance of non-dietary exposure in a representative sample. Multiple exposure and control scenarios could be explored using such a modeling approach.

Lunchick (2001) discussed the role of probabilistic modeling in the risk assessment and regulatory process. Although not a model as such, the author presented an interesting discussion of policy implication and the potential for modeling to aid in the process of determining likely exposure distributions. This work focused on occupational exposures; however, the "philosophy" of the paper is applicable to children's exposures through non-dietary routes as well.

Youngren et al. (2001) produced a companion piece to the Lunchick paper outlining the need to address uncertainty in exposures determined through modeling efforts. One focus of the paper is the manner in which available data are used to develop estimates of exposure factors. This is relevant to the process being undertaken in the present work on child-specific exposure factors.

6.3.2 Monitoring Studies

Fenske et al. (2000) presented the results of a study of organophosphorus pesticide exposure in 109 children using a biological marker of exposure. Most of the study subjects were children of agricultural workers in Washington State. No specific data on non-dietary exposure are given; however, this data set is rich and, coupled with the biological measurement of exposure, should be explored for non-dietary exposure markers. Lu et al. (2000) (from the same research group) discussed dermal concentrations using results from the same study as that of Fenske et al. (2000). Such data, coupled with modeling efforts and, perhaps, the earlier videotaping studies, may prove useful in modeling the uptake of pesticides and may be correlated with urinary biomarker output.

Wilson et al. (2000) reported on an investigation of nine children ages 2-5 years. Data collected include floor dust samples, outdoor play area soil, hand samples, and solid and liquid food. Biomonitoring samples (i.e., urine samples) were also collected. Such data could prove useful in identifying the role of inadvertent ingestion relative to exposure experienced through other pathways/routes. Although the sample size is very small, few such data are available anywhere.

Wong et al. (2000) reported on the results of a telephone survey assessing the amount of time children have contact with soil, grass, and other outdoor surfaces. Such data are useful in establishing larger databases of information regarding non-dietary exposure-related activities but may be more focused on time-activity data than on non-dietary exposure. However, telephone surveys rely on recall and thus are subject to the errors discussed previously in this chapter. These data are part of the University of Washington Research Program.

Moschandreas et al. (2001) reported results of exposure to two organophosphorus pesticides, chlorpyrifos and diazinon, experienced by a population in Arizona, and attempted to correlate the biomarker results with exposure. This study was part of the NHEXAS investigations, a multicomponent investigation undertaken by several research groups. The exposures were modeled in Buck et al. (2001). The NHEXAS data sets, with data collected in Arizona, the Upper Great Lakes states, Minneapolis-St. Paul, and Baltimore may prove quite valuable in establishing non-dietary exposure factors for children when the data become generally available within the next year.

6.3.3 Other Papers of Interest

Faustman et al. (2000) discussed the importance of child-specific risk assessment in a special children's health supplement to the journal *Environmental Health Perspectives*. Hubal et al. (2000) presented an overview of factors important in the analysis of children's environmental exposure-related risk.

6.4 STUDIES SELECTED FOR ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

At this time, no studies are recommended as definitive in aiding the selection of age-appropriate factors for the age bins proposed by EPA. There have been no systematic, probability-based studies undertaken that would afford a reasonable assessment of such, nor have any studies been designed and implemented that would determine whether age-bin-specific factors differ from one another. Sample sizes in the studies outlined above are too small. Study designs are not consistent and often span only part of the range (e.g., very little work has been done on children ages 10-20).

6.5 RECOMMENDATIONS FOR PROPOSED AGE BINS

No recommendations can be made for factors for the proposed age bins at this time. The existing data are derived from a series of small studies conducted by pioneers in a nascent field. The data are of high quality, as evidenced by their placement in the top exposure-related, peer-reviewed journals. However, studies of four (or even 92) children, or of children in other countries, as well as more sophisticated modeling efforts being undertaken, do not give confidence in establishing exposure factors for children of various ages, despite the apparent agreement between some of the studies. Such efforts are grounded in the data currently available, and those data are simply too sparse. Choosing from among these studies or from among the small number of new investigations is simply not warranted.

Exposure assessment, especially in a new area such as non-dietary ingestion, is data driven. It is difficult to address the uncertainties introduced by using the existing data to assess exposures for children. The uncertainty associated with using data from, say, a single 2-year-old child with regard to mouthing activities and projecting that to a population of 2 to 4-year-olds across the country cannot be judged. In addition, numerical estimates derived from the studies evaluated are not addressed. It is difficult to discuss whether numerical estimates for a population are good without at least a modicum of data to assess their validity. Until new data are collected in a systematic, representative manner, factors selected will have to be used only with the strongest cautions. A confidence evaluation of how well the existing non-dietary exposure studies used in the current CSEFH address the proposed age groups is presented in Table 6-1.

6.6 RECOMMENDATION FOR FURTHER ANALYSIS AND RESEARCH NEEDS

Throughout this discussion, numerous recommendations have been made regarding analyses of existing data sets or modifications of study design. The most important research need at present in the non-dietary exposure factors area is a systematic method of data collection. Current meta-analysis is limited by inconsistencies in data and small sample sizes. One clear recommendation to be made from this assessment of existing data is that a new, comprehensive data collection effort to determine non-dietary ingestion exposure factors should be designed and undertaken.

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Table 6-1. Confidence Evaluation of the Existing Non-Dietary Exposure Studies[a]

Considerations	< 1 Month	1-2 Months	3-6 Months	6-11 months	1-2 Years	3-5 Years	6-10 Years	11-15 Years	16-17 Years
Study Elements			Davis Groot	Davis Groot	Davis Groot Stanek	Reed Zartarian Davis to age 4 Groot Stanek	Reed Stanek		
• Peer Review	NA	NA	Low/Medium	Low/Medium	Low/Medium	High	High	NA	NA
• Accessibility	NA	NA	Medium	Medium	Medium	High	High	NA	NA
• Reproducibility	NA	NA	Medium	Medium	Medium	Medium	Medium	NA	NA
• Focus on factor of interest	NA	NA	High	High	High	High	High	NA	NA
• Data pertinent to U.S.	NA	NA	Davis High Groot Low	Davis High Groot Low	Davis High Groot Low	High	High	NA	NA
• Primary data	NA	NA	High	High	High	High	High	NA	NA
• Currency	NA	NA	High	High	High	High	High	NA	NA
• Validity of approach	NA	NA	Medium	Medium	Medium	Medium Differing methods with strengths and weaknesses	Medium Differing methods with strengths and weaknesses	NA	NA
• Representativeness	NA	NA	Low	Low	Low	Low	Low	NA	NA
• Characterization of variability	NA	NA	Low	Low	Low	Low	Low	NA	NA
• Lack of bias in study	NA	NA	Unknown	Unknown	Unknown	Unknown	Unknown	NA	NA
• Measurement error	NA	NA	Unknown	Unknown	Unknown	Unknown	Unknown	NA	NA
Other Elements									
• Number of studies	0	0	2 Unknown Numbers	2 Unknown Numbers	2 + 1 Unknown Numbers	4 + 1 Unknown Numbers	2 age 6 only	0	0
• Agreement between researchers	Not Applicable	Not Applicable	High	High	Medium Different Methods	Medium Different Methods	Medium Different Methods	Not Applicable	Not Applicable
Overall Rating	Low	Low	Low Very Low Sample Sizes with Unknown Effects	Low Very Low Sample Sizes with Unknown Effects	Low Very Low Sample Sizes + Potential Recall Problems	Low Very Low Sample Sizes + Potential Recall Problems	Low Very Low Sample Sizes with Unknown Effects	Low	Low

a The table represents a criticism of the data as a whole, not of the work done by individual researchers. As can be seen from inspection of the table, many categories have no data at all, while the remaining have unknown (but small) sample sizes. Confidence that these data are generally representative of exposure factors for each individual age category must be uniformly low. This confidence will remain low until such time as a large, population-based investigation is undertaken, analyzed, and evaluated.

NA = Study data not available.

7.0 EXPOSURE FACTORS FOR INHALATION

7.1 INTRODUCTION

The *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) reviewed several studies in order to estimate age-dependent inhalation rates for children. However, to develop more refined estimates of inhalation rates for proposed EPA age groupings, from birth through age 17, the existing studies must be reevaluated and, where possible, updated to reflect new data or analyses.

Three basic techniques are used for estimating inhalation rates. The first technique is to assign breathing rates to various activities and then to calculate daily values as the sum of the products of the various breathing rates and their duration. This is referred to as an activity-based approach. In contrast, a metabolically based approach determines breathing rate as a function of the oxygen demand needed to provide the metabolic energy for sustaining a given lifestyle. The third approach is a hybrid of the first two. A physiological measure of oxygen consumption, such as heart rate, is used along with activity data and a personal calibration curve of heart rate to inhalation to estimate how much air is inhaled during an individual's daily activities.

The sections below review studies that have used these approaches, or modifications of them, to develop inhalation estimates for different age groups. Our focus is on the data and methods that can best be used to develop recommendations for inhalation exposure factors for the following proposed age groups: < 1 month, 1-2 months, 3-5 months, 6-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and 16-17 years.

7.2 EVALUATION OF EXISTING DATA

An individual's breathing rate changes during the course of the day as a function of the kinds of activities that are carried out. For inhalation exposure assessment, research must characterize inhalation rates that are indicative of specific activities as well as inhalation rates associated with different locations (e.g., indoors vs. outdoors) or times of day. In those types of assessments, short-term breathing rates are used; however, other exposure assessments may require daily, or chronic, breathing rates for the purpose of determining the inhalation of airborne contaminants. The emphasis in this analysis is on the chronic or daily inhalation rates applicable to the proposed childhood age groups.

7.2.1 Activity-Based Estimation of Inhalation Rates

The study conducted by Allan and Richardson (1998) estimated breathing rates for different age groups using an activity-based approach in which five separate activity levels were defined that reflect varying levels of physical effort. These levels were (a) resting, (b) very light activity, (c) light activity, (d) light to moderate activity, and (e) moderate to heavy activity. Probability distributions were developed to represent the minute volumes for each activity level for the following age groups: infants, birth to 6 months; toddlers, 7 months to 4 years; children, 5 to 11 years; teenagers, 12 to 19 years; adults, 20 to 59 years; and seniors, 60 years and older. Probability distributions were also constructed for the various activities based on time-activity studies. The probability density functions (PDFs) for the age-dependent inhalation rates were developed using a Monte Carlo sampling technique to propagate the uncertainty in the products of the PDFs for activity-specific levels and associated time periods.

Table 7-1 presents the results of simulations for the age groups through 19 years. The primary methodological issues associated with this approach are the misspecification of the activity levels (i.e., the time- or minute-volume PDF for a given activity level is biased in some way) or their misclassification (i.e., a given activity, such as walking, is assigned to the wrong activity level).

Table 7-1. Summary of the Inhalation Rate Estimates for Selected Age Groups

Age	Breathing Rate, m^3/day (CV)[a]		
	Male	Female	Male and Female
Birth to 6 months	NA	NA	2.1 (0.27)
7 months to 4 years	9.7 (0.28)	8.8 (0.27)	9.2 (0.28)
5 to 11 years	15.1 (0.22)	14.0 (0.21)	14.5 (0.22)
12 to 19 years	17.7 (0.23)	14.0 (0.2)	15.8 (0.25)

[a] Coefficient of variation
NA = Data not available
Source: Allan and Richardson (1998).

Unfortunately, this study does not easily lend itself to a reanalysis that would support recommendations for the new age bins because the authors developed and organized their supporting data around the age bins defined above. Another problem with their approach is the lack of inhalation rate data to cover the broad range of activities that are associated with individuals in different age groups. So, even if reanalysis was attempted, the fundamental challenge would remain; that is, properly linking activities recorded in time-activity studies with the applicable breathing rate distributions for each age group. An interesting observation that Allan and Richardson make is that the inhalation rates are particularly sensitive to the minute volumes associated with the lowest activity level (i.e., resting). They note that time-activity studies show that most people spend a significant amount of time conducting activities requiring low expenditures of metabolic energy, and hence the breathing rates selected to represent them will have a significant influence on estimates of daily breathing rates.

7.2.2 Metabolically Based Inhalation Rates

Layton (1993) presented three different approaches for determining inhalation rates that each rely on estimates of energy expenditure or food energy intake. The basic equation used to estimate inhalation in the study was:

$$V_E = E \times H \times VQ \times F$$

where:

V_E	=	ventilation rate, m^3/day;
E	=	energy expenditure or intake, kcal/day;
H	=	volume of oxygen at standard temperature and pressure, dry air (STPD) consumed in the production of 1 kcal of energy expended, L/kcal, (equal to 0.21 L O_2/kcal);
VQ	=	ventilatory equivalent, ratio of the minute volume at body temperature • ambient pressure • with air saturated with water vapor (BTPS) to the oxygen uptake rate, unitless; and
F	=	conversion factor, 0.001 m^3/L.

The two methods for estimating inhalation rates based on energy expenditure—one using activity patterns and the other a multiplier of basal metabolic rate—cannot directly support the proposed age bins for chronic inhalation rates. Specifically, the activity-based approach did not cover children, and the basal metabolic rate (BMR) multiplier approach has a very limited data set upon which to determine applicable multipliers for different age groups and genders. Nevertheless, the BMR multiplier approach for determining short-term inhalation rates associated with graded levels of physical activity is still applicable for children.

The inhalation estimates for children based on food energy intakes, however, can be updated to reflect more recent dietary surveys of children in the United States as well as more realistic estimates of the ventilatory equivalent for children. The ventilatory equivalent, which is the ratio of minute volume to oxygen consumption, is used to relate oxygen uptake to breathing rate. In Layton (1993) this parameter was mainly estimated using adult data, and consequently updated values would provide more realistic estimates of children's breathing rates.

7.2.3 Inhalation Rates Determined from Heart Rate Measurements and Activity Data

Spier et al. (1992) and Linn et al. (1992) implemented a protocol for determining inhalation rates that relied on the use of personal heart rate monitors to record diurnal changes in heart rate for subjects and individual calibration equations that related heart rate with inhalation rate. Relevant cohorts in these studies included elementary age and high school students. The advantage of this methodology is that a real-time physiological measure of activity is monitored that can be related to specific activities, locations, and times of day. Unfortunately, the test cohorts involved in these studies were small, and the age groupings do not directly relate to the proposed age groups.

7.3 STUDIES SELECTED FOR THE ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

The metabolically based methods described by Layton (1993) for determining age-dependent inhalation rates can serve as the foundation for developing new recommendations for age-specific inhalation rates. Accordingly, the sections that follow review more recent information that addresses data gaps pertaining to the calculation of breathing rates for children of different ages. The principal emphasis is the development of recommendations for determining daily breathing rates using food-energy intakes to represent daily energy expenditures.

7.3.1 Food Energy Intakes for Children

The food energy intake data presented in Layton (1993) were based on the 1977-78 National Food Consumption Survey (NFCS) conducted by the U.S. Department of Agriculture (USDA, 1984). Since then the USDA has conducted additional dietary studies of the U.S. population. For example, the Continuing Survey of Food Intakes by Individuals (CSFII) included a number of surveys targeted at different population groups. Of particular interest here are the 1994-96 and 1998 CSFII studies (USDA, 1999). The 1998 survey focused on food and nutrient intakes for 5,559 children from birth to 9 years of age. This particular study was prompted by the Food Quality Protection Act of 1996, which required additional data on the dietary habits of children in order to improve EPA's estimates of childhood exposures to pesticides in diets. A total of 9,812 children were sampled, including the 4,253 children of the same age in the earlier 1994-96 CSFII. An important attribute of the CSFII studies is that they are probability samples of the U.S. population, so they are specifically designed to be representative of children's dietary practices across the country.

Table 7-2 compares the food energy intakes for the combined 1994-96 and 1998 CSFII studies and the 1977-78 NFCS for overlapping age groups from birth to 5 years of age. The food energy intakes are approximately 10 percent higher in the newer dietary surveys, which means that the associated breathing rates would also be proportionately higher. Males in the 6 to 11 age group sampled in the CSFII studies consumed 2,050 kcal/day of food energy, whereas females consumed 1,825 kcal/day, or nearly 90 percent of the male value. The distinction between male and female food energy intakes as a function of age should be evaluated further to determine at what age the two genders should be considered separately for the purposes of determining inhalation rates. The food surveys, for example, have previously used ages between 5 and 8 years as cutoffs when presenting gender-specific results.

Table 7-2. Comparison of Food Energy Intakes for Children Under 5 Years of Age Sampled in the 1994-96 and 1998 CSFII and the 1977-78 NFCS

Age Bins (years)	CSFII Surveys	NFCS Survey	Ratio, CSFII/NFCS
	kcal/day (number)		
<1	856 (1,126)	793 (421)	1.08
1-2	1,330 (2,118)	1,209 (1,035)	1.10
3-5	1,658 (4,574)	1,466 (1,719)	1.13

The other applicable age bin presented in a summary table of CSFII results consisted of ages 12 through 19 years, which is not consistent with the proposed age bins of 11 to 15 years and 16 to 17 years. To determine food energy intakes for those particular cohorts will require statistical analyses of the actual CSFII databases. Moreover, such analyses should also address the other age groups as well in order to determine the variances of the results. Until additional analyses can be completed on the CSFII data, Table 7-3 presents estimates of food energy intakes for the two cohorts using data in the 1977-78 NFCS.

Table 7-3. Summary of Energy Expenditures for Children and Adolescents (kcal/day)

Age Bins (years)	Male	Female	Male and Female
3-5[a]	NA	NA	1,658
6-10[b]	2,026	1,796	
11-15[c]	2,700	2,200	
16-17[d]	3,100	2,100	

[a] From the 1994-96, 1998 CSFII studies.
[b] Average values of age bins 6-9 and 6-11 years given in the summary table of the CSFII study.
[c] Estimated as the product of the value of the age bin 12-14 years in the 1977-78 NFCS and the factor 1.2 to account for underreporting of food intakes in the NFCS (see Layton, 1993). Results are rounded to two significant figures.
[d] Estimated as the product of the value of the age bins 15-18 years in the 1977-78 NFCS and the factor 1.2 to account for underreporting of food intakes in the NFCS (see Layton, 1993). Results are rounded to two significant figures.

7.3.2 Ventilatory Equivalents for Children

The ventilatory equivalent (VQ) is basically a measure of breathing efficiency, with lower values representing higher efficiencies—that is, the lungs require less ventilation per unit of oxygen consumed in generating the metabolic energy necessary for sustaining a given level of physical activity. As the respiratory system of a child matures, the ventilatory equivalent gradually decreases until it reaches a minimum value sometime in adolescence. Layton (1993) used a VQ value of 27 to represent all age groups, based on a literature review of VQ data for children and a statistical analysis of values in the open literature for adults. However, additional data have since been identified that can be used to define VQ values that are more applicable to children.

Adams (1993), for example, conducted a series of respiratory measurements on children (6-12.9 years of age), adolescents (13-18.9 years of age), adults (19-59.9 years of age), and seniors (older than 60 years of age). In addition to these groups, a pilot group consisting of 12 young children ages 3 to 5 years participated in a limited set of respiratory measurements. The average VQ value of the 6- to 12.9-year-old group was 32.3 for a series of 6 respiratory experiments in which 31 to 40 children (including both males and females) were walking on a treadmill at different velocities. No significant differences between genders were observed for ventilation and oxygen uptake rates. In contrast, the VQ values for the pilot group averaged 38.9 for three different walking velocities (i.e., 1.5, 1.88, and 2.24 mph; n = 12, n = 11, and n = 11). Adams (1993) cited the work of Astrand (1952), who also found that young children in this age cohort have higher VQ values than older children or early adolescents. Indeed, the average VQ for male adolescents in the Adams study, walking at two different velocities (i.e., 2.5 and 3.3 mph; n = 20 and n = 11), was 24.8, compared with a mean value of 28.0 for female adolescents at two walking velocities (i.e., 2.5 and 3.0 mph; n = 20 and n = 14).

The higher VQ values for the preadolescents are consistent with the results of other studies. Wilmore and Sigerseth (1967) measured ventilation rates and oxygen uptake rates for 62 females ages 7 to 13 years who were using a bicycle ergometer. The mean VQ value for their measurements was 31.4. More recently, Rowland and Cunningham (1997) conducted a longitudinal 5-year study of changes in respiratory responses in a group of 20 children consisting of 11 girls and 9 boys, with an average age of 9.2 years at the beginning of the study (range of 7.9 to 10.3 years). For the boys, the average VQ in the first year of the study (for submaximal oxygen uptake) was 31.4 (standard deviation = 5.10), declining to 26.34 (2.66) in the fifth year. The average VQ for girls in the first year was 32.3 (2.8), compared with 29.0 (2.34) in the final year. Differences between genders were not statistically significant. In another study, Armstrong et al. (1997) reported the results of respiratory measurements made on 101 boys and 76 girls with an average age of 11.1 years. At an exercise rate of 70 to 75 percent of peak aerobic capacity, the average VQ value for boys was 23.3 (standard deviation = 2.9, n = 63), while for girls the average VQ was 24.1 (2.4). At 80-85 percent of aerobic capacity, the mean VQ values increased slightly to 25.0 (Standard Deviation = 2.7, n = 58) for boys and 24.9 (Standard Deviation = 3.3, n = 42) for girls.

Table 7-4 summarizes the "best" estimates for the different age bins based on available literature values. Unfortunately, little information is available on the respiratory characteristics of children younger than 3 years of age. More research clearly needs to be carried out on this particular age group. The VQ values selected reflect the increasing ventilation efficiency (i.e., demonstrated by decreasing VQ values) as children mature. The higher VQ values for the younger cohorts somewhat compensate for the lower energy intakes/expenditures for those groups compared with the older children. Additional longitudinal studies would provide valuable information on how VQ values decrease with age. Of special interest is the age at which ventilation efficiency reaches the adult level. The coefficients of variation (CV) for the VQ values given in Rowland and Cunningham (1997) and Armstrong et al. (1997) are about 10 percent, so the VQ estimates given in Table 7-4 are expected to have similar CVs.

Table 7-4. Summary of Ventilatory Equivalents for Children and Adolescents

Age Bins (years)	Male	Female	Male and Female
3 – 5	NA[a]	NA	39[b]
6 – 10	NA	NA	32
11 – 15[c]	25	28	27
16 – 17[c]	25	28	27

[a] NA = data not available.
[b] Provisional value based on the pilot study by Adams (1993).
[c] Gender differences for this age bin may not be statistically significant.

7.4 RECOMMENDATIONS FOR PROPOSED AGE BINS

Recommended daily inhalation rates for children and adolescents are presented in Table 7-5. The values are calculated as the product of the energy intake/expenditure values given in Table 7-3, the VQ values recommended in Table 7-4, the parameter H (i.e., 0.21 L O_2/kcal), and the conversion factor 0.001 m^3/L. The resulting estimates indicate that the inhalation rates for the younger children represented by the 6- to 10-year-old age group are comparable to the older age groups. This occurs because the increase in VQ values as age decreases more than compensates for the reduction in energy intake/expenditure. For the age groups that are 6 years and above, the variability in the inhalation rates is about a factor of 1.3, based on the variability in energy expenditure [(CV ≈ 0.2 to 0.3) and VQ data (expenditure CV ≈ 0.1)]. For comparison, inhalation estimates from the activity-based approach of Allan and Richardson (given in Table 7-1) have CV values ranging from 0.2 to 0.28, which represent similar levels of variability.

A principal source of uncertainty involves the inhalation estimates for children under 5 years of age. The inhalation rate for the 3- to 5-year-old bin clearly needs to be verified as it was based on an average VQ value determined from a limited set of measurements made by Adams (1993) using a pilot study group. No estimates are provided for the under 3 age groups because of a lack of respiratory data in the literature. Finally, Table 7-6 provides an overview of the metrics used to gauge the reliability of the recommended values.

Table 7-5. Daily Inhalation Rates Estimated for Children and Adolescents[a] (m^3/day)

Age Bins (years)	Male	Female	Male and Female
3 – 5[a]	—	—	14
6 – 10[b]	14	12	—
11 – 15[c]	14	13	—
16 – 17[d]	16	12	—

[a] Values calculated as the product of the ventilatory equivalents in Table 7.3, the energy expenditure rates in Table 7-4, the parameter H (0.21 L/kcal), and the factor 0.001 m^3/L. Results are presented to two significant figures.
[b] Average values of age bin 6-9 and 6-11 years given in the summary table of the CSFII study.
[c] Estimated as the product of the value for the age bin 12-14 years in the 1977-78 NFCS and the factor 1.2 to account for underreporting of food intakes in the NFCS (see Layton, 1993). Results are rounded to two significant figures.
[d] Estimated as the product of the value for the age bin 15-18 years in the 1977-78 NFCS and the factor 1.2 to account for underreporting of food intakes in the NFCS (see Layton, 1993). Results are rounded to two significant figures.

7.5 RECOMMENDATIONS FOR FURTHER ANALYSIS AND RESEARCH NEEDS

There are basically two lines of research needed to improve inhalation estimates of children, especially those under 5 years of age for which little data exist to make reliable estimates. First, additional studies are needed to analyze data on food-energy intakes as well as energy expenditures. For example, statistical analyses of the CSFII dietary surveys can provide valuable information on energy intakes for age groups considered in the *Child-Specific Exposure Factors Handbook* as well as the more refined age bins addressed in this assessment. The dietary data can be used to develop estimates of chronic inhalation rates, but to derive diurnal inhalation estimates, time-activity data for children would have to be obtained and relevant breathing rates assigned, as done in the factorial approach by Allan and Richardson (1998). However, improved estimates could also be developed using an energy expenditure-based approach originally described by Layton (1993), but improved upon by McCurdy (2000) of the U.S. EPA National Exposure Research Laboratory. Specifically, inhalation is calculated in the same manner as Equation 1, except that E is estimated using a factorial approach in which an individual's activities are assigned energy expenditure values based on a multiplier of basal metabolic rate (termed a MET). The total daily value is equal to the sum of calculated energy expenditures. This approach was enhanced by McCurdy to reflect the energy expenditures of hundreds of different activities associated with activity patterns of children and adults characterized by various investigators. The core component of the improved methodology is the Consolidated Human Activity Database (CHAD), which includes 16,900 person-days of diurnal activities. But perhaps more importantly, CHAD includes MET values for a given activity that can be explicitly incorporated in a Monte Carlo sampling procedure. Values of the BMR, H, and VQ can also be treated stochastically. As a quality assurance check, daily energy expenditures computed using CHAD can also be compared with food-energy intakes obtained from the USDA food-consumption surveys for children in the different age bins.

One critical area of research for improving estimates of inhalation rates for children under 5 years of age would be to develop expanded data sets of VQ measurements on children from the applied physiology literature together with new, direct measurements. Reanalysis of raw data from selected studies should be attempted first. For example, age-dependent distributions of VQ could be obtained from a reanalysis of the raw measurements developed in the study by Adams (1993). Results of such analyses could be used to design experimental studies targeting children in selected age bins. Another related issue concerns the nature of the age-dependent decline in VQ as well as related gender differences (e.g., at what age should males and females be treated separately with respect to VQ?). In addition, Linn et al. (1991) noted that asthmatic children in their study had higher inhalation rates. Given those children's enhanced susceptibility to ozone, this also should be an area of special research.

In summary, until additional data on VQ values are obtained for children ages 5 years and younger, estimates of inhalation rates for this particular age cohort will have potentially significant uncertainties. The existing recommendations given in the *Child-Specific Exposure Factors Handbook* could underestimate actual inhalation rates by 50 percent or more, depending on the results of additional measurements of VQ values as well as the development of improved estimates of age-specific energy intakes and expenditures.

Table 7-6. Confidence in Recommendations for Inhalation Rates

	Rating (High, Medium, Low)								
	Age								
Considerations	<1 Month	1-2 Mos	3-5 Mos	6-11 Mos	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
• Level of peer review	N/A	N/A	N/A	N/A	N/A	Low	Medium	Medium	Medium
• Accessibility	N/A	N/A	N/A	N/A	N/A	Low	Medium	Medium	Medium
• Reproducibility	N/A	N/A	N/A	N/A	N/A	Medium	High	High	High
• Focus on factor of interest	N/A	N/A	N/A	N/A	N/A	Medium	Medium	Medium	Medium
• Data pertinent to U.S.	N/A	N/A	N/A	N/A	N/A	Medium	Medium to high	Medium to high	Medium to high
• Primary data	N/A	N/A	N/A	N/A	N/A	Medium	Medium	Medium	Medium
• Currency	N/A	N/A	N/A	N/A	N/A	Medium	High to medium	High to medium	High to medium
• Adequacy of data collection period	N/A	N/A	N/A	N/A	N/A	Low	Medium	Medium	Medium
• Validity of approach	N/A	N/A	N/A	N/A	N/A	High	High	High	High
• Representativeness of the population	N/A	N/A	N/A	N/A	N/A	Low	Medium	Medium	Medium
• Characterization of variability in the population	N/A	N/A	N/A	N/A	N/A	Low	Medium	Medium	Medium
• Lack of bias in study design	N/A	N/A	N/A	N/A	N/A	Low	Medium	Medium	Medium
• Measurement error	N/A	N/A	N/A	N/A	N/A	Low	Medium	Medium	Medium
Overall Rating	N/A	N/A	N/A	N/A	N/A	Low	Medium to high	Medium to high	Medium to high

NA = Not applicable; data were not found for these age bins.

7.6 REFERENCES

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8.0 EXPOSURE FACTORS FOR THE DERMAL ROUTE

8.1 INTRODUCTION

Dermal exposure is estimated, in part, by the amount of body surface area available for contact with contaminated media. The amount of body surface area exposed during an event is influenced by age-specific behavioral factors. For children, such factors include playing and crawling on contaminated surfaces, and the amount of clothing worn during play activities. Surface area of the skin is determined via direct measurement or regression models that consider the dependence of surface area on such other body dimensions as height and weight. The principles upon which the regression models are based are that body density and shape are roughly the same, and the relationship of the surface area to any dimension may be represented by the curve of central tendency of their plotted values or by the algebraic expression for the curve (U.S. EPA, 1997). The *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) described various measurement techniques and reviewed pertinent surface area studies as a basis for recommending body surface areas for children that are representative of the sub-population under consideration (i.e., age and sex-dependent).

For scenarios that involve contact with contaminated soil, dermal exposure is a function of how much soil adheres to the skin during a specific event. A number of studies were described in *Dermal Exposure Assessment: Principles and Applications* (U.S. EPA, 1992). The *Exposure Factors Handbook* (U.S. EPA, 1997) and the *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) evaluated more recent studies for use as exposure factors.

The U.S. EPA is currently interested in developing exposure factors for the following proposed age bins: <1 month, 1-2 months, 3-5 months, 6-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and 16-17 years. The purpose of this section is to evaluate the studies considered by U.S. EPA in the *Child-Specific Exposure Factors Handbook* to determine if, and how, the existing data can be presented within the proposed age bins. Additionally, more recent studies that might supplement the existing data will be discussed, and recommendations will be made, where possible, regarding the analytical approach to redistribute the data into the proposed age bins.

8.2 EVALUATION OF EXISTING DATA

8.2.1 Surface Area Studies

Direct surface area measurement data presented in Gehan and George (1970) were analyzed in EPA (1985). In their study, Gehan and George used all of the records for postnatal subjects that had been reported in a comprehensive study by Boyd (1935), and for which direct measurements of surface area, height, and weight were reported. The Boyd data used in the Gehan and George study consisted of a total of 401, including observations of a relatively high number of Japanese and Chinese subjects, and some individuals with unusual body types (U.S. EPA, 1985). Of the 401 subjects, 229 were less than 5 years of age, 42 were between 5 and 20 years of age, and 130 were greater than 20 years of age (Gehan and George, 1970). The data were analyzed using a least squares method of multiple regression to develop revised constants for a bi-exponential surface area model proposed in an earlier study by DuBois and DuBois (1916). In that study, DuBois and DuBois developed the model based on a sample of only nine individuals for whom surface area was already measured (U.S. EPA, 1997). Additionally, the subjects were predominantly male, two were deformed, and the only child was described as sickly. The constants developed by Gehan and George (1970) explain more than 99 percent of the variations in surface area among the 401 measured individuals.

Although the revised model proposed by Gehan and George (1970) was determined by EPA to be the best choice for estimating total body surface area, that study gave insufficient information to estimate the standard error about the regression (U.S. EPA, 1985). Subsequently, EPA used the least squares to reanalyze the direct measurement data for the 401 individuals reported in Gehan and George to determine the standard errors of the individual constants as well as the standard error about the regression. The resulting standard error about the regression was 0.00374. EPA was satisfied that the revised model explained more than 99 percent of the total variation in surface area among the observations and is identical to two significant figures with the model developed by Gehan and George (U.S. EPA, 1985).

For the purpose of estimating percentiles (and their standard errors) for total surface area of male and female children, EPA used height and weight data gathered in the second National Health and Nutrition Examination Survey (NHANES II). Those data were analyzed using QNTLS, an SAS macro developed by Rochon and Kalsbeek (1983) that performs variance estimation of multistage sample survey data using the jackknife repeated replicate approach (JRRA) (U.S. EPA, 1985). JRRA uses resampling to calculate estimates of linear statistics (e.g., means, distributions, totals) and more complex nonlinear measures such as covariances, correlations, and the slope and intercept from a simple (weighted) linear regression in addition to their standard errors (Rochon and Kalsbeek, 1983). The technique used in JRRA, resampling with replacement from the observed data, is necessary because resampling observations of the observed data mimics the process of sampling observations of the population.

The total surface area percentile estimates for male and female children were calculated using the Gehan and George bi-exponential model and the height and weight results of the QNTLS analysis. However, because the NHANES II height data were not available for children younger than 2 years of age, total surface area was not estimated for that age group.

The lack of NHANES II height data precludes estimation of recommended total surface area values for children less than 1 month old, 1 to 2 months, 3 to 5 months, 6 to 11 months, or 1 to 2 years of age. However, values for children 3 to 5, 6 to 10, 11 to 15, and 16 to 17 years of age can be estimated by compiling subsets of the NHANES II data that correspond to the recommended age bins. Subsequently, the subsets can be analyzed using QNTLS or any other statistical software package that is able to estimate the variance of multistage sample survey data using JRRA. In view of the large data gap for children under 2 years of age, additional data are needed to support the age bin recommendations for that age group.

Another precaution regarding use of the total body surface area values derived from the NHANES II data is the currency of those data. During the two decades since NHANES II data were collected, there has been an upward shift in the prevalence of overweight among children and adolescents. The U.S. Department of Health and Human Services, Centers for Disease Control and Prevention reported that from the 1960s to 1980, overweight in children and adolescents was relatively stable. However, from NHANES II (1976-80) to NHANES III (1988-94), the prevalence of overweight nearly doubled among those age groups. During that time period, the prevalence of overweight among children ages 6 to 11 years increased from 7 percent to 11 percent, and adolescents ages 12 to 19 years increased from 5 percent to 11 percent (U.S. CDC, 2001). A review of NHANES 1999 data suggests that overweight in children and adolescents may be increasing to even higher levels than in 1994 (Figure 8-1). Subsequently, age-specific total surface area values based on NHANES II data may not be representative of the current population.

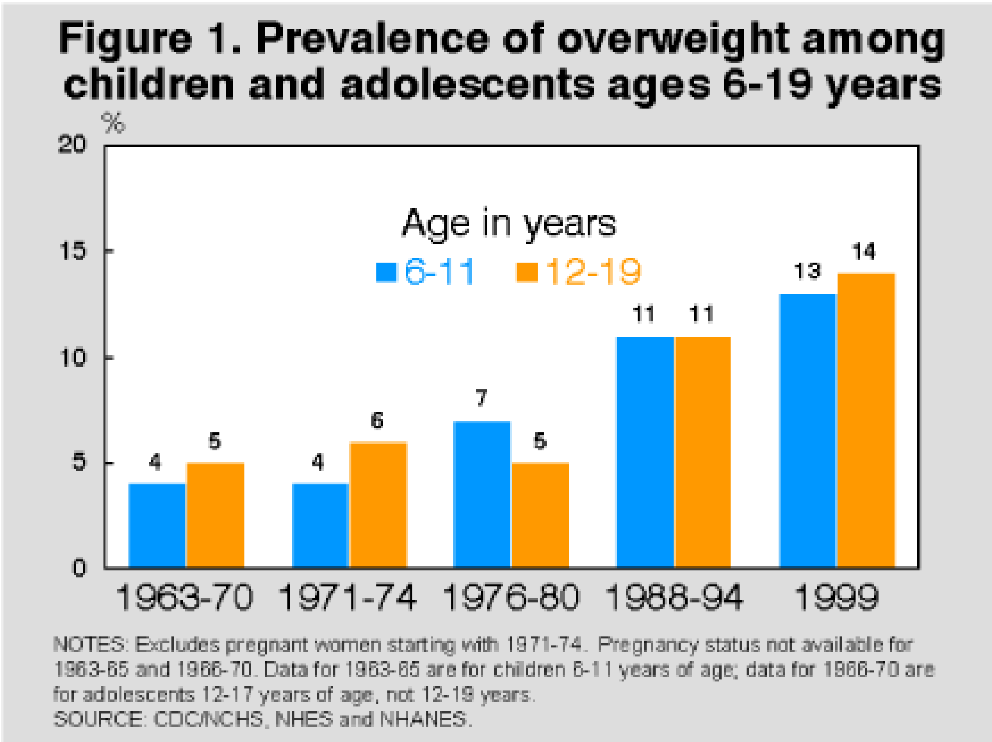

Figure 8-1. Prevalence of Overweight Among Children and Adolescents Ages 6-19 Years

Phillips et al. (1993) calculated surface area to body weight ratios for three age groups of the population. The study evaluated the 401 individual observations that were reported by Boyd (1935) and used by Gehan and George (1970) to develop their bi-exponential surface area model. Phillips et al. used Pearson's product moment correlation analysis to compare surface area data with corresponding body weights. Subsequently, surface area/body weight (SA/BW) ratios were calculated for each of the individuals in the data set, and summary statistics were calculated for the entire data set. Data were sorted by sex and age to evaluate the effect they had on SA/BW distributions. The resulting SA/BW were plotted against the corresponding ages of the individuals in the data set, and visual inspection was used to divide the SA/BW curve into three segments at the ages where obvious changes had occurred. The age segments corresponded approximately to the ages of infants (0 to 2 years), children (2.1 to 17.9 years), and adults (> 18 years). Comparisons of the mean SA/BW ratio differences for males and females were not found to be statistically different at the 0.05 level of confidence. However, a strong negative correlation was observed between age and SA/BW for all ages combined, and for infants and children when these age groups were tested separately.

The results of the Phillips et al. (1993) study can be presented within the age bins proposed by EPA. However, the data upon which the SA/BW ratios were derived are over six decades old and may not be representative of the characteristics of the current population, based on the discussion above regarding the increased prevalence of obesity among children and adolescents. Additionally, the conclusions of the Phillips et al. study could not be modified using NHANES data, because height measurements are not available for children less than 2 years of age in those surveys.

8.2.2 Soil Adherence Studies

In the past, the U.S. EPA recommended one value to represent dermal soil adherence to all body parts, regardless of the soil type or conditions, or type of activity that leads to soil contact. The work of Kissel et al. (1996a, 1996b, 1998) and Holmes et al. (1999) has attempted to determine the magnitude of dermal soil adherence. Kissel et al. (1996a) conducted sieved and unsieved soil adherence experiments for five soil types. Kissel et al. (1996b, 1998) and Holmes et al. (1999) estimated soil adherence associated with various indoor and outdoor activities. The results of those studies showed that soil adherence generally could be directly correlated with moisture content, inversely correlated with particle size, and independent of clay content or organic carbon. Additionally, the rate of soil adherence is higher for hands than for other parts of the body.

These studies have made great strides in our understanding of the magnitude of soil adherence under different soil conditions and human activities, but all of the aforementioned studies were based on a small number of participants, and, for at least one study (Kissel et al., 1998), a relatively short activity duration. Additionally, the activity settings and children selected for the study may not be representative of the U.S. population. With regard to age bins, soil adherence is more activity- than age-specific, therefore, the values recommended in the *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) can be used for any age group, depending on the activity considered.

8.3 STUDIES SELECTED FOR THE ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

EPA did a thorough job of reviewing the peer-reviewed literature to derive reasonable values for total body surface area and dermal soil adherence values for the *Exposure Factors Handbook* (U.S. EPA, 1997) and the *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001). For this present effort, a thorough search of peer-reviewed literature back to 1997 was conducted; however, no new studies were identified that have been performed relative to those factors since the development of the EPA documents (1997, 2001). Although one expert expressed optimism during the technical workshop that the NHANES III body weight data might supply new insight into surface area in children less than 2 years of age, the NHANES III format is apparently the same as that of NHANES II. The reason that total surface area could not be estimated from the NHANES II data set is because height information, which is equally important to calculate surface area, was not included. That same information apparently is missing from the NHANES III data. Consequently, the new data should not provide any new insight into total surface area within the context of the age bins recommended by EPA.

8.4 RECOMMENDATIONS FOR PROPOSED AGE BINS

Presently, no recommendations can be made with respect to the proposed age-bin-specific surface area values. As indicated previously, the lack of NHANES II height data precludes estimation of recommended total surface area values for children less than 1 month of age, 1 to 2 months, 3 to 5 months, 6 to 11 months, or 1 to 2 years of age. With regard to children in the age groups of 3 to 5 years, 6 to 10 years, 11 to 15 years, and 16 to 17 years, estimation of surface area values would require compilation of the NHANES II data into subsets that correspond to the recommended age bins. Subsequently, the subsets would need to be analyzed using a routine to estimate the variance of multistage sample survey data using JRRA. Unfortunately, this analysis cannot be performed within the scope of this document for various reasons. First, the analysis requires that the NHANES data be in the same format as the original evaluation, conducted for *Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments* (U.S. EPA, 1985). Second, the JRRA for variance estimation, described by Rochon and Kalsbeek (1983), has some weaknesses. Although the procedure is conceptually straightforward and moderately easy to use, error checking is limited. The authors cautioned that the JRRA macros assume that information entered through the parameter macros is accurate, and consequently, users may be left to the mercy of the PROC MATRIX error message (Rochon and Kalsbeek, 1983). Because of this, considerable time may be required to verify the information entered into the programs. Until a new analysis of an existing dataset or new data are collected, factors selected to address the proposed age bins will have to be used with caution. A confidence evaluation of the existing studies used in the current CSEFH is presented in Table 8-1.

As previously stated, soil adherence is more activity- than age-specific. Therefore, the values recommended in the *Child-Specific Exposure Factors Handbook* can be used for any age group depending on the activity considered.

8.5 RECOMMENDATIONS FOR FURTHER ANALYSIS AND RESEARCH NEEDS

Presently, the most important research need is to compile appropriate height and weight data for children under 2 years of age. Because of their behavior patterns (e.g., playing and crawling on contaminated surfaces with fewer clothes for protection) and physical factors (i.e., higher surface area relative to body weight), children in this age group may have potentially higher exposure to environmental toxicants than other age groups.

With regard to dermal soil adherence, the *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) has recommended that, because the controlled experiments and field studies conducted to date were based on specific situations and a limited number of measurements, more-detailed studies are necessary to determine variation among individuals, the effects of time of activity, protective clothing, and seasonal factors on dermal soil adherence.

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Table 8-1. Evaluation of Existing Surface Area Studies

Considerations	Rating (High, Medium, Low)								
	Age								
	<1 Month	1-2 Mos	3-5 Mos	6-11 Mos	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
Study Elements									
• Level of Peer Review	NA	NA	NA	NA	NA	High	High	High	High
• Accessibility	NA	NA	NA	NA	NA	Medium	Medium	Medium	Medium
• Reproducibility	NA	NA	NA	NA	NA	High	High	High	High
• Focus on factor of interest	NA	NA	NA	NA	NA	High	High	High	High
• Data pertinent to U.S.	NA	NA	NA	NA	NA	High	High	High	High
• Primary data	NA	NA	NA	NA	NA	High	High	High	High
• Currency	NA	NA	NA	NA	NA	Low	Low	Low	Low
• Adequacy of data collection period	NA	NA	NA	NA	NA	Low	Low	Low	Low
• Validity of approach	NA	NA	NA	NA	NA	High	High	High	High
• Representativeness of the population	NA	NA	NA	NA	NA	Medium	Medium	Medium	Medium
• Characterization of variability in the population	NA	NA	NA	NA	NA	High	High	High	High
• Lack of bias in study design	NA	NA	NA	NA	NA	Medium	Medium	Medium	Medium
• Measurement error	NA	NA	NA	NA	NA	High	High	High	High
Overall Rating	NA	NA	NA	NA	NA	Medium	Medium	Medium	Medium

9.0 CHILD-SPECIFIC ACTIVITY PATTERNS

9.1 INTRODUCTION

Each exposure route (dermal, inhalation and ingestion) is influenced by physiological, behavioral, physical activities, and demographic characteristic (Hubal et al., 2000). For each exposure route, an algorithm (see Section 1.1) is used to express exposure as a function of (1) the chemical concentration in the exposure medium, (2) contact rate, (3) rate of transfer of the chemical from the exposure medium to the portal of entry, and (4) the exposure duration (Hubal et al., 2000). Exposure duration, addressed as time spent in various microenvironments and in various microactivities in the home environment, is discussed in this section; other exposure factors expressed in the algorithms are addressed in other sections of this issue paper and the CSEFH.

Chemical exposures of children are influenced by the types of activities in which they are engaged as well as the locations of the activities and the level of participation in those activities. Consequently, exposure to chemicals in the environment can vary among children of similar developmental stages because of the variability in their behavior. Additionally, seasonal and geographic differences among children of similar developmental stages influence the variability of exposure. In any microenvironment (the location that a child occupies at a particular time), exposure to contaminants is influenced, among other things, both by the activity in which the child is engaged (e.g., such *macroactivities* as watching TV, eating, playing games, and crawling on the floor) and, the detailed actions that occur within the macroactivity (e.g., such *microactivities* as hand-to-surface and hand-to-mouth behavior) (Hubal et al., 2000). Macroactivity data are discussed in Section 6, Non-Dietary Ingestion. This section focuses on macroactivity data only. The *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) and Hubal et al. (2000) described various measurement techniques and reviewed pertinent activity studies as a basis for recommending activity factors for children that are representative of the subpopulations (i.e., age- and sex-dependent) under consideration.

The U.S. EPA is interested in developing exposure factors for the following age bins: <1 month, 1-2 months, 3-5 months, 6-11 months, 1-2 years, 3-5 years, 6-10 years, 11-15 years, and 16-17 years. The purpose of this section is to evaluate the studies considered by U.S. EPA in the *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) to determine if, and how, the existing data can be presented within the proposed age bins. Additionally, more recent studies that might supplement the existing data will be discussed, and recommendations will be made, where possible, regarding the analytical approach to redistribute the data into appropriate age bins.

supplement the existing data will be discussed, and recommendations will be made, where possible, regarding the analytical approach to redistribute the data into appropriate age bins.

9.2 EVALUATION OF EXISTING DATA

The *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001) evaluated several activity studies in an attempt to derive recommended default values for use in exposure assessments for children. The most significant studies are described below, including a discussion of their inherent strengths and weaknesses.

Timmer et al. (1985) - How Children Use Time

Timmer et al. (1985) evaluated children's time use data obtained from a 1981-82 panel study of children between the ages of 3 and 17 years. The authors concluded that more time was spent by girls than boys performing household work and personal care activities, and less time playing sports. Additionally, children spent most of their free time watching television. Older children spent more time doing household and market work, studying, and watching television, and less time eating, sleeping, and playing. The study was limited with respect to the age of the data as well as the time span upon which the children's time use was based. Specifically, since the data were collected two decades ago, they may no longer be representative of children today. Additionally, data in the panel study were collected only during the time of year when children attend school, and therefore do not provide overall annual estimates of children's time use (U.S. EPA, 2001).

Robinson and Thomas (1991) - Time Spent in Activities, Locations, and Microenvironments: A California-National Comparison Project

Robinson and Thomas (1991) evaluated and compared children's time use data obtained from the 1987-88 California Air Resources Board (CARB) study for California residents and the 1985 national study, *America's Use of Time*. Both studies comprised children 12 years and older. The authors concluded that, in both studies, males spent more time in work locations, automobiles and other vehicles, garages, and physical outdoor activities. Females, on the other hand, spent more time cooking, engaging in other kitchen activities, performing other chores, and shopping (U.S. EPA, 2001). This study was limited with respect to the area in which the data were collected, the age of the data, and the length of the study. Specifically, since data were collected only for California residents, the results may not be representative of other areas of the United States. Also, as with the Timmer et al. (1985) study, because of the time lapse since the data were collected, the results may no longer be representative of children today.

Tsang and Klepeis (1996) - National Human Activity Pattern Survey (NHAPS)

Tsang and Klepeis (1996) produced the largest and most current human activity pattern survey available. The survey gathered data from 9,386 study participants of all ages regarding the duration and frequency of selected activities and the time spent in selected microenvironments. The NHAPS data set is representative of the U.S. population and has been adjusted to be balanced geographically, seasonally, and temporally (U.S. EPA, 2001). It is also race-specific and is representative of all ages and gender. However, the data are limited with respect to children ages 1 to 17 as well as time spent in certain activities. Specifically, for children ages 1 to 17, data for most activities are sparse. Additionally, for selected activities, means cannot be calculated for time spent at the high end of the distribution for those activities. For example, for swimming events, Tsang and Klepeis (1996) reported the 90th percentile value of 180 minutes per swimming event (based on one event/month) and 99th percentile as 181 minutes. The 181-minute value was used to indicate that more than 180 minutes were spent in the activity, thereby masking actual time spent.

Hubal et al. (2000) - Children's Exposure Assessment: A Review of Factors Influencing Children's Exposure and the Data Available to Characterize and Assess That Exposure

Hubal et al. (2000) reviewed the U.S. EPA National Exposure Research Laboratory's Consolidated Human Activity Database (CHAD), a storehouse of data from several studies on human activities. Although CHAD contains 4,300 person-days of information for children younger than 18 years and 3,009 person-days of microactivity data for 2,640 children younger than 12 years, the database is limited with respect to activity codes. Specifically, the authors noted that although CHAD contains approximately 140 activity codes and 110 location codes, the data generally are not available for all activity locations for any single respondent (U.S. EPA, 2001). Furthermore, many of the activity codes are broadly defined, thereby ignoring many child-oriented behaviors. This author queried CHAD for male and female children ranging in age from 1 to 17 years and experienced the same problem with the activity codes as Hubal et al. (2000). Moreover, for some activity codes, the activity may be spelled differently on different records or is described colloquially, thereby making compilation of those data subgroups difficult or impossible to analyze. Consequently, the descriptions of the activities in the database do not really give a clear indication as to the levels of activity among the children. Nonetheless, Hubal et al. (2000) compiled data from three studies incorporated into CHAD that contained activity data for children under 12 years of age. Those studies included the 1990 California "children and youth" recall survey (Wiley et al., 1991), the 1983 Cincinnati diary study sponsored by the Electric Power Research Institute (Johnson, 1989), and the "air" and "water" versions of the 1992-1994 National Human Activity Pattern Survey

(NHAPS) recall survey (Klepeis et al., 1995). The results of the analysis conducted by Hubal et al. (2000) are presented in Tables 9-1 through 9-3.

Table 9-1. Number of Person-Days/Individuals[a] for Children in CHAD Database

Age Group	All Studies[b]	California	Cincinnati[b]	NHAPS-Air	NHAPS-Water
0 yr	223/199	104	36/12	39	44
0-6 mo		50	15/5		
6-12 mo		54	21/7		
1 yr	259/238	97	31/11	64	67
12-18 mo		57			
18-24 mo		40			
2 yr	317/264	112	81/28	57	67
3 yr	278/242	113	54/18	51	60
4 yr	259/232	91	41/14	64	63
5 yr	254/227	98	40/14	52	64
6 yr	237/199	81	57/19	59	40
7 yr	243/213	85	45/15	57	56
8 yr	259/226	103	49/17	51	55
9 yr	229/195	90	51/17	42	46
10 yr	224/199	105	38/13	39	42
11 yr	227/206	121	32/11	44	30
Total	3009/2640	1200	556/187	619	634

[a] CHAD = Consolidated Human Activity Database, available on U.S. EPA Intranet.
[b] The number of person-days of data are the same as the number of individuals for all studies except for the Cincinnati study. Since up to 3 days of activity pattern data were obtained from each participant in this study, the number of person-days of data is approximately three times the number of individuals.

Source: Hubal et al. (2000, Table 1).

Table 9-2. Number of Hours Per Day Children Spend in Various Microenvironments by Age (Average ± std. dev. percent of children reporting >0 hours in microenvironment)

Age (years)	MICROENVIRONMENT				
	Indoors at Home	Outdoors at Home	Indoors at School	Outdoors at Park	In Vehicle
0	19.6±4.3 (99%)	1.4±1.5 (20%)	3.5±3.7 (2%)	1.6±1.5 (9%)	1.2±1.0 (65%)
1	19.5±4.1 (99)	1.6±1.3 (35)	3.4±3.8 (5)	1.9±2.7 (10)	1.1±0.9 (66)
2	17.8±4.3 (100)	2.0±1.7 (46)	6.2±3.3 (9)	2.0±1.7 (17)	1.2±1.5 (76)
3	18.0±4.2 (100)	2.1±1.8 (48)	5.7±2.8 (14)	1.5±0.9 (17)	1.4±1.9 (73)
4	17.3±4.3 (100)	2.4±1.8 (42)	4.9±3.2 (16)	2.3±1.9 (20)	1.1±0.8 (78)
5	16.3±4.0 (99)	2.5±2.1 (52)	5.4±2.5 (39)	1.6±1.5 (28)	1.3±1.8 (80)
6	16.0±4.2 (98)	2.6±2.2 (48)	5.8±2.2 (34)	2.1±2.4 (32)	1.1±0.8 (79)
7	15.5±3.9 (99)	2.6±2.0 (48)	6.3±1.3 (40)	1.5±1.0 (28)	1.1±1.1 (77)
8	15.6±4.1 (99)	2.1±2.5 (44)	6.2±1.1 (41)	2.2±2.4 (37)	1.3±2.1 (82)
9	15.2±4.3 (99)	2.3±2.8 (49)	6.0±1.5 (39)	1.7±1.5 (34)	1.2±1.2 (76)
10	16.0±4.4 (96)	1.7±1.9 (40)	5.9±1.5 (39)	2.2±2.3 (40)	1.1±1.1 (82)
11	14.9±4.6 (98)	1.9±2.3 (45)	5.9±1.5 (41)	2.0±1.7 (44)	1.6±1.9 (74)

Source: Hubal et al. (2000, Table 2).

Table 9-3. Number of Hours Per Day Children Spend Doing Various Macroactivities While Indoors at Home by Age (percent of children reporting >0 hours for microenvironment/macroactivity)

Age (yr)	MACROACTIVITY IN HOME MICROENVIRONMENT						
	Eat	Sleep or Nap	Shower or Bathe	Play Games	Watch TV or Listen to Radio	Read, Write, Homework	Think, Relax, Passive
0	1.9 (96%)	12.6 (99%)	0.4 (44%)	4.3 (29%)	1.1 (9%)	0.4 (4%)	3.3 (62%)
1	1.5 (97)	12.1 (99)	0.5 (56)	3.9 (68)	1.8 (41)	0.6 (19)	2.3 (20)
2	1.3 (92)	11.5 (100)	0.5 (53)	2.5 (59)	2.1 (69)	0.6 (27)	1.4 (18)
3	1.2 (95)	11.3 (99)	0.4 (53)	2.6 (59)	2.6 (81)	0.8 (27)	1.0 (19)
4	1.1 (93)	10.9 (100)	0.5 (52)	2.6 (54)	2.5 (82)	0.7 (31)	1.1 (17)
5	1.1 (95)	10.5 (98)	0.5 (54)	2.0 (49)	2.3 (85)	0.8 (31)	1.2 (19)
6	1.1 (94)	10.4 (98)	0.4 (49)	1.9 (35)	2.3 (82)	0.9 (38)	1.1 (14)
7	1.0 (93)	9.9 (99)	0.4 (56)	2.1 (38)	2.5 (84)	0.9 (40)	0.6 (10)
8	0.9 (91)	10.0 (96)	0.4 (51)	2.0 (35)	2.7 (83)	1.0 (45)	0.7 (7)
9	0.9 (90)	9.7 (96)	0.5 (43)	1.7 (28)	3.1 (83)	1.0 (44)	0.9 (17)
10	1.0 (86)	9.6 (94)	0.4 (43)	1.7 (38)	3.5 (79)	1.5 (47)	0.6 (10)
11	0.9 (89)	9.3 (94)	0.4 (45)	1.9 (27)	3.1 (85)	1.1 (47)	0.6 (10)

Source: Hubal et al. (2000, Table 3).

9.3 STUDIES SELECTED FOR THE ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

This author used the Medline and Toxline databases to conduct a thorough search of peer-reviewed literature relative to children's activity factors. The search was limited to those articles that were published after 1997 to the present date in order to identify any studies not considered in the *Child-Specific Exposure Factors Handbook* (U.S. EPA, 2001). Unfortunately, no new pertinent studies have been performed relative to those factors since the development of those two documents. Therefore, Hubal et al. (2000) was selected for the analysis to obtain new recommendations.

9.4 RECOMMENDATIONS FOR EACH AGE BIN

Presently, no recommendations can be made with respect to activity factor values for children less than 1 month old, 1 to 2 months, 3 to 5 months, 6 to 11 months, 11 to 15 years, or 16 to 17 years. As stated by Hubal et al. (2000), the current database on children's macroactivities is sparse and data are insufficient to adequately assess exposures to environmental contaminants. However, the results of the Hubal et al. (2000) evaluation of CHAD data for children less than 12 years of age (see Tables 9-1 through 9-3) are sufficient to estimate values for time in microenvironments and participation in certain macroactivities for children in age bins of 1-2 years, 3-5 years, and 6-10 years. Therefore, weighted average values for the microenvironments and macroactivities within those age bins were estimated based on the averages of the year groups within each of the age bins and the respective person-days reported by Hubal et al. (2000) for those year groups. The recommended values for microenvironments and macroactivities for children in age bins of 1-2 years, 3-5 years, and 6-10 years are presented in Tables 9-4 and 9-5, respectively. The level of confidence for the recommended activity factor values is presented in Table 9-6.

Table 9-4. Estimated Number of Hours Per Day Children Spend in Various Microenvironments by Age Bin

Age Bin	MICROENVIRONMENT				
	Indoors at Home	Outdoors at Home	Indoors at School	Outdoors at Park	In Vehicle
<1 mo	NA	NA	NA	NA	NA
1-2 mo	NA	NA	NA	NA	NA
3-5 mo	NA	NA	NA	NA	NA
6-11 mo	NA	NA	NA	NA	NA
1-2 yr	18.6	1.9	5.5	2.0	1.2
3-5 yr	17.2	2.3	5.4	1.8	1.3
6-10 yr	15.7	2.3	6.0	2.0	1.2
11-15 yr	NA	NA	NA	NA	NA
16-17 yr	NA	NA	NA	NA	NA

NA = Data are insufficient to estimate time spent in microenvironment.

Source: Adapted from Hubal et al. (2000).

Table 9-5. Estimated Number of Hours Per Day Children Spend Doing Various Macroactivities While Indoors at Home by Age Bin

Age Bin	MACROACTIVITY IN HOME MICROENVIRONMENT						
	Eat	Sleep or Nap	Shower or Bathe	Play Games	Watch TV or Listen to Radio	Read, Write, Homework	Think, Relax, Passive
<1 mo.	NA	NA	NA	NA	NA	NA	NA
1-2 mo.	NA	NA	NA	NA	NA	NA	NA
3-5 mo.	NA	NA	NA	NA	NA	NA	NA
6-11 mo.	NA	NA	NA	NA	NA	NA	NA
1-2 yr	1.4	11.8	0.5	3.2	2.0	0.6	1.8
3-5 yr	1.1	10.9	0.5	2.5	2.5	0.8	1.1
6-10 yr	1.0	9.9	0.4	1.9	2.8	1.1	0.8
11-15 yr	NA	NA	NA	NA	NA	NA	NA
16-17 yr	NA	NA	NA	NA	NA	NA	NA

NA = Data are insufficient to estimate time spent doing macroactivity.

Source: Adapted from Huban et al. (2000).

Table 9-6. Confidence for Recommendations for Activity Factors

Considerations	Rating (High, Medium, Low)								
	Age								
	<1 Month	1-2 Mos	3-5 Mos	6-11 Mos	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
Study Elements									
• Level of peer review	NA	NA	NA	NA	High	High	High	NA	NA
• Accessibility	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Reproducibility	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Focus on factor of interest	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Data pertinent to U.S.	NA	NA	NA	NA	High	High	High	NA	NA
• Primary data	NA	NA	NA	NA	High	High	High	NA	NA
• Currency	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Adequacy of data collection period	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Validity of approach	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Representativeness of the population	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Characterization of variability in the population	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Lack of bias in study design	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
• Measurement error	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA
Overall Rating	NA	NA	NA	NA	Medium	Medium	Medium	NA	NA

9.5 RECOMMENDATIONS FOR FURTHER ANALYSIS AND RESEARCH NEEDS

The present state of knowledge regarding children's exposures and activities are inadequate to assess exposures to environmental contaminants sufficiently. This author supports the conclusions and recommendations presented by Hubal et al. (2000). Research needs to be conducted in three specific areas in order to improve the database that is currently available to assess children's exposures. Methods for monitoring children's activities and exposures need to be improved. Additionally, physical activity data for children, but especially young children less than 4 years of age and in age bins 11-15 years and 16-17 years, need to be collected in order to assess exposure by all routes. In order to accomplish this, population-based data are required to improve the characterization of children's activities and exposures as a function of age, gender, environmental setting (residence, school, day care), socioeconomic status, race/ethnicity, location (urban, suburban, rural), region, and season.

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10.0 BODY WEIGHT

10.1 INTRODUCTION

Body weight is an important parameter in several aspects of the metrics of toxicology, the elements of exposure, and the expression of risk. Exposure and risk assessments are frequently expressed as a function of dose normalized to the average body weight of the exposed population. Body weight is one of the parameters in the calculation of the body mass index, by which overall fitness is categorized and body fat content estimated. It can also serve as one parameter in estimating body surface area, which is a key factor in some exposure and risk scenarios.

Creating an average growth reference of the relationship between weight and age requires a database that is representative of the population under consideration, contains accurate measurements from the sample subjects, and uses a statistical process that appropriately fits smooth percentile curves to the data (Ulijaszek et al., 1998). These three principles are good guides for the evaluation of data and consideration of appropriate age bins.

Since the 1970s, one database has been the cornerstone for data on growth parameters for the population of the United States. That is the National Health and Nutrition Examination Survey and its predecessor surveys. The most recent survey is the Third National Health and Nutrition Examination Survey (NHANES III), conducted between 1988 and 1994. In 1977 the National Center for Health Statistics (NCHS), within the Centers for Disease Control (CDC), created multipurpose growth charts that have been used by many research, clinical, and international health organizations, including the World Health Organization (WHO). The underlying data, statistical treatment of those data, and various other aspects of creating the growth charts have been subjected to scrutiny by the users of the charts. In December 2000, NCHS released the revised growth charts for the United States using the NHANES III data (CDC, 2000). Documentation on the population surveyed, the survey techniques, and the statistics applied to the data are provided with the growth charts.

10.2 EVALUATION OF EXISTING DATA

The NHANES III database, distributed by NCHS, contains measured physical parameters on a representative population of more than 30,000 individuals between the ages of 2 months and 90 years, collected between 1988 and 1994. Our literature search identified no comparably large set of consistently measured data on physical characteristics of the population. The NHANES III data support classification not only by age, but also by sex, race (white, black, other), and ethnicity (Mexican-American, other Hispanic, not Hispanic). NHANES III:

- Reflects actual measurements under consistent conditions (as opposed to self-reported values),
- Includes data on a large number of individuals collected as a representative sample of the U.S. population, and
- Contains demographic data that have been confirmed by in-person interviews with survey respondents (for other databases, these values may be either self-reported or inferred).

Although the NHANES III data appear to be the best available, they are cross-sectional. Inferences about the temporal relationships of growth can be made with these data, but actual longitudinal data about height and weight are not available. A second problem is that the data are limited in terms of the numbers of individuals in particular demographic subgroups (defined by sex, race, and ethnicity). These limitations reflect the attempt to capture the relative demographic composition of the U.S. population as a whole within a limited set of measurements. However, this composition results in the prediction of changes in growth parameters that is more uncertain for small demographic subgroups than for the majority groups. For example, NHANES III has data for 5,340 male, white, non-Hispanic individuals but only 256 male, "other" (includes racial groups other than white or black), non-Hispanic individuals.

Setting up a growth reference as the relationship between age and weight can be accomplished directly if age is a good predictor of weight. If age is not a good predictor of weight, one can explore other options, such as weight as a function of height. If age is a good predictor of height, and if height is a good predictor of weight, height to weight references may be employed. Other population factors, such as gender and ethnicity, may influence these relationships.

In creating the growth charts, the CDC grouped data by month of age from 1 through 11 months, by 3-month intervals (bins) from 12 through 23 months, and by 6-month intervals from 2 through 19 years. Survey weights were applied to the empirical data, then empirical percentile data points were calculated and plotted at the midpoint of each age group. Statistical smoothing procedures were applied to the observed data to generate the reference curves. All procedures are described in detail by CDC and reflect improvements collected over the 30 years of experience with such tasks.

CDC has generated weight-for-age growth curves for age groups birth to 36 months and 2 to 20 years, considering boys and girls independently. The 50th percentile of the population of children ages 0 to 36 months, along with the variability described by the 3rd to 97th percentile of these populations, show little difference by gender. Growth is described by a phase of steep weight gain per unit time from 0 to 6 months of age. A second, less steep weight gain slope follows from 6 to 12 months. From 12 to 36 months, a third slope can be fitted to the weight gain curve. The differences in the slopes during these time periods are less pronounced for girls than for boys. The variability described between the 3rd and 97th percentile of the population increases with age, and by 36 months variability is large (CDC, 2000; Figures 1 and 2).

Similar curves were fitted for the length-for-age relationships (CDC, 2000; Figures 3 and 4). The curve shows less obvious regions of discrete slopes, and the variability across the population is modest, even at 36 months, compared with the variability demonstrated in the weight-for-age growth curves.

Weight-for-age percentiles were also constructed for boys and girls ages 2 to 20 years (CDC, 2000; Figures 9 and 10, respectively). The length-for-age growth charts—now called stature-for-age percentiles—were constructed for these gender/age groups also (CDC, 2000; Figures 11 and 12).

Both the central tendency and variability of height and weight increase as age increases. Changes in height and weight are clearly nonlinear, and the emerging plateaus reflect a transition from childhood to adult patterns.

Height shows a clear biphasic pattern, with a nearly linear increase up to about 16 years of age. The actual inflection point varies, primarily reflecting earlier attainment of adult height in females. Weight shows a similar pattern, except that a broader band of variability is evident. Height and weight are relatively highly correlated for heights less than 4.5 feet, and very poorly correlated beyond that point.

10.3 STUDIES SELECTED FOR ANALYSIS TO OBTAIN NEW RECOMMENDATIONS

NHANES III provides data for constructing age-based bins of growth parameters, including age-to-weight. It also provides data for which age-to-height measurements and age-to-body mass indices can be constructed. Data are presented for population percentiles, by gender, and are also graphically presented in the CDC growth charts. These data sets and graphs are convenient for estimating exposure factors data for the proposed age bins.

10.4 RECOMMENDATIONS FOR PROPOSED AGE BINS

The data sets for the CDC growth charts provide weight calculations for males and females for each month between birth and 20 years of age. Midpoints are reported for each selected percentile. In our analysis, the 50^{th} percentile values were selected for each age grouping. For time periods over several months, we summed the values and computed an average. One value for males and one for females is thus calculated for each time category. These are summed and the average reported. The recommended values for body weight are presented in Table 10-1. The confidence in rating for the body weight recommendations is shown in Table 10-2. To address other percentiles, further statistical analysis is needed which is beyond the scope of this issue paper (see Section 10.5).

10.5 RECOMMENDATIONS FOR FURTHER ANALYSIS AND RESEARCH NEEDS

The age-to-weight bins in the CDC growth charts are adequate for estimations of exposure and risk, normalized by averages of the population weights. However, this approach is only minimally adequate in that many exposure and risk assessments use other body metrics as key components. The dermal exposure assessments use surface area factors and are usually related to some age groups and gender/age subpopulations. Increasingly, risk assessment considers pharmakokinetic and pharmacodynamic relationships. In those cases, consideration of the fat compartments of the population or subpopulation are useful. The NHANES III survey provides data for all of these situations, and may be as valuable as the age-to-weight factors.

The age-to-weight factor approach can be improved by computing age-to-length (age-to-stature) relationships and then relating the average and variance of weight around each of those categories. Similarly, a Body Mass Index value (BMI) may be presented in the same way.

Many risk assessments address some subpopulation of the U.S. population, especially by gender and/or by ethnicity. The NHANES III survey, as presented in the CDC growth tables, provide the growth measurements of interest as a function of gender-specific percentiles. It would be an improvement to present the age-to-weight estimates as gender-specific values. This is particularly important for values representing ages greater than 2 years. As age increases, the differences between boys and girls increase. The CDC summaries do not address ethnic differences, but the NHANES III data are available to conduct separate analyses for selected ethnic groups. These will provide better accuracy when used with ethnic-specific exposure and risk assessments.

Table 10-1. Recommended Body Weight Values for Proposed Age Bins (kg)

Age bin	Male: Mean at 50^{th} percentile	Female: Mean at 50^{th} percentile	Average Male/Female Age Bin Value
0-1 month	4.00	3.80	**3.90**
1-2 months	4.88	4.54	**4.71**
3-5 months	6.72	6.15	**6.43**
6-11 months	9.04	8.28	**8.66**
1-2 years	11.53	10.80	**11.16**
3-5 years	16.27	15.83	**16.05**
6-10 years	25.86	25.95	**25.90**
11-15 years	45.77	45.41	**45.59**
16-17 years	62.84	54.54	**58.69**

Table 10-2. Confidence in Recommendations for Body Weight

	Rating (High, Medium, Low)								
	Age								
Considerations	<1 Month	1-2 Mos	3-5 Mos	6-11 Mos	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-15 Yrs	16-17 Yrs
Study Elements									
• Level of peer review	High	High	High	High	High	High	High	High	High
• Accessibility	High	High	High	High	High	High	High	High	High
• Reproducibility	High	High	High	High	High	High	High	High	High
• Focus on factor of interest	High	High	High	High	High	High	High	High	High
• Data pertinent to U.S.	High	High	High	High	High	High	High	High	High
• Primary data	High	High	High	High	High	High	High	High	High
• Currency	High	High	High	High	High	High	High	High	High
• Adequacy of data collection period	High	High	High	High	High	High	High	High	High
• Validity of approach	High	High	Medium	Medium	Medium	Medium	Medium	Low	Low
• Representativeness of the population	High	High	High	High	High	High	High	High	High
• Characterization of variability in the population	High	High	Medium	Medium	Medium	Medium	Medium	Low	Low
• Lack of bias in study design	High	High	High	High	High	High	High	High	High
• Measurement error	High	High	High	High	High	High	High	High	High
Overall Rating	High	High	Medium	Medium	Medium	Medium	Medium	Low	Low

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