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**Chapter 8 - Body Weight**

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**8 BODY WEIGHT STUDIES**

**8.1 INTRODUCTION**

The average daily dose (ADD) is a dose that is typically normalized to the average body weight of the exposed population. If exposure occurs only during childhood years, the average child body weight during the exposure period should be used to estimate risk (U.S. EPA, 1989).

The purpose of this section is to describe a key published study on body weight for children in the general U.S. population, as described in Section 1.5 of this handbook. The recommendations for body weight are provided in the next section, along with a summary of the confidence ratings for these recommendations. The recommended values are based on one key study identified by U.S. EPA for this factor. Following the recommendations, the key study on body weight is summarized. Relevant data on body weight are also provided. Since childhood obesity is a growing concern and may increase the risk of chronic diseases during adulthood, information on body mass index (BMI) and height are also provided.

**8.2 RECOMMENDATIONS**

The recommended values for body weight are summarized in Table 8-1. Table 8-2 presents the confidence ratings for body weight recommendations. The recommended values represent mean body weights in kilograms for the age groups recommended by U.S. EPA in *Guidance for Monitoring and Assessing Childhood Exposures to Environmental Contaminants* (U.S. EPA, 2005). Use of upper percentile body weight values are not routinely recommended for calculating ADDs because inclusion of an upper percentile value in the denominator of the ADD equation would be a non-conservative approach. However, distributions of body weight data are provided in section 8.3 of this chapter. These distributions may be useful if probabilistic methods are used to assess exposure. Also, if gender-specific data are needed, or if data for finer age bins are needed, the reader should refer to the tables in Section 8.3.



Table 8-1. Recommended Values for Body Weight

Age Group	Mean kg	Multiple Percentiles	Source
Birth to <1 month	4.8		
1 to <3 months	5.6		
3 to <6 months	7.4		
6 to <11 months	9.2		
1 to <2 years	11.4	Tables 8-3 through 8-5	U.S. EPA analysis of NHANES, 1999-2006 data
2 to <3 years	13.8		
3 to <6 years	18.6		
6 to <11 years	31.8		
11 to <16 years	56.8		
16 to <21 years	71.6		



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Table 8-2. Confidence in Recommendations for Body Weight		
General Assessment Factors	Rationale	Rating
<b>Soundness</b>		High
<i>Adequacy of Approach</i>	The survey methodology and secondary data analysis analysis was adequate. NHANES consisted of a large sample size; sample size varied with age. Direct measurements were taken during a physical examination.	
<i>Minimal (or Defined) Bias</i>	No significant biases were apparent.	
<b>Applicability and Utility</b>		High
<i>Exposure Factor of Interest</i>	The key study is directly relevant to body weight.	
<i>Representativeness</i>	NHANES was a nationally representative sample of the U.S. population; participants are selected using a complex, stratified, multi-stage probability cluster sampling design.	
<i>Currency</i>	The U.S. EPA analysis used the most current NHANES data.	
<i>Data Collection Period</i>	The U.S. EPA analysis was based on 4 data sets of NHANES data covering 1999-2006.	
<b>Clarity and Completeness</b>		High
<i>Accessibility</i>	NHANES data are available from NCHS; the U.S. EPA analysis of the NHANES data is available upon request.	
<i>Reproducibility</i>	The methods used were well-described; enough information was provided to allow for reproduction of results.	
<i>Quality Assurance</i>	Quality assurance of NHANES data was good; quality control of secondary data analysis was not well described.	
<b>Variability and Uncertainty</b>		High
<i>Variability in Population</i>	The full distributions were given in the key study.	
<i>Uncertainty</i>	No significant uncertainties were apparent in the NHANES data, nor in the secondary analyses of the data.	
<b>Evaluation and Review</b>		Medium
<i>Peer Review</i>	NHANES received a high level of peer review. The U.S. EPA analysis was not published in a peer-reviewed journal.	
<i>Number and Agreement of Studies</i>	The number of studies is 1.	
<b>Overall Rating</b>		<b>High</b>



**8.3 KEY BODY WEIGHT STUDY**

**8.3.1 U.S. EPA analysis of NHANES 1999-2006 data**

The U.S. EPA analyzed data from the 1999-2006 National Health and Nutrition Examination Survey (NHANES) to generate distributions of body weight for various age ranges of children. NHANES is conducted annually by the Center for Disease Control (CDC), National Center of Health Statistics (NCHS). The survey's target population is the civilian, noninstitutionalized U.S. population. The NHANES 1999-2006 survey was conducted on a nationwide probability sample of approximately 40,000 persons for all ages, of which approximately 20,000 were children. The survey is designed to obtain nationally representative information on the health and nutritional status of the population of the United States through interviews and direct physical examinations. A number of anthropometric measurements, including body weight, were taken for each participant in the study. Unit non-response to the household interview was 19 percent, and an additional 4 percent did not participate in the physical examinations (including body weight measurements).

The NHANES 1999-2006 survey includes over-sampling of low-income persons, adolescents 12-19 years, persons 60+ years of age, African Americans and Mexican Americans. Sample data were assigned weights to account both for the disparity in sample sizes for these groups and for other inadequacies in sampling, such as the presence of non-respondents. Because the U.S. EPA utilized four NHANES data sets in its analysis (NHANES 1999-2000, 2001-2002, 2003-2004, and 2005-2006) sample weights were developed for the combined data set in accordance with CDC guidance from the NHANES' website

([http://www.cdc.gov/nchs/about/major/nhanes/nhane\\_s2005-2006/faqs05\\_06.htm#question%2012](http://www.cdc.gov/nchs/about/major/nhanes/nhane_s2005-2006/faqs05_06.htm#question%2012)).

Using the data and the weighting factors from the four NHANES data sets, U.S. EPA calculated body weight statistics for the standard age categories. The mean value for a given group was calculated using the following formula:

$$\bar{x} = \frac{\sum_i w_i x_i}{\sum_i w_i} \quad (\text{Eqn. 8-1})$$

where:

- $\bar{x}$  = sample mean;
- $x_i$  = the  $i^{\text{th}}$  observation;
- $w_i$  = sample weight assigned to observation  $x_i$ .

Percentile values were generated by first calculating the sum of the weights for all observations in a given group and multiplying this sum by the percentile of interest (e.g., multiplying by 0.25 to determine the 25<sup>th</sup> percentile). The observations were then ordered from least to greatest, and each observation was assigned a cumulative weight, equal to its own weight plus all weights listed before the observation. The first observation listed with a cumulative weight greater than the value calculated for the percentile of interest was selected.

Table 8-3 presents the body weight means and percentiles, by age category, for male and female children, combined. Tables 8-4 and 8-5 present the body weight means and percentiles for male and female children, respectively.

The advantage of this study is that it provides body weight distributions for children at ages ranging from infancy to young adults. A limitation of the study is that the data in Tables 8-3 to 8-5 may underestimate current body weights due to an observed upward trend in body weights (Ogden et al., 2004). However, the NHANES data are nationally representative and remain the principal source of body weight data collected nationwide from a large number of subjects.

**8.4 RELEVANT BODY WEIGHT STUDIES**

**8.4.1 National Center for Health Statistics, 1987 - Anthropometric reference data and prevalence of overweight, United States, 1976-80**

This study used anthropometric measurement data for body weight for the U.S. population that were collected by NCHS as part of the second National Health and Nutrition Examination Survey (NHANES II). NHANES II began in February 1976 and was completed in February 1980. The survey was conducted on a nationwide probability sample of 27,801 persons aged 6 months to 74 years from the civilian, noninstitutionalized population of the United States. A total of 20,322 individuals in the sample were interviewed and



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examined, resulting in a response rate of 73.1 percent. The sample was selected so that certain subgroups thought to be at high risk of malnutrition (persons with low incomes, preschool children, and the elderly) were over sampled. The estimates were weighted to reflect national population estimates. The weighting was accomplished by inflating examination results for each subject by the reciprocal of selection probabilities, adjusted to account for those who were not examined, and-post stratifying by race, age, and sex.

NHANES II collected standard body measurements of sample subjects, including height and weight, that were made at various times of the day and in different seasons of the year. This technique was used because an individual's weight may vary between winter and summer and may fluctuate with patterns of food and water intake and other daily activities (NCHS, 1987). NCHS (1987) provided descriptive statistics of the body weight data. Means and percentiles, by age category, are presented in Table 8-6 for males, and in Table 8-7 for females.

The advantages of the study are that it is nationally representative and provides data for various age groups of children, beginning at 2 months of age. The limitation of the study is the age of the data.

#### **8.4.2 Burmaster and Crouch, 1997 - Lognormal distributions for body weight as a function of age for males and females in the United States, 1976-1980**

Burmaster and Crouch (1997) performed data analysis to fit normal and lognormal distributions to the body weights of females and males aged 9 months to 70 years. The data used in this analysis were from the second survey of the National Center for Health Statistics, NHANES II, which was based on a national probability sample of 27,801 persons 6 months to 74 years of age in the U.S. (Burmaster and Crouch 1997). The NHANES II data had been statistically adjusted for non-response and probability of selection, and stratified by age, sex, and race to reflect the entire U.S. population prior to reporting. Burmaster and Crouch (1997) conducted exploratory and quantitative data analyses and fit normal and lognormal distributions to percentiles of body weights of children and teens, as a function of age. Cumulative distribution functions were plotted for female and male body weights on both linear and logarithmic scales.

Burmaster and Crouch (1997) used "maximum likelihood" estimation to fit lognormal distributions to the data. Linear and quadratic regression lines were fitted to the data. A number of goodness-of-fit measures were conducted on the data generated. The investigators found that lognormal distributions gave strong fits to the data for each gender across all age groups. The statistics for the lognormal probability plots for female and male children aged 9 months to 20 years are presented in Tables 8-8 and 8-9, respectively. These data can be used for further analyses of body weight distribution (i.e., application of Monte Carlo analysis).

The advantage of this study is that NHANES data were used for the analysis and the data are representative nationally. It also provides statistics for probability plot regression analyses for females and males from 6 months to 20 years old. However, the analysis is based on an older set of NHANES data.

#### **8.4.3 U.S. EPA, 2000 - Body weight estimates on NHANES III Data**

U.S. EPA's Office of Water has estimated body weights for children by age and gender using data from NHANES III, which was conducted from 1988 to 1994. NHANES III collected body weight data for approximately 15,000 children between the ages of 2 months and 17 years. Table 8-10 presents the body weight estimates in kilograms by age and gender. Table 8-11 shows the body weight estimates for infants under the age of 3 months.

The limitations of this analysis are that data were not available for infants under 2 months old, and that the data are roughly 14 to 20 years old. With the upward trends in body weight from NHANES II (1976-1980) to NHANES III, which may still be valid, the data in Tables 8-10 and 8-11 may underestimate current body weights. However, the data are national in scope and represent the general children's population.

#### **8.4.4 Kuczarski et al., 2002 - 2000 CDC growth charts for the United States: methods and development**

NCHS published growth charts for infants, birth to 36 months of age, and children and adolescents, 2 to 20 years of age (Kuczarski et al., 2002). Growth charts were developed with data from five national health examination surveys: National Health Examination Survey (NHES) II (1963-65) for ages 6-11 years, NHES



III (1966-70) for ages 12-17 years, National Health and Nutrition Examination Survey (NHANES) I (1971-74) for ages 1-17 years, NHANES II (1976-80) beginning at 6 months of age, and NHANES III (1988-94) beginning at 2 months of age. Data from these national surveys were pooled because no single survey had enough observations to develop these charts. For the infant charts, a limited number of additional data points were obtained from other sources where national data were either not available or insufficient. Birth weights <1,500 grams were excluded when generating the charts for weights and lengths. Also, the length-for-age charts exclude data from NHANES III for ages <3.5 months. Supplemental birth certificate data from the U.S. vital statistics were used in the weight-for-age charts and supplemental birth certificate data from Wisconsin and Missouri vital statistics, CDC Pediatric Nutrition Surveillance System data were used for ages 0.5, 1.5, 2.5, 3.5, and 4.5 months for the length-for-age charts. The Missouri and Wisconsin birth certificate data were also used to supplement the surveys for the weight-for-length charts. Table 8-12 presents the percentiles of weight by gender and age. Figures 8-1 and 8-2 present weight by age percentiles for boys and girls, aged birth to 36 months, respectively. Figures 8-3 and 8-4 present weight by length percentiles for boys and girls, respectively. Figures 8-5 and 8-6 provide the Body Mass Index (BMI) for boys and girls aged 2 to 20 years old.

A limitation of this analysis is that trends in the weight data cannot be assessed because data from various years were combined. The advantages of this analysis are that it is based on a nationally representative sample of the U.S. population and it provides body weight on a month-by-month basis up to 36 months of age, as well as BMI data for children through age 20 years.

#### **8.4.5 Ogden et al., 2004 - Mean body weight, height, and body mass index, United States 1960-2002**

Ogden et al. (2004) analyzed trends in body weight measured by the National Health Examination Surveys II and III (NHES II and III), the National Health and Nutrition Examination Surveys I, II, and III (NHANES I, II, and III), and NHANES 1999-2002.

The surveys covered the period from 1960 to 2002. Table 8-13 presents the measured body weights for various age groups as measured in NHES and NHANES. Tables 8-14 and 8-15 present the mean height and BMI data for the same population, respectively. The BMI data were calculated as weight in kilograms divided by the square of height in meters. Population means were calculated using sample weights to account for variation in sampling for certain subsets of the U.S. population, non-response, and non-coverage (Ogden et al., 2004). The data indicate that mean body weight has increased over the period analyzed.

There is some uncertainty inherent in such an analysis, however, because of changes in sampling methods during the 42 year time span covered by the studies. Because this study is based on an analysis of NHANES data, its limitations are the same as those for that study. However, it serves to illustrate the importance of the use of timely data when analyzing body weight.

#### **8.4.6 Freedman et al., 2006 - Racial and ethnic differences in secular trends for childhood BMI, weight, and height**

Freedman et al. (2006) examined sex and race/ethnicity differences in secular trends for childhood BMI, overweight, weight, and height in the United States using data from NHANES I (1971 to 1974), NHANES II (1976- 1980), NHANES III (1988 to 1994) and NHANES 1999-2002. The analyses included children 2 to 17 years olds. Persons with missing weight or height information were excluded from the analyses (Freedman et al., 2006). The authors categorized the data across the four examinations and presented the data for non-Hispanic White, non-Hispanic Black, or Mexican American. Freedman et al. (2006) excluded other categories of race/ethnicity such as other Hispanics, because the sample sizes were small. Height and weight data were obtained for each survey and BMI was calculated as weight in kilograms divided by height in meters square. Sex specific z-scores and percentiles of weight-for-age, height-for-age, and BMI-for-age were calculated. Childhood overweight was defined as BMI-for-age  $\geq 95^{\text{th}}$  percentile and childhood obesity was defined as children with a BMI-for-age  $\geq 99^{\text{th}}$  percentile.

In the analyses, sample weights were used to account for differential probabilities, non-selection, non



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response, and non-coverage. The sample sizes used in the analyses by age, race and survey are presented in Table 8-16. Mean BMI levels are provided in Table 8-17 and the prevalence of overweight and obesity is shown in Table 8-18. Table 8-17 shows that in 1971-1974 survey total population, Mexican American children had the highest mean BMI level (18.6 kg/m<sup>2</sup>). However the greatest increase throughout the survey occurred among Black children increasing from 17.8 to 20 kg/m<sup>2</sup> (Freedman et al., 2006). Table 8-18 shows that 2 to 5 year old White children had slightly larger increases in overweight, but among the older children, the largest increases were among the Black and Mexican American children (Freedman et al., 2006). Overall, in most sex-age groups, Mexican Americans experienced the greater increase in BMI and overweight than what was experienced by Black and White Children (Freedman et al., 2006). Black children experienced larger secular increases in BMI, weight, and height than did White children (Freedman et al., 2006). According to Freedman et al. (2006) racial/ethnicity differences were less marked in the 2 to 5 years old children.

The advantages of the study are that the sample size is large and the analysis was designed to represent the general population of the racial and ethnic groups studied. The disadvantage is that some ethnic population groups were excluded because of small sample sizes.

**8.4.7 Martin et al., 2007 - Births: final data for 2005**

Martin et al. (2007) provided statistics on the percentage of live births categorized as having low or very low birth weights in the U.S. Low birth weight was defined as <2,500 grams (<5 pounds 8 ounces) and very low birth weight was defined as <1,500 grams (<3 pounds 4 ounces). The data used in the analysis were from birth certificates registered in all states and the District of Columbia for births occurring in 2005. Data were presented for maternal demographic characteristics including race ethnicity: non-Hispanic White, non-Hispanic Black, and Hispanic.

The numbers of live births within various weight ranges, and the percentages of live births with low or very low birth weights are presented in Table 8-19. The percentage of live births with low birth

weights was 8.2, and the percentage of very low birth weights was 1.5 in 2005. Non-Hispanic Blacks had the highest percentage of low birth weights (14.0 percent) and very low birth weights (3.3 percent). Martin et al. (2007) also provided statistics on the numbers and percentages of pre-term live births in the U.S. Of the 4,138,349 live births in the U.S. in 2005, 522,913 were defined as pre-term (i.e., less than 37 weeks gestation). A total of 43.3 percent of these pre-term infants had low birth weights and 11.3 percent had very low birth weights. The advantage of this data set is that it is nationally representative and provides data for infants.

**8.4.8 Portier et al., 2007 - Body weight distributions for risk assessment**

Portier et al. (2007) provided age-specific distributions of body weight based on NHANES II, III, and IV data. The number of observations in these surveys was 20,322, 33,311, and 9,965, respectively. Portier et al. (2007) computed the means and standard deviations of body weight as back transformations of the weighted means and standard deviations of natural log-transformed body weights. Body weight distributions were computed by gender and various age brackets (Portier et al., 2007). The estimated mean body weights are shown in Tables 8-20, 8-21, and 8-22 using NHANES II, III, and IV data, respectively. The sample size (N) shown in the tables is the observed number of individuals and not the expected population size (sum of the sample weights) in each age category (Portier et al., 2007). The authors noted that the age groups are defined as starting at the birth month and include the next eleven months (i.e., age group 2 includes children 24-35 months at the time of the health assessment). Table 8-23 provides estimates for age groups that are often considered in risk assessments (Portier et al., 2007). The authors concluded that the data show changes in the average body weight over time and that the changes are not constant for all ages. The reader is referred to Portier et al. (2007) for equations suggested by the authors to be used when performing risk assessments where shifts and changes in body weight distributions need factoring in.

The advantages of this study are that it represents the U.S. general population, it provides distribution data, and can be used for trend analysis. In addition, the data are provided for both genders and for single-year age groups. The study results are also based on a large sample size.



#### **8.4.9 Kahn and Stralka, 2008 - Estimated daily average per capita water ingestion by child and adult age categories based on USDA's 1994-96 and 1998 Continuing Survey of Food Intakes**

As part of an analysis of water ingestion, Kahn and Stralka (2008) provided body weight distributions for children. The analysis was based on self reported body weights from the 1994 - 1996, 1998 Continuing Survey of Food Intake Among Individuals (CSFII). The average body weight across all individuals was 65 kilograms. According to Kahn and Stralka (2008), 10 kilograms, which is often used as the default body weight for babies, is the 95<sup>th</sup> value of the distribution of body weight for children in the 3 to <6 months category. The median weight is 9 kilograms for the 6 to 12 month age category and 11 kilograms for the 1 to 2 year old category (Kahn and Stralka, 2008). The body weight distributions are presented in Table 8-24 and the intervals around the mean and 90<sup>th</sup> and 95<sup>th</sup> percentiles are presented in Table 8-25.

The advantages of the study are its large sample size and that it is representative of the U.S. population for the age groups presented. A limitation of the study is that the data are based on self reporting from the participants.

### **8.5 RELEVANT FETAL WEIGHT STUDIES**

#### **8.5.1 Brenner et al., 1976 - A Standard of Fetal Growth for the United States of America**

Brenner et al. (1976) determined fetal weights for 430 fetuses aborted at 8 to 20 weeks of gestation and for 30,772 liveborn infants delivered at 21 to 44 weeks of gestation. Gestational age for the aborted fetuses was determined through a combination of the physician's estimate of uterine size and the patient's stated last normal menstrual period. Data were not used when these two estimates differed by more than 2 weeks. To determine fetal growth, the fetuses were weighed and measured (crown-to-rump and crown-to-heel lengths). All abortions were legally performed at Memorial Hospital, University of North Carolina at Chapel Hill from 1972 to 1975. For the liveborn infants, data were analyzed from single birth deliveries with the infant living at the onset of labor, among pregnancies not complicated by pre-eclampsia,

diabetes or other disorders. Infants were weighed on a balance scale immediately after delivery. The liveborn infants were delivered at MacDonald House, University Hospitals of Cleveland, Ohio from 1962 to 1969.

Percentiles for fetal weight were calculated from the data at each week of gestation and are shown in Table 8-26. The resulting percentile curves were smoothed with two-point weighted means. Variables associated with significant differences in fetal weight in the latter part of pregnancy (after 34-38 weeks of gestation) included maternal parity and race, and fetal gender.

The advantage of this study is the large sample size. Limitations of the study are that the data were collected more than 30 years ago in only two U.S. states. In addition, a number of variables which may affect fetal weight (i.e., maternal smoking, disease, nutrition, and addictions) were not evaluated in this study.

#### **8.5.2 Doubilet et al., 1997 - Improved Birth Weight Table for Neonates Developed from Gestations Dated by Early Ultrasonography**

Doubilet et al. (1997) matched a database of obstetrical ultrasonograms over a period of 5 years from 1988 to 1993 to birth records for 3,718 infants (1,857 males and 1,861 females). The study population included 1,514 Whites, 770 Blacks, 1,256 Hispanics, and 178 who were either unclassified, or classified as "other." Birth weights were obtained from hospital records and a gestational age was assigned based on the earliest first trimester sonogram. The database was screened for possible outliers, defined as infants with birth weights that exceeded 5000 grams. Labor and delivery records and mother-infant medical records were retrieved to correct any errors in data entry for infants with birth weights exceeding 5000 grams. The mean gestational age at initial sonogram was  $9.5 \pm 2.3$  weeks. Regression analysis techniques were used to derive weight tables for neonates at each gestational age for 25 weeks of gestation onward. Weights for each gestational age were found to conform to a natural logarithm distribution. Polynomial equations were derived from the regression analysis to estimate mean weight by gestational age for males, females, and males and females combined. Table 8-27 provides the distribution of neonatal weights by gestational age from 25 weeks of gestation onward.



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**8.6 REFERENCES FOR CHAPTER 8**

- Brenner, W.E.; Edelman, D.A.; Hendricks, C.H. (1976) A standard of fetal growth for the United States of America. *Am J Obstet Gynecol* 1:126(5):555-64.
- Burmaster, D.E.; Crouch, E.A.C. (1997) Lognormal distributions for body weight as a function of age for males and females in the United States, 1976-1980. *Risk Anal* 17(4):499-505.
- Doubilet, P.M.; Benson, C.B.; Nadel, A.S.; Ringer, S.A. (1997) Improved birth weight table for neonates developed from gestations dated by early ultrasonography. *J Ultrasound Med* 16:241-249.
- Freedman, D.; Kettel, K.; Serdula, M.; Ogden, C.; Dietz, W. (2006) Racial and ethnic differences in secular trends for childhood BMI, weight, and height. *Obesity* 14(2):301:307.
- Kahn, H.; Stralka, K. (2008) Estimated daily average per capita water ingestion by child and adult age categories based on USDA's 1994-96 and 1998 continuing survey of food intakes (CSFII). *J Expo Sci Environ Epidemiol* (2008) 1-9.
- Kuczumarski, R.J.; Ogden, C.L.; Guo, S.S.; Grummer-Strawn, L.; Flegal, K., et al. (2000) CDC growth charts for the United States: methods and development. National Center for Health Statistics. *Vital Health Stat.* 11(246)2002.
- LSRO (1995) Third report on nutrition monitoring in the United States: Volume 1. Prepared by: Federation of American Societies for Experimental Biology, Life Sciences Research Office for the Interagency Board for Nutrition Monitoring and Related Research. Washington, D.C.: U.S. Government Printing Office.
- Martin, J.; Hamilton, B.; Sutton, P.; Ventura, S.; Fay, M.; et al. (2007) Births: final data for 2005. CDC National Vital Statistics Report, Volume 56. No. 6.
- National Center for Health Statistics (NCHS). (1987) Anthropometric reference data and prevalence of overweight, United States, 1976-80. Data from the National Health and Nutrition Examination Survey, Series 11, No. 238. Hyattsville, MD: U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics. DHHS Publication No. (PHS) 87-1688.
- Ogden, C.L.; Fryar, C.D.; Carroll, M.D.; Flegal, K. M. (2004) Mean Body Weight, Height, and Body Mass Index, United States 1960-2002. Advance Data from Vital and Health Statistics, No. 347, October 27, 2004. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Portier K.; Tolson, J.; Roberts, S. (2007) Body weight distributions for risk assessment. *Risk Anal* 27(1)11-26.
- U.S. EPA (1989) Risk assessment guidance for Superfund, Volume I: Human health evaluation manual. Washington, DC: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA/540/1-89/002.
- U.S. EPA (2000) Memorandum entitled: Body weight estimates on NHANES III data, revised, Contract 68-C-99-242, Work Assignment 0-1 from Bob Clickner, Westat Inc. to Helen Jacobs, U.S. EPA dated March 3, 2000.
- U.S. EPA (2005) Guidance on selecting age groups for monitoring and assessing childhood exposures to environmental contaminants (2005). Washington, D.C.: U.S. Environmental Protection Agency, EPA/630/P-03/003F.



Table 8-3. Mean and Percentile Body Weights (kilograms) Derived from NHANES 1999-2006, Males and Females Combined

Age Group	N	Mean	Percentiles								
			5 <sup>th</sup>	10 <sup>th</sup>	15 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	85 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
Birth to <1 month	158	4.8	3.6	3.9	4.1	4.2	4.8	5.1	5.5	5.8	6.2
1 to <3 months	284	5.9	4.5	4.7	4.9	5.2	5.9	6.6	6.9	7.1	7.3
3 to <6 months	489	7.4	5.7	6.1	6.3	6.7	7.3	8.0	8.4	8.7	9.1
6 to <12 months	927	9.2	7.1	7.5	7.9	8.3	9.1	10.1	10.5	10.8	11.3
1 to <2 years	1176	11.4	8.9	9.3	9.7	10.3	11.3	12.4	13.0	13.4	14.0
2 to <3 years	1144	13.8	10.9	11.5	11.9	12.4	13.6	14.9	15.8	16.3	17.1
3 to <6 years	2318	18.6	13.5	14.4	14.9	15.8	17.8	20.3	22.0	23.6	26.2
6 to <11 years	3593	31.8	19.7	21.3	22.3	24.4	29.3	36.8	42.1	45.6	52.5
11 to <16 years	5297	56.8	34.0	37.2	40.6	45.0	54.2	65.0	73.0	79.3	88.8
16 to <21 years	4851	71.6	48.2	52.0	54.5	58.4	67.6	80.6	90.8	97.7	108.0

Source: U.S. EPA Analysis of NHANES 1999-2006 data.



**Chapter 8 - Body Weight**

Table 8-4. Mean and Percentile Body Weights (kilograms) for Males Derived from NHANES 1999-2006

Age Group	N	Mean	Percentiles								
			5 <sup>th</sup>	10 <sup>th</sup>	15 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	85 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
Birth to <1 month	88	4.9	3.6	3.6	4.0	4.4	4.8	5.5	5.8	6.2	6.8
1 to <3 months	153	6.0	4.6	5.0	5.1	5.4	6.1	6.8	7.0	7.2	7.3
3 to <6 months	255	7.6	5.9	6.4	6.6	6.9	7.5	8.2	8.6	8.8	9.1
6 to <12 months	472	9.4	7.3	7.9	8.2	8.5	9.4	10.3	10.6	10.8	11.5
1 to <2 years	632	11.6	9.0	9.7	10.0	10.5	11.5	12.6	13.2	13.5	14.3
2 to <3 years	558	14.1	11.4	12.0	12.2	12.8	14.0	15.2	15.9	16.4	17.0
3 to <6 years	1158	18.8	13.5	14.4	14.9	15.9	18.1	20.8	22.6	23.8	26.2
6 to <11 years	1795	31.9	20.0	21.8	22.9	24.8	29.6	36.4	41.2	45.2	51.4
11 to <16 years	2593	57.6	33.6	36.3	38.9	44.2	55.5	66.5	75.5	81.2	91.8
16 to <21 years	2462	77.3	54.5	57.6	60.0	63.9	73.1	86.0	96.8	104.0	113.0

Source: U.S. EPA Analysis of NHANES 1999-2006 data.

Table 8-5. Mean and Percentile Body Weights (kilograms) for Females Derived from NHANES 1999-2006

Age Group	N	Mean	Percentiles								
			5 <sup>th</sup>	10 <sup>th</sup>	15 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	85 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
Birth to <1 month	70	4.6	3.6	4.0	4.1	4.2	4.6	4.9	5.0	5.2	5.9
1 to <3 months	131	5.7	4.3	4.6	4.74	5.1	5.5	6.4	6.6	6.9	7.3
3 to <6 months	234	7.2	5.5	5.9	6.2	6.4	7.2	7.9	8.2	8.4	9.0
6 to <12 months	455	9.0	7.1	7.3	7.6	8.0	8.9	9.8	10.3	10.6	11.2
1 to <2 years	544	11.1	8.7	9.1	9.4	10.0	11.1	12.2	12.9	13.2	13.7
2 to <3 years	586	13.5	10.5	11.0	11.5	12.1	13.2	14.6	15.5	16.2	17.1
3 to <6 years	1160	18.3	13.5	14.3	14.7	15.6	17.5	19.7	21.3	23.2	26.2
6 to <11 years	1798	31.7	19.3	20.9	22.0	23.9	29.0	37.3	43.1	46.7	53.4
11 to <16 years	2704	55.9	34.9	38.6	41.6	45.7	53.3	62.8	70.7	76.5	86.3
16 to <21 years	2389	65.9	46.2	48.6	51.1	54.5	61.5	73.3	83.4	89.9	99.7

Source: U.S. EPA Analysis of NHANES 1999-2006 data.



Table 8-6. Weight in Kilograms for Males 2 Months-19 Years of Age– Number Examined, Mean, and Selected Percentiles, by Age Category: United States, 1976-1980<sup>a</sup>

Age Group	Number of Persons Examined	Mean (kg)	Percentiles								
			5 <sup>th</sup>	10 <sup>th</sup>	15 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	85 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
Birth to <1 month	-	-	-	-	-	-	-	-	-	-	-
1 to <2 months	-	-	-	-	-	-	-	-	-	-	-
2 to <3 months	103	6.6	5.3	5.5	5.7	5.9	6.8	7.2	7.6	7.8	8.4
3 to <6 months	287	7.7	6.3	6.6	6.7	7.0	7.7	8.4	8.9	9.2	9.6
6 to <12 months	589	9.4	7.5	7.9	8.1	8.6	9.4	10.2	10.6	10.9	11.4
1 to <2 years	613	11.7	9.4	9.8	10.1	10.8	11.7	12.6	13.1	13.7	14.5
2 to <3 years	627	13.7	11.4	11.8	12.2	12.6	13.6	14.6	15.2	15.8	16.5
3 to <6 years	1556	18.0	13.7	14.6	14.9	15.7	17.5	19.7	21.0	22.0	24.0
6 to <11 years	1373	30.7	19.5	21.1	22.1	24.0	28.5	35.2	40.5	43.5	48.7
11 to <16 years	1037	55.2	34.0	36.5	38.7	42.8	53.0	63.0	69.4	74.8	84.3
16 to <21 years	890	71.8	54.1	56.6	58.3	61.8	68.7	77.9	84.3	89.7	101.0
<sup>a</sup>	Includes clothing weight, estimated as ranging from 0.09 to 0.28 kilogram.										
-	No data available for infants less than two months old.										
Source:	National Center for Health Statistics, 1987.										



Table 8-7. Weight in Kilograms for Females 6 Months-19 Years of Age– Number Examined, Mean, and Selected Percentiles, by Age Category: United States, 1976-1980<sup>a</sup>

Age Group	Number of Persons Examined	Mean (kg)	Percentiles								
			5 <sup>th</sup>	10 <sup>th</sup>	15 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	85 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
Birth to <1 month	-	-	-	-	-	-	-	-	-	-	-
1 to <2 months	-	-	-	-	-	-	-	-	-	-	-
2 to <3 months	131	6.0	4.7	5.1	5.2	5.6	6.0	6.5	7.1	7.3	7.8
3 to <6 months	269	7.1	5.8	5.9	6.1	6.4	7.1	7.7	7.9	8.4	8.7
6 to <12 months	574	8.8	7.2	7.5	7.7	8.0	8.7	9.4	10.1	10.4	10.8
1 to <2 years	617	11.0	9.1	9.4	9.6	9.9	10.9	11.9	12.6	12.9	13.4
2 to <3 years	597	13.4	10.8	11.2	11.6	12.1	13.2	14.6	15.4	15.6	16.3
3 to <6 years	1658	18.0	13.3	14.0	14.5	15.4	17.2	19.7	21.1	22.6	25.1
6 to <11 years	1321	30.6	19.0	20.5	21.3	23.4	28.9	35.0	39.6	44.3	50.2
11 to <16 years	1144	53.2	34.1	37.2	40.4	45.2	51.6	60.0	67.2	70.6	78.2
16 to <21 years	1001	62.2	46.7	48.2	49.7	52.2	58.9	68.3	74.7	80.8	92.6
<sup>a</sup>	Includes clothing weight, estimated as ranging from 0.09 to 0.28 kilogram.										
-	No data available for infants less than two months old.										
Source: National Center for Health Statistics, 1987.											



Table 8-8. Statistics for Probability Plot Regression Analyses:  
Females Body Weights 6 Months to 20 Years of Age

Age Midpoint (years)	Lognormal Probability Plots Linear Curve	
	$\mu_2^a$	$\sigma_2^a$
0.75	2.16	0.145
1.5	2.38	0.129
2.5	2.56	0.112
3.5	2.69	0.136
4.5	2.83	0.134
5.5	2.98	0.164
6.5	3.10	0.174
7.5	3.19	0.174
8.5	3.31	0.156
9.5	3.46	0.214
10.5	3.57	0.199
11.5	3.71	0.226
12.5	3.82	0.213
13.5	3.92	0.215
14.5	3.99	0.187
15.5	4.00	0.156
16.5	4.05	0.167
17.5	4.08	0.165
18.5	4.07	0.147
19.5	4.10	0.149

<sup>a</sup>  $\mu_2$ ,  $\sigma_2$  - correspond to the mean and standard deviation, respectively, of the lognormal distribution of body weight (kg).

Source: Burmaster and Crouch, 1997.



Table 8-9. Statistics for Probability Plot Regression Analyses:  
Males Body Weights 6 Months to 20 Years of Age

Age Midpoint (years)	Lognormal Probability Plots Linear Curve	
	$\mu_2^a$	$\sigma_2^a$
0.75	2.23	0.132
1.5	2.46	0.119
2.5	2.60	0.120
3.5	2.75	0.114
4.5	2.87	0.133
5.5	2.98	0.138
6.5	3.13	0.145
7.5	3.21	0.151
8.5	3.33	0.181
9.5	3.43	0.165
10.5	3.59	0.195
11.5	3.69	0.252
12.5	3.78	0.224
13.5	3.88	0.215
14.5	4.02	0.181
15.5	4.09	0.159
16.5	4.20	0.168
17.5	4.19	0.167
18.5	4.25	0.159
19.5	4.26	0.154

<sup>a</sup>  $\mu_2$ ,  $\sigma_2$  - correspond to the mean and standard deviation, respectively, of the lognormal distribution of body weight (kg).

Source: Burmaster and Crouch, 1997.



Table 8-10. Body Weight Estimates (kilograms) by Age and Gender, U.S. Population Derived From NHANES III (1988-94)

Age Group	Sample Size	Population	Male and Female		Male		Female	
			Median	Mean	Median	Mean	Median	Mean
2 to 6 months	1,020	1,732,702	7.4	7.4	7.6	7.7	7.0	7.0
7 to 12 months	1,072	1,925,573	9.4	9.4	9.7	9.7	9.1	9.1
1 year	1,258	3,935,114	11.3	11.4	11.7	11.7	10.9	11.0
2 years	1,513	4,459,167	13.2	12.9	13.5	13.1	13.0	12.5
3 years	1,309	4,317,234	15.3	15.1	15.5	15.2	15.1	14.9
4 years	1,284	4,008,079	17.2	17.1	17.2	17.0	17.3	17.2
5 years	1,234	4,298,097	19.6	19.4	19.7	19.3	19.6	19.4
6 years	750	3,942,457	21.3	21.7	21.5	22.1	20.9	21.3
7 years	736	4,064,397	25.0	25.5	25.4	25.5	24.1	25.6
8 years	711	3,863,515	27.4	28.1	27.2	28.4	27.9	27.9
9 years	770	4,385,199	31.8	32.7	32.0	32.3	31.1	33.0
10 years	751	3,991,345	35.2	35.6	35.9	36.0	34.3	35.2
11 years	754	4,270,211	40.6	41.5	38.8	40.0	43.4	42.8
12 years	431	3,497,661	47.2	46.9	48.1	49.1	45.7	48.6
13 years	428	3,567,181	53.0	55.1	52.6	54.5	53.7	55.9
14 years	415	4,054,117	56.9	61.1	61.3	64.5	53.7	57.9
15 years	378	3,269,777	59.6	62.8	62.6	66.9	57.1	59.2
16 years	427	3,652,041	63.2	65.8	66.6	69.4	56.3	61.6
17 years	410	3,719,690	65.1	67.5	70.0	72.4	60.7	62.2
1 and older	31,311	251,097,002	66.5	64.5	73.9	89.0	80.8	80.3
1 to 3 years	4,080	12,711,515	13.2	13.1	13.4	13.4	13.0	12.9
1 to 14 years	12,344	56,653,796	24.9	29.9	25.1	30.0	24.7	29.7
15 to 44 years	10,393	118,430,653	70.8	73.5	77.5	80.2	63.2	67.3

Source: U.S. EPA, 2000.



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**Chapter 8 - Body Weight**

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Table 8-11. Body Weight Estimates (in kilograms) by Age, U.S. Population Derived From NHANES III (1988-94)					
Age Group	Sample Size	Population	Male and Female		
			Median	Mean	95% CI
2 Months	243	408,837	6.3	6.3	6.1-6.4
3 Months	190	332,823	7.0	6.9	6.7-7.1
3 Months and Younger	433	741,660	6.6	6.6	6.4-6.7
CI = Confidence Interval.					
Source: U.S. EPA, 2000.					



Table 8-12. Observed Mean, Standard Deviation and Selected Percentiles for Weight (kilograms) by Gender and Age: Birth to 36 Months

Age Group	Mean	SD	Percentile					
			10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
<b>Boys</b>								
Birth	3.4	0.6	2.7	3.1	3.4	3.8	4.1	4.3
0 < 1 months	-	-	-	-	-	-	-	-
1 < 2 months	-	-	-	-	-	-	-	-
2 < 3 months	6.5	0.8	5.6	5.8	6.7	6.9	7.4	7.5
3 < 4 months	7.0	0.9	5.9	6.5	7.0	7.5	8.2	8.5
4 < 5 months	7.2	0.8	6.3	6.7	7.2	7.7	8.0	8.4
5 < 6 months	7.9	0.9	6.7	7.5	7.8	8.6	9.4	9.6
6 < 7 months	8.4	1.1	7.3	7.6	8.4	9.0	10.2	10.7
7 < 8 months	8.6	1.1	7.1	7.8	8.6	9.5	10.1	10.4
8 < 9 months	9.3	1.1	7.9	8.6	9.2	10.1	10.5	11.0
9 < 10 months	9.3	0.9	8.2	8.6	9.3	10.0	10.8	10.9
10 < 11 months	9.5	1.1	8.3	8.7	9.3	10.1	11.3	11.5
11 < 12 months	10.0	1.0	8.7	9.5	10.0	10.6	11.1	11.6
12 < 15 months	10.6	1.2	9.2	9.8	10.6	11.3	12.1	12.4
15 < 18 months	11.4	1.9	9.9	10.5	11.3	12.0	12.8	13.5
18 < 21 months	12.1	1.5	10.4	11.0	11.9	12.7	13.9	15.5
21 < 24 months	12.4	1.3	10.9	11.6	12.4	13.1	14.4	14.7
24 < 30 months	13.1	1.7	11.3	12.1	12.9	14.1	15.1	15.9
30 < 36 months	14.0	1.5	12.0	13.0	13.8	14.7	16.0	16.6
<b>Girls</b>								
Birth	3.3	0.5	2.6	3.0	3.3	3.6	3.9	4.1
0 < 1 months	-	-	-	-	-	-	-	-
1 < 2 months	-	-	-	-	-	-	-	-
2 < 3 months	5.4	0.5	4.8	5.0	5.6	5.9	6.0	-
3 < 4 months	6.3	0.7	5.6	5.8	6.3	6.8	7.4	7.8
4 < 5 months	6.7	0.9	5.8	6.1	6.6	7.4	8.0	8.3
5 < 6 months	7.3	0.9	6.3	6.7	7.1	7.7	8.5	8.8
6 < 7 months	7.7	0.8	6.6	7.1	7.6	8.1	8.9	9.0
7 < 8 months	8.0	1.4	6.7	7.4	7.8	8.6	9.4	9.8
8 < 9 months	8.3	0.9	7.3	7.8	8.3	8.9	9.4	9.8
9 < 10 months	8.9	0.9	7.8	8.1	8.7	9.4	10.1	10.5
10 < 11 months	9.0	1.1	7.8	8.4	9.0	9.5	10.4	10.9
11 < 12 months	9.3	1.0	7.9	8.6	9.2	10.1	10.6	10.9
12 < 15 months	9.8	1.1	8.5	9.1	9.8	10.4	11.3	11.6
15 < 18 months	10.4	1.1	9.1	9.7	10.3	11.2	11.8	12.0
18 < 21 months	11.1	1.4	9.6	10.2	11.0	11.9	12.8	13.5
21 < 24 months	11.8	1.3	10.1	10.9	11.8	12.8	13.5	13.9
24 < 30 months	12.5	1.5	10.8	11.5	12.4	13.3	14.5	15.1
30 < 36 months	13.6	1.7	11.8	12.5	13.4	14.52	15.7	16.4
- No data available.								
Source: Kuczmarski et al. 2002.								



CDC Growth Charts: United States

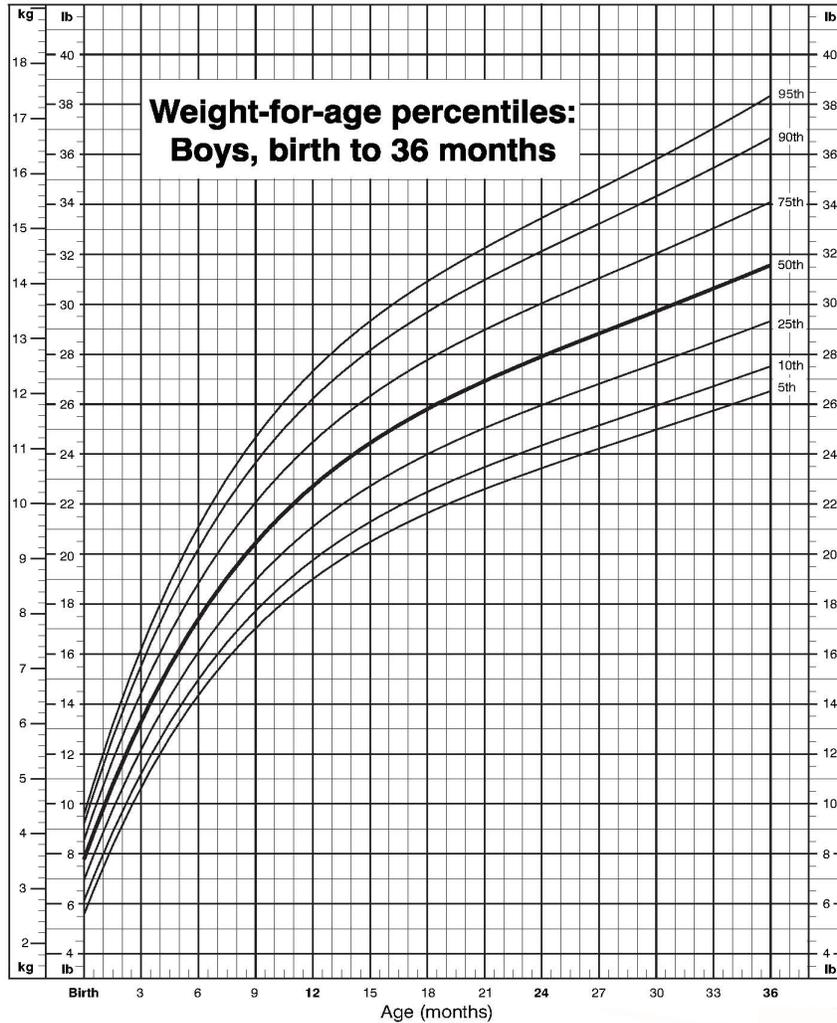


Figure 8-1. Weight by Age Percentiles for Boys Aged Birth to 36 Months

Source: Kuczmarski et al., 2002.



CDC Growth Charts: United States

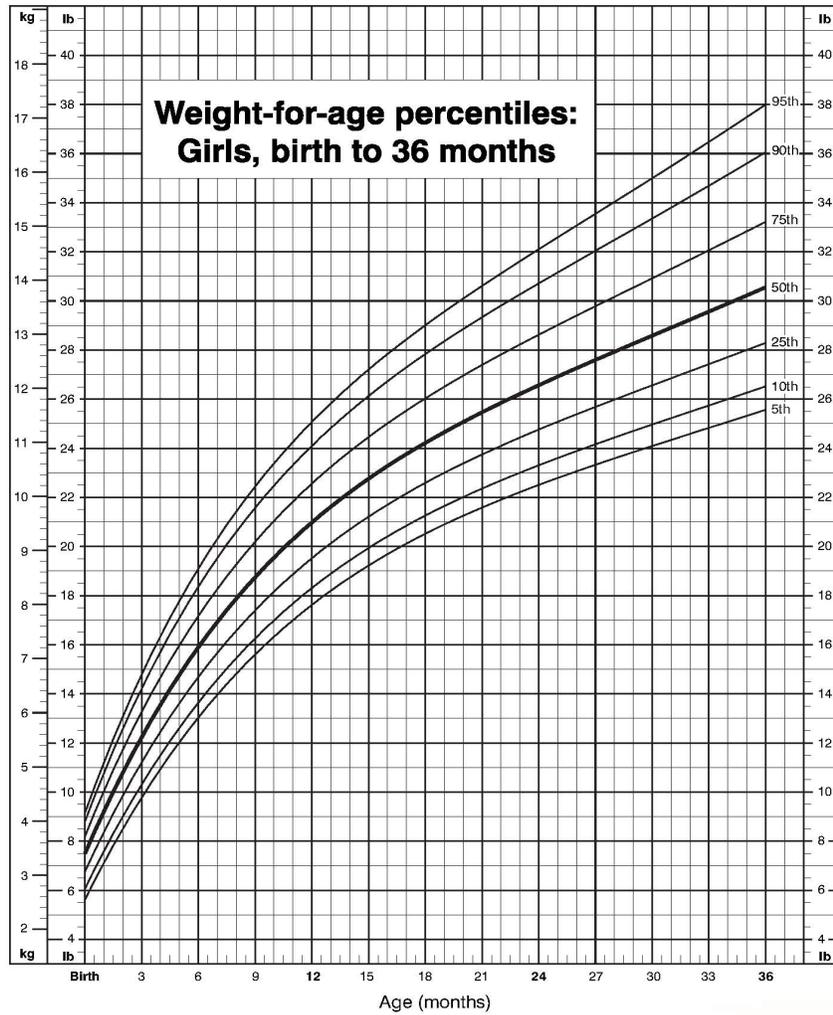


Figure 8-2. Weight by Age Percentiles for Girls Aged Birth to 36 Months

Source: Kuczmarski et al., 2002.



CDC Growth Charts: United States

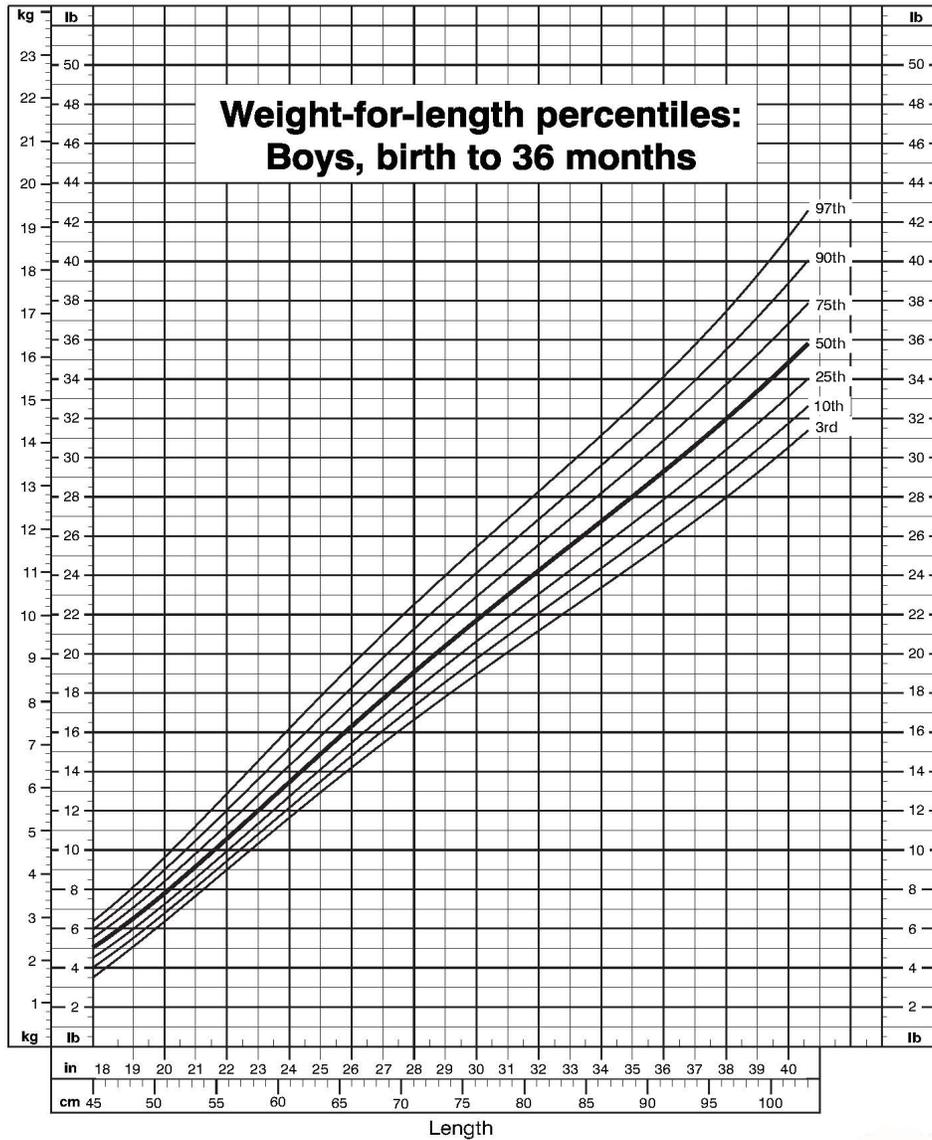


Figure 8-3. Weight by Length Percentiles for Boys Aged Birth to 36 Months

Source: Kuczmarski et al., 2002.



CDC Growth Charts: United States

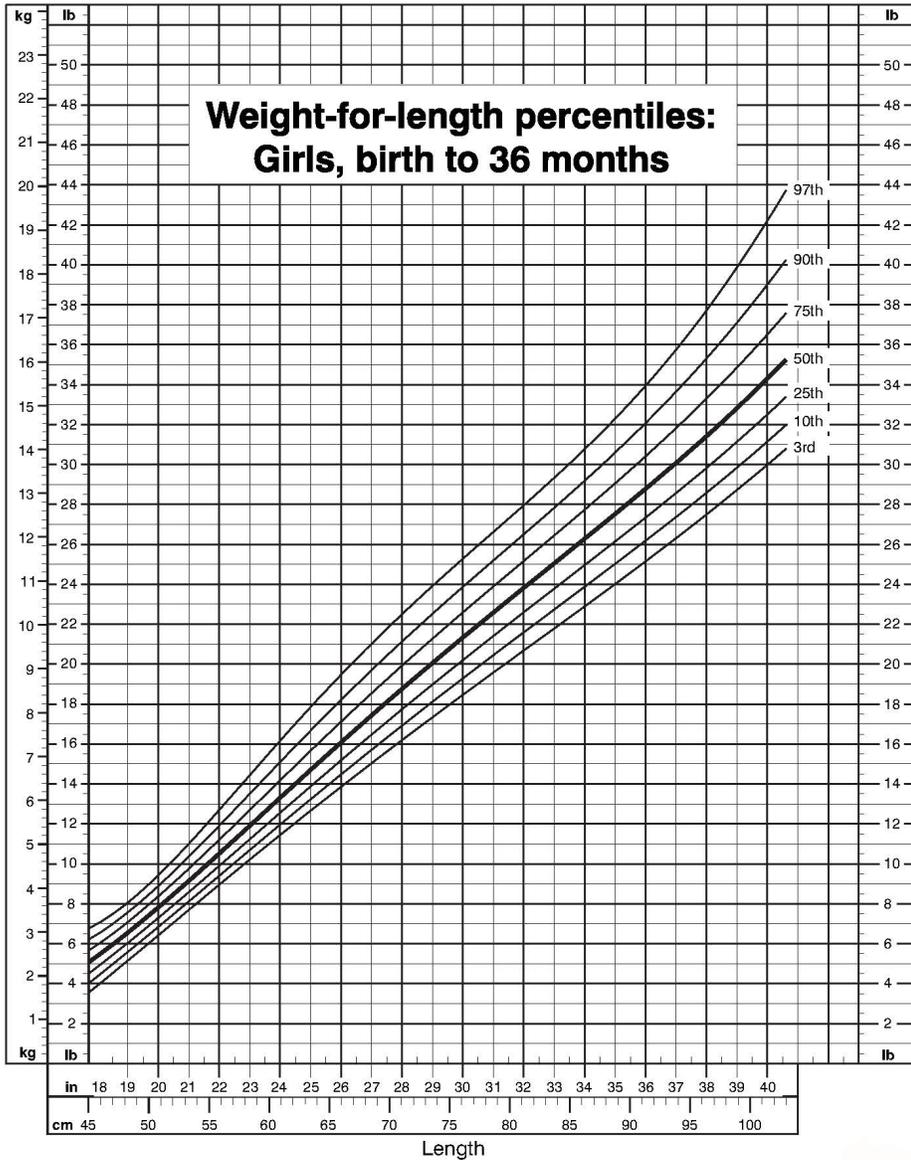


Figure 8-4. Weight by Length Percentiles for Girls Aged Birth to 36 Months

Source: Kuczmarski et al., 2002.



CDC Growth Charts: United States

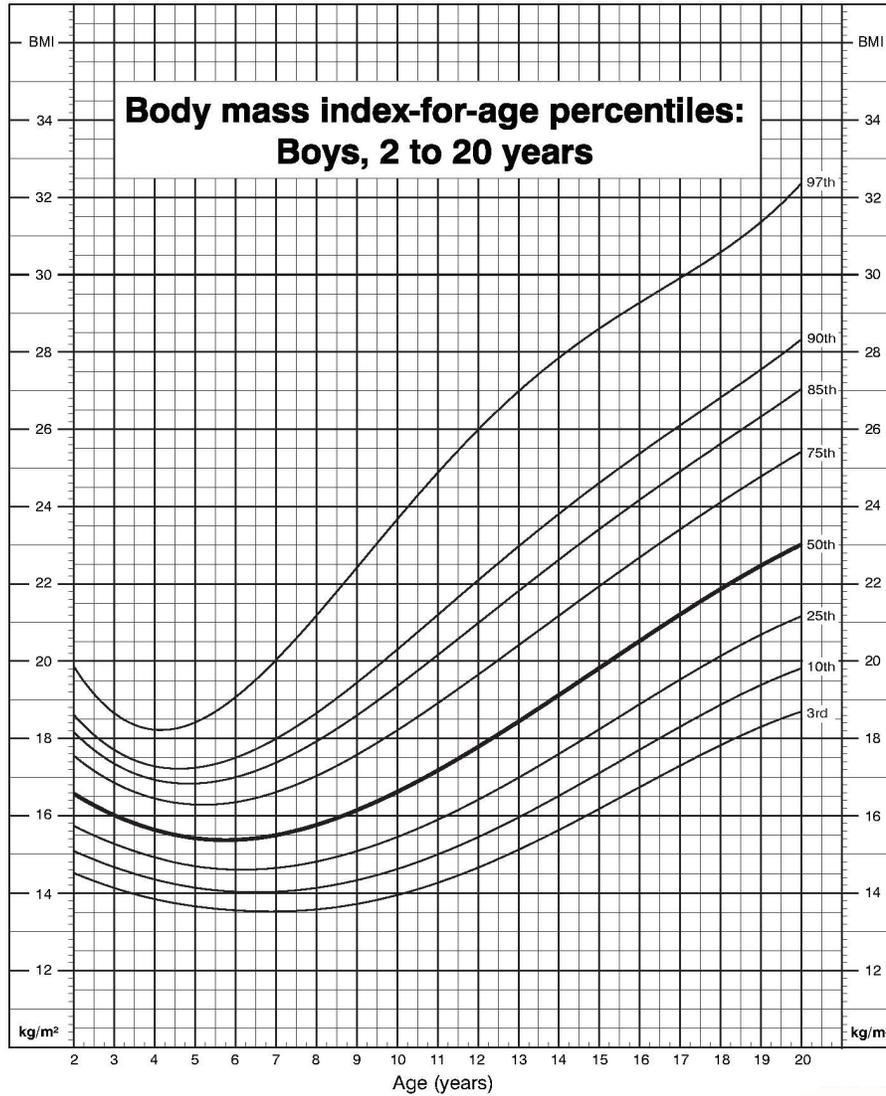


Figure 8-5. Body Mass Index-for-Age Percentiles: Boys, 2 to 20 Years

Source: Kuczmarski et al., 2002.



CDC Growth Charts: United States

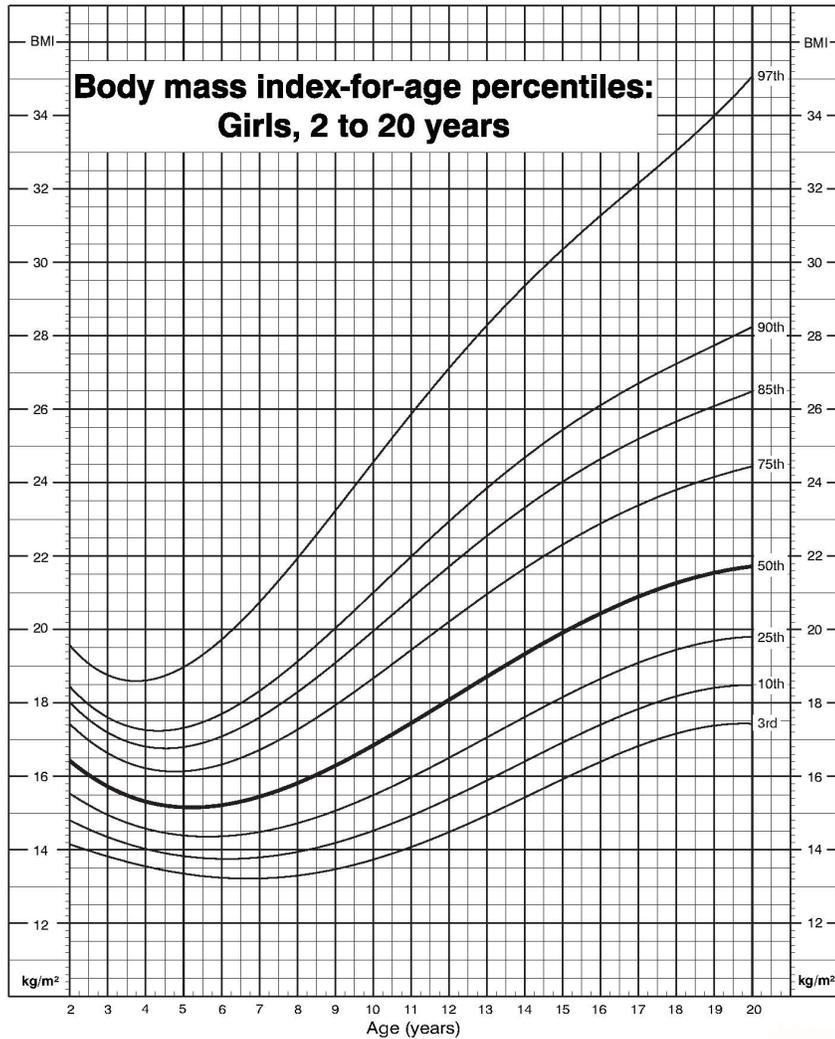


Figure 8-6. Body Mass Index-for-Age Percentiles: Girls, 2 to 20 Years

Source: Kuczmarski et al., 2002.



Table 8-13. Mean Body Weight (kilograms) by Age and Gender Across Multiple Surveys

Gender and Age (years)	NHES II, 1963-65			NHES III, 1966-70			NHANES I, 1971-74			NHANES II, 1976-80			NHANES III, 1988-94			NHANES 1999-2002		
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE
<b>Male</b>																		
2	-	-	-	-	-	-	298	13.6	0.2	370	13.4	0.1	644	13.6	0.1	262	13.7	0.1
3	-	-	-	-	-	-	308	15.6	0.1	421	15.5	0.1	516	15.8	0.2	216	15.9	0.2
4	-	-	-	-	-	-	304	17.7	0.1	405	17.6	0.1	549	17.6	0.2	179	18.5	0.2
5	-	-	-	-	-	-	273	20.2	0.2	393	19.7	0.1	497	20.1	0.2	147	21.3	0.5
6	575	22.0	0.1	-	-	-	179	22.0	0.3	146	22.8	0.4	283	23.2	0.6	182	23.5	0.4
7	632	24.7	0.2	-	-	-	164	24.9	0.4	150	24.9	0.4	269	26.3	0.4	185	27.2	0.4
8	618	27.8	0.2	-	-	-	152	26.4	0.3	145	28.0	0.6	266	30.2	0.8	214	32.7	1.0
9	603	31.2	0.4	-	-	-	169	31.6	0.8	141	30.7	0.6	281	34.4	1.0	174	36.0	0.7
10	576	33.7	0.3	-	-	-	184	34.2	0.6	165	36.2	0.7	297	37.3	0.9	187	38.6	0.8
11	595	38.2	0.3	-	-	-	178	38.8	0.8	153	39.7	0.9	281	42.5	0.9	182	43.7	1.1
12	-	-	-	643	42.9	0.4	200	44.0	0.8	147	44.1	1.0	203	49.1	1.1	299	50.4	1.3
13	-	-	-	626	50.0	0.5	174	49.9	1.0	165	49.5	1.2	187	54.0	1.0	298	53.9	1.9
14	-	-	-	618	56.7	0.6	174	56.3	0.9	188	56.4	0.9	188	64.1	3.6	266	63.9	1.6
15	-	-	-	613	61.6	0.4	171	60.3	1.2	180	61.2	1.0	187	66.9	1.9	283	68.3	1.1
16	-	-	-	556	64.8	0.6	169	66.9	1.3	180	66.5	1.2	194	68.7	1.6	306	74.4	1.4
17	-	-	-	458	68.1	0.4	176	68.6	1.1	183	66.7	0.8	196	72.9	1.3	313	75.6	1.4
18	-	-	-	-	-	-	124	74.3	1.3	156	71.1	1.2	176	71.3	1.7	284	75.6	1.1
19	-	-	-	-	-	-	136	72.6	1.3	150	71.8	0.8	168	73.0	2.2	270	78.2	1.3
<b>Female</b>																		
2	-	-	-	-	-	-	272	13.0	0.1	330	12.8	0.1	624	13.2	0.1	248	13.3	0.1
3	-	-	-	-	-	-	292	15.0	0.2	367	14.8	0.1	587	15.4	0.1	178	15.2	0.2
4	-	-	-	-	-	-	281	16.8	0.2	388	16.8	0.2	537	17.9	0.3	191	17.9	0.3
5	-	-	-	-	-	-	314	19.7	0.3	369	19.4	0.3	554	20.2	0.2	186	20.6	0.6
6	536	21.5	0.2	-	-	-	176	21.6	0.3	150	21.9	0.4	272	22.6	0.6	171	22.4	0.5
7	609	24.2	0.2	-	-	-	169	24.3	0.4	154	24.6	0.5	274	26.4	0.8	196	25.9	0.5
8	613	27.5	0.2	-	-	-	152	27.5	0.5	125	27.5	0.4	248	29.9	0.6	184	31.9	1.2
9	581	31.4	0.4	-	-	-	171	32.0	0.6	154	31.7	0.7	280	34.4	1.2	183	35.4	0.7
10	584	35.2	0.4	-	-	-	197	33.8	0.6	128	35.7	0.6	258	37.9	1.2	164	40.0	1.0
11	525	39.8	0.4	-	-	-	166	41.2	0.8	143	41.4	0.9	275	44.1	1.1	194	47.9	1.3
12	-	-	-	547	46.6	0.4	177	46.7	1.0	146	46.1	0.9	236	49.0	1.2	316	52.0	1.1
13	-	-	-	582	50.5	0.5	198	51.8	1.0	155	50.9	1.2	220	55.8	1.6	321	57.7	1.4
14	-	-	-	586	54.2	0.4	184	54.6	1.0	181	54.3	1.0	218	58.5	1.4	324	59.9	1.0
15	-	-	-	503	56.5	0.5	167	56.6	0.9	144	55.0	0.8	191	58.1	1.1	266	61.1	1.7
16	-	-	-	536	58.1	0.7	171	56.8	1.1	167	57.7	0.9	208	61.3	1.4	273	63.0	1.2
17	-	-	-	442	57.6	0.6	150	59.5	1.6	134	59.6	1.0	201	62.4	1.2	256	61.7	1.2
18	-	-	-	-	-	-	141	58.2	1.1	156	59.0	1.0	175	61.2	1.9	243	65.2	1.5
19	-	-	-	-	-	-	130	59.5	1.4	158	59.8	1.0	177	63.2	1.9	225	67.9	1.2
-	Data not available.																	
N	= Number of individuals.																	
SE	= Standard error.																	
Source:	Ogden et al., 2004.																	



Table 8-14. Mean Height (centimeters) by Age and Gender Across Multiple Surveys

Gender and Age (years)	NHES II, 1963-65			NHES III, 1966-70			NHANES I, 1971-74			NHANES II, 1976-80			NHANES III, 1988-94			NHANES 1999-2002		
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE
<b>Male</b>																		
2	-	-	-	-	-	-	298	91.1	0.4	350	91.1	0.2	589	90.9	0.2	254	91.2	0.3
3	-	-	-	-	-	-	308	98.5	0.3	421	98.7	0.3	513	98.8	0.3	222	98.6	0.3
4	-	-	-	-	-	-	304	106.0	0.3	405	105.5	0.4	551	105.2	0.4	183	106.5	0.4
5	-	-	-	-	-	-	273	112.8	0.3	393	112.3	0.3	497	112.3	0.3	156	113.0	0.5
6	575	118.9	0.2	-	-	-	179	118.1	0.6	146	119.1	0.5	283	118.9	0.7	188	119.2	0.5
7	632	124.5	0.3	-	-	-	164	125.0	0.5	150	124.5	0.5	270	125.9	0.6	187	126.2	0.6
8	618	130.0	0.3	-	-	-	152	129.0	0.5	145	129.6	0.7	269	131.3	0.6	217	132.5	0.7
9	603	135.5	0.4	-	-	-	169	135.1	0.6	141	135.0	0.6	280	137.7	0.7	177	138.1	0.4
10	576	140.2	0.3	-	-	-	184	140.0	0.5	165	141.3	0.6	297	142.0	1.1	188	141.4	0.6
11	595	145.5	0.3	-	-	-	178	146.3	0.7	153	145.5	0.6	285	147.4	0.7	187	148.7	0.9
12	-	-	-	643	152.3	0.4	200	152.8	0.7	147	152.5	0.7	207	155.5	1.1	301	154.8	0.7
13	-	-	-	626	159.8	0.4	174	159.3	0.8	165	158.3	0.8	190	161.6	0.8	298	160.1	0.8
14	-	-	-	618	166.7	0.5	174	166.7	0.6	188	166.8	0.6	191	169.0	0.9	267	168.5	0.9
15	-	-	-	613	171.4	0.3	171	170.8	0.9	180	171.2	0.7	188	172.8	1.0	287	173.8	0.6
16	-	-	-	556	174.3	0.4	169	175.0	0.8	180	173.4	0.5	197	175.0	0.9	310	175.3	0.6
17	-	-	-	458	175.6	0.4	176	176.9	0.5	183	174.8	0.5	196	176.5	0.9	317	175.3	0.6
18	-	-	-	-	-	-	124	176.6	0.7	156	177.3	0.6	176	177.3	1.0	289	176.4	0.7
19	-	-	-	-	-	-	136	176.5	0.9	150	176.1	0.5	169	175.5	0.6	275	176.7	0.6
<b>Female</b>																		
2	-	-	-	-	-	-	272	90.1	0.3	314	89.4	0.3	564	89.7	0.2	233	90.1	0.4
3	-	-	-	-	-	-	292	97.7	0.3	367	97.1	0.2	590	98.2	0.2	187	97.6	0.5
4	-	-	-	-	-	-	281	104.2	0.4	388	104.2	0.4	535	105.1	0.3	195	105.9	0.5
5	-	-	-	-	-	-	314	112.2	0.4	369	111.2	0.4	557	112.2	0.5	190	112.4	0.7
6	536	117.8	0.3	-	-	-	176	118.2	0.5	150	117.9	0.6	274	117.9	0.6	172	117.1	0.7
7	609	123.5	0.2	-	-	-	169	124.6	0.7	154	123.4	0.7	275	124.3	0.7	200	124.4	0.5
8	613	129.4	0.3	-	-	-	152	129.2	0.6	125	129.5	0.5	247	131.1	0.6	184	130.9	0.6
9	581	135.5	0.3	-	-	-	171	135.9	0.5	154	134.1	0.5	282	136.6	0.7	189	136.9	0.7
10	584	140.9	0.3	-	-	-	197	140.1	0.8	128	141.7	0.6	262	142.7	0.6	164	143.3	0.9
11	525	147.3	0.3	-	-	-	166	148.2	0.8	143	147.4	0.7	275	150.2	0.7	194	151.4	0.7
12	-	-	-	547	46.6	0.3	177	154.6	0.6	146	143.8	0.6	239	155.5	0.7	318	156.0	0.7
13	-	-	-	582	50.5	0.3	198	158.9	0.5	155	158.7	0.5	225	159.9	0.9	324	159.1	0.6
14	-	-	-	586	54.2	0.3	184	160.8	0.6	181	160.7	0.7	224	161.2	0.7	326	161.8	0.6
15	-	-	-	503	56.5	0.5	167	163.6	0.6	144	163.3	0.5	195	162.8	0.6	271	162.0	0.6
16	-	-	-	536	58.1	0.3	171	161.7	0.5	167	162.8	0.5	214	163.0	0.7	275	161.9	0.5
17	-	-	-	442	57.6	0.3	150	162.1	0.9	134	163.5	0.6	201	163.6	0.6	258	163.2	0.6
18	-	-	-	-	-	-	141	164.7	0.5	156	162.8	0.5	175	163.2	0.9	249	163.0	0.5
19	-	-	-	-	-	-	130	163.1	0.5	158	163.2	0.4	178	163.4	0.7	231	163.1	0.7
-	Data not available.																	
N	= Number of individuals.																	
SE	= Standard error.																	
Source:	Ogden et al., 2004.																	



Table 8-15. Mean Body Mass Index (BMI) by Age and Gender Across Multiple Surveys

Gender and Age (years)	NHES II, 1963-65			NHES III, 1966-70			NHANES I, 1971-74			NHANES II, 1976-80			NHANES III, 1988-94			NHANES 1999-2002		
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE
<b>Male</b>																		
2	-	-	-	-	-	-	298	16.3	0.1	350	16.2	0.1	588	16.5	0.1	225	16.6	0.1
3	-	-	-	-	-	-	308	16.0	0.1	421	15.9	0.1	512	16.1	0.2	209	16.2	0.1
4	-	-	-	-	-	-	304	15.7	0.1	405	15.8	0.1	547	15.9	0.1	178	16.3	0.2
5	-	-	-	-	-	-	273	15.6	0.1	393	15.6	0.1	495	15.9	0.1	147	16.5	0.3
6	575	15.6	0.1	-	-	-	179	15.7	0.2	146	16.0	0.2	282	16.3	0.3	182	16.4	0.2
7	632	15.9	0.1	-	-	-	164	15.8	0.2	150	16.0	0.2	269	16.5	0.2	185	17.0	0.2
8	618	16.3	0.1	-	-	-	152	15.8	0.2	145	16.5	0.2	266	17.3	0.4	214	18.4	0.4
9	603	16.9	0.2	-	-	-	169	17.1	0.3	141	16.8	0.2	279	18.0	0.7	174	18.7	0.3
10	576	17.1	0.1	-	-	-	184	17.3	0.2	165	18.0	0.3	297	18.4	0.3	187	19.1	0.3
11	595	17.9	0.1	-	-	-	178	18.0	0.3	153	18.6	0.3	280	19.4	0.3	182	19.6	0.4
12	-	-	-	643	18.4	0.1	200	18.7	0.2	147	18.8	0.3	203	20.1	0.3	299	20.7	0.4
13	-	-	-	626	19.4	0.1	174	19.6	0.3	165	19.5	0.4	187	20.5	0.3	298	20.7	0.5
14	-	-	-	618	20.2	0.2	174	20.2	0.3	188	20.2	0.2	188	22.3	1.1	266	22.3	0.4
15	-	-	-	613	20.9	0.1	171	20.5	0.3	180	20.8	0.3	187	22.3	0.5	283	22.5	0.3
16	-	-	-	556	21.3	0.1	169	21.8	0.3	180	22.0	0.3	194	22.3	0.5	306	24.1	0.4
17	-	-	-	458	22.1	0.1	176	21.9	0.3	183	21.8	0.2	196	23.4	0.4	313	24.5	0.4
18	-	-	-	-	-	-	124	23.7	0.3	156	22.6	0.4	176	22.6	0.5	284	24.2	0.3
19	-	-	-	-	-	-	136	23.3	0.5	150	23.1	0.3	168	23.7	0.6	269	24.9	0.4
<b>Female</b>																		
2	-	-	-	-	-	-	272	15.9	0.1	314	16.1	0.1	562	16.5	0.1	214	16.4	0.1
3	-	-	-	-	-	-	292	15.7	0.1	367	15.6	0.1	582	15.9	0.1	173	16.0	0.1
4	-	-	-	-	-	-	281	15.5	0.1	388	15.5	0.1	533	16.0	0.2	190	15.9	0.2
5	-	-	-	-	-	-	314	15.5	0.1	369	15.6	0.1	554	15.9	0.1	186	16.1	0.3
6	536	115.4	0.1	-	-	-	176	15.4	0.1	150	15.6	0.2	272	16.1	0.3	170	16.2	0.2
7	609	15.8	0.1	-	-	-	169	15.6	0.2	154	16.1	0.2	274	16.9	0.3	196	16.6	0.2
8	613	16.4	0.1	-	-	-	152	16.4	0.2	125	16.3	0.2	247	17.3	0.3	184	18.3	0.5
9	581	17.0	0.1	-	-	-	171	17.2	0.2	154	17.5	0.3	280	18.2	0.5	183	18.7	0.3
10	584	17.6	0.2	-	-	-	197	17.1	0.2	128	17.7	0.3	258	18.4	0.4	163	19.3	0.3
11	525	18.2	0.2	-	-	-	166	18.6	0.3	143	18.9	0.3	275	19.4	0.4	194	20.7	0.4
12	-	-	-	547	19.2	0.1	177	19.5	0.4	146	19.3	0.3	236	20.2	0.5	315	21.2	0.4
13	-	-	-	582	19.9	0.1	198	20.4	0.3	155	20.1	0.4	220	21.8	0.6	321	22.6	0.4
14	-	-	-	586	20.8	0.1	184	21.1	0.3	181	21.0	0.3	218	22.4	0.5	324	22.9	0.4
15	-	-	-	503	21.4	0.2	167	21.1	0.3	144	20.6	0.3	191	21.9	0.4	266	23.2	0.5
16	-	-	-	536	21.9	0.2	171	21.7	0.3	167	21.8	0.3	208	23.0	0.5	273	24.0	0.4
17	-	-	-	442	21.7	0.2	150	22.6	0.5	134	22.3	0.4	201	23.3	0.5	255	23.1	0.4
18	-	-	-	-	-	-	141	21.5	0.3	156	22.3	0.4	175	22.9	0.6	243	24.4	0.5
19	-	-	-	-	-	-	130	22.5	0.6	158	22.4	0.3	177	23.7	0.8	225	25.5	0.4
-	Data not available.																	
N	= Number of individuals.																	
SE	= Standard error.																	
Source:	Ogden et al., 2004.																	



Table 8-16. Sample Sizes by Age, Sex, Race, and Examination

Age Group	Sex	Race <sup>a</sup>	NHANES Examination			
			I (1971-1974)	II (1976-1980)	III (1988-1994)	1999-2002
Overall			6431 (10.3) <sup>b</sup>	6395 (10.6)	9610 (9.9)	6710 (10.1)
2 to 5 years	Boys	White	829 (3.9)	1082 (4.1)	605 (4.0)	226 (3.9)
		Black	286 (3.9)	273 (4.1)	693 (3.9)	234 (4.0)
		Mexican American	51 (3.8)	105 (4.2)	732 (4.0)	231 (3.9)
	Girls	White	772 (4.0)	1028 (4.0)	639 (4.0)	235 (4.1)
		Black	297 (4.0)	234 (4.0)	684 (3.9)	222 (4.0)
		Mexican American	56 (4.1)	102 (4.2)	800 (3.9)	238 (4.1)
6 to 11 years	Boys	White	711 (9.1)	667 (9.0)	446 (8.9)	298 (8.9)
		Black	249 (9.0)	137 (9.0)	584 (9.0)	371 (9.0)
		Mexican American	51 (9.0)	60 (9.2)	565 (9.0)	384 (9.0)
	Girls	White	722 (9.1)	631 (9.1)	428 (9.1)	293 (8.9)
		Black	268 (9.0)	155 (9.0)	538 (9.0)	363 (9.1)
		Mexican American	45 (8.9)	40 (9.3)	581 (8.9)	361 (9.0)
12 to 17 years	Boys	White	764 (14.9)	786 (15.1)	282 (14.9)	449 (14.9)
		Black	252 (14.9)	155 (15.1)	412 (15.0)	543 (14.9)
		Mexican American	42 (15.0)	49 (15.0)	406 (15.0)	648 (15.0)
	Girls	White	749 (15.0)	695 (15.1)	344 (15.0)	456 (14.9)
		Black	251 (14.8)	159 (15.0)	450 (14.9)	528 (14.8)
		Mexican American	36 (14.9)	37 (15.2)	421 (14.8)	631 (14.9)
<sup>a</sup>	Race was recoded in the first two examinations (using data concerning ancestry/national origin) to create comparable categories in all surveys.					
<sup>b</sup>	Mean ages are shown in parentheses.					
Source: Freeman et al., 2006.						



Table 8-17. Mean BMI (kg/m <sup>2</sup> ) Levels and Change in the Mean Z-Scores by Race-Ethnicity and Sex									
	Race	Examination Year <sup>a</sup>				Increase in Mean z-score From 1971-1974 to 1999-2002			
		1971-1974	1976-1980	1988-1994	1999-2002	BMI	Weight	Height	
Overall	White	18.0 <sup>b</sup>	18.0	18.8	19.0	+0.33	+0.36	+0.20	
	Black	17.8	18.2	19.1	20.0	+0.61	+0.63	+0.31	
	Mexican-American	18.6	18.8	19.5	20.1	+0.32	+0.52	+0.39	
Sex	Boys	White	17.9	18.0	18.8	19.0	+0.37	+0.42	+0.25
		Black	17.7	17.8	18.8	19.6	+0.53	+0.58	+0.32
		Mexican-American	18.6	18.9	19.4	20.3	+0.38	+0.67	+0.57
	Girls	White	18.0	18.0	18.7	19.0	+0.30	+0.32	+0.16
		Black	17.9	18.6	19.5	20.4	+0.71	+0.69	+0.30
		Mexican-American	18.5	18.6	19.6	19.9	+0.25	+0.35	+0.21
Age (years)	2 to 5	White	15.8	15.7	16.0	16.2	+0.21	+0.22	+0.13
		Black	15.8	15.7	15.9	16.2	+0.34	+0.32	+0.18
		Mexican-American	16.5	16.2	16.5	16.5	-0.02	+0.29	+0.43
	6 to 11	White	16.7	16.9	17.6	17.9	+0.42	+0.47	+0.30
		Black	16.5	17.1	17.9	18.7	+0.67	+0.69	+0.36
		Mexican-American	16.9	17.7	18.5	18.8	+0.50	+0.65	+0.41
	12 to 17	White	20.7	20.6	21.8	22.0	+0.32	+0.35	+0.15
		Black	20.4	20.9	22.4	23.7	+0.72	+0.77	+0.33
		Mexican-American	21.6	21.5	22.6	24.0	+0.37	+0.55	+0.34
<sup>a</sup> Secular trends for BMI, BMI-for-age, weight-for-age, and height-for-age were each statistically significant at the 0.001 level. Trends in BMI, BMI-for-age, and weight also differed (p <0.001) by race. <sup>b</sup> Mean BMI levels have been adjusted for differences in age and sex across exams.									
Source: Freedman et al., 2006.									



Table 8-18. Prevalence of Overweight and Obesity<sup>a</sup> Among Children

	Race	Examination year				Increase in Prevalence From 1971-1974 to 1999-2002		
		1971-1974	1976-1980	1988-1994	1999-2002	Overweight	Obesity	
Overall	White	5% (1) <sup>b</sup>	5% (1)	9% (2)	12% (3)	+8	+2	
	Black	6% (1)	7% (2)	12% (3)	18% (5)	+12	+4	
	Mexican-American	8% (1)	10% (1)	14% (4)	21% (5)	+12	+4	
Sex	Boys	White	5% (1)	5% (1)	10% (2)	13% (4)	+8	+3
		Black	6% (2)	5% (1)	11% (3)	16% (5)	+10	+3
		Mexican-American	8% (1)	12% (1)	15% (4)	24% (4)	+16	+6
	Girls	White	5% (1)	5% (1)	9% (2)	12% (2)	+7	+1
		Black	6% (1)	9% (2)	14% (3)	21% (6)	+14	+5
		Mexican-American	8% (2)	7% (0)	14% (3)	17% (4)	+9	+2
Age (years)	2 to 5	White	4% (1)	3% (1)	5% (1)	9% (3)	+5	+2
		Black	7% (3)	4% (0)	8% (3)	9% (4)	+2	+1
		Mexican-American	10% (5)	11% (3)	12% (5)	13% (5)	+3	0
	6 to 11	White	4% (0)	6% (1)	11% (3)	13% (4)	+10	+3
		Black	4% (0)	9% (3)	15% (3)	20% (5)	+15	+4
		Mexican-American	6% (0)	11% (0)	17% (4)	22% (5)	+16	+5
	12 to 17	White	6% (1)	4% (0)	11% (2)	13% (2)	+7	+1
		Black	8% (1)	8% (1)	13% (3)	22% (6)	+14	+5
		Mexican-American	9% (0)	8% (1)	14% (2)	25% (5)	+15	+5

<sup>a</sup> Overweight is defined as a BMI  $\geq$  95<sup>th</sup> percentile or  $\geq$  30 kg/m<sup>2</sup>; obesity is defined as a BMI  $\geq$  99<sup>th</sup> percentile or  $\geq$  40 kg/m<sup>2</sup>.  
<sup>b</sup> Values are percentage of overweight children (percentage of obese children).

Source: Freedman et al., 2006.



**Chapter 8 - Body Weight**

Table 8-19. Numbers of Live Births by Weight and Percentages of Live Births with Low and Very Low Birth Weights, by Race and Hispanic Origin of Mother: United States, 2005				
	All Races <sup>a</sup>	Non-Hispanic White <sup>b</sup>	Non-Hispanic Black <sup>b</sup>	Hispanic <sup>c</sup>
Total Births	4,138,349	2,279,768	583,759	985,505
Weight (grams)	Number of Live Births			
< 500	6,599	2,497	2,477	1,212
500-999	23,864	10,015	8,014	4,586
1,000-1,499	31,325	14,967	8,573	5,988
1,500-1,999	66,453	33,687	15,764	12,710
2,000-2,499	210,324	104,935	46,846	43,300
2,500-2,999	748,042	364,726	144,803	176,438
3,000-3,499	1,596,944	857,136	221,819	399,295
3,500-3,999	1,114,887	672,270	108,698	266,338
4,000-4499	289,098	167,269	22,149	64,704
4,500-4999	42,119	27,541	3,203	9,167
>5,000	4,715	2,840	405	1,174
Not stated	3,979	1,885	1,008	593
	Percent of Total			
Low Birth Weight <sup>d</sup>	8.2	7.3	14.0	6.9
Very Low Birth Weight <sup>e</sup>	1.5	1.2	3.3	1.2
<sup>a</sup>	All Races includes White, Black, and races other than White and Black and origin not stated.			
<sup>b</sup>	Race categories are consistent with the 1977 Office of Management and Budget standards.			
<sup>c</sup>	Hispanic includes all persons of Hispanic origin of any race.			
<sup>d</sup>	Low birth weight is birth weight less than 2,500 grams (5 lb 8 oz).			
<sup>e</sup>	Very low birth weight is birth weight less than 1,500grams (3 lb 4 oz).			
Source:	Martin et al., 2007.			



Table 8-20. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES II Data

Age Group <sup>a</sup>	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
0 to 1 year	9.4	1.3	179	8.8	1.3	177	9.1	1.2	356
1 to 2 years	11.8	1.6	370	10.8	1.4	336	11.3	1.5	706
2 to 3 years	13.6	1.8	375	13.0	1.5	336	13.3	1.6	711
3 to 4 years	15.6	1.9	418	14.9	2.1	366	15.2	1.8	784
4 to 5 years	17.8	2.4	404	17.0	2.3	396	17.4	2.4	800
5 to 6 years	19.8	2.8	397	19.6	3.2	364	19.7	2.8	761
6 to 7 years	23.0	3.7	133	22.1	3.9	135	22.5	3.6	268
7 to 8 years	25.1	3.8	148	24.7	4.6	157	24.8	3.8	305
8 to 9 years	28.2	5.6	147	27.8	4.8	123	28.1	5.6	270
9 to 10 years	31.1	5.8	145	31.8	7.3	149	31.4	5.9	294
10 to 11 years	36.4	7.2	157	36.1	7.7	136	36.2	7.1	293
11 to 12 years	40.2	9.8	155	41.8	10.1	140	41.0	9.9	295
12 to 13 years	44.2	9.8	145	46.4	10.1	147	45.4	10.0	292
13 to 14 years	49.8	11.4	173	50.9	11.2	162	50.4	11.5	335
14 to 15 years	57.1	10.7	186	54.7	10.7	178	55.9	10.5	364
15 to 16 years	61.0	10.4	184	55.1	9.0	145	58.0	9.9	329
16 to 17 years	67.1	11.7	178	58.1	9.6	170	62.4	10.9	348
17 to 18 years	66.7	11.3	173	59.6	10.4	134	63.3	10.7	307
18 to 19 years	71.0	12.0	164	59.0	10.2	170	64.6	10.9	334
19 to 20 years	71.7	11.3	148	60.1	10.1	158	65.3	10.3	306
20 to 21 years	71.6	12.0	114	60.5	10.7	162	65.2	10.9	276

<sup>a</sup> Data were converted from ages in months to ages in years. For instance, age 1–2 years represents ages from 12 to 23 months.  
SD = Standard Deviation.  
N = Number of individuals.

Source: Portier et al., 2007.



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Age Group <sup>a</sup>	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
0 to 1 years	8.5	1.5	902	7.8	1.6	910	8.17	1.7	1,812
1 to 2 years	11.6	1.5	660	10.9	1.4	647	11.2	1.5	1,307
2 to 3 years	13.6	1.5	644	13.2	1.8	624	13.4	1.8	1,268
3 to 4 years	15.8	2.3	516	15.4	2.2	587	15.6	2.2	1,103
4 to 5 years	17.6	2.4	549	17.9	3.2	537	17.8	3.2	1,086
5 to 6 years	20.1	3.0	497	20.2	3.5	554	20.2	3.5	1,051
6 to 7 years	23.2	5.0	283	22.6	4.7	272	22.9	4.8	555
7 to 8 years	26.3	5.0	269	26.3	6.2	274	26.4	6.2	543
8 to 9 years	30.1	6.9	266	29.8	6.7	248	30.0	6.7	514
9 to 10 years	34.4	7.9	281	34.3	9.0	280	34.4	9.0	561
10 to 11 years	37.3	8.6	297	37.9	9.5	258	37.7	9.4	555
11 to 12 years	42.5	10.5	281	44.2	10.5	275	43.4	10.3	556
12 to 13 years	49.1	11.1	203	49.1	11.6	236	49.1	11.7	439
13 to 14 years	54.0	12.9	187	55.7	13.2	220	54.8	13.0	407
14 to 15 years	63.7	17.1	188	58.3	11.8	220	60.6	12.2	408
15 to 16 years	66.8	14.9	187	58.3	10.1	197	61.7	10.7	384
16 to 17 years	68.6	14.9	194	61.5	12.8	215	65.2	13.6	409
17 to 18 years	72.7	13.3	196	62.4	11.9	217	67.6	12.9	413
18 to 19 years	71.2	14.3	176	61.5	14.2	193	66.4	15.3	369
19 to 20 years	73.0	12.8	168	63.6	14.5	193	68.3	15.6	361
20 to 21 years	72.5	13.4	149	61.7	12.9	180	66.1	13.8	329

<sup>a</sup> Data were converted from ages in months to ages in years. For instance, age 1–2 years represents ages from 12 to 23 months.  
SD = Standard Deviation.  
N = Number of individuals.

Source: Portier et al., 2007.



Table 8-22. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES IV Data

Age Group <sup>a</sup>	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
0 to 1 year	9.3	1.8	116	9.3	1.5	101	9.3	1.5	217
1 to 2 years	11.3	1.4	144	11.5	1.9	98	11.4	1.8	242
2 to 3 years	13.7	2.0	130	13.3	1.9	113	13.5	2.0	243
3 to 4 years	16.4	2.3	105	15.2	2.1	77	15.9	2.2	182
4 to 5 years	18.8	2.6	95	18.1	3.2	87	18.5	3.3	182
5 to 6 years	20.2	3.3	65	20.7	4.9	92	20.6	4.9	157
6 to 7 years	22.9	4.3	94	22.0	4.5	74	22.5	4.6	168
7 to 8 years	28.1	5.6	100	26.0	6.2	82	27.4	6.5	182
8 to 9 years	31.9	8.6	100	30.8	7.2	89	31.3	7.3	189
9 to 10 years	36.1	7.5	76	36.0	8.4	84	36.2	8.5	160
10 to 11 years	39.5	9.0	92	39.4	10.2	84	39.5	10.2	176
11 to 12 years	42.0	10.2	84	47.2	12.2	97	44.6	11.6	181
12 to 13 years	49.4	12.7	158	51.6	12.3	160	50.3	11.9	318
13 to 14 years	54.9	16.2	161	59.8	15.3	156	56.9	14.6	317
14 to 15 years	65.1	19.9	137	59.9	13.3	158	61.5	13.7	295
15 to 16 years	68.2	15.7	142	63.4	13.9	126	65.9	14.4	268
16 to 17 years	72.5	18.6	153	63.4	16.0	142	68.0	17.1	295
17 to 18 years	75.4	17.9	146	59.9	11.9	128	66.6	13.2	274
18 to 19 years	74.8	15.9	131	65.0	15.2	139	70.2	16.4	270
19 to 20 years	80.1	17.2	129	68.7	17.4	132	74.6	19.0	261
20 to 21 years	80.0	15.5	37	66.3	15.5	44	74.3	17.4	81

<sup>a</sup> Data were converted from ages in months to ages in years. For instance, age 1–2 years represents ages from 12 to 23 months.  
SD = Standard Deviation.  
N = Number of individuals.

Source: Portier et al., 2007.



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Table 8-23. Estimated Body Weights of Typical Age Groups of Interest in U.S. EPA Risk Assessments<sup>a</sup>

Age Group	NHANES	Males (kg)			Females (kg)			Overall (kg)		
		Mean	SD	N	Mean	SD	N	Mean	SD	N
1 to 6 years	II	17.0	4.6	2,097	16.3	4.7	1,933	16.7	4.5	4,030
	III	16.9	4.7	3,149	16.5	4.9	3,221	16.8	5.0	6,370
	IV	17.1	4.9	633	17.5	5.0	541	17.3	5.0	1,174
7 to 16 years	II	45.2	17.6	1,618	43.9	15.9	1,507	44.8	17.5	3,125
	III	49.3	20.9	2,549	46.8	18.0	2,640	47.8	18.4	5,189
	IV	47.9	20.1	1,203	47.9	19.2	1,178	47.7	19.1	2,381

<sup>a</sup> Estimates were weighted using the sample weights provided with each survey.  
SD = Standard Deviation.  
N = Number of individuals.

Source: Portier et al., 2007.

Table 8-24. Estimated Percentile Distribution of Body Weight by Fine Age Categories Derived From 1994-96, 1998 CSFII

Age Group	Sample Size	Mean	Weight (kilograms)								
			Percentile								
			1 <sup>st</sup>	5 <sup>th</sup>	10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>	99 <sup>th</sup>
Birth to 1 month	88	4	1 <sup>a</sup>	2 <sup>a</sup>	3 <sup>a</sup>	3	3	4	4 <sup>a</sup>	5 <sup>a</sup>	5 <sup>a</sup>
1 to <3 months	245	5	2 <sup>a</sup>	3 <sup>a</sup>	4	4	5	6	6	7 <sup>a</sup>	8 <sup>a</sup>
3 to <6 months	411	7	4 <sup>a</sup>	5	5	6	7	8	9	10	12 <sup>a</sup>
6 to <12 months	678	9	6 <sup>a</sup>	7	7	8	9	10	11	12	13 <sup>a</sup>
1 to <2 years	1,002	12	8 <sup>a</sup>	9	9	10	11	13	14	15	19 <sup>a</sup>
2 to <3 years	994	14	10 <sup>a</sup>	10	11	12	14	16	18	19	22 <sup>a</sup>
3 to <6 years	4,112	18	11	13	13	16	18	20	23	25	32
6 to <11 years	1,553	30	16 <sup>a</sup>	18	20	23	27	35	41	45	57 <sup>a</sup>
11 to <16 years	975	54	29 <sup>a</sup>	33	36	44	52	61	72	82	95 <sup>a</sup>
16 to <18 years	360	67	41 <sup>a</sup>	46 <sup>a</sup>	50	56	63	73	86	100 <sup>a</sup>	114 <sup>a</sup>
18 to <21 years	383	69	45 <sup>a</sup>	48 <sup>a</sup>	51	58	66	77	89	100 <sup>a</sup>	117 <sup>a</sup>

<sup>a</sup> Sample size does not meet minimum reporting requirements as described in the "Third Report on Nutrition Monitoring in the United States" (LSRO, 1995).

Source: Kahn and Stralka, 2008.



Table 8-25. Estimated Percentile Distribution of Body Weight By Fine Age Categories With Confidence Interval										
Weight (Kilograms)										
Age Group	Sample Size	Mean			90 <sup>th</sup> Percentile			95 <sup>th</sup> Percentile		
		Estimate	90% CI		Estimate	90% BI		Estimate	90% BI	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound		Lower Bound	Upper Bound
Birth to 1 month	88	4	3	4	4 <sup>a</sup>	4 <sup>a</sup>	5 <sup>a</sup>	5 <sup>a</sup>	5 <sup>a</sup>	5 <sup>a</sup>
1 to <3 months	245	5	5	5	6	6	7	7 <sup>a</sup>	7	7
3 to <6 months	411	7	7	7	9	9	9	10	10	10
6 to <12 months	678	9	9	9	11	11	11	12	12	12
1 to <2 years	1,002	12	12	12	14	14	15	15	15	16
2 to <3 years	994	14	14	14	18	17	18	19	18	19
3 to <6 years	4,112	18	18	18	23	23	23	25	25	25
6 to <11 years	1,553	30	29	30	41	41	43	45	44	48
11 to <16 years	975	54	53	55	72	70	75	82	81	84
16 to <18 years	360	67	66	68	86	84	95	100 <sup>a</sup>	95 <sup>a</sup>	109 <sup>a</sup>
18 to <21 years	383	69	68	70	89	88	95	100 <sup>a</sup>	95 <sup>a</sup>	104 <sup>a</sup>
<sup>a</sup> Sample size does meet minimum reporting requirements as described in the "Third Report on Nutrition Monitoring in the United States"(Vol. I). Interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of variance. CI = Confidence interval. BI = Percentile intervals estimated using percentile bootstrap method with 1,000 bootstrap replications. Source: Kahn and Stralka, 2008.										



**Chapter 8 - Body Weight**

Table 8-26. Fetal Weight (grams) Percentiles Throughout Pregnancy

Gestational Age (weeks)	Number of Women	10th	25th	50th	75th	90th
8	6	— <sup>a</sup>	—	6.1 <sup>b</sup>	—	—
9	7	—	—	7.3 <sup>b</sup>	—	—
10	15	—	—	8.1 <sup>b</sup>	—	—
11	13	—	—	11.9 <sup>b</sup>	—	—
12	18	—	11	21	34	—
13	43	—	23	35	55	—
14	61	—	3,405	51	77	—
15	63	—	51	77	108	—
16	59	—	80	117	151	—
17	36	—	125	166	212	—
18	58	—	172	220	298	—
19	31	—	217	283	394	—
20	21	—	255	325	460	—
21	43	280	330	410	570	860
22	69	320	410	480	630	920
23	71	370	460	550	690	990
24	74	420	530	640	780	1,080
25	48	490	630	740	890	1,180
26	86	570	730	860	1,020	1,320
27	76	660	840	990	1,160	1,470
28	91	770	980	1,150	1,350	1,660
29	88	890	1,100	1,310	1,530	1,890
30	128	1,030	1,260	1,460	1,710	2,100
31	113	1,180	1,410	1,630	1,880	2,290
32	210	1,310	1,570	1,810	2,090	2,500
33	242	1,480	1,720	2,010	2,280	2,690
34	373	1,670	1,910	2,220	2,510	2,880
35	492	1,870	2,130	2,430	2,730	3,090
36	1,085	2,190	2,470	2,650	2,950	3,290
37	1,798	2,310	2,580	2,870	3,160	3,470
38	3,908	2,510	2,770	3,030	3,320	3,610
39	5,413	2,680	2,910	3,170	3,470	3,750
40	10,586	2,750	3,010	3,280	3,590	3,870
41	3,399	2,800	3,070	3,360	3,680	3,980
42	1,725	2,830	3,110	3,410	3,740	4,060
43	507	2,840	3,110	3,420	3,780	4,100
44	147	2,790	3,050	3,390	3,770	4,110

<sup>a</sup> Data not available.  
<sup>b</sup> Median fetal weights may be overestimated. They were derived from only a small proportion of the fetuses delivered at these weeks' gestation.

Source: Brenner et al., 1976.



Table 8-27. Neonatal Weight by Gestational Age for Males and Females Combined

Gestational Age (weeks)	Weight (g)						
	5 <sup>th</sup>	10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
25	450	490	564	660	772	889	968
26	523	568	652	760	885	1,016	1,103
27	609	660	754	875	1,015	1,160	1,257
28	707	765	870	1,005	1,162	1,322	1,430
29	820	884	1,003	1,153	1,327	1,504	1,623
30	947	1,020	1,151	1,319	1,511	1,706	1,836
31	1,090	1,171	1,317	1,502	1,713	1,928	2,070
32	1,249	1,338	1,499	1,702	1,933	2,167	2,321
33	1,422	1,519	1,696	1,918	2,169	2,421	2,587
34	1,608	1,714	1,906	2,146	2,416	2,687	2,865
35	1,804	1,919	2,125	2,383	2,671	2,959	3,148
36	2,006	2,129	2,349	2,622	2,927	3,230	3,428
37	2,210	2,340	2,572	2,859	3,177	3,493	3,698
38	2,409	2,544	2,786	3,083	3,412	3,736	3,947
39	2,595	2,735	2,984	3,288	3,622	3,952	4,164
40	2,762	2,904	3,155	3,462	3,798	4,127	4,340
41	2,900	3,042	3,293	3,597	3,930	4,254	4,462
42	3,002	3,142	3,388	3,685	4,008	4,322	4,523
43	3,061	3,195	3,432	3,717	4,026	4,324	4,515

Source: Doubilet et al., 1997.