

Prevalence of Overweight and Obesity Among US Children, Adolescents, and Adults, 1999-2002

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THE PREVALENCE OF overweight and obesity is considered an important public health issue in the United States.^{1,2}

Healthy People 2010 identified overweight and obesity as 1 of the 10 leading health indicators.¹ The data source for monitoring the national prevalence of overweight and obesity is the National Health and Nutrition Examination Survey (NHANES).¹ Since 1960, NHANES data on measured height and weight have been used to determine obesity levels in the United States.³ Estimates of the prevalence of overweight and obesity among the US population in 1999-2000 showed continuing increases among both children and adults.^{3,4} This report is intended to update those estimates with additional NHANES data from 2001-2002.

METHODS

In NHANES, a representative sample of the US noninstitutionalized civilian population was selected using a complex multistage probability design. Height and weight measurements were obtained using standardized techniques and equip-

Context The prevalence of overweight and obesity has increased markedly in the last 2 decades in the United States.

Objective To update the US prevalence estimates of overweight in children and obesity in adults, using the most recent national data of height and weight measurements.

Design, Setting, and Participants As part of the National Health and Nutrition Examination Survey (NHANES), a complex multistage probability sample of the US noninstitutionalized civilian population, both height and weight measurements were obtained from 4115 adults and 4018 children in 1999-2000 and from 4390 adults and 4258 children in 2001-2002.

Main Outcome Measure Prevalence of overweight (body mass index [BMI] ≥ 95 th percentile of the sex-specific BMI-for-age growth chart) among children and prevalence of overweight (BMI, 25.0-29.9), obesity (BMI ≥ 30.0), and extreme obesity (BMI ≥ 40.0) among adults by sex, age, and racial/ethnic group.

Results Between 1999-2000 and 2001-2002, there were no significant changes among adults in the prevalence of overweight or obesity (64.5% vs 65.7%), obesity (30.5% vs 30.6%), or extreme obesity (4.7% vs 5.1%), or among children aged 6 through 19 years in the prevalence of at risk for overweight or overweight (29.9% vs 31.5%) or overweight (15.0% vs 16.5%). Overall, among adults aged at least 20 years in 1999-2002, 65.1% were overweight or obese, 30.4% were obese, and 4.9% were extremely obese. Among children aged 6 through 19 years in 1999-2002, 31.0% were at risk for overweight or overweight and 16.0% were overweight. The NHANES results indicate continuing disparities by sex and between racial/ethnic groups in the prevalence of overweight and obesity.

Conclusions There is no indication that the prevalence of obesity among adults and overweight among children is decreasing. The high levels of overweight among children and obesity among adults remain a major public health concern.

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ment. Adults were defined as persons aged 20 years or older and children as persons aged 2 through 19 years. For adults, *overweight*, *obesity*, and *extreme obesity* were defined as a body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters) of 25.0 to 29.9, 30.0 or more, and 40.0 or more, respectively.^{3,5}

For children, the 2000 Centers for Disease Control and Prevention Growth Charts for the United States were used

to define overweight and at risk for overweight.^{4,6} The sex-specific BMI-for-age growth charts are based on na-

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tional data from 1963 to 1994.⁶ *At risk for overweight* was defined as at or above the 85th percentile but less than the 95th percentile of the sex-specific BMI for age, as defined by the growth chart. The category at risk for overweight is intended to identify children who should be referred for a second level of screening to determine if there are any additional health risks that would warrant intervention.⁷ *Overweight* was defined as at or above the 95th percentile of the sex-specific BMI-for-age growth chart.

Data were analyzed using the statistical programs SAS version 8.02 (SAS Institute Inc, Cary, NC) and SUDAAN version 8.0 (Research Triangle Institute, Research Triangle Park, NC). Pregnant females were excluded from the analyses. All analyses used sample weights to account for differential probabilities of selection into the sample, nonresponse, and noncoverage. Data for adults were age-standardized to the 2000 US Census using age groups 20 through 39 years, 40 through 59 years, and 60 years or older. Standard errors were esti-

mated using Taylor series linearization. The *t* statistic was used to test hypotheses at the overall significance level of $P < .05$. The Bonferroni method was used to adjust for multiple comparisons across 3 racial/ethnic groups.

RESULTS

Sample sizes and selected demographic characteristics are shown in TABLE 1. Between 1999-2000 and 2001-2002, there were no significant changes in the overall prevalence of overweight and obesity among adults or at risk for over-

Table 1. Sample Size of Adults and Children by Sex, Age, and Racial/Ethnic Group: United States, 1999-2002

Sex	Age, y	Sample Size, No.											
		1999-2000				2001-2002				1999-2002			
		All*	Non-Hispanic White	Non-Hispanic Black	Mexican American	All*	Non-Hispanic White	Non-Hispanic Black	Mexican American	All*	Non-Hispanic White	Non-Hispanic Black	Mexican American
Males	2-5	376	94	107	131	383	126	120	100	759	220	227	231
	6-11	543	119	160	226	581	176	203	158	1124	295	363	384
	12-19	1156	235	320	512	1162	344	364	348	2318	579	684	860
	20-39	666	276	125	184	750	322	148	215	1416	598	273	399
	40-59	595	262	127	157	773	407	161	152	1368	669	288	309
	≥60	782	408	122	197	696	428	126	113	1478	836	248	310
Females	2-5	352	100	93	124	411	130	120	114	763	230	213	238
	6-11	506	111	152	197	584	170	199	164	1090	281	351	361
	12-19	1085	220	295	455	1137	341	332	372	2222	561	627	827
	20-39	640	249	140	180	712	313	157	178	1352	562	297	358
	40-59	653	249	141	193	721	376	148	139	1374	625	289	332
	≥60	779	387	139	194	738	441	129	128	1517	828	268	322

*Includes racial/ethnic groups not shown separately.

Table 2. Prevalence of At Risk for Overweight and Overweight in Children by Sex, Age, and Racial/Ethnic Group: United States, 1999-2002*

Sex	Age, y	Prevalence, % (SE)							
		At Risk for Overweight and Overweight (BMI for Age ≥85th Percentile)				Overweight (BMI for Age ≥95th Percentile)			
		All	Non-Hispanic White	Non-Hispanic Black	Mexican American	All	Non-Hispanic White	Non-Hispanic Black	Mexican American
Both	6-19	31.0 (1.1)	28.2 (1.6)†‡	35.4 (0.9)‡§	39.9 (1.3)‡§	16.0 (0.8)	13.6 (1.1)†‡	20.5 (0.8)§	22.2 (1.1)§
	2-5	22.6 (1.5)	20.8 (2.0)	23.2 (2.3)	26.3 (2.7)	10.3 (1.2)	8.6 (1.5)	8.8 (1.5)	13.1 (2.0)
	6-11	31.2 (1.8)	28.6 (2.6)‡	33.7 (1.6)	38.9 (2.2)§	15.8 (1.1)	13.5 (1.5)†‡	19.8 (1.4)§	21.8 (1.7)§
	12-19	30.9 (1.0)	27.9 (1.5)†‡	36.8 (1.3)§	40.7 (1.6)§	16.1 (0.8)	13.7 (1.1)†‡	21.1 (1.2)§	22.5 (1.3)§
Boys	6-19	31.8 (1.4)	29.2 (2.4)‡	31.0 (1.3)‡	42.8 (1.6)‡§	16.8 (0.8)	14.3 (1.1)‡	17.9 (1.0)‡	25.5 (1.3)‡§
	2-5	23.0 (2.3)	21.7 (3.2)	20.9 (2.5)	27.6 (3.1)	9.9 (1.6)	8.2 (1.9)	8.0 (1.8)	14.1 (2.1)
	6-11	32.5 (2.3)	29.3 (3.8)‡	29.7 (2.2)‡	43.9 (3.0)‡§	16.9 (1.3)	14.0 (1.5)‡	17.0 (1.5)‡	26.5 (2.2)‡§
	12-19	31.2 (1.5)	29.2 (2.3)‡	32.1 (2.1)‡	41.9 (1.8)‡§	16.7 (0.9)	14.6 (1.3)‡	18.7 (1.7)	24.7 (1.9)§
Girls	6-19	30.3 (1.3)	27.0 (1.7)†‡	40.1 (1.4)§	36.6 (1.8)§	15.1 (1.1)	12.9 (1.6)†‡	23.2 (1.1)§	18.5 (1.4)§
	2-5	22.3 (1.8)	20.0 (2.3)	25.6 (3.0)	25.0 (3.8)	10.7 (1.5)	9.1 (2.0)	9.6 (1.8)	12.2 (3.4)
	6-11	29.9 (2.1)	27.7 (2.8)	37.9 (2.8)	33.8 (2.6)	14.7 (1.6)	13.1 (2.3)†	22.8 (2.5)§	17.1 (2.0)
	12-19	30.5 (1.3)	26.5 (2.0)†‡	41.9 (1.7)§	39.3 (2.3)§	15.4 (1.2)	12.7 (1.8)†	23.6 (1.8)§	19.9 (1.9)

Abbreviation: BMI, body mass index, calculated as weight in kilograms divided by square of height in meters.

*BMI was rounded to the nearest tenth. Pregnant girls were excluded. All category included racial/ethnic groups not shown separately.

†Significantly different from non-Hispanic blacks at $P < .05$, with Bonferroni adjustment.

‡Significantly different from Mexican Americans at $P < .05$, with Bonferroni adjustment.

§Significantly different from non-Hispanic whites at $P < .05$, with Bonferroni adjustment.

Table 3. Prevalence of Overweight and Obesity in Adults by Sex, Age, and Racial/Ethnic Group: United States, 1999-2002*

Sex	Age, y	Prevalence, % (SE)							
		Overweight and Obesity (BMI ≥25)				Obesity (BMI ≥30)			
		All	Non-Hispanic White	Non-Hispanic Black	Mexican American	All	Non-Hispanic White	Non-Hispanic Black	Mexican American
Both	≥20	65.1 (0.8)	63.3 (1.1)†‡	70.7 (1.0)§	72.5 (1.5)§	30.4 (0.9)	29.4 (1.0)†	39.4 (1.3)‡§	32.6 (1.6)†
	20-39	57.5 (1.2)	54.8 (1.9)†‡	63.2 (2.0)§	63.6 (2.2)§	25.9 (1.0)	23.8 (1.2)†	36.2 (2.0)‡§	26.7 (2.0)†
	40-59	69.7 (1.4)	68.0 (1.8)‡	73.9 (2.0)	80.7 (1.9)§	33.8 (1.5)	33.1 (1.8)†	41.0 (1.8)§	39.3 (2.6)
	≥60	70.8 (1.2)	70.3 (1.5)†	78.2 (1.9)§	74.6 (2.7)	32.9 (1.2)	33.0 (1.3)†	42.5 (2.6)‡§	32.1 (2.6)†
Men	≥20	68.8 (0.9)	69.4 (1.2)†	62.9 (1.6)‡§	73.1 (1.9)†	27.6 (0.9)	28.2 (1.0)	27.9 (1.3)	27.3 (1.4)
	20-39	60.3 (1.4)	60.0 (2.2)	55.4 (2.8)	64.8 (2.8)	23.0 (1.1)	22.9 (1.6)	24.7 (2.1)	23.4 (2.5)
	40-59	74.7 (1.5)	76.1 (1.8)†	65.0 (3.1)‡§	80.5 (2.7)†	30.7 (1.6)	31.3 (1.8)	29.7 (2.2)	31.3 (2.5)
	≥60	73.9 (1.1)	74.8 (1.4)	72.2 (2.5)	75.4 (3.0)	30.5 (1.4)	32.2 (1.7)	30.5 (3.2)	27.4 (2.6)
Women	≥20	61.6 (1.2)	57.2 (1.7)†‡	77.2 (1.4)§	71.7 (1.9)§	33.2 (1.1)	30.7 (1.3)†‡	49.0 (2.0)‡§	38.4 (2.5)†§
	20-39	54.5 (1.6)	49.0 (2.4)†‡	70.3 (2.7)§	61.8 (3.1)§	29.1 (1.5)	24.9 (1.7)†	46.6 (2.8)‡§	31.2 (3.9)†
	40-59	64.9 (1.8)	59.9 (2.6)†‡	81.5 (1.9)§	80.9 (2.2)§	36.7 (1.9)	34.9 (2.3)†‡	50.6 (2.4)§	47.7 (3.3)§
	≥60	68.4 (1.7)	66.7 (2.1)†	82.2 (2.8)§	73.9 (3.5)	34.7 (1.5)	33.7 (1.8)†	50.3 (4.8)‡§	35.8 (3.3)†

Abbreviation: BMI, body mass index, calculated as weight in kilograms divided by square of height in meters.

*BMI was rounded to the nearest tenth. Pregnant women were excluded. All category included racial/ethnic groups not shown separately. Estimates for ages 20 years or older were age-standardized by the direct method to the 2000 US Census population, using the age groups 20 through 39 years, 40 through 59 years, and 60 years or older.

†Significantly different from non-Hispanic blacks at $P < .05$, with Bonferroni adjustment.

‡Significantly different from Mexican Americans at $P < .05$, with Bonferroni adjustment.

§Significantly different from non-Hispanic whites at $P < .05$, with Bonferroni adjustment.

weight and overweight among children. In 2001-2002, 65.7% of adults (SE, 0.6) were either overweight or obese, 30.6% (1.1) were obese, and 5.1% (0.5) were extremely obese compared with 64.5% (1.6), 30.5% (1.5), and 4.7% (0.6), respectively, in 1999-2000.³ Among children aged 6 through 19 years in 2001-2002, 31.5% (1.3) were at risk for overweight or overweight and 16.5% (1.0) were overweight compared with 29.9% (1.7) and 15.0% (1.0), respectively, in 1999-2000.

Because 4 years of data yield more precise estimates than 2 years, the remainder of this report presents estimates based on the NHANES 1999-2002 data. The prevalence of at risk for overweight and overweight for children in 1999-2002 is shown in TABLE 2. Nearly one third (31.0%) of children aged 6 through 19 years were either at risk for overweight or overweight and 16.0% were considered overweight. For girls aged 6 through 19 years, the prevalence of overweight among non-Hispanic white girls was significantly lower than that of non-Hispanic black and Mexican American girls. For boys aged 6 through 19 years, Mexican American boys had a significantly higher prevalence of overweight than their non-Hispanic white and black counterparts.

Table 4. Prevalence of Extreme Obesity in Adults by Sex, Age, and Racial/Ethnic Group: United States, 1999-2002*

Sex	Age, y	Prevalence of Extreme Obesity (BMI ≥40), % (SE)†			
		All	Non-Hispanic White	Non-Hispanic Black	Mexican American
Both	≥20	4.9 (0.4)	4.4 (0.4)‡	9.0 (0.8)§	4.2 (0.6)‡
	20-39	4.6 (0.4)	3.8 (0.5)	8.1 (1.4)	3.5 (0.7)
	40-59	5.9 (0.7)	5.6 (0.7)	9.5 (1.4)	5.5 (1.3)
	≥60	3.9 (0.4)	3.7 (0.5)	9.6 (1.6)	3.5 (0.4)
Men	≥20	3.3 (0.5)	3.3 (0.5)	3.4 (0.6)	2.9 (0.7)
	20-39	3.7 (0.6)	3.5 (0.7)	4.1 (1.2)	2.0 (0.8)¶
	40-59	3.9 (0.7)	4.1 (0.9)	2.9 (0.9)¶	4.4 (1.2)
	≥60	1.7 (0.4)	1.8 (0.5)	3.0 (1.1)¶	1.9 (0.8)¶
Women	≥20	6.4 (0.5)	5.5 (0.5)‡	13.5 (1.2)§	5.7 (0.9)‡
	20-39	5.6 (0.6)	4.2 (0.7)	11.8 (1.9)	5.5 (1.3)
	40-59	7.8 (1.0)	7.0 (1.1)	15.1 (2.4)	6.6 (1.9)
	≥60	5.6 (0.6)	5.2 (0.8)	14.0 (2.5)	4.8 (0.8)

Abbreviation: BMI, body mass index, calculated as weight in kilograms divided by square of height in meters.

*BMI was rounded to the nearest tenth. Pregnant women were excluded. All category included racial/ethnic groups not shown separately. Estimates for ages 20 years or older were age-standardized by the direct method to the 2000 US Census population, using the age groups 20 through 39 years, 40 through 59 years, and 60 years or older.

†Only comparisons across racial/ethnic groups for at least 20 years performed.

‡Significantly different from non-Hispanic blacks at $P < .05$, with Bonferroni adjustment.

§Significantly different from Mexican Americans at $P < .05$, with Bonferroni adjustment.

||Significantly different from non-Hispanic whites at $P < .05$, with Bonferroni adjustment.

¶Does not meet standard of statistical reliability and precision (relative SE, >30%).

The percentage of adults at a healthy weight (BMI, 18.5-24.9) was 33.0%. The prevalence of overweight, obesity, and extreme obesity among adults in 1999-2002 is shown in TABLE 3 and TABLE 4. Among adults aged at least 20 years, 65.1% were overweight or obese, 30.4% were obese, and 4.9% were extremely obese. In almost every age and

racial/ethnic group, the prevalence of overweight or obesity exceeded 50%.

The prevalence of obesity by age, sex, and racial/ethnic group ranged from 22.9% of non-Hispanic white men aged 20 through 39 years to 50.6% of non-Hispanic black women aged 40 through 59 years. Among women, non-Hispanic black women had the highest level of

extreme obesity (13.5%) compared with 5.5% and 5.7% of non-Hispanic white and Mexican American women, respectively. There was no significant difference in the prevalence of obesity among men across racial/ethnic categories for all age groups. Among women aged at least 20 years, the prevalence of obesity differed significantly between racial/ethnic groups, with non-Hispanic white women having the lowest prevalence (30.7%), non-Hispanic black women having the highest (49.0%), and the prevalence among Mexican American women falling in between (38.4%). The prevalence of obesity was significantly higher among women than men ($P < .01$).

COMMENT

The data from NHANES 1999-2002 presented herein provide updated estimates of the prevalence of overweight and obesity among children and adults in the United States. Previous reports based on NHANES data have shown continuing increases in overweight and obesity among adults and in overweight among children and adolescents during the past 2 decades.^{3,4} This increase has been attributed to environmental factors related to both calorie intake and physical activity.⁸

Estimates from NHANES 1999-2000 provided evidence of a continuing increase in the prevalence of obesity.^{3,4} The current prevalence estimates based on 4 years of data further support the 1999-2000 findings. Four years of data yield more stable and precise estimates of the prevalence of obesity because data were collected from a greater number of locations and sample sizes were larger.

The overall prevalence of overweight and obesity showed no significant changes between 1999-2000 and 2001-2002 for either children or adults. However, due to the short time frame as well as sampling and nonsampling errors, it is difficult to assess trends between 1999-2000 and 2001-2002. Although it may be possible to make broad comparisons, caution is advised in comparing the 1999-2000 data with the 2001-2002 data. This is especially true for demographic subgroups in which the sample size is

relatively small. Some apparently large changes within racial/ethnic groups (eg, Mexican American adults) were not statistically significant and may simply reflect the uncertainty of estimates based on 2 years of NHANES data. There are some indications of a possible increase among children and non-Hispanic white adults. Further monitoring is warranted to determine whether the upward trend in the prevalence of obesity is continuing or leveling off.

The prevalence estimates of obesity from NHANES 1999-2002 exceed the most recent estimates of adult obesity from the Behavioral Risk Factor Surveillance System (BRFSS) and the National Health Interview Survey (NHIS).^{9,10} In 2001, the prevalence of obesity among adults aged at least 18 years was 20.9% based on the BRFSS and 22.5% based on the NHIS.^{9,10} In NHANES 1999-2002, the prevalence of obesity was 30.4% among adults aged at least 20 years. This discrepancy between estimates is expected because the BRFSS and NHIS estimates are based on self-reported height and weight, which yield lower estimates of the prevalence of overweight and obesity.¹¹

The NHANES results indicate continuing disparities between racial/ethnic groups in the prevalence of overweight and obesity. The prevalence of overweight was significantly higher among Mexican American boys than among non-Hispanic white and black boys. However, there were no significant differences in the prevalence of obesity by racial/ethnic group for adult men. The prevalence of overweight for girls starting at age 6 years and the prevalence of obesity for women of all age groups were significantly higher for non-Hispanic blacks vs non-Hispanic whites. Although Mexican American girls did not have significantly lower prevalence levels of overweight than non-Hispanic black girls, the prevalence of obesity among Mexican American women was significantly lower than among non-Hispanic black women.

The most recent NHANES estimates indicate neither an increase nor decrease in the prevalence of obesity among adults

or overweight among children. In 1999-2002, the percentage of adults at a healthy weight (33.0%) was approximately half of the Healthy People 2010 target level of 60%.¹ The prevalence of obesity among adults (30.4%) was double the target prevalence (15%).¹ Among children aged 6 through 19 years, the prevalence of overweight (16.0%) was more than 3 times the target prevalence (5%).¹ Substantial progress will need to be made in the efforts to lower the prevalence of overweight and obesity if the goals of Healthy People 2010 are to be met.

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Study concept and design: Hedley, Ogden, Flegal. **Acquisition of data; obtained funding; administrative, technical, or material support:** Johnson.

Analysis and interpretation of data: Hedley, Ogden, Johnson, Carroll, Curtin, Flegal.

Drafting of the manuscript: Hedley.

Critical revision of the manuscript for important intellectual content: Ogden, Johnson, Carroll, Curtin, Flegal.

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