Descriptive Epidemiology of Body Weight and Weight Change in U.S. Adults

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■ Data on body weight and weight change collected from nationally representative samples of U.S. adults are reviewed. The body mass index (weight [kg]/height [m^2]) has a low correlation with height and is used to compare body weights between persons of differing heights. The BMI varies to a greater degree in women than in men. Below the 75th percentile of the BMI distribution, women have lower BMIs than men, whereas at the 75th percentile and above, women have higher BMIs than men. Overweight is defined as a BMI of 27.8 or more in men and of 27.3 or more in women, corresponding to approximately 20% or more above desirable weight in the 1983 Metropolitan Life Insurance Company tables. For persons of average height (men, 5'9"; women, 5'4") this definition is equivalent to a body weight above 85 kg (187 pounds) in men and above 72 kg (158 pounds) in women. Among adults 20 to 74 years of age, 24% of men and 27% of women are overweight, yielding an estimated total of 34 million persons in the United States. The prevalence of overweight increases with age, for both men and women but to a greater degree in women. Blacks and Hispanics have a higher prevalence of overweight than do whites, especially among women. Between 1960 and 1980, the prevalence of overweight among whites increased by 3% in women and by 6% in men. In blacks, however, the prevalence of overweight increased by 7% in women and by 28% in men. Longitudinal body weight measurements taken 10 years apart show that adults younger than 55 years tend to gain weight, whereas those 55 years and older tend to lose weight. The youngest adults gain the most weight, and the oldest adults lose the most weight. In all age groups, women have substantially greater variation in their 10-year weight change than do men.

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This review examines published articles on body weight and weight change from nationally representative data on U.S. adults. These articles were identified both by computer search and by the author's perusal of the literature.

Distribution of Body Mass Index

The most recently available national data on height and weight of U.S. adults 18 to 74 years old comes from the Second National Health and Nutrition Examination Survey (NHANES II), which was conducted between 1976 and 1980 (1). Men were found to have an average height slightly more than 1.75 m (5'9") and an average weight of approximately 77 kg (170 pounds). Nonpregnant women had an average height of nearly 1.63 m (5'4") and an average weight of slightly less than 63 kg (138 pounds). These height and weight data are expressed in terms of the body mass index (weight [kg]/height [m^2]), which tends to have a low correlation with height and thus allows comparison of body weights among persons of differing heights. For persons of average height, one BMI unit is equivalent to approximately 3.1 kg (6.8 pounds) in men and 2.6 kg (5.8 pounds) in women.

Figure 1 compares the percentile distribution of BMI for men and women. If men and women had identical BMI distributions, all percentiles would lie on the 45° line. Because women generally have smaller bones and less muscle tissue than do men, women's BMI would be expected to be less than that of men for any given percentile; that is, the percentile curve would lie consistently below the 45° line. This theory holds true below the 75th percentile of the BMI distribution. In the upper quarter of the distribution, however, women's BMIs are higher than men's. For example, at the 95th percentile of the two distributions, the BMI of women (36.0) is nearly 3.5 units higher than that of men (32.6). This finding indicates that the distribution of body weight in women is more variable and skewed toward heavier body weights than that in men.

Prevalence of Overweight

The National Center for Health Statistics has defined overweight as a BMI of 27.8 or more in men and of 27.3 or more in women. Severe overweight was defined as a BMI of 31.1 or more in men and of 32.3 or more in women. The lower cutoffs correspond to approximately 20% above desirable body weight in the 1983 Metropol-

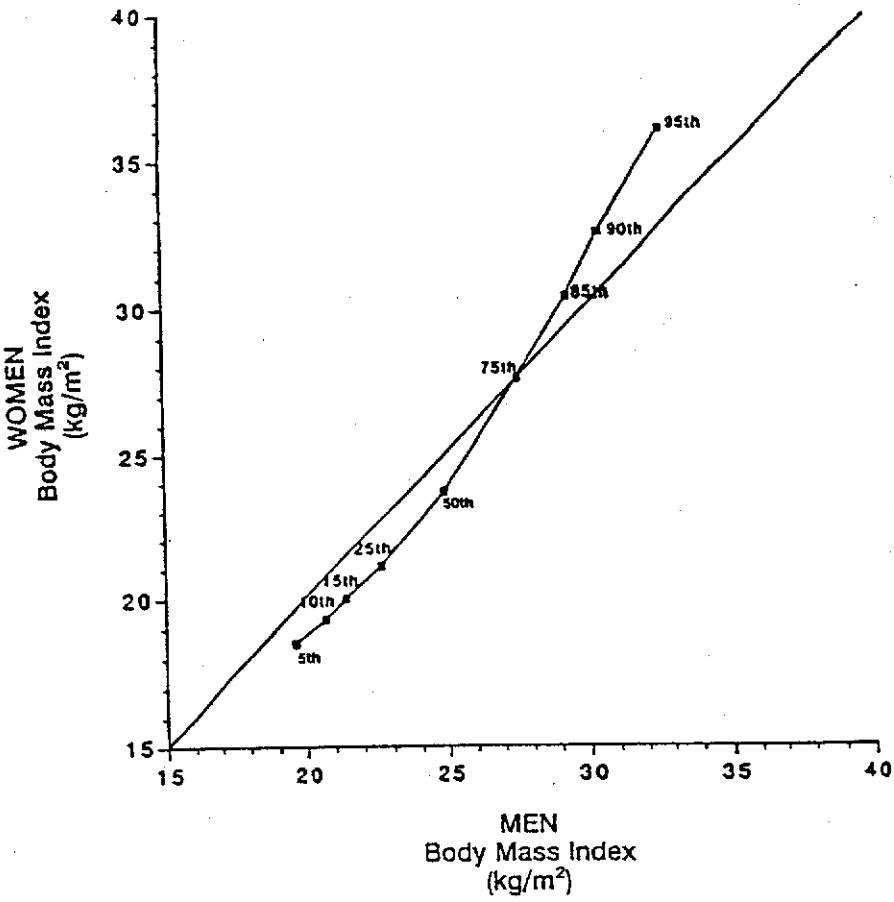

Figure 1. Comparison of the body mass index percentiles between men and women between 18 and 74 years old. Data are from the Second National Health and Nutrition Examination Survey (1976 to 80) as reported by Najjar and Rowland (1).

weight greater than 85 kg (187 pounds) in men and greater than 72 kg (158 pounds) in women, whereas severe overweight is equivalent to a body weight greater than 95 kg (210 pounds in men) and greater than 85 kg (188 pounds) in women. In adults 20 to 74 years old, the prevalence of overweight is 24.2% in men (15.4 million) and 27.1% in nonpregnant women (18.6 million), yielding 34 million overweight Americans (1, 2) (Table 1).

For both men and women, the prevalence of overweight has its greatest increase at the ages between the early twenties and the early thirties. In men, the peak prevalence of overweight occurs between 45 and 54 years of age when it reaches a level of 31.0%; subsequently, the prevalence of overweight decreases with increasing age. In women, however, the prevalence of overweight continues to increase throughout the entire age range, reaching a peak of 38.5% in 65- to 74-year-old women.

Kuczmarski (2) has summarized the estimated prevalences of severe overweight for adults 20 to 74 years old. Eight percent of men (5.1 million persons) and 10.8% of women (7.4 million persons) are estimated to be severely overweight, yielding a total of 12.5 million Americans. Kuczmarski has defined morbid obesity as a

to be 0.6% (327 000 persons) in men and 2.5% (1 676 000 persons) in women, yielding a total of more than 3 million Americans (2).

Modest ethnic variation exists in the prevalence of overweight among men, with the greatest prevalence difference between whites (24.4%) and Mexican-Americans (31.2%) (3). The prevalence of overweight in black men (26.3%) is similar to that of their white counterparts. Among women, the ethnic variation in overweight is much greater. The prevalence of overweight in whites is 24.6% compared with 45.1% in blacks. Mexican- and Puerto Rican-American women have a prevalence of overweight approximately 15 percentage points higher than that of white women (3).

Secular Trend in Overweight

Kuczmarski has estimated the age-adjusted prevalences of overweight in black and white adults 20 to 74 years old in three nationally representative surveys conducted from 1960 to 1962, 1971 to 1974, and 1976 to 1980 (2). Although the prevalence of overweight appears to have increased by only about 1 percentage point among white adults over these three surveys, it

overweight was 3.2 percentage points (a relative increase of 7%).

Flegal and colleagues (4, 5) have analyzed these data for evidence of a secular trend in mean BMI (rather than overweight) and limited their analysis to adults aged 18 to 34 years. They found little evidence of any secular trend in mean BMI in black or white men but found strong evidence of an increasing trend in BMI for women of both races: The mean annual increase in BMI ranged from 0.07 to 0.25 units, depending on the race-education subgroup examined. Shah and colleagues (6) have analyzed data collected between 1980 and 1987 in three communities in the upper midwestern United States. In this sample of predominantly white adults 25 to 74 years old, they found strong evidence of a secular trend in both mean BMI and in the prevalence of overweight in both sexes, with the strongest trends observed in women. The results of these reports on secular trends are somewhat inconsistent, possibly owing to differences in age groups studied or to differences in the covariates used for statistical adjustment over time.

Weight Change Associated with Aging

Williamson and colleagues (7) have analyzed data on weight change from the First National Health and Nutrition Examination Survey Follow-up Study (NHEFS). In this nationally representative cohort of approximately 10 000 U.S. adults 25 to 74 years old, body weights were measured an average of 10 years apart from 1971 to 1975 and from 1982 to 1984. At the first weighing, patients wore a disposable paper uniform and foam rubber slippers and were weighed on a self-balancing scale. At the second weighing, patients wore light indoor clothing without shoes, and 1.6 kg was subtracted from the weight to adjust for indoor clothing. A portable spring scale was used for weight measurements. In both sexes, the net change in weight during a 10-year period was a modest gain of 2 pounds. However, substantial heterogeneity was noted in weight change across age groups: On average, both men and women younger than 55 years tended to gain weight, whereas those 55 years or older tended to lose weight. The magnitude of weight gain for both sexes decreased with increasing age, whereas the magnitude of weight loss increased with increasing age. At all ages, however, the magnitude of weight change was substantially greater for women than for men.

Although data were inadequate to examine ethnic differences in weight change with age in men, white and black women were compared (8). Among women 30 to 55 years old, the average 10-year change in weight was virtually identical in black (+ 2.0 kg) and white (+ 2.1 kg) women. This average, however, masked substantial heterogenity between black and white women in their distributions of 10-year weight change. At the 5th (loss) and 95th (gain) percentiles of the weight-change distribution, black women had about twice the magnitude of weight change as did their white counterparts.

Sex Differences in Variability of Weight Change

The question of whether women have greater variability in weight change than do men has been raised with regard to the interpretation of epidemiologic studies of weight cycling (9). Using data from eight biennial examinations in the Framingham heart study, Lissner and colleagues (10) reported that body weight had a coefficient of variation of 6.7% in women compared with 5.7% in men.

Table 2 shows the distribution of weight change over 10 years in three age groups of men and women as estimated from NHEFS data. Women in all three age groups tended to have a higher probability of being in the extremes of weight change. For example, among adults 25 to 44 years old, 2.9% of men gained 25% or more of their starting body weight during the 10-year period. In women, however, the proportion was 6.5%.

Table 1. Mean Body Mass Index, Percentage Overweight, and Percentage Severely Overweight by Age and Ethnicity in U.S. Adults*

Variable	Men			Women		
	Mean BMI	Overweight (n = 15.4 million)	Severe Overweight (n = 5.1 million)	Mean BMI	Overweight (n = 18.6 million)	Severe Overweight (n = 7.4 million)
		%			%	
Age, y						
20 to 24	23.5	12.1	4.2	22.6	11.4	3.5
25 to 34	25.2	20.4	6.7	24.1	20.0	8.8
35 to 44	26.0	28.9	8.9	25.3	27.0	12.1
45 to 54	26.3	31.0	10.7	26.1	32.5	12.9
55 to 64	26.1	28.1	9.2	26.5	37.0	14.2
All ages	25.3	24.2	8.0	25.0	27.1	10.6
Ethnicity						
White	25.4	24.4	7.8	24.5	24.6	9.6
Black	25.3	26.3	10.4	27.1	45.1	19.7
Mexican	25.9	31.2	10.8	26.6	41.5	16.7
Cuban	26.0	28.5	10.3	25.5	31.0	[illegible]

Table 2. Distribution of U.S. Men and Women by Percentage Change in Body Weight over a 10-Year Period*

Variable	Age Group, y					
	25 to 44		45 to 64		65 to 74	
	Men	Women	Men	Women	Men	Women
Weight change, %						
−25 or more	0.3	1.1	0.7	1.8	2.2	6.5
−15 to −24.9	2.7	3.3	4.5	8.9	11.6	19.1
−5 to −14.9	20.3	18.2	33.3	27.3	45.0	36.9
−4.9 to +4.9	25.5	19.6	26.8	22.1	23.4	21.4
+5 to +14.9	37.9	36.7	29.1	28.1	16.1	13.5
+15 to +24.9	10.2	14.8	4.5	8.1	1.7	2.3
+25 or more	2.9	6.5	1.8	2.9	0.5	0.4
Sample size	1572	3127	1381	1729	774	1082
Mean change, %	3.4	5.2	0.0	0.3	−4.1	−6.3
Variance	142.7	198.3	107.3	129.3	99.4	187.2
F ratio (women/men)	1.6		1.2		1.9	
P value	<0.01		<0.01		<0.01	

* Data are from the First National Health and Nutrition Examination Survey Follow-up Study (1971–1975 to 1982–1984) as analyzed by the author. Weight change categories are expressed as a percentage of starting body weight.

indicating that they were more than twice as likely as men to have gained this much weight.

These data can be formally tested to determine whether the variance of weight change among women differs statistically from that among men. Table 2 indicates that in all three age groups the female-to-male ratio of the variances (F ratio) is significantly higher in women than in men. For example, in the 65- to 74-year age group, the variability in 10-year weight change among women is 90% greater than that among men ($F = 1.9$, $P < 0.01$). Similar results are achieved when absolute weight change (in kilograms) is used instead of percentage weight change.

Summary

The national data on body weight in U.S. adults indicate that marked differences exist between men and women in their distributions of body weight and weight change. Relatively more women than men are at both extremes of the body weight distribution, especially in the upper range of the distribution associated with obesity. More women than men are also found at both extremes of the distribution of 10-year weight change. Among younger adults, women are substantially more likely than men to gain weight, whereas among older adults, women are substantially more likely than men to lose weight over time. Currently, we do not know what factors account for these gender differences in body weight and weight change. It seems reasonable that differences between men and women in the prevalence, duration, and intensity of voluntary weight loss attempts might explain the observed differences in body weight and weight change. Other important factors that Studies are needed to examine the individual and joint effects of these factors to explain the observed gender differences in body weight and weight change between men and women in the United States.

This review also noted a substantially higher prevalence of overweight in black and Hispanic women compared with white women. The reason for the marked ethnic differences in overweight in U.S. women remains obscure (11). Although a genetic cause for these differences cannot be ruled out, this explanation is somewhat tenuous because the pronounced ethnic differentials in overweight are not seen in men. Thus, current research efforts are focused on health practices related to body weight as well as on cultural factors that determine the appropriateness of weight loss programs for minority women (12). A fairly consistent finding of this research is that black women appear to have lower levels of physical activity and physical fitness than do their white counterparts (12). Because low levels of physical activity are related to increased cardiovascular death (13) as well as obesity (14), further studies of the determinants of physical activity in ethnic minorities should be given a high priority in public health research.

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