Patterns of Caloric Intake and Body Mass Index Among U.S. Adults

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Thirty-one percent of U.S. adults between age 20 and 74 are now obese. Based on data from the National Health and Nutrition Examination Surveys, this level represents a 100-percent increase over the prevalence of adult obesity during 1976-80. Increases in obesity have occurred in both men and women, in all age groups, and in all racial and ethnic groups. The reason for this increase is clear—an excess of dietary energy intake over energy expenditure. The causes behind this growing energy, or caloric, imbalance are complex, involving metabolic, behavioral, environmental, cultural, and socioeconomic components.

The rising trend of obesity concerns health authorities, as does the disparity in the prevalence of obesity and overweight across sociodemographic segments of the U.S. population. Differences related to gender, race, ethnicity, income, and educational attainment are major sources of health disparities in the United States. Reducing such health disparities, and disparities in related risk factors, such as obesity, is a goal of the Federal Government's *Healthy People 2010* initiative. With better knowledge of the dietary differences and potential excessive energy intakes among population subgroups, public health professionals can devise more effective strategies for correcting the caloric imbalance among vulnerable subgroups.

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Data from USDA's Continuing Survey of Food Intakes by Individuals (CSFII) are helpful in examining the energy intake side of the obesity equation. This survey provides 2 nonconsecutive days of 24-hour self-reported dietary intake information for a representative sample of the U.S. population. Because a person's day-to-day intake is highly variable, the 2-day average of his or her intake is unlikely to represent his or her longrun, or "usual," intake. However, with at least 2 days of intake data, the usual intakes for subpopulations can be estimated by special statistical procedures. To obtain the usual intakes reported in this study, we used Software for Intake Distribution Estimation, a statistical tool developed by Iowa State University. The estimates are weighted so as to be representative of the U.S. population.

It is tempting to examine the relationship between disparities in obesity and differences in energy intake directly by relating the energy intake among subpopulations with the prevalence of obesity. One would expect to find a strong positive association between caloric intake and a measure of body fatness, such as the body mass index (BMI). However, nutrition studies using self-reported food intake data, such as the CSFII data, have failed to find such an association, primarily because overweight persons tend to underreport intakes to a greater degree than healthy-weight persons. Also, at any given time, overweight persons may be on weight-loss diets.

Therefore, we attempt to infer implications for obesity due to excessive energy intake indirectly by looking at variations in self-reported energy intake across subpopulations and comparing the patterns with variations in BMI across the same groups. For example, if a certain demographic group has a pattern of lower caloric intakes at all intake levels (low, moderate, and high) than another demographic group, then, assuming energy expenditures remain the same, a similar pattern of lower BMI at all levels of the BMI distribution must be evident for the first group, compared with the second. How closely do the distributions of self-reported caloric intake and BMI match? For men, there is a fair level of agreement; for women, there is disagreement.

Among women, higher levels of income and education might be associated with higher levels of physical activity and energy expenditure.

Credit: PhotoDisc.

Revealing Differences: A Look Beyond the "Average" Required

Comparisons of nutrient intakes among subpopulations require looking beyond differences in average, or mean intakes. For many nutrients, the likelihood that intakes exceed or fall below the requirements (that is, the risk of dietary excess or inadequacy) is greater at the upper or lower parts of the intake distributions than at the means. This effect is illustrated by the estimated distributions of self-reported caloric intakes among U.S. men and women, age 20 or older, excluding pregnant or lactating women (table 1).

For men and women of both age groups, the average usual caloric intakes are below the recommended levels. The percentiles of usual intakes show that a majority of adults have caloric intakes below the recommended levels. However, at the 90th percentile (that is, the intake level at which 90 percent consume below that level and 10 percent consume above that level), the caloric intakes of all groups exceed the recommended levels. For example, for men over age 50, the 90th percentile of estimated usual daily intake is 2,865 calories, compared with the recommended intake of 2,300 calories. Since caloric intakes that exceed requirements are one cause of obesity, comparing subpopulations at the 90th percentile would be of greater interest than comparing subpopulations at the mean.

Perhaps because they expend more energy performing physically demanding work, lower income men have only a slightly higher prevalence of obesity than men at the highest income level, despite higher calorie intakes.

Credit: Ken Hammond, USDA.

In general, comparing mean nutrient intakes alone would be satisfactory if the intakes of the comparison groups have identical distributions (that is, similar shapes and spreads). However, as a practical matter, nutrient intakes of subpopulations rarely have identical distributions. When the intake distributions of subgroups are dissimilar, comparison of dietary intakes based solely on means can mask deeper differences at other parts of the distribution of intakes. In such instances, comparison of intakes at various percentiles can be more meaningful.

For example, there is little difference between the usual energy intake of men with less than a high school education and men who completed high school. Compared with these two groups, however, men with more than a high school education appear to consume considerably more calories on average (table 2). Does this mean that men with more than a high school education consume more calories than men with lesser education at all parts of the distribu-

Table 1—Mean Usual Caloric Intakes Are Below Recommended Levels

Sex/Age	Recommended daily intake[1]	Daily usual intake					
			Percentile				
		Mean	10	25	50	75	90
	Calories/day						
Men:							
Age 20-50	2,900	2,650	1,728	2,091	2,557	3,103	3,676
Over age 50	2,300	2,072	1,351	1,647	2,013	2,431	2,865
Women:							
Age 20-50	2,200	1,729	1,191	1,419	1,693	1,998	2,310
Over age 50	1,900	1,486	1,028	1,223	1,458	1,717	1,978

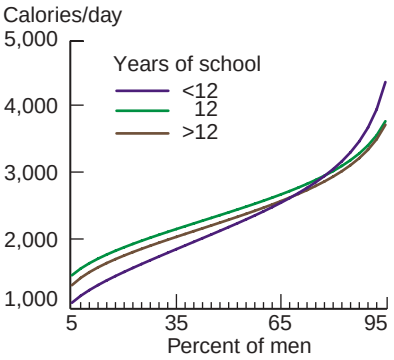
[1]From National Research Council's Recommended Dietary Allowances, 1989.
Source: Estimated by USDA's Economic Research Service from 1994-96 CSFII.

Table 2—Mean Usual Energy Intakes Vary Widely by Education and Income

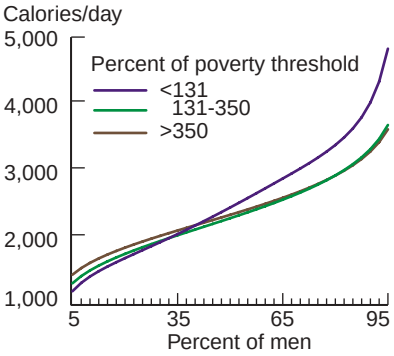
Group	Men	Women
	Calories/day	
Education:		
Less than 12 years	2,399	1,453
12 years	2,411	1,624
Over 12 years	2,516	1,719
Income:[1]		
Less than 131 percent	2,689	1,554
131-350 percent	2,407	1,629
Over 350 percent	2,452	1,689
Race/Ethnicity:		
White, non-Hispanic	2,456	1,642
Black, non-Hispanic	2,562	1,644
Hispanic	2,452	1,564

[1]Annual gross household income expressed as a percentage of the poverty threshold.
Source: Estimated by USDA's Economic Research Service from 1994-96 CSFII.

Figure 1—Many Men With Less Than a High School Education Have Either Very Low or Very High Usual Energy Intake...



...And a Greater Share of Low-Income Men Consume Excessive Calories



Source: USDA's Economic Research Service.

tion of calorie intake? In other words, among light eaters, moderate eaters, and heavy eaters, do men with more than a high school education consume more calories than men with lesser education? Or is it that among heavy eaters, men with more education eat considerably more calories than men with lesser education?

In fact, neither of these scenarios is correct. Among light and moderate eaters, those with more than a high school education consume more calories than the other groups, whereas among the heaviest of eaters, men with less than a high school education consume the most calories. Until about the 80th percentile of caloric intake, men with less than 12 years of education consume a lower amount of calories than men with more than 12 years of education (fig. 1). However, beyond the 80th percentile—that is, among the top 20 percent of the calorie consumers—the relationship reverses, and men with less than a high school education consume more calories than others.

An almost similar relationship is observed between the level of household income and calorie intake of men. Although men with household incomes below 131 percent of the poverty threshold have a higher mean usual energy intake (2,689 calories) than men between 131 and 350 percent of the poverty threshold (2,407 calories) and men above 350 percent of the poverty threshold (2,452 calories), this is not due to uniformly higher intake at all parts of the intake distribution. Rather, the higher mean intake of low-income men is due to their predominance among those consuming large amounts of calories, especially above the 2,900-calorie level (fig. 1). About 22.5 percent of men with incomes above 350 percent of the poverty threshold have usual calorie intakes above the 2,900-calorie level, compared with 35 percent of men with incomes below 131 percent of the poverty threshold.

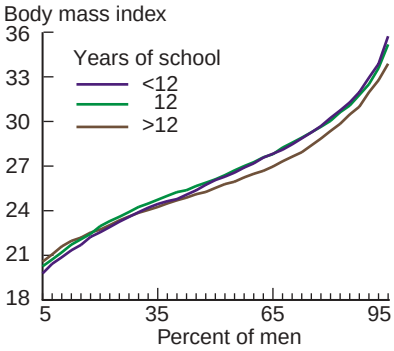
Does Men's Body Fatness Show a Similar Pattern?

If the effects of education and income on caloric intake are fundamental, one might expect to see similar effects of these variables on the distribution of body fatness. Persistent differences in caloric intakes between two groups accumulated over time could result in a similar disparity in their weight distributions. We examined this possibility by charting the percentiles of BMI for adults age 20 and older (excluding pregnant or lactating women). The data are from the Third National Health and Nutrition Examination Survey (NHANES III), conducted over 1988-94, and are adjusted with sampling weights to make the estimates representative of the U.S. population.

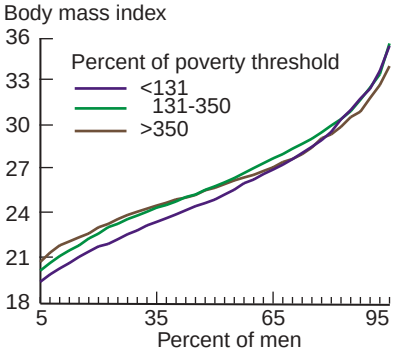
The results for men are rather striking, especially with regard to educational attainment. Just as for energy intake, men with more than a high school education are less prevalent among those with low BMI as well as those with high BMI (fig. 2). For example, for men with less than a high school education, the 10th percentile of BMI is 20.9; for men with more than a high school education, the 10th percentile of BMI is 21.6. At the other end of the BMI distribution, about 22 percent of men with less than a high school education are obese (defined as BMI at or above 30), compared with only 17 percent of men with more than a high school education.

The picture is less clear with respect to income (fig. 2). The prevalence of obesity is slightly higher among men in the lowest income group (19.4 percent) than among men in the highest income group (18.2 percent), but the differ-

Figure 2—Difference in Body Fatness by Education Level is Wider Among Heavier Men...



...While Differences in Body Fatness by Income Level Is Greater Among Lighter Men

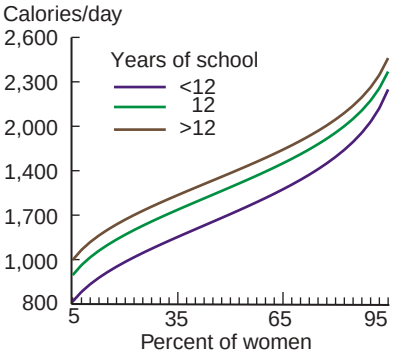


Source: USDA's Economic Research Service.

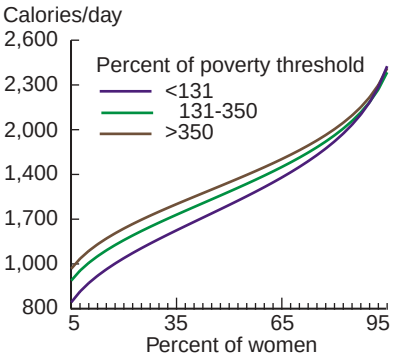
ence between lowest and highest income groups in the upper end of the BMI distribution is less than suggested by their caloric intake distributions. This effect may result from lower income men consuming larger amount of calories but also expending more energy through more physically demanding work or leisure-time activities.

An implication of these findings is that higher levels of educational attainment and household income influence men toward moderating their energy intakes, especially excessive intakes. This implication is bolstered by the finding that greater education and income tend to shift the upper end of the BMI distributions downward. Health economists have found a strong correlation between education and a variety of desirable health behaviors, including more healthful diets. They attribute this correlation to the increased ability of those with more education to acquire and use information on healthful lifestyles. At the same time, the link between income and health is well documented in public health research. Higher incomes may provide individuals with greater access to health care and enable them to adopt more healthful behaviors. Our analysis found further evidence of the positive effects of income and education on health behaviors through moderation in caloric intake.

Figure 3—Women's Usual Energy Intake Increases With Education...



...And Income, Except for the Top Decile



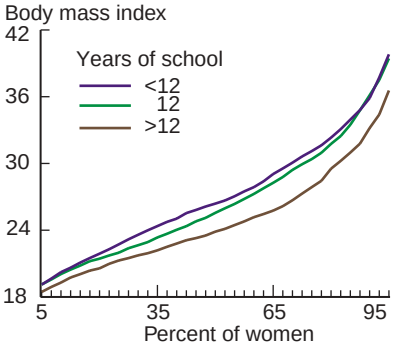
Source: USDA's Economic Research Service.

Reported Caloric Intakes and BMIs Do Not Always Match

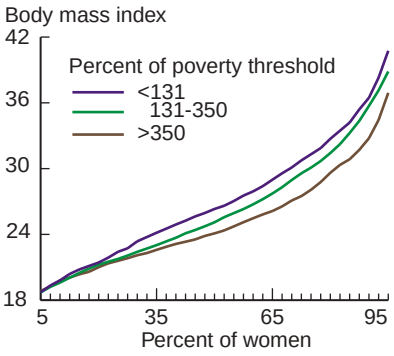
One has to be cautious with this interpretation of the effects of income and education on caloric intakes and body fatness because similar results—that is, the tendency toward moderation with higher education and income—are not found for women. Men and women arguably face similar environmental and social factors that influence their caloric intakes and body fatness. However, the patterns of self-reported caloric intake and BMI distributions among subpopulations of women are completely different than patterns among men.

Among women, lower income and lower educational attainment are associated with lower usual energy intakes at the mean (table 2), as well as at other parts of the energy intake distribution (fig. 3). Meanwhile, women's BMI distributions across educational and income groups show an opposing pattern—lower income and lower educational attainment are associated with higher BMI (fig. 4). For example, the median BMI for women with more than a high school education is 23.9 while that for women with less than a high school education is 26.4. And while 18.7 percent of women in the top income category are obese, 31.1 percent of women in the bottom income category are obese.

Figure 4—Body Fatness Varies Inversely With Education Among Healthy Weight, Overweight, and Obese Women...



...While the Share of Overweight and Obese Women Varies Inversely with Income



Source: USDA's Economic Research Service.

Clearly, the caloric intake pattern does not match the pattern of body fatness among women categorized by education and income. One explanation could be that among women, higher income and education might be associated with greater physical activity and energy expenditure. Alternatively, women with lower household incomes and lower education may be underreporting energy intake to a greater degree, compared with women of higher income and education. Resolving this puzzle requires better data on both caloric intakes and physical activity levels.

Racial and Ethnic Variations in Reported Caloric Intake and BMI Patterns

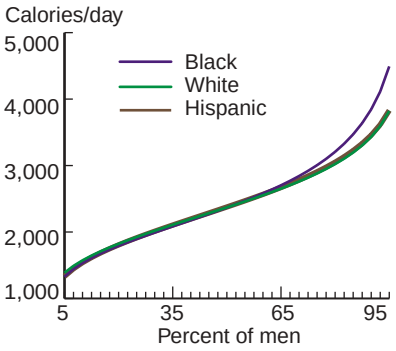
Among men, non-Hispanic Blacks have higher mean usual caloric intakes (2,562 calories) than

non-Hispanic Whites (2,456 calories) or Hispanics (2,452). The distribution of caloric intake among these groups shows that most of this difference occurs among those men consuming more than 2,900 calories daily (fig. 5). The bottom 65 percent of all three groups has nearly identical energy intake levels. Consistent with the disparity in caloric distributions, the BMI distributions show a slightly higher level of BMI among the top quintile of Blacks, compared with the top quintiles of Whites and Hispanics. On the other hand, among those with healthy weights (BMI < 25), Blacks have slightly lower BMI than Whites and Hispanics.

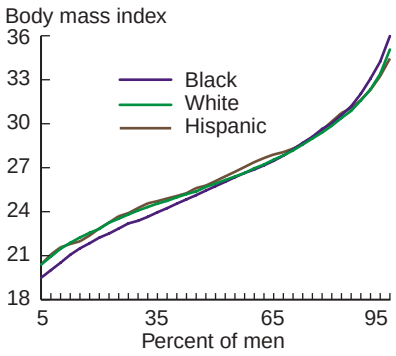
Among women, Hispanics have lower usual caloric intakes than non-Hispanic Whites and Blacks (fig. 6). Although Black and White women have almost the same caloric intake on average, Black women consume a slightly lower amount of calories than White women among the bottom half. However, this effect is offset by the upper respective halves among which Black women have a higher caloric intake. Just as with income and education subgroups, the BMI patterns among racial/ethnic subgroups of women fail to match the pattern implied by caloric intakes. At any given percentile, non-Hispanic Black women have higher BMI than non-Hispanic White women (fig. 6). BMI of Hispanic women fall between non-Hispanic White and Black women. While about 23 percent of White women are obese, 31 percent of Hispanic women and 37 percent of Black women are obese.

Several trends, including increasing consumption of soft drinks and snacks, greater proportion of food expenditures spent on food away from home, the growing portion size of restaurant meals, and our increasingly sedentary lifestyles, have been mentioned as possible causes of the growth in obesity in the United States. But disparities in obesity prevalence across subpopulations are equally worrisome. Aside from genetic differences, such inequalities could only result from differences in caloric intakes or physical activity levels. It appears that differences in caloric intakes among men may be associated with some of the disparities in obesity. Among women, there is dissonance between the distribution of usual caloric intake and the distribution of BMI. Whether this dissonance occurs because of differences in physical activity levels or underreporting of caloric intakes is an issue that needs to be resolved for a better understanding of the causes of disparities in overweight and obesity among women.

Figure 5—A Greater Share of Non-Hispanic Black Men Have Excessive Caloric Intakes...

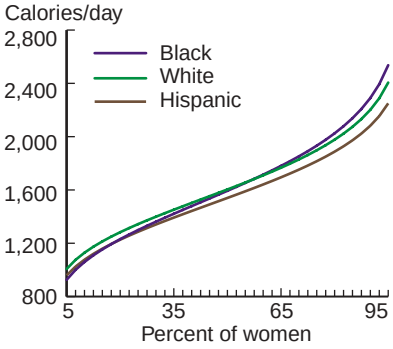


...And BMIs in the Healthy or Obese Range

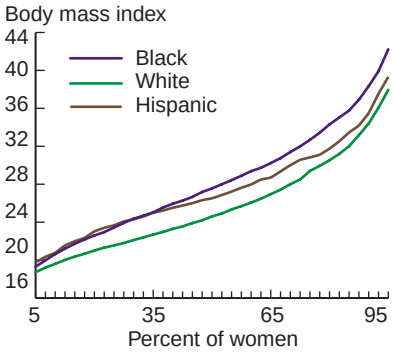


Source: USDA's Economic Research Service.

Figure 6—Hispanic Women Report Lower Usual Caloric Intakes Than Non-Hispanic Women...



...But Non-Hispanic White Women Have Lower BMIs



Source: USDA's Economic Research Service.

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