

## Special Article

## A PROSPECTIVE STUDY OF HOLIDAY WEIGHT GAIN

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## ABSTRACT

**Background** It is commonly asserted that the average American gains 5 lb (2.3 kg) or more over the holiday period between Thanksgiving and New Year's Day, yet few data support this statement.

**Methods** To estimate actual holiday-related weight variation, we measured body weight in a convenience sample of 195 adults. The subjects were weighed four times at intervals of six to eight weeks, so that weight change was determined for three periods: preholiday (from late September or early October to mid-November), holiday (from mid-November to early or mid-January), and postholiday (from early or mid-January to late February or early March). A final measurement of body weight was obtained in 165 subjects the following September or October. Data on other vital signs and self-reported health measures were obtained from the patients in order to mask the main outcome of interest.

**Results** The mean ( $\pm$ SD) weight increased significantly during the holiday period (gain,  $0.37 \pm 1.52$  kg;  $P < 0.001$ ), but not during the preholiday period (gain,  $0.18 \pm 1.49$  kg;  $P = 0.09$ ) or the postholiday period (loss,  $0.07 \pm 1.14$  kg;  $P = 0.36$ ). As compared with their weight in late September or early October, the study subjects had an average net weight gain of  $0.48 \pm 2.22$  kg in late February or March ( $P = 0.003$ ). Between February or March and the next September or early October, there was no significant additional change in weight (gain,  $0.21 \text{ kg} \pm 2.3 \text{ kg}$ ;  $P = 0.13$ ) for the 165 participants who returned for follow-up.

**Conclusions** The average holiday weight gain is less than commonly asserted. Since this gain is not reversed during the spring or summer months, the net 0.48-kg weight gain in the fall and winter probably contributes to the increase in body weight that frequently occurs during adulthood. (N Engl J Med 2000;342:861-7.)

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**O**VERWEIGHT and obesity affect approximately one half of the U.S. adult population,<sup>1,2</sup> and the proportion of those with obesity, defined as a body-mass index (the weight in kilograms divided by the square of the height in meters) of 30 or more, has increased by 50 percent during the past decade.<sup>3</sup> Because obesity, once established, is difficult to reverse, the development of effective strategies for prevention is imperative.

Understanding times when people are more likely to gain weight throughout the life cycle is important for the development of such strategies. Several periods, including adolescence,<sup>4,5</sup> pregnancy,<sup>6,7</sup> and mid-life<sup>8</sup> in women and the period after marriage in men,<sup>9</sup> appear to be times of particular susceptibility to weight gain. Behavioral or environmental changes, such as quitting smoking<sup>10,11</sup> or emigrating to a more highly urbanized culture,<sup>12,13</sup> can also be associated with weight gain.

For most adults, there is a slight increase in weight over time, with the average weight gain in young adults ranging from 0.2 to 0.8 kg per year.<sup>14-19</sup> The first National Health and Nutrition Examination Survey follow-up study found that among adults 25 to 44 years old, the body weight measured at 10-year intervals increased by an average of 3.4 percent in men and 5.2 percent in women.<sup>16,18</sup>

It is not known whether the weight gain observed in long-term studies of U.S. adults results from small, steady increases in weight throughout the year or from increases during discrete periods of increased energy intake, decreased energy expenditure, or both, such as holiday periods or particular seasons. Few studies have measured individual changes in body weight at intervals of less than one year. Two studies reported self-measured body weight in narrowly selected populations in Europe.<sup>20,21</sup> Each found seasonal variations in body weight of less than 0.6 kg. In contrast, studies relying on self-reports have found that healthy people believe their weight increases, on average, by more than 5 lb (2.3 kg) in the fall and winter.<sup>22,23</sup>

In the United States, the winter holiday season is generally considered to begin with Thanksgiving and end after New Year's Day. Winter holiday-related weight gain has been the subject of many reports in the lay press. For example, on December 25, 1995, the Cable News Network reported that "the aver-

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age American [will] gain seven to 10 pounds [3.2 to 4.5 kg] before the New Year.”<sup>24</sup> A report from the Texas Medical Association stated that “most studies show the average American gains 8 pounds [3.6 kg] during the period from Thanksgiving to New Year’s Day.”<sup>25</sup> All the reports we retrieved<sup>24-31</sup> suggested that at least 5 lb were gained from Thanksgiving to New Year’s Day, but none offered a credible source for that suggestion. A literature review failed to identify any clinical research findings supporting the claim of a 5-lb or greater average weight gain over the winter season.<sup>20,21,32-35</sup>

In order to determine the effect of both the season and the holiday period on changes in body weight in U.S. adults, we measured weight in a convenience sample of adults from September to March and calculated individual changes in body weight before, during, and after the winter holiday season. We hypothesized that any observed weight change would be similar during each measurement period.

## METHODS

### Subjects

A total of 200 subjects were recruited for a study of “seasonal changes in vital signs” by means of advertisements placed throughout the National Institutes of Health campus in Bethesda, Maryland. Subjects were compensated for participation. Recruitment was stratified to ensure the equitable participation of both sexes, several racial and ethnic groups, and a range of ages and occupations (Table 1). Entry criteria included an age of at least 18 years, good general health, and willingness to attend all study visits. Subjects were excluded if they had serious medical conditions, were taking medications known to affect body weight, or were pregnant. Subjects were enrolled without regard to weight, dietary habits, or dieting history. The study was approved by the institutional review board of the National Institute of Child Health and Human Development, and all subjects provided written informed consent before enrollment.

### Protocol

The subjects were seen on four occasions at intervals of six to eight weeks: during late September or early October, during mid-November (before Thanksgiving), in early or mid-January (after New Year’s Day), and in late February or early March. Height was measured to the nearest 1 mm at the first visit with a stadiometer (Holtain, Crymmyck, United Kingdom) that was calibrated against a standard height before each use. At each visit, weight was measured to the nearest 0.01 kg with an electronic scale (Life Measurement Instruments, Concord, Calif.) that was calibrated against a standard weight before each measurement. The subjects were weighed wearing undergarments and hospital gowns without shoes. Each subject was weighed at the same time of day as at the initial visit (e.g., in the morning after breakfast or in the afternoon after lunch).

We masked the main outcome of interest (changes in body weight) by carrying out additional measurements at study visits. Temperature was measured electronically (Sherwood Medical, St. Louis) once at each visit, and both pulse and blood pressure were measured with an automated sphygmomanometer (Critikon, Tampa, Fla.) before and after the subjects completed a series of questionnaires. These questionnaires included a health screening form and forms evaluating factors such as stress, dietary and activity patterns, and depression, including winter seasonal affective disorder.<sup>22,23</sup> The subjects were asked to describe changes in their habits during the previous six weeks at the first visit, and changes since the

**TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF THE 195 SUBJECTS.\***

VARIABLE	VALUE
Age (yr)	
Mean	39±12
Range	19–82
Sex (%)	
Male	49
Female	51
Race or ethnic group (%)	
Black	17
Asian	10
White	67
Hispanic	6
Initial weight (kg)	
Mean	74.4±16.3
Range	43.4–139.2
Initial body-mass index	
Mean	25.9±4.8
Range	17.8–46.8
<25 (%)	52
≥25 but <30 (%)	28
≥30 (%)	21
Hollingshead scale of socioeconomic status	
Median	IV
Range	II–V
No. of holiday parties attended	
Mean	4.4±2.8
Range	0–10

\*Plus-minus values are means ±SD. The body-mass index is the weight in kilograms divided by the square of the height in meters. The Hollingshead scale of social classes ranges from I (the status of unskilled workers) to V (that of professionals). Because of rounding, not all percentages total 100.

last visit at all other visits. At the visit in late February or early March, the subjects were asked about their understanding of the main purpose of the research project and were asked how much weight they believed they had gained over the winter holiday period.

The subjects were subsequently invited to return for two additional visits, in June and in late September or early October, for observation of changes in body weight over a one-year period.

### Statistical Analysis

The data were analyzed on a Macintosh PowerPC with Stat-View software (version 4.5, Abacus Concepts, Berkeley, Calif.). The weights from the first four measurements were used to compute weight change for three periods: preholiday (from late September or early October to mid-November), holiday (from mid-November to early or mid-January), and postholiday (from early or mid-January to late February or early March). Because there were individual differences in the intervals between measurements, the data were also analyzed as weight change adjusted for a six-week interval by dividing the weight change by the number of days between measurements and multiplying by 42. The results were unchanged when this method of analysis was used, and therefore the unadjusted weight changes are presented. The weight change between measurements was also calculated for the subgroup of subjects measured in June and September or October.

Analysis of variance for repeated measures was used to examine both body weight and change in body weight, with race or ethnic group and sex tested as independent factors. Post hoc paired *t*-tests, with significance adjusted by the Bonferroni correction for multiple comparisons, were used to detect differences in weight and in

weight change for each interval. Paired t-tests were also used to determine differences between actual holiday weight change and the change estimated by the subjects. Contingency-table analysis was used to determine differences in weight change among subjects who were not overweight (body-mass index,  $<25$ ), subjects who were overweight (body-mass index,  $\geq 25$  but  $<30$ ), and subjects who were obese (body-mass index,  $\geq 30$ ). Linear regression was used to determine the relation between weight change and continuous variables such as age and initial body-mass index. Data are presented as means  $\pm$  SD unless otherwise stated.

## RESULTS

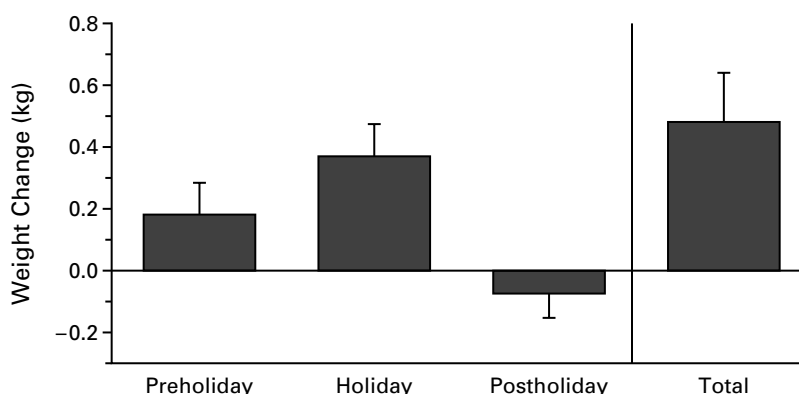
Demographic data on the 200 recruited subjects are presented in Table 1. Fifty-one percent of the subjects were women. The sample was racially diverse, and ages ranged from 19 to 82 years. The initial mean body-mass index ( $25.9 \pm 4.8$ ) and median body-mass index (24.8) were similar to the median body-mass index reported for the U.S. adult population (25.5),<sup>1</sup> as was the prevalence of overweight (27 percent of the subjects had a body-mass index of  $\geq 25$  but  $<30$ ) and obesity (21 percent had a body-mass index of  $\geq 30$ ).<sup>2</sup> Eighty-eight percent of the subjects worked at the National Institutes of Health, a government facility that employs more than 19,000 people in occupations ranging from maintenance and food service to biomedical research. The subjects were recruited from a variety of occupations. Their socioeconomic status, as assessed by the Hollingshead scale, ranged from social classes II through V, with a class of I indicating the status of unskilled workers and a class of V that of professionals.<sup>36</sup>

Of the 200 recruited subjects, complete data on weight from the first four visits were available for 195 (98 percent). Analysis of variance for repeated measures revealed that weight changed significantly during

the study ( $P=0.01$ ). The mean weight increased significantly (Fig. 1) during the holiday period (gain,  $0.37 \pm 1.52$  kg; range,  $-6.96$  to  $+4.07$  [negative numbers indicate weight loss];  $P<0.001$ ), but not during the preholiday period (gain,  $0.18 \pm 1.49$  kg; range,  $-4.33$  to  $+8.07$ ;  $P=0.09$ ) or the postholiday period (loss,  $0.07 \pm 1.14$  kg; range,  $-6.18$  to  $+2.47$ ;  $P=0.36$ ). The weight change during the holiday period was not significantly different from the weight change during the preholiday period ( $P=0.23$ ), but it was greater than that in the postholiday period ( $P=0.002$ ). As compared with their weight in September or early October, the study subjects had an average net weight gain of  $0.48 \pm 2.22$  kg at the February or March measurement (range,  $-9.33$  to  $+8.02$  kg;  $P=0.003$ ). However, most subjects had no large changes in weight: at more than 50 percent of all measurements after the initial one, the weight differed from that in the previous measurement by no more than 1 kg (Fig. 2).

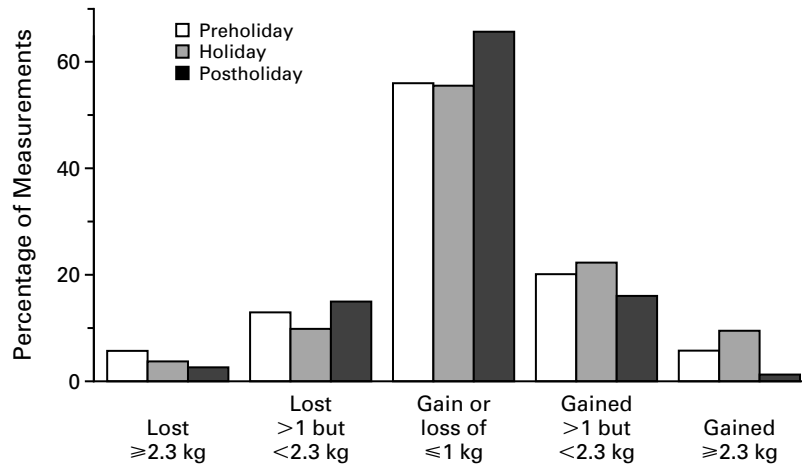
Twenty-nine subjects (15 percent) reported that they attempted to lose weight during the holiday period, but their holiday weight change ( $+0.13 \pm 1.73$  kg) did not differ significantly from that of the subjects who reported no such attempts ( $+0.42 \pm 1.49$  kg,  $P=0.35$ ). There were no independent effects of sex, race or ethnic group, or socioeconomic status on weight change during any interval, and there was no correlation between weight change and age ( $r^2<0.001$ ).

Forty-five percent of the subjects were weighed during the first week of January, and 86 percent were weighed before January 14. There was no significant relation between the week in January during which weight was measured and the amount of weight



**Figure 1.** Mean ( $\pm$ SE) Weight Change in 195 Subjects.

The preholiday period is the interval from late September or early October to mid-November (before Thanksgiving). The holiday period is the interval from mid-November to early or mid-January (after New Year's Day). The postholiday period is the interval from early or mid-January to late February or early March. Total is the interval from the first measurement in late September or early October to the last measurement in late February or early March.  $P<0.001$  for the weight increase over the holiday period;  $P=0.002$  for the change in weight between the holiday and the postholiday periods;  $P=0.003$  for the weight increase over the total measurement period.



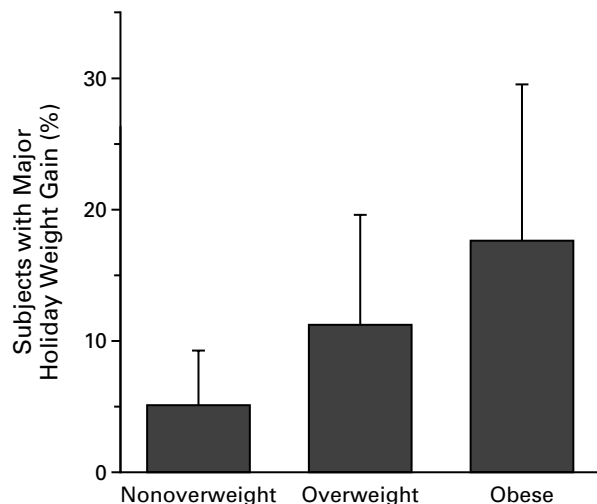
**Figure 2.** Distribution of Weight Changes.

In more than 50 percent of all measurements of weight after the initial one, the change from the previous measurement was no more than 1 kg.

change (first week,  $+0.55 \pm 1.4$  kg; second week,  $+0.23 \pm 1.49$  kg; third week,  $+0.56 \pm 1.67$  kg; fourth week,  $+0.30 \pm 1.77$  kg) or the proportion of subjects reporting that they had attempted to lose weight during the holiday period ( $P=0.74$  by chi-square test).

The amount of weight change during the holiday period was not significantly correlated with body-mass index ( $r^2 < 0.006$ ). However, when the subjects were categorized as not overweight, overweight, or obese according to their body-mass index, there was a trend toward a greater likelihood of gaining at least 2.3 kg with increasing degree of overweight ( $P=0.06$ ) (Fig. 3). Because a weight gain of 2.3 kg corresponds to a 3 percent weight change for a person with the average body weight in this study (74.4 kg), we also determined whether a holiday weight gain of at least 3 percent was more common among overweight or obese subjects. When a major weight gain was defined in this manner, the probability of a weight gain of at least 3 percent did not differ significantly ( $P=0.76$ ) among subjects who were not overweight (probability, 7.9 percent), overweight (11.1 percent), or obese (7.5 percent).

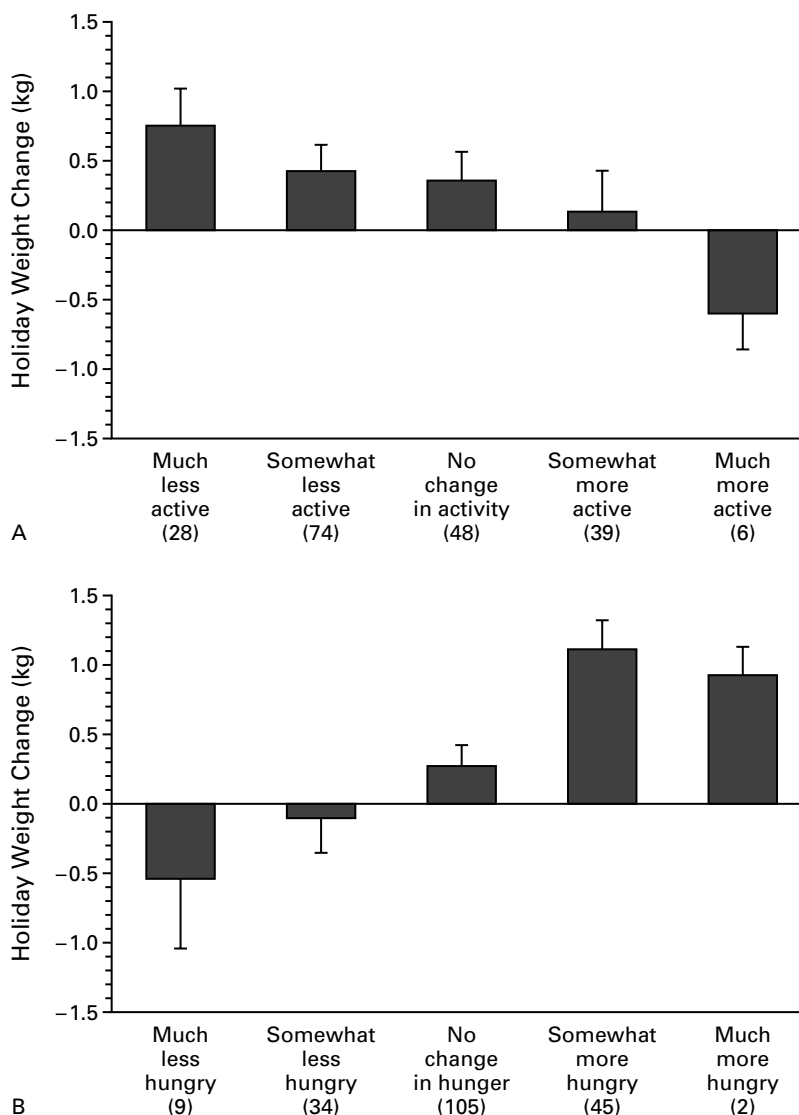
Using self-reported data, we examined several other possible predictive factors for holiday weight gain: changes in the level of perceived stress, hunger, or activity; changes in smoking habits; the presence of winter seasonal affective disorder; and the number of parties or receptions attended. The only factors related to holiday weight change were reported changes in activity ( $P=0.01$ ) and in hunger ( $P<0.001$ ) (Fig. 4). Those who reported being much more active or much less hungry since their last visit had the greatest weight loss; conversely, those reporting being much less active or much more hungry since their last visit gained the most over the holiday interval.



**Figure 3.** Percentage of Subjects with Major Holiday Weight Gain ( $\geq 2.3$  kg) among 101 Nonoverweight, 54 Overweight, and 40 Obese Subjects.

Nonoverweight subjects were defined as those with a body-mass index of  $<25$ , overweight subjects as those with a body-mass index of  $\geq 25$  but  $<30$ , and obese subjects as those with a body-mass index of  $\geq 30$ . The 95 percent upper confidence limit is shown. There was a trend toward a greater likelihood of major holiday weight gain as the degree of overweight increased ( $P=0.06$ ).

The subjects were asked at their February or March clinic visit how much weight they believed they had gained over the holiday period. The perceived weight gain ( $1.57 \pm 1.47$  kg) was significantly greater than the measured weight gain by an average of  $1.12 \pm 1.79$  kg ( $P<0.001$  by paired t-test); there was no effect of sex,



**Figure 4.** Mean ( $\pm$ SE) Self-Reported Changes in Physical Activity (Panel A) and Hunger (Panel B) in Relation to Weight Change during the Holiday Interval.

The relation was significant for both activity ( $P=0.01$ ) and hunger ( $P<0.001$ ). The values in parentheses are the numbers of subjects in the subgroups.

race or ethnic group, or body-mass index on the degree of overestimation.

In order to assess the adequacy of the masking procedures, the subjects were also asked at the February or March visit to describe what they believed to be the primary purpose of the study. Only 21.4 percent identified seasonal weight change as the main outcome of interest. The remainder named a variety of primary outcomes, including seasonal changes in psychological factors or vital signs such as temperature, pulse, or blood pressure (64.8 percent), or were unsure (13.8 percent). The holiday weight change of those who identified weight as the primary outcome

( $+0.24 \pm 1.52$  kg) was not significantly different from that of subjects who named other primary outcome measures ( $+0.41 \pm 2.33$  kg,  $P=0.53$ ).

A subgroup of 165 subjects (85 percent) agreed to return for two additional visits in June and in late September or early October. The subjects who completed these additional visits did not differ significantly from those who declined to return with regard to initial body weight, body-mass index, age, sex, race or ethnic group, or socioeconomic status. Their average holiday weight change ( $+0.32 \pm 1.52$  kg,  $P=0.003$ ) and their net weight change from September or October to February or March ( $+0.40 \pm 2.28$  kg) were

also not significantly different from the weight changes of those who did not choose to return. For these 165 subjects, there were no significant changes in body weight between February or March and June ( $+0.03 \pm 1.91$  kg,  $P=0.86$ ), or between June and the next September or October ( $+0.19 \pm 1.75$  kg,  $P=0.16$ ). Between February or March and September or October, their net change in weight was a gain of  $0.21 \pm 2.3$  kg ( $P=0.13$ ), leading to a net weight gain of  $0.62 \pm 3.03$  kg during the one-year observation period ( $P=0.01$ ).

## DISCUSSION

In contrast to the common perception that weight increases during the winter holiday season, the measured weight of the vast majority of subjects in this study changed little between Thanksgiving and New Year's Day. The subjects believed they had gained four times as much weight as their actual holiday weight gain of 0.37 kg. Fewer than 10 percent of subjects gained 2.3 kg or more, and more than half of all measurements of weight after the initial one were within 1 kg of the previous measurement. Thus, despite the fact that 85 percent of the study subjects made no effort to control their weight, large weight gains over the winter holiday season were not the norm. Unfortunately, we also found that the 0.18-kg average weight gain during the fall preholiday period and the 0.37-kg increase during the holiday season were largely maintained during the postholiday winter period from January to February or March, resulting in a net average weight gain of 0.48 kg. In subjects who completed one year of observation, the weight increased by an average of 0.32 kg during the holiday period and 0.62 kg over the entire year, suggesting that the period contributing most to yearly weight change is the six-week holiday period.

A potential limitation of our study is that we used a convenience sample, primarily National Institutes of Health employees, rather than a population-based sample. The subjects resided in a large, urban area, and persons from the lowest socioeconomic levels were underrepresented. It is also possible that National Institutes of Health employees may be more health-conscious than the general population. Although the range of the study group in terms of age, race or ethnic group, socioeconomic status, and body-mass index was broad, and although both the mean body weight and the prevalence of overweight and obesity were remarkably similar to those in the U.S. adult population, these findings may not be generalizable to all U.S. population groups.

The rate of retention of the cohort was excellent, with 98 percent of the subjects completing the primary study and 85 percent of these returning for weight measurements in June and September or October. Accurate measurements of body weight were obtained with the use of standardized protocols for

weighing, which required each subject to wear similar clothing each time he or she was weighed and to be weighed at the same time of day. Our attempts to mask the primary purpose of the study by collecting additional data appeared to be effective, since only 21.4 percent of the subjects concluded that investigating change in body weight was the primary purpose of the study. Masking may have decreased the likelihood that the subjects would attempt to change their body weight (for example, by dieting or skipping meals) before their study visits. We believe that our results are likely to reflect actual holiday weight change more accurately than studies that rely on clinical samples or self-reports.

We also found that those who had a major holiday weight gain, defined as a gain of at least 2.3 kg, were more likely to be overweight or obese than those who did not have such a major gain. Such weight gain may be clinically important, particularly for those who are already at risk for obesity-related conditions. A Swedish study of obese subjects in a weight-maintenance program and of hospital employees found that self-recorded Christmastime weight gain (over a three-week period) averaged 0.6 kg or less in each group. However, the variability in weight change was significantly greater in obese subjects who had previously lost weight than in controls (maximal increases in weight, 6.1 and 2.2 kg, respectively).<sup>21</sup> Others have described a lowering of the efficacy of weight-reduction or weight-maintenance programs during the winter season.<sup>35,37-39</sup>

Taken together, these results suggest that the winter holiday season may present special risks for those who are already overweight or obese and that such persons may benefit from seasonal efforts to prevent weight gain.<sup>35,39,40</sup> The relation we found between reported physical activity and weight change points to the need for further studies to determine whether increasing physical activity can prevent holiday-related weight gain in persons at risk.

Weight gain during adulthood has serious consequences for health and is a risk factor for the development of type 2 diabetes,<sup>41</sup> cardiovascular disease,<sup>42</sup> and other conditions.<sup>43,44</sup> The 0.48-kg weight gain of the subjects in this study between September or October and February or March might not appear to be clinically important and could easily go unnoticed by both the subjects and health care providers. Our data suggest that this weight gain is not reversed during the spring and summer months. Therefore, the cumulative effects of yearly weight gain during the fall and winter are likely to contribute to the substantial increase in body weight that frequently occurs during adulthood.

Supported by a grant (Z01 HD-00641) from the National Institute of Child Health and Human Development and the Office of Research on Minority Health (to Dr. Jack A. Yanovski).

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