

Food intake and meal patterns of weight-stable and weight-gaining persons¹⁻³

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ABSTRACT

Background: Weight gain is a result of changes in the regulation of short-term meal-to-meal intake. An investigation of the short-term intake and activity levels of weight-gaining persons may provide insight into the nature of the cues signaling weight gain.

Objective: The basic hypothesis was that the investigation of energy balance during periods of dynamic weight gain should provide clues to the regulatory differences that result in obesity.

Design: The eating behavior and activity levels of 19 weight-gaining men and women and of weight-stable, matched control subjects were compared with the use of 7-d diet diaries. Participants recorded their activity levels, everything that they ate or drank, and the environmental and psychological factors surrounding each eating episode for 7 consecutive days.

Results: The weight-gaining group ingested 1645 kJ/d more than did the weight-stable group because of a greater consumption of carbohydrate and fat and larger meal sizes.

Conclusion: The greater food intake in the weight-gaining group did not result from environmental, social, or psychological factors, suggesting that the overeating associated with weight gain might be physiologically based. *Am J Clin Nutr* 2002; 76:107-12.

KEY WORDS Food intake, meal patterns, weight gain, weight stability, obesity, physical activity

INTRODUCTION

Weight gain occurs as a result of a decrease in energy expenditure, an increase in energy intake, or both. Self-report studies show that overweight persons consume similar amounts of food as do their normal-weight counterparts (1-3); however, studies using physiologic measures indicate that overweight persons underestimate their intakes greatly (4-8). In addition, human studies indicate that obesity is associated with the consumption of high-fat diets (9-11).

Among the components of energy expenditure, basal metabolic rate (BMR) does not seem to be an influential component of weight gain. Doubly labeled water studies indicate that the elevated BMR found in overweight persons is due to the increased cost of maintaining an overweight body (12, 13) and is most likely a consequence rather than a cause of maintaining an overweight body. In addition, diet-induced thermogenesis is known to be highly variable (14) and is lower, at least to a cer-

tain degree, in obese persons. However, this lower diet-induced thermogenesis in weight-stable obese persons is probably not a cause of weight gain but rather an effect of dieting. Self-report studies comparing the physical activity levels of overweight and normal-weight control subjects have yielded conflicting results (1, 9, 15, 16). However, studies using the doubly labeled water method and activity monitors showed no differences in activity levels between obese and normal-weight control subjects (12, 17-19).

Overweight persons ingest more total food energy and fat than do normal-weight persons; however, these studies did not make a distinction between weight-stable and weight-gaining persons. In a weight-stable situation, the increased intake is probably a consequence rather than a cause of overweight. Kulesza (20) compared the self-reported food intakes of weight-stable obese (10% weight gain within the previous year), weight-gaining obese, and normal-weight control subjects. No differences in energy intake or diet composition were found between the weight-stable obese group and the control subjects. However, the weight-gaining group consumed more energy, fat, and carbohydrate than did the weight-stable obese group. These findings suggest that weight-maintaining, obese persons do not consume more energy than do their normal-weight counterparts. However, weight-gaining, obese persons eat more than do their weight-stable obese and normal-weight control subjects. Although these findings are important, only the effects of meal patterns in women were studied, and the effects of activity levels, mood, hunger, and social facilitation were not assessed.

In the present study we examined the detailed food intake patterns and activity levels of weight-gaining and weight-stable persons. The investigation of energy balance during periods of weight gain should provide clues to the regulatory differences that result in obesity.

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TABLE 1
Characteristics of the weight-stable and weight-gaining groups by sex¹

Characteristic	Weight-stable group	Weight-gaining group
Women (<i>n</i> = 12)		
Weight (kg)	85.51 ± 6.57	80.67 ± 5.52
Height (m)	1.70 ± 0.01	1.66 ± 0.01
BMI (kg/m ²)	30.49 ± 2.23	30.19 ± 2.04
Age (y)	25.92 ± 2.18	23.17 ± 2.26
TFEQ		
Disinhibition	5.78 ± 0.91	7.20 ± 1.13
Cognitive restraint	6.56 ± 1.27	7.50 ± 1.71
Perceived hunger	6.11 ± 0.84	5.90 ± 1.12
Men (<i>n</i> = 7)		
Weight (kg)	85.02 ± 5.64	86.35 ± 6.41
Height (m)	1.79 ± 0.03	1.80 ± 0.04
BMI (kg/m ²)	27.45 ± 1.33	27.62 ± 2.23
Age (y)	24.14 ± 1.84	28.00 ± 4.36
TFEQ		
Disinhibition	6.00 ± 1.34	4.33 ± 0.99
Cognitive restraint	4.20 ± 1.69	3.33 ± 1.36
Perceived hunger	6.80 ± 1.62	5.50 ± 1.61

¹ $\bar{x} \pm \text{SEM}$. TFEQ, Three-Factor Eating Questionnaire (21). There were no significant differences between groups.

SUBJECTS AND METHODS

Participants

Fourteen men and 24 women were recruited through the research pool at Georgia State University. Participants received research participation credit, which partially satisfied a course requirement, and they received a detailed nutritional analysis based on their food intakes over the 7-d reporting period. Informed consent was obtained from all subjects, who were told that their nutrient intakes were being studied, and the protocol was approved by the Georgia State University. To participate, the subjects must not have been actively dieting, pregnant or lactating, or taking any medication that could influence their eating behavior or metabolism. Subject characteristics, including age, weight, height, body mass index (in kg/m²), and scores from the Three-Factor Eating Questionnaire (21) are presented separately for the men and women in **Table 1**. Note that not all of the subjects in the weight-gaining group were overweight. Body mass indexes ranged from 21.71 to 45.28 and from 21.57 to 46.82 in the weight-stable and weight-gaining groups, respectively.

Participant screening

Subjects were asked to draw a graph representing their weight during the past 6 mo. On the basis of this graph, subjects were classified as weight gaining or weight stable. The criteria for being classified as weight gaining were as follows: a weight gain of >5% of current body weight during the previous 6 mo, no medical reason for the weight gain (eg, surgery limiting mobility), and continued weight gain in the month before the study. The criterion for being classified as weight stable was a stable weight during the previous 6 mo (ie, weight fluctuations of <2%). Subjects who met the weight requirements and indicated that they were interested in further participation were contacted by phone and asked to participate in the second part of the study. The weight-gaining and weight-stable subjects were matched for sex, height, and weight.

Data collection

Weight and height were measured with a standard medical scale both before and after the recording period while the subjects were wearing indoor clothing. Each participant must have gained weight during the week that they were recording their food intakes to be included in the weight-gaining group.

Food intake

Subjects were given a 1-d (practice) and a 7-d food intake diary (a pocket-sized booklet containing detailed instructions) to record their food intakes. At the time of each eating episode (meals or snacks), the subjects were asked to record in as detailed a manner as possible every item that they ate or drank, the location of the eating episode, the number of other persons present during the meal and their relation to the subject, and the beginning and ending times of the eating episode. In addition, the subject's hunger, thirst, depression, and anxiety—both before and after each eating episode—were recorded on 7-point Likert scales. After completion of the 1-d practice diary, the diary was reviewed by the experimenter, and the subjects were reinstructed if any recording deficiencies were noted. The subjects were then instructed to begin recording their food intakes in the 7-d diaries. To more accurately estimate food intake, subjects were also given a 35-mm camera that printed the time and date that the picture was taken on each photograph. The participants were instructed to take a picture of their food at the beginning and at the end of each eating episode. The photos were used to verify both the occurrence of meals and the amounts reported in the diaries. After the completed diaries were submitted, the experimenter reviewed the diaries and contacted the subjects by phone to clarify any ambiguities or missing data. *See de Castro (22)* for details of the diary recording procedure and its reliability and validity.

Food intake analysis

The items and quantities reported in the diaries were coded by the experimenter using a file of >3500 food items created from the US Department of Agriculture Handbook nos. 6 and 456 of the nutritive value of American foods. Complex food items were broken down into individual components, for example, a sandwich was broken down into 2 slices of white bread, 30 g grape jam, and 15 g peanut butter. All liquids were also coded and included in the analysis of meal composition. The diary codes were then entered into a computer, bouts were identified, and the composition of the individual items composing the meal were summed. To cover a range of definitions from lenient to strict, 5 different definitions of a meal were used that combined these minimum criteria: 15 min/209 kJ, 45 min/209 kJ, 45 min/418 kJ, 45 min/836 kJ, and 90 min/209 kJ. For a reported intake to be classified as a meal, it must have contained ≥209 kJ food energy or, more stringently, 418 or 837 kJ, and it also must have been separated in time from the preceding and following ingestive behaviors by ≥15 min. More stringent definitions of 45 and 90 min were also used.

Total daily intakes and the individual meals were characterized by their contents of total energy, carbohydrate, fat, protein, and sugar. Total daily intakes and the individual meals were also characterized by the hour of the day in which the meal was initiated, the number of other persons present during the meal, the duration of the meal, the rate of intake (kJ/min), the amount of time since the last meal (the premeal interval), the amount of



TABLE 2
Food intakes of the weight-stable and weight-gaining groups by sex¹

	Weight-stable group	Weight-gaining group
Women (n = 12)		
Daily intake		
Total intake (kJ)	7385.8 ± 363.19	9679.1 ± 678.1 ^{2,3}
Carbohydrate (g)	222.2 ± 9.0	308.3 ± 27.7 ²
Fat (g)	66.2 ± 4.3	85.9 ± 6.4
Protein (g)	62.8 ± 4.5	77.5 ± 5.5 ³
Carbohydrate (% of energy)	50.1 ± 1.2	52.7 ± 1.6
Fat (% of energy)	33.1 ± 1.3	33.4 ± 1.5
Protein (% of energy)	14.0 ± 0.6	13.4 ± 0.5 ³
Total intake (kJ/kg body wt)	92.0 ± 8.6	119.9 ± 3.5 ²
Carbohydrate (kJ/kg body wt)	46.1 ± 3.9	63.6 ± 2.6 ²
Fat (kJ/kg body wt)	31.1 ± 3.3	40.0 ± 2.2 ²
Protein (kJ/kg body wt)	12.8 ± 1.0	16.2 ± 0.8 ³
Mean activity rating	2.17 ± 0.13	2.01 ± 0.04
Men (n = 7)		
Daily intake		
Total intake (kJ)	10019.2 ± 759.4	10552.89 ± 1312.0 ^{2,3}
Carbohydrate (g)	298.4 ± 20.0	312.4 ± 32.5 ²
Fat (g)	86.1 ± 10.3	98.9 ± 16.0
Protein (g)	98.6 ± 7.1	97.4 ± 12.6 ³
Carbohydrate (% of energy)	49.3 ± 2.1	49.9 ± 2.7
Fat (% of energy)	31.4 ± 2.1	33.7 ± 2.4
Protein (% of energy)	16.3 ± 1.0	15.3 ± 1.0 ³
Total intake (kJ/kg body wt)	119.3 ± 9.2	121.5 ± 12.3 ²
Carbohydrate (kJ/kg body wt)	59.8 ± 4.9	61.7 ± 7.3 ²
Fat (kJ/kg body wt)	37.6 ± 2.7	42.1 ± 5.5 ²
Protein (kJ/kg body wt)	20.2 ± 2.3	17.9 ± 2.0 ³
Mean activity rating	2.37 ± 0.11	2.30 ± 0.20

¹ $\bar{x} \pm \text{SEM}$.²Significantly different from weight-stable group, $P < 0.05$.³Significantly different from opposite sex, $P < 0.05$.

time until the next meal (the postmeal interval), the premeal activity rating, and the pre- and postmeal self-ratings of hunger, thirst, depression, anxiety, and the attractiveness of the food. The estimated premeal and postmeal stomach contents were calculated with a computer model in which the reported intake is estimated to empty from the stomach at a rate proportional to the square root of the energy content of the stomach:

$$s_{n+1} = s_n - 5\sqrt{s_n} \quad (1)$$

where s is the stomach content (in kcal) and n is a particular minute of the day (23).

For each subject, meal sizes (in kJ) were correlated by using Pearson's product-moment correlations with the pre- and postmeal self ratings, beginning meal time, the number of other persons present during the meal, the premeal interval, the postmeal interval, the duration of the meal, the rate of intake (kJ/min), and the estimated premeal stomach content.

Activity level

The activity level was estimated by using an established, reliable activity diary method (24). Subjects were given a small, 7-page activity diary to be completed during the same 7 d as the food intake diary was completed. Each page corresponded to a particular recording day and was divided into 96 periods of 15 min each. Subjects were asked to qualify and record the dominant activity of each 15-min period on a 1–9-point scale with the use of a list of categorized activities. These activities ranged in inten-

sity from sleeping (a score of 1) to intense manual work or competitive sports (a score of 9). A mean for all of the scores reported in the activity diary for each day was used to determine a daily categorical activity score. The mean of these 7 daily scores was calculated to obtain an overall daily categorical activity value.

Statistical analysis

A 2×2 analysis of variance with the factors of sex (men and women) and weight status (weight stable and weight gaining) was used for the analysis of daily and total intakes. No significant interactions were found; therefore, the men and women were combined to form mixed-sex, weight-stable and weight-gaining groups for the meal-pattern analysis. Differences in meal patterns between the weight-stable and weight-gaining groups were assessed with t tests. Pearson's product-moment correlation coefficients were calculated for each subject individually and then transformed into z scores. These transformed correlation coefficients were then averaged for the weight-stable and weight-gaining groups, and t tests were used to determine differences in these coefficients between the groups (25).

RESULTS

Mean daily and total intakes and daily activity levels

To estimate underreporting, the ratio of energy intake (EI) to the BMR was calculated for each group. The EI:BMR was 1.14 for the weight-stable group and was 1.33 for the weight-gaining group. These ratios indicate that both groups were underreporting their energy intake considerably.

The mean (\pm SEM) daily macronutrient intakes and the proportion of macronutrients ingested in both subject groups are shown in **Table 2** by sex. No significant interactions were found between the groups. Significant ($P < 0.05$) main effects were found for weight status; the weight-gaining group ingested 1645.0 kJ more total food energy and 59.6 g more carbohydrate daily than did the weight-stable group. When body weight was taken into consideration, significant differences were found between the groups. The weight-gaining group ingested 18.43 kJ more total food energy, 11.7 kJ more energy as carbohydrate, and 7.6 kJ more energy as fat per kilogram body weight than did the weight-stable group ($P < 0.05$ for all). No significant differences in the grams of fat; the grams of protein; the percentage of energy as carbohydrate, fat, or protein; and the kilojoules of protein per kilogram body weight ingested were found between the groups.

Significant main effects of sex were observed in the men who ingested daily 1912.5 kJ more in total food, 28.7 g more protein, 2.1% more protein, and 4.5 kJ more protein per kilogram body weight than did the women ($P < 0.05$ for all). However, no significant differences in carbohydrate intake, fat intake, the percentage of energy as carbohydrate or fat ingested, total food energy ingested per kilogram body weight, the amount of carbohydrate ingested per kilogram body weight, and the amount fat ingested per kilogram body weight were found between the groups. No significant differences in activity estimates based on the activity diary or the activity questionnaire were found between groups (Table 2).

Meal characteristics

Analyses of the meal characteristics were performed on the basis of the 5 different meal definitions to determine whether any

TABLE 3
Meal intake characteristics of the weight-stable and weight-gaining groups¹

Characteristic	Weight-stable group (n = 7 M, 12 F)	Weight-gaining group (n = 7 M, 12 F)
Meal intake		
Meal frequency (no./d)	3.30 ± 0.14	3.52 ± 0.13
Meal size (kJ)	2546.87 ± 113.61	2845.52 ± 162.80 ²
Carbohydrate (kJ)	1277.96 ± 50.00	1463.28 ± 68.45 ²
Fat (kJ)	847.25 ± 54.00	982.28 ± 80.04 ²
Protein (kJ)	385.76 ± 22.90	407.60 ± 30.66
Premeal stomach content		
Total energy (kJ)	194.22 ± 35.06	437.02 ± 73.72 ²
Carbohydrate (kJ)	96.48 ± 18.12	224.89 ± 39.58 ²
Fat (kJ)	65.56 ± 12.51	153.43 ± 26.65 ²
Protein (kJ)	32.23 ± 6.82	58.71 ± 10.67
Postmeal stomach content (kJ)		
2391.45 ± 119.08	2963.44 ± 185.35 ²	
Beginning meal time (min)³		
918.00 ± 19.34	941.91 ± 16.21	
Premeal interval (min)		
270.51 ± 16.92	249.14 ± 14.73	
Postmeal interval (min)		
266.98 ± 15.48	249.14 ± 14.73	
Palatability ratings		
Premeal	5.47 ± 0.18	5.32 ± 0.19
Postmeal	5.25 ± 0.22	5.00 ± 0.22
Hunger ratings		
Premeal	5.38 ± 0.16	5.14 ± 0.15
Postmeal	2.25 ± 0.10	2.67 ± 0.16
Social facilitation		
Number of other persons present during the meal	1.60 ± 0.54	0.48 ± 0.07
Number of other men present during the meal	0.68 ± 0.16	0.29 ± 0.07 ²
Number of other women present during the meal	0.95 ± 0.40	0.24 ± 0.04

¹ $\bar{x} \pm \text{SEM}$.

²Significantly different from weight-stable group, $P < 0.05$.

³Minutes since midnight.

qualitative differences existed among the definitions. No significant qualitative differences in the results were obtained; therefore, the minimum definition (ie, 209 kJ/45 min) was used as representative. The mean (\pm SEM) energy and macronutrient intakes from the meals, proportions of the macronutrients ingested, meal frequencies, and stomach contents of both groups are shown in **Table 3**.

The significantly greater energy intake in the weight-gaining group was not due to an increase in meal frequency (ie, the number of meals ingested/d) but occurred because this group ate significantly larger meals. The weight-gaining group ingested 298.6 kJ more overall in total food energy, 185.3 kJ more energy as carbohydrate, and 135.0 kJ more energy as fat per meal than did the weight-stable group ($P < 0.05$ for all). No significant difference in the amount of energy ingested as protein was found between the groups. Conversely, the weight-stable group ate a larger proportion of protein per meal than did the weight-gaining group ($P < 0.05$).

The premeal stomach content was estimated to be significantly greater in the weight-gaining group than in the weight-stable group in regard to total food energy ($P < 0.05$) and the percentage of energy as carbohydrate ($P < 0.05$) and fat ($P < 0.01$). Similarly, the postmeal stomach content was estimated to be significantly greater in the weight-gaining group than in the weight-stable

group in regard to total food energy and the percentage of energy as carbohydrate and fat ($P < 0.01$ for all). No significant differences in meal frequency, the duration of meals, the time of day at which the meals were initiated, the rate of intake, or the premeal and postmeal intervals were found between the groups. In addition, no significant differences in pre- and postmeal self-ratings of hunger, thirst, depression, anxiety, or the attractiveness of the food were found between the groups (Table 3).

Correlation coefficients

Mean correlation coefficients and the slopes of the regression lines between meal size and premeal stomach contents, premeal and postmeal intervals, beginning meal time, number of other persons present during the meal, and premeal and postmeal hunger ratings are provided in **Table 4**. No significant differences in these correlations were found between the groups. However, a significant difference was found in the mean correlation coefficients for postmeal palatability ratings and meal size between the groups ($P < 0.05$). In addition, the slope of the postmeal palatability-meal size regressions differed significantly ($P < 0.05$) between the weight-stable and weight-gaining groups, indicating that the relation between postmeal palatability ratings and the amount eaten in the meal differed significantly between the 2 groups ($P < 0.05$). In the weight-stable group, the slope of the regression suggests that for each increase of 481 kJ in meal size, there was a one-unit increase in the postmeal palatability rating; however, in the weight-gaining group the slope of the regression was not significantly different from zero.

DISCUSSION

Although the 7-d food intake diary has been shown to be a reliable method for estimating food intakes in free-living humans (26, 27), it is not without error. This technique has been shown to underestimate intakes, especially in overweight participants (4–8). The EI:BMR values indicate that both groups of subjects in the present study underreported their energy intakes considerably. However, many of these subjects were overweight, and overweight persons are known to underreport their food intakes. In addition, the participants in this study were matched for weight and height; thus, there was no reason to expect that underestimates of food intakes would be larger in one group than in the other. Consequently, the differences in intake found between the weight-stable and weight-gaining groups are probably reliable and valid estimates of the differences in eating behaviors between the 2 groups. The small sample size in the present study must also be taken into consideration when interpreting the results. Although strong differences in food intakes and meal patterns between the 2 groups were found, a larger sample size may have been needed to detect subtle differences between the groups with the statistical techniques used.

The participants weight-gaining group consumed \approx 1600 kJ more food energy per day than did their weight-stable counterparts. A positive energy balance of this magnitude would result in a weight gain of 1 kg adipose tissue every 3 wk. If the weight gain were to persist for 1 y, 16 kg fat would be deposited. This increase in weight was primarily due to an increase in the consumption of carbohydrate and fat. Similarly, Kulesza (20) found that weight-gaining women consumed 2000 kJ more food energy per day than did weight-stable women. This difference is even more striking than that found in the present study; however, the



TABLE 4

Mean correlation coefficients and the slopes of the regression lines between meal size and meal intake variables in the weight-stable and weight-gaining groups

Variable	Weight-stable group (n = 7 M, 12 F)		Weight-gaining group (n = 7 M, 12 F)	
	r ²	Slope	r ²	Slope
Premeal stomach content				
Total energy	-0.12	-0.29	-0.19 ¹	0.59
Carbohydrate	-0.10	-0.87	-0.19 ¹	1.07
Fat	-0.12 ¹	-0.34	-0.17 ¹	2.06
Protein	-0.13	1.66	-0.17 ¹	4.13
Beginning meal time	0.25 ¹	0.32	0.09	0.15
Premeal interval	0.15	0.15	0.20 ¹	0.00
Postmeal interval	0.21 ¹	0.08	0.21 ¹	0.08
Premeal palatability rating	0.31 ¹	109.25	0.18 ¹	76.10
Postmeal palatability rating	0.27 ¹	115.46	-0.01	-12.53 ²
Premeal hunger rating	0.45 ¹	137.34	0.44 ¹	149.33
Postmeal hunger rating	-0.39 ¹	-144.13	-0.54 ¹	-210.45
Social facilitation				
Number of other persons present during the meal	0.34 ¹	84.92	0.35 ¹	231.66
Number of other men present during the meal	0.34 ¹	114.38	0.31 ¹	282.96
Number of other women present during the meal	0.21 ¹	85.94	0.17	128.50

¹Significantly different from zero, $P < 0.05$ (z test).²Significantly different from weight-stable group, $P < 0.05$.

disparity may have been because the women in Kulesza's (20) study were obese and were not matched for weight.

The estimate of weight gain in the present study was very high, possibly because the participants were at the peak of their weight-gaining periods. The requirement for inclusion in the present study as a weight-gaining participant was a weight gain of $\geq 5\%$ in the previous 6 mo. In addition, the weight-gain estimates did not take into account the metabolic consequences of weight gain, eg, an elevated BMR and the increased cost of weight-bearing activities. As one gains weight, more food energy is needed to produce a constant amount of gain.

High-fat diets were shown to be associated with weight gain, even when the energy content of the diet was held constant (28). However, in the present study, although the weight-gaining participants ate more fat than did their weight-stable control subjects, no significant difference in the proportion of fat ingested was found between the groups. The weight gain in the weight-gaining group appeared to be due to the ingestion of a high-energy diet and not to the consumption of a diet proportionally high in fat.

The difference in intakes between the groups was due to differences in the sizes of the meals ingested. The weight-gaining group ate larger meals, not more often, than did the weight-stable group. In addition, the weight-gaining group had more food in their stomachs after each meal than did the weight-stable group. Meal size appears to be related to the duration of time since the last meal was eaten. A difference in response to this cue could underlie weight gain. However, no significant differences in either the pre- or postmeal intervals were found between the groups. In addition, the correlation coefficients and the slopes of the relation between these intervals and meal size were not significantly different between the groups. Interestingly, significant correlations were found between meal size and the duration of the postmeal interval in both groups, but no significant group differences were detected. This relation indicated that as the meal size increased, the time until the next meal also increased. This finding is somewhat unusual because this relation is not usually found in free-living adults (29). It is possible that the


rigid time constraints responsible for this pattern were not found in the current sample because most of the participants were full-time students. This relation was reported previously in French and Dutch students but not in American students (30).

Hunger and, in contrast, fullness are psychological representations of short-term physiologic cues for persons to terminate a meal. Although the weight-gaining group ate significantly larger meals, no significant differences in premeal or postmeal hunger ratings were found between the groups. This finding indicates that although the weight-gaining group consumed more energy per meal, they did not experience more premeal hunger and did not feel any fuller after the meal than did the weight-stable subjects.

The positive energy balance resulting from a heightened food intake would not result in weight gain if it was accompanied by a comparable increased level of energy expenditure. No differences between the activity levels of overweight persons and their normal or lean counterparts have been found (17, 18). However, the activity levels of weight-gaining and weight-stable persons have never been compared. The present study did not detect differences in activity levels between the weight-stable and weight-gaining groups. Therefore, the higher energy intake found in the weight-gaining group did not appear to be offset by a higher energy expenditure due to activity. Hence, the weight gain found in the weight-gaining group appeared to be solely a result of a higher energy intake.

The social facilitation of intake (ie, an increase in meal size as the number of other persons present during the meal increases) has been shown in adults (31, 32). The social facilitation of intake was equivalent in both groups. No significant differences in the correlation coefficients, slopes, or number of other persons present during the meal were found between the 2 groups, indicating that the reactivity to eating with others did not change during periods of weight gain. Therefore, differences in social facilitation do not appear to explain the greater meal sizes found during periods of weight gain. Differences in emotionality or its effects on intake might underlie weight gain (33). However, in the present study, no significant differences in the relation between

premeal and postmeal mood scales and meal size were found between the groups. Hence, although emotional factors may play a role in eating behavior, the present findings indicate that they do not differentially affect persons who are gaining weight.

The present findings suggest that the greater intake found in the weight-gaining adults was not due to any environmental, social, or psychological factors investigated to date. These influences appear to affect intake to the same extent in both groups. The weight-gaining subjects ate larger meals, but did not eat more often, than did the weight-stable subjects. The weight-gaining group continued to eat past the time when the weight-stable group stopped eating. These results suggest that the weight gain may have been caused by a lessened short-term satiation signal in the weight-gaining group. During periods of weight gain, these persons may not be receiving a signal to stop eating, may not respond strongly to the signal, or may not be producing a strong signal. These possibilities suggest, by default, that the overeating associated with weight gain may be physiologically based. The altered physiologic signals, possibly hormonal or metabolic, that are involved in the short-term (cues to terminate meals) and long-term (cues from adipose tissue to suppress long-term weight gain) regulation of food intake may be integral components of weight gain. 

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