

PERSONAL THEORIES OF HUNGER AND EATING

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Abstract

Recent research on hunger and eating has shown (a) that among individuals with ad libitum access to food, hunger and eating are not regulated by deviations in the body's energy resources from energy set-points, and (b) that it is healthier for people to consume their daily caloric intake as several small snacks than as three large meals. People's beliefs about hunger and eating were assessed in two questionnaire studies. In Study 1, a large sample of university undergraduates was surveyed; in Study 2, dietetics students, nursing students, medical students, dietitians, nurses, and doctors were surveyed. Both studies revealed that people's personal theories of hunger and eating were inconsistent with recent research findings in ways that are likely to promote over consumption and ill health. These results suggest that educational programs designed to modify the beliefs about hunger and eating of people suffering from problems of over consumption and of health professionals who treat problems of over consumption may increase the effectiveness of current treatment regimens.

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Introduction

In many industrialized countries, health problems associated with overeating have reached epidemic proportions. In the United States alone, for example, at least 34 million adults are at risk for developing diabetes, hypertension, heart disease, and certain cancers because they are overweight (see Millar & Stephens, 1986). Unfortunately, although efforts to treat overeating have met with some short-term success, long-term results generally have been poor (Garner & Wooley, 1991; Goodrick & Foreyt, 1991; Wilson, 1994)--in one study, fewer than 3% of patients beginning a weight-reduction program maintained their weight losses for more than 4 years (Kramer, Jeffery, Forster, & Snell 1989). The studies reported here are, to my knowledge, the first to approach the problems of overeating and weight reduction by trying to understand how people think about their own motivations to eat. The studies tested two hypotheses, both of which were derived from a series of pilot interviews: (a) that most people believe that their eating behavior is regulated by deviations in their body's energy resources (e.g., blood glucose, body fat) from homeostatic set points and (b) that most people believe that it is healthier to consume their daily caloric intake as three large meals than as several small snacks. Neither of these beliefs is consistent with the empirical evidence (see Bolles, 1980; Friedman & Stricker, 1976; Toates, 1981; Woods, 1991). Below, I review this contradictory evidence, introduce new theoretical perspectives on

hunger and eating that are more compatible with it, and explain how misconceptions about hunger and eating may contribute to over consumption and ill health among people living in food-replete societies.

Evidence Incompatible with Set-Point Theories of Hunger and Eating

Set-point theories of hunger and eating make three predictions: (a) that the feeding system maintains the body's energy resources at homeostatic set points, that is, at stable levels that are optimal for health and survival, (b) that hunger and eating are promoted by decreases in the body's energy resources below their set points, and (c) that hunger and eating are inhibited by increases in the body's energy resources to their set points. None of these predictions, however, have been reliably confirmed.

Evidence that the Feeding System Does Not Maintain Energy Reserves at Homeostatic Levels

Evidence from studies of both humans and laboratory animals indicates that the primary function of the feeding system is not to maintain the body's energy reserves at levels that are optimal for health and survival. Indeed, humans and other animals living with ad libitum access to palatable foods tend to eat far more than is optimal for their health and survival. This point has been made in two ways: (a) by documenting the high levels of consumption (e.g.,

Fidanza, 1980), obesity (e.g., Millar & Stephens, 1986), and health problems associated with overeating (e.g., Bray, 1992) in populations living with ad libitum access to palatable foods; and (b) by demonstrating the dramatic improvements in health and longevity that result from reducing consumption levels to well below ad libitum levels (for reviews see Bucci, 1992; Masoro, 1988; Weindruch & Walford, 1992).

The high heritability index of obesity--.44 in one study (Price, Ness, & Laskarzewski, 1990)--has led some (e.g., Hewitt, Stunkard, Carroll, Sims, & Turner, 1991) to suggest that the inheritance of high set points may be an important factor in overeating and obesity. The high incidence of overeating and obesity in some populations renders this hypothesis untenable. If the incidence of obesity were low, then the feeding systems of individuals who are obese could be seen as pathological exceptions to systems that have evolved to maintain most people's energy resources at optimal levels; however, a set-point system that results in obesity, ill health, and premature death in a substantial portion of the population is unlikely to have evolved.

Evidence that Hunger and Eating are Not Normally

Triggered by Declines in Energy Resources

Evidence, again from studies of both humans and laboratory animals, indicates that hunger and eating are not normally caused by decreases in the body's energy reserves. Although major decreases in blood glucose produced by insulin injections (e.g., Rowland, 1981) and major decreases in body fat

produced by starvation (e.g., Keys, Brozek, Henschel, Mickelsen, & Taylor, 1950) do stimulate hunger and eating, virtually all bouts of consumption in subjects living with ad libitum access to food occur in the absence of such deficits (see Weingarten, 1985). Indeed, blood glucose levels are closely regulated by pancreatic hormones and, as a result, rarely display major fluctuations under ad libitum conditions (e.g., Smith, Gibbs, Strohmayer, & Stokes, 1972); and injections of insulin that produce the slight decreases in blood glucose that do routinely occur in subjects living under ad libitum conditions do not elicit consumption (VanderWeele, Harackiewicz, & Van Itallie, 1982).

Among the observations most frequently offered in support of set-point theories of hunger and eating is the tendency for individuals who have lost weight to regain it once they return to their previous eating-and-energy-related lifestyle. Although this line of evidence is seductive, it is not sufficient to establish a case for energy set-points: No regulation at all is required to explain why body weight drifts back to its original level once the factors that influence it return to their original states (Bolles, 1980). For example, the temperature of a house with no heating and air conditioning will drop during a cold spell, but will drift back to its original level once the outside temperature returns to normal--this does not imply set-point regulation, and neither does the return of body weight to its original level after the termination of a weight-loss program.

Evidence that Increases in Energy Resources Do Not Reliably

Reduce Hunger and Eating

Evidence, again from studies of both humans and laboratory animals, indicates that increases in energy resources do not reduce hunger and eating. Several studies of the effects of caloric preloads on hunger and eating have found that preloads actually stimulate hunger and eating rather than suppress them; for example, premeal infusions of glucose often increase intake (see Geiselman, 1987), and subjects who consume small amounts of food before a meal often experience increased feelings of hunger (see Bolles, 1990). Other studies have found that caloric preloads have no effect on consumption (e.g., Foltin & Schuster, 1984).

Summary

Considered together, the three aforementioned lines of evidence lead unavoidably to the conclusion that eating is not regulated by deviations in energy resources from energy set points. Rather, they suggest that, under typical ad libitum conditions, variations in the body's energy resources have little impact on hunger and eating.

Contemporary Theories of Hunger and Eating

Because of their inability to account for basic phenomena of hunger and eating, set-point theories are gradually being supplanted by new theories. Three

of these theories--the positive-incentive theory of hunger and eating, Woods' theory of meal intolerance, and the evolutionary theory of hunger and eating--together provide a strong theoretical framework within which most research findings can readily be integrated (see Pinel, 1997).

Positive-Incentive Theory of Hunger and Eating

The central premise of the positive-incentive theory of hunger and eating is that humans and other animals are not driven to eat by energy deficits but are drawn to eat by the anticipated pleasure of eating--that is, by food's positive-incentive value. Accordingly, the anticipated taste of the available food is held to be one of the main factors motivating consumption. The major impact of taste on eating, an effect that is not accounted for by set-point theories, has been demonstrated in innumerable studies. For example, in one study rats fed a highly palatable diet of chocolate and bread in addition to their usual laboratory chow increased their average intake of calories by 84% and, after 120 days, increased their body weights by 49% (Rogers & Blundell, 1980)--a finding that is totally at odds with the predictions of set-point theories.

Other evidence for the major effect of taste on consumption comes from studies of sensory specific satiety--studies that demonstrate that the satiating effect of food consumption is largely specific to the tastes of the foods being eaten. In one study, human subjects were asked to rate the palatability of eight different foods, and then they ate a meal of one of them. After the meal, they were asked to rate the palatability of the eight foods once again. It was found

that their rating of the food they had just eaten had declined substantially more than had their ratings of the other seven foods. Moreover, when the subjects were unexpectedly offered a second meal, they consumed most of it unless it was the same as the first (Rolls, Rolls, Rowe, & Sweeney, 1981).

Factors other than taste can influence the positive-incentive value of food. These include the time of day in relation to usual mealtimes (e.g., Weingarten, 1983), the type and quantity of food in the gut (e.g., Geiselman, 1987), whether other people are present and eating (e.g., Redd & De Castro, 1991), and whether blood glucose levels are within their normal range (e.g., Rowland, 1981). Positive-incentive theory does not deny that major declines in energy resources--although rare under ad libitum conditions--can increase hunger and eating. According to positive-incentive theory, however, major decreases in the body's energy resources increase hunger by increasing the positive-incentive value of food. The experiences of a subject in an experiment on semistarvation support this view; when asked how it felt to starve, the subject replied:

I wait for mealtime. When it comes I eat slowly and make the food last as long as possible. The menu never gets monotonous even if it is the same each day or is of poor quality. It is food and all food tastes good. Even dirty crusts of bread in the street look appetizing (Keys, Brozek, Henschel, Mickelsen, & Taylor, 1950, p. 852)

Woods' Theory of Meal Intolerance: Evidence that Snacks
are Healthier than Meals

Woods and his colleagues (e.g., Woods, 1991; Woods & Strubbe, 1994) have pointed out that eating a large meal, rather than restoring homeostasis, is a major homeostasis-disturbing event. Before a meal, the body is in reasonable homeostatic balance; then, as a meal is consumed, there is a sudden influx of fuels into the bloodstream which disturbs the homeostatic balance of several physiological systems: For example, blood glucose levels increase, body temperature increases, basal metabolic rate increases, and hepatic temperature increases. In order to minimize these changes, the body undergoes a variety of compensatory changes during the cephalic stage of digestion. For instance, just before meal-time, insulin is released from the pancreas, which extracts glucose from the blood and reduces the subsequent increase in blood glucose resulting from the meal. Indeed, it is likely that it is these premeal preparatory changes, rather than energy deficits, that are the primary stimuli for premeal hunger, and conversely, the homeostatic disturbances resulting from meal consumption, rather than energy replenishment, that are the primary stimuli for satiety.

Given the homeostasis-disturbing nature of eating large meals, Woods (1991) concluded that it is healthiest to consume one's daily allotment of calories as several small meals (i.e., snacks) rather than a few large meals. The evidence supports his view. Regularly eating several small snacks rather than a few large meals has been found to result in several beneficial metabolic

changes, including the lowering of glucose and lipid levels in the blood (Jenkins et al., 1989). Conversely, the regular consumption of large meals has been associated with several metabolic abnormalities and an increased risk of cardiovascular disease (Bray, 1972).

Evolutionary Theory of Hunger and Eating

The evolutionary theory of hunger and eating (see Pinel, Assanand, & Lehman, 1996) maintains that the mammalian feeding system evolved to anticipate and prevent energy deficits, rather than to merely react to them. According to this theory, this occurred because the environment in which the mammalian feeding system evolved was characterized by an inconsistent and unpredictable food supply. For a hunger and eating mechanism to have been adaptive under such conditions, it would have had to promote high levels of consumption when food was available, so that excess energy could be stored in the body as a buffer against unpredictable periods of food shortage. According to this view, the mammalian feeding system has evolved to promote high levels of consumption of sweet, salty, and fatty foods whenever they are available because in nature these tastes are invariably rich in calories, vitamins, and minerals.

From this evolutionary perspective, the prevalence of overeating in industrialized societies can be readily understood. In modern societies, the very tastes that humans have evolved to consume abundantly are almost continuously accessible in a seemingly endless variety.

Personal Theories of Hunger and Eating

I anticipated on the basis of pilot research that, in contrast to the empirical evidence, most people would believe (a) that their experiences of hunger result from decreases in their body's energy resources below levels that are optimal for health and (b) that it is healthier for them to consume their daily caloric intake as three meals than as several snacks.

The belief that hunger results from energy deficits may have adverse implications for health. Implicit in this belief is the idea that the maintenance of good health requires that one "listen to one's body" and eat whenever one is hungry--that hunger is proportional and appropriate to need. Given the recent evidence that, under normal conditions, hunger does not reflect a need state but rather reflects either the anticipated pleasure of eating or the preparatory changes in the body associated with the expectation of a meal, eating in response to each sensation of hunger is clearly not a requisite for good health. Indeed, in modern societies--societies in which a virtually endless variety of high positive-incentive value foods are readily available--eating in response to each sensation of hunger is likely to result in overeating and, thus, to contribute to ill health.

The belief that it is healthier to consume one's daily caloric intake as three meals than as several snacks may also have adverse implications for health. This belief is likely to lead people to regularly engage in three extended bouts of eating per day--as opposed to several smaller bouts--thus exposing

them to the potentially health-threatening homeostatic perturbations associated with eating large meals.

The present research was concerned with documenting the prevalence of these potentially health-compromising beliefs about hunger and eating among both lay people and health professionals. Although an understanding of the beliefs of lay people is clearly important, an understanding of the beliefs of health professionals is, perhaps, even more important given the influence that they are likely to have both on the people whom they treat and on the general public. Accordingly, two studies were conducted--one examining the beliefs of university undergraduates, and one examining the beliefs of students in health professional programs and health professionals.

Study 1

In Study 1, the personal theories of hunger and eating of a large sample of university undergraduates were assessed.

Method

Participants. The participants were 206 undergraduates enrolled in a health psychology class at the University of British Columbia. The sample was 69% female, with an average age of 21.3 years (SD = 3.7).

Procedure and measures. The students were asked to complete a brief questionnaire about their beliefs about hunger and eating. They completed the questionnaire during class time, and they received course credit in exchange for participation.

The questionnaire comprised eight items that measured respondents' set-point beliefs. These items are listed as 1 through 8 in the Appendix. They formed a reliable scale, with a Cronbach's alpha of .85. In addition, principal-components factor analysis of the items indicated that they formed a unidimensional scale. The analysis produced one distinct factor that accounted for 49% of the total variance, and all item loadings were greater than .55.

Two items in the questionnaire measured respondents' beliefs regarding the healthiness of consuming their daily caloric intake as three meals and as several snacks. These items are listed as 9 and 10 in the Appendix.

Two additional items in the questionnaire asked respondents to provide their height and weight. These measures were obtained for the computation of respondents' body mass indices. Body mass index (BMI), defined as weight (kg) divided by height (m) squared (kg/m^2), is highly correlated with weight ($r = .86$) but relatively independent of height ($r = -.03$; Romieu, Willett, & Stampfer, 1988).

Results

The eight items measuring set-point beliefs were averaged to produce a composite set-point score for each respondent. Complicating the analysis was the fact that the items differed from one another in terms of which values on the

scale represented the lack of set-point beliefs. On items 1 through 4 scores of 1 indicated the absence of set-point beliefs, whereas on items 5 through 8 scores of 1, 2, or 3 indicated the absence of set-point beliefs (assuming that items 7 and 8 are reverse scored). Accordingly, a respondent who did not endorse any of the set-point beliefs assessed by the items could have obtained a maximum total score of 16 (the sum of the highest scores representing the absence of set-point beliefs on the items) and, thus, a maximum composite set-point score of 2.0 (the average of the highest scores representing the absence of set-point beliefs on the items). For the sample, the distribution of composite set-point scores was approximately normal, with a mean of 3.52 and a standard deviation of .54, indicating that most respondents held set-point beliefs. Indeed, none of the respondents had composite set-point scores below 2.00, 17% had scores between 2.01 and 3.00, 57.3% had scores between 3.01 and 4.00, and 25.7% had scores between 4.01 and 5.00 (see Figure 1). A statistically significant correlation between composite set-point scores and BMI was found ($r = .18$, $p < .05$), indicating that respondents with higher BMIs held stronger set-point beliefs than respondents with lower BMIs.

Responses to items 9 and 10 were compared to assess whether the respondents believed that it is healthier to consume their daily caloric intake as three meals or as several snacks. Scores on item 9 (eating three meals per day, $M = 4.25$, $SD = .63$) were significantly higher than scores on item 10 (snacking several times per day, $M = 3.03$, $SD = 1.23$; $t[205] = 11.63$, $p < .001$), suggesting

that respondents believed that it is healthier to eat three meals per day than several snacks per day. Of the respondents, 66.1% rated eating three meals per day as more healthy than snacking throughout the day, 15.5% rated eating three meals per day as as healthy as snacking throughout the day, and 18.4% rated eating three meals per day as less healthy than snacking throughout the day. Moreover, relatively few respondents believed that snacking is a healthy practice. Of the respondents, only 37.3% rated snacking throughout the day as healthy. Difference scores generated by subtracting item 9 from item 10 for each respondent were not correlated significantly with either composite scores or BMIs.

Study 2

In Study 2, the personal theories of hunger and eating of samples of students in health professional programs and samples of health professionals were assessed.

Method

Participants. Six samples were recruited: 44 students in their final year of study in dietetics (93% female; average age = 23.0 years, SD = 2.8), 35 students in their final year of study in nursing (94% female; average age = 22.9 years, SD = 2.59), 25 students in their final year of study in medicine (52% female; average age 25.6 = years, SD = 3.9), 32 dietitians working in local hospitals (97% female;

average age 33.8 = years, SD = 8.26), 31 nurses working in local hospitals (97% female; average age = 36.2 years, SD = 6.9), and 30 physicians working in local hospitals (37% female; average age = 41.5 years, SD = 7.8).

Procedure and measures. The respondents completed the questionnaire described in Study 1. The dietetics students and nursing students completed the questionnaire during class time, and the dietitians, nurses, and physicians completed the questionnaire during staff meetings. Because access to medical students during their classes could not be obtained, questionnaires were left in their mailboxes along with a brief introductory letter containing contact telephone numbers; they had 2 weeks to complete the questionnaire and were asked to return them to a dropbox placed near their mailboxes.

The eight items measuring respondents' set-point beliefs formed a reliable scale in each of the six samples. Alphas for the samples ranged from .86 to .90. In addition, principal-components factor analysis of the items in the combined-sample (generated by collapsing the six samples) produced only one distinct factor. The factor accounted for 54% of the total variance, with all item loadings greater than .59. The six samples were combined for factor analysis because the means for each item did not differ significantly among the samples, and because the combined-sample size allowed for a more reliable factor analysis.

Results

As in Study 1, the eight items measuring set-point beliefs were averaged to produce a composite set-point score for each respondent. The mean composite set-point score for each sample is listed in Table 1, along with its standard deviation. The distribution of composite set-point scores for each sample is shown in Figure 2. The composite set-point scores of the samples did not differ significantly, nor did they differ significantly from the composite set-point scores obtained from the undergraduate sample in Study 1, indicating that the students and health professionals in the present study were as likely to maintain set-point beliefs as the undergraduate students in Study 1. The correlations between composite set-point scores and BMIs were not significant for any of the samples; however, the variabilities in BMI in the samples were relatively small and may have been insufficient to constitute reasonable tests of this trend.

Mean scores and standard deviations on items 9 and 10 for each of the samples are listed in Table 2. Scores on these items did not differ significantly in any of the samples, suggesting that the respondents believed that snacking throughout the day is as healthy as eating three meals per day. Across the six samples, 25.9% of the respondents rated eating three meals per day as more healthy than snacking throughout the day, 56.4% rated eating three meals per day as as healthy as snacking throughout the day, and 17.8% rated eating three meals per day as less healthy than snacking throughout the day. Difference

scores generated by subtracting item 9 from item 10 for each respondent were not correlated significantly with either composite set-point scores or BMIs in any of the samples.

Discussion

The present research was the first to examine how people interpret their own hunger and eating behavior. It was predicated on the premise that most people hold beliefs about hunger and eating that are likely to promote excessive consumption and ill health.

One hypothesis was that most people would believe that their hunger and eating behavior are regulated by deviations in their body's energy resources from levels that are optimal for their health. The results of both studies were consistent with this hypothesis--all of the undergraduate students in Study 1, and almost all of the students in health professional programs and health professionals in Study 2 had composite set-point scores of more than 2.0, indicating at least some commitment to the belief that their feelings of hunger are produced by decreases in energy resources below levels that are optimal for health.

In Study 1, there was a positive correlation between set-point thinking and BMI, indicating that respondents with higher BMIs had stronger set-point beliefs than respondents with lower BMIs. This finding lends support to the argument that set-point beliefs contribute to excessive consumption. Nevertheless, I did

not expect to see evidence of such a correlation for two reasons. First, factors in addition to level of consumption (e.g., level of energy expenditure and metabolic rate) greatly influence BMI (see Keesey & Powley, 1986). Second, given that most students were expected to evince set-point beliefs, I did not anticipate that there would be enough variation in that measure for a significant correlation to emerge.

Another hypothesis was that most people would believe that it is healthier to consume their daily caloric intake as three meals than as several snacks. The results of Study 1 were consistent with this hypothesis--the majority of the undergraduate students believed that the consumption of three meals per day is healthier than snacking throughout the day. However, the results from Study 2 revealed that the majority of the students in health professional programs and health professionals believed that the consumption of three meals per day is as healthy as snacking throughout the day. Although this belief is more consistent with the evidence than was anticipated, it is important to recognize that it does not discourage meal consumption. Indeed, the only belief that is likely to discourage the consumption of meals is the belief that eating three meals per day is less healthy than snacking throughout the day--and relatively few of the students in health professional programs and health professionals held this belief.

Interestingly, although most of the students in health professional programs and health professionals surveyed in Study 2 did not differ from the

undergraduate students surveyed in Study 1 in their beliefs about energy set points, the majority of the students in health professional programs and health professionals held beliefs about snacking and meal consumption that were intermediate between common beliefs and recent research findings: They believed that snacking and meal consumption are equally healthy. This may be explained by the greater exposure that students in health professional programs and health professionals are likely to have had to recent research findings on hunger and eating and by the relative ease with which the idea that snacking is healthy is likely to be accommodated into people's beliefs about hunger and eating. This idea could be added to most people's beliefs about hunger and eating without presenting a major challenge to how they think about hunger and eating. In contrast, the idea that hunger is not normally regulated by decreases in energy resources below set points would require a more thorough revision of most people's thinking.

The findings of the presents studies have three unsettling implications. First, they suggest that misconceptions about hunger and eating that may have adverse implications for health are common among both lay people and health professionals. Second, they suggest that the training that students in health professional programs receive does not adequately modify their misconceptions about hunger and eating. And third, they suggest that health professionals are disseminating misinformation about hunger and eating to the general public that may be encouraging the very problems that they are trying to treat--this may be

one reason why current efforts to prevent and treat eating-related problems are largely unsuccessful.

Recent evidence suggests that the problem of overeating is far more pervasive than may be commonly assumed (see Sohal & Weindruch, 1996). Ad libitum consumption in the absence of obesity has been found to increase the risks of numerous diseases (e.g., diabetes, hypertension, heart disease, cancer), to accelerate aging-related physiological and behavioral changes (e.g., decreases in immunological response, decreases in muscle mass, decreases in protein production), and to decrease life expectancy--because it produces high levels of oxygen molecules that cause damage to cells (e.g., base alterations in DNA, single-strand breaks in DNA, modification of proteins). Be that as it may, the pilot interviews that I conducted suggest that many people believe that all of the adverse effects of overeating on health are mediated by obesity--that people who eat a lot but who are not obese because they have high levels of energy expenditure are immune to the negative health consequences of overeating. This may be another misconception that contributes to excessive intake, and thus it warrants systematic study.

Future research needs to evaluate the effectiveness of educational programs designed to treat over consumption by modifying people's beliefs about hunger and eating. Given the prevalence of overeating in many parts of the world, its dire consequences for health, and the role that beliefs about hunger and eating may play in promoting over consumption, the potential

benefits of such educational programs are immense. In much the same way that many people who have understood the adverse effects on health of eating too much fat have been able to reduce their fat consumption, people who develop an understanding for why they feel hungry at regular meal times or when high-incentive-value foods are available may be better able to reduce their intake.

Table 1
Mean Composite Set-Point Scores for Study 2

Sample	<u>n</u>	<u>Composite scores</u>	
		<u>X</u>	<u>SD</u>
Dietetics students	44	3.54	.75
Nursing students	35	3.30	.70
Medical students	25	3.42	.78
Dietitians	32	3.71	.65
Nurses	31	3.50	.69
Physicians	30	3.60	.56

Note. Composite set-point scores ranged from 1 to 5. A higher score represents higher endorsement of set-point beliefs. The highest composite score that was obtainable by a respondent who did not endorse any set-point beliefs was 2.0.

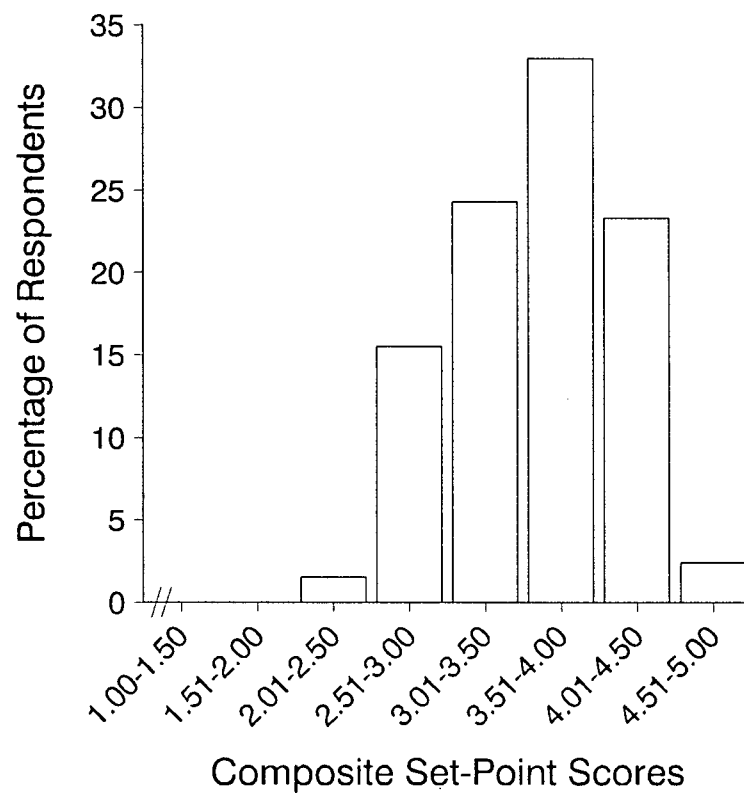
Table 2

Mean Scores on Items Assessing Beliefs about Snacking and
Meal Consumption for Study 2

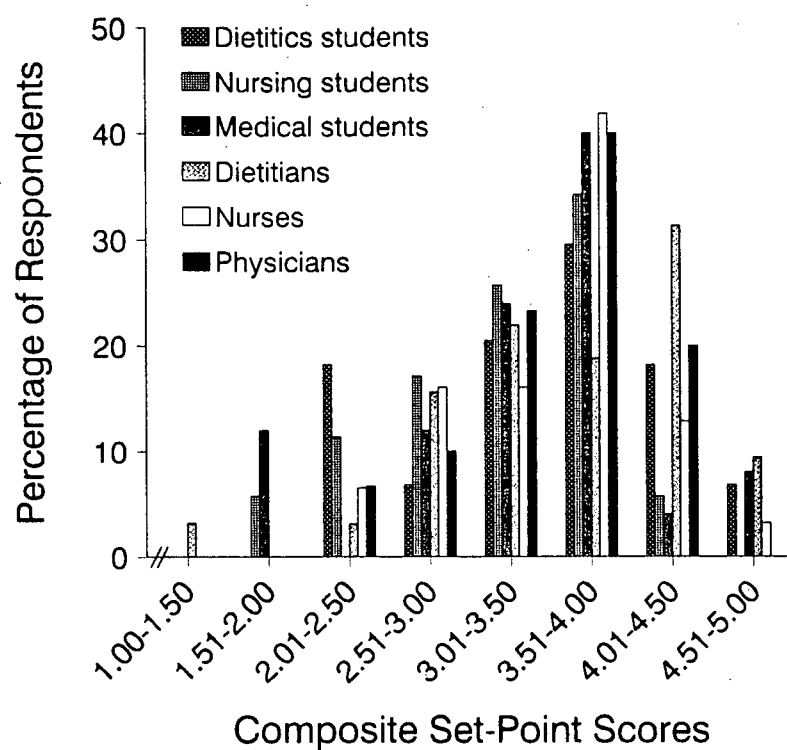
Sample	<u>Snacking throughout the day</u>		<u>Three meals per day</u>	
	<u>X</u>	<u>SD</u>	<u>X</u>	<u>SD</u>
Dietetics students	4.18	.90	4.32	.47
Nursing students	3.86	.91	4.11	.72
Medical students	4.08	.70	4.24	.88
Dietitians	4.63	.55	4.72	.63
Nurses	4.19	.79	4.35	.71
Physicians	4.37	.61	4.50	.51

Note. Scores ranged from 1 (very unhealthy) to 5 (very healthy).

Distribution of Composite Set-Point Scores in Study 1



Distribution of Composite Set-Point Scores in Study 2



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Appendix

1. To what degree do you believe that the hunger that you normally experience before eating a meal is a feeling generated by your body's need for energy at that time? (1 = Not at all, 2 = To a small degree, 3 = To a moderate degree, 4 = To a large degree, 5 = Completely)
2. To what degree do you believe that the hunger that you normally experience before eating a snack is a feeling generated by your body's need for energy at that time? (1 = Not at all, 2 = To a small degree, 3 = To a moderate degree, 4 = To a large degree, 5 = Completely)
3. To what degree do you believe that the fulfillment of your body's need for energy is responsible for causing you to stop eating a meal when there is still plenty of food left? (1 = Not at all, 2 = To a small degree, 3 = To a moderate degree, 4 = To a large degree, 5 = Completely)
4. To what degree do you believe that the fulfillment of your body's need for energy is responsible for causing you to stop snacking when there is still plenty of food left? (1 = Not at all, 2 = To a small degree, 3 = To a moderate degree, 4 = To a large degree, 5 = Completely)
5. It is unhealthy for me not to eat if I am feeling hungry. (1= Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)
6. It is unhealthy for me to stop eating if I am still feeling hungry. (1= Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)

7. The hunger that I feel before I eat a meal is not normally caused by a need that my body has for energy at that time. (1= Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)
8. The hunger that I feel before I eat a snack is not normally caused by a need that my body has for energy at that time. (1= Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree)

Assuming that the foods eaten in the following two patterns of consumption are equally nutritious and result in the same total caloric intake, how healthy do you believe it is to consume your total daily food intake as:

9. three meals eaten at three different times during the day? (1 = Very unhealthy, 2 = Somewhat unhealthy, 3 = Neutral, 4 = Somewhat healthy, 5 = Very healthy)
10. several snacks eaten throughout the day? (1 = Very unhealthy, 2 = Somewhat unhealthy, 3 = Neutral, 4 = Somewhat healthy, 5 = Very healthy)