

Biopsychology:

The Positive-Incentive Perspective and Diet Maintenance

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Abstract

Weight loss and diet maintenance are at the forefront of health discussions and the United States has reached an all time high for obesity rates. Biopsychology, which is the study of the biology of behavior, has begun to focus on the mechanics behind hunger and eating by researching hunger and consumption theories and the positive-incentive perspective of eating. This theory offers the most opportunity to understand all biopsychosocial behaviors associated with eating, nutrition, and diet maintenance. Opposing theories, such as the set-point theories, are discussed as well as the implications of the positive-incentive theories on behavioral psychology. In closing, recommendations for further research are discussed.

Biopsychology: Positive-Incentive Perspectives and Diet Maintenance

The Biopsychology of Diet Maintenance

The United States, as well as most developed countries, is obsessed with weight and body image and the ideal body image today is thin and perhaps at a lower body mass index than what is considered to be healthy (Ahern & Hetherington, 2006). Given that the United States has reached an all time high for obesity rates the fact that millions of Americans are focused on weight control and diet maintenance should not come as a surprise (Winter, 2005). Biopsychology, which is the study of the biology of behavior, has begun to focus in detail on the mechanics behind hunger and eating by researching hunger and consumption theories and the positive-incentive perspective of eating (Pinel, 2006). There are a variety of theories, both supported and unsupported by research, regarding hunger and consumption that are used to explain weight loss, gain, and stability. For example, historically people believed that the stomach was in control of the bodily function of managing hunger and weight (White, 2006). However, that theory was disregarded when research using patients who had their stomachs removed still expressed a sensation of feeling hungry (Oxford University Press, 2007). The set-point theory suggests that there is a natural weight that a person's body feels comfortable and that is why most adults maintain a stable size throughout life (Harris, 1990). However, this theory does not account for the fact that most adults do have weight variation and that other factors contribute to how much a person eats, what his or her metabolism rate is, and whether or not he or she will avoid eating disorders such as obesity. The positive incentive perspective does account for these factors and presents a variety of theories to suggest that humans eat because of influences including social situations, routine and

desirability of the food type, anticipated pleasure factors, and biological factors (White, 2006).

Biopsychology and Hunger and Nutrition

In order to understand these theories the mechanics behind digestion needs to be addressed. Biologically the human body is set up to run efficiently using the natural processes of the desire for food and the nutritional benefit to the body. Digestion officially begins in the mouth by the chewing of food to prepare it for digestion. After swallowing food, it flows down the esophagus, through a valve that connects the esophagus to the stomach, and next it enters the upper part of the stomach (NIH, 2004). The lower stomach then mixes the food, liquid, and digestive juice that is produced in the stomach. The food is then pushed into the small intestine in which nutrients are pulled from food throughout the digestive process (NIH, 2004). Finally, the unabsorbed matter is pushed into the colon and it is expelled through a bowel movement. Hormones, such as ghrelin which is produced in the stomach and upper intestine, are said to stimulate appetite with the absence of food, and other amino acids such as peptide YY which is produced in the gastrointestinal tract is said to repress appetite (Il,1993). Additionally there are nerves that regulate the speed in which this process occurs.

In addition to the mechanical part of digestion there are the cephalic, absorptive, and fasting phases that occur to help the body metabolize energy. In the cephalic phase the body prepares for food that is about to be absorbed by releasing small amounts of insulin, and this phase is triggered by the expectation of food and the tasting and chewing of food (Teff, 2000). The anticipation and expectation of eating occurs and is furthered

through sight, smell, and perhaps even cooking sounds (Toray & Cooley, 1997). Insulin levels begin to rise during the cephalic phase and glucose levels are typically low.

The next phase is the absorption phase in which carbohydrates also called sugars or glucose, proteins also referred to as amino acids, and fats also referred to as lipids are absorbed into the bloodstream. This is the phase in which the physical aspect of eating occurs and the insulin and glucose levels remain the same as they were in the cephalic phase (Teff, 2000). During this phase the body begins to process and absorb the glycogen, amino acids, and fats. Additionally the stomach, as it stretches, sends neural impulses to the brain to reduce hunger (National Institute of Health, 2004).

The last phase upon completion of eating is the fasting phase in which the body uses the energy it has pulled from the food and stored to function. During this phase glucose is the primary source of energy, secondarily fatty acids are turned into ketones and utilized by muscles, and finally stored fat is used as an energy source (White, 2006).

Biological overview caloric consumption and turning food into energy

With regard to calorie consumption a very easy equation determines whether a person gains, loses, or maintains his or her existing weight. If a person eats the same amount of calories that he or she expends then weight remains stable, if less calories are consumed than expended weight is lost, and if more calories are eaten than expended weight is gained (Al-Haboubi, 1999). Therefore, it is important to understand how food is turned into energy so that a person can understand how diet maintenance can be achieved by managing the amount of energy that is stored. During the absorption phase three types of energy are stored in the body. The first type is glucose which is absorbed by the blood and stored as glycogen which is easily retrievable. Next amino acids that

have been absorbed become proteins and are stored as muscle. Finally fat synthesis occurs in which extra glucose is stored as fat reserves in the body (Pittas, Hariharan, Stark, Hajduk, Greenberg, & Roberts, 2005). Glucose is a simple carbohydrate that is used for immediate energy and lipids are used for long-term storage of energy. Therefore, energy consumed that is not expended becomes fat and a person gains weight.

Glucostatic and Lipostatic Set-Point Theories

Two theories were developed to explain and understand the concept of weight gain, loss, and maintenance and they are the glucostatic and lipostatic theories. These theories complement each other in that they both support an overall concept that the adult human body has a set-point, or a natural range with minimal variation, that the body is comfortable at and even if it varies away from the set point it will eventually return. These theories state that eating a meal or gaining and losing weight are all done with the effort of returning to a homeostatic body state and any deviation from this state is assumed to be monitored by the mechanisms supported by the hypothalamus (Pittas, Hariharan, Stark, Hajduk, Greenberg, & Roberts, 2005).

The glucostatic theory is based upon the idea that the body regulates itself for the short term by the blood glucose level. The theory suggests that as the level of blood glucose is depleted the person begins to prepare for the next meal and after completion of the meal the body returns to homeostasis, or its set-point. This theory was tested in the 1970s on rats and biologically it implies that the desire to eat or the need to be hungry is controlled by the ventromedial hypothalamus because this area was assumed to be sensitive to whether insulin levels were high or low (Panksepp, Tonge, & Oatley, 1972). A healthy ventromedial hypothalamus was assumed to be capable to manage hunger.

When the hypothalamus determined the insulin level to be low and the glucagons level to be high a signal would be sent off neurologically that would initiate hunger and instigate the consumption of a meal. This was all assumed to be based on an internal metabolic rate, or set-point, that had to be defended by the body to keep the correct ratio of insulin and glycogen stable; although there are also a variety of additional chemicals from the hypothalamus that have been determined to have association with hunger and consumption in the paraventricular hypothalamus (De Castro, Paullin, & DeLugas, 1978).

The lipostatic theory is based upon a similar idea regarding regulation except this theory is based upon fat storage and long-term regulation. This theory suggests that eating and metabolism are acting upon if there is a deviation from the body's weight set-point. The lipostatic theory assumes that the relative stability of an adult's body weight is because leptin manages the stability of the body regardless of short-term behavioral differences in food consumption or exercise behaviors. This theory states that the body has its own place of stability with regard to total weight and amount of fat, and that the body will eventually return to that state regardless of environmental influences (Baile, Della-Fere, & Martin, 2000). This is based upon the understanding of the influence of a hormone called leptin. Leptin has been associated with eating patterns, lipid and glucose metabolism, and cardiovascular functions. Experiments with mice were the first to reveal this relationship. When leptin was removed via genetic mutation the mice became sterile, obese, and diabetic. However, when leptin was introduced to mice with the hypothesis that there was a relationship between the hormone and metabolic rate, body temperature, and body fat and the experiments were able to substantiate the hypothesis. (Baile, Della-Fere, & Martin, 2000). The mice changed their body size and ability to process glucose.

Challenges to these theories

The American Obesity Association states that 64.5 percent of Americans are considered obese and that obesity is a chronic illness that increases the possibility of developing high blood pressure, type 2 diabetes, and heart disease (2005). Currently the Center for Disease Control states that obesity in the United States, determined by using a measurement of percentage of body fat called the body mass index has risen from 15% to 32.9% in the past 24 years (2006). The question exists to researchers as to how is it possible that these statistics could be so severe if the glucostatic and lipostatic set-point theories are correct. If humans all have a natural tendency to return to our set point then the obesity epidemic as well as other eating disorders such as bulimia and anorexia, would not likely exist in such extreme fashion. This is supported by a recent study which points at two variables that have equal, if not greater, influence on how and why a person eats which are the psychological desire for a meal and the feeling of being hungry. Pittas, Hariharan, Stark, Hajduk, Greenberg, and Roberts (2005) conducted a study to measure the amount of glucose that circulates in the blood stream throughout the day in a group of healthy, non-obese women with a median age of 26.5 years with the goal of determining if glucose level was a determinant in their desire to have a meal. Their study determined that absolute glucose level was a determining factor in when the women decided to have a meal; however, the psychological desire for a meal and the feeling of being hungry were quantitatively stronger than the glucogen factor. This study shows that the glucostatic set-point theory has gaps that do not account for all the reasons why a person eats.

Additionally, in various studies animals were intentionally brought to a level of obesity. If the lipostatic set-point theory is correct, then any hyperphagia the animals displayed should halt allowing for the animal to return to their set-point body weight. However, these studies did not show a reduction in hyperphagia upon reaching the unnatural state of obesity which suggests that other metabolic factors influence dietary behavior that are not explained by the lipostatic set-point theory (Ramirez, 1990). There are additional issues regarding satiety that can not be completely accounted for by set-point theories. For example, the glucostatic theory states that when a certain amount of glucose is achieved in the blood levels a person will no longer feel hunger or need to eat and when the glucose levels drop hunger will return because of a chemical signal that is activated in the hypothalamus (Panksepp, Tonge, & Oatley, 1972). However, satiety is achieved long before the majority of the food consumed has been digested and even had an opportunity to release glucose into the blood stream (Stunkard, 1975). Additionally, a great deal of data supporting set-point theory is based upon the behavior of rats, their eating and hoarding patterns, and forced hyperphagia or hypophagia; humans have much more complex eating patterns and social situations which complicate the set-point theory's applicability in all situations (Harris, 1991).

Positive-Incentive Theories

There are a variety of factors, rather than just a glucostatic or lipostatic set-point, that regulate body weight, eating patterns, and diet maintenance. The positive-incentive theory suggests that in addition to biological reasons, humans eat because of the psychological response to feeling that food is pleasurable, the eating process is enjoyed, and there are social reasons that encourage or discourage the frequency and the amount of

consumption (Pinel, 2006). Rolls performed a variety of experiments on rats and he came to the conclusion that food selection may be made in the area of the amygdala, but it was made based upon preference and previous experience rather than the body being out of homeostasis (Rolls & Rolls, 1973). Additional research was performed that demonstrated that the desire to eat may be driven in the same manner in which humans are motivated sexually (Singer & Toates, 1987). These ideas in addition to the biological factors developed new theories about hunger.

Hunger is determined by many factors

Hunger is a complex feeling that is not just based upon the timing since the last meal. Hunger is strongly influenced by a variety of biopsychological factors such as taste, the eating experience, and additional social factors. Taste plays a role in how much a person eats, how much a person enjoys what he or she eats, and all people have different taste preferences and taste aversions (Caihol & Mormede, 2002). Taste is unique to each person and is dependent on the chemical sensors located on the tongue. This chemical sensing system is what manages the process of tastes and this process starts with the gustatory cells reacting to food or beverages they come in contact with, the cells transmit messages to the brain, and the brain then identifies the taste as being either sweet, sour, salty, bitter, or umami (NIDCD, 2006). If a person has a taste aversion to a particular food it is unlikely that he or she will have a positive-incentive reaction to it and they will not likely continue to eat it (Caihol & Mormede, 2002). Taste is also influenced by culture and can be modified given the circumstances of social events (Liebman, 1995). For example, from a cultural perspective people who are Creole grow up eating spicier food and may develop a long-term preference for very spicy food. Or, socially a person

may eat foods such as caviar or pate because they are attending a party although from a taste perspective he or she may not particularly enjoy the flavor.

Additional factors associated with hunger include the understanding of how eating behavior is managed. People make cognitive decisions about their eating patterns that are not associated with their deviation from homeostasis. For example, the eating experience itself can be associated with grazing behaviors, binge eating, or gorging at one meal setting (Oxford University Press, 2007). A person may cognitively be aware that they should not overeat but some experience a momentary pleasure from the food and he or she may lose control and continue to overeat, and he or she may experience guilt and shame after the binge eating comes to completion (Oxford University Press, 2007). Or, a person may experience different social pressures to lose weight or obtain a body image that is unrealistically thin and then decisions are made cognitively to obsessively diet or restrict the next meal.

Social factors seem to have a stronger influence on eating behavior than blood sugar levels do (Franklin, Germov, & Williams, 2001). For instance, in a study conducted by the University of Toronto 120 female college students were observed eating either alone or with friends (Liebman, 1995). The students who ate alone consumed 375 calories whereas the students who ate with friends consumed over 700 calories suggesting that social factors influence how much someone eats and the social influence usually results in increased consumption. Unfortunately, negative social pressures, such as a perception to lose weight, can be attributed to the onset of eating disorders such as bulimia, anorexia nervosa, or extreme exercise behaviors to compensate for caloric intake (Kansi, Wichstrom, & Bergman, 2005).

Eating patterns and diet maintenance

The positive-incentive theories explain that food is desired because of anticipated pleasure that comes with eating in addition to biological and hunger factors. The idea of eating out and celebrating a special occasion with a special meal is not a new concept; however, it should be noted that these activities are looked upon with anticipation and excitement (Segelken, 2005). Sociologists note that these occasions are built upon mannered rituals, the bringing together of family and friends, and notably, structured meals (Chaney, 2002).

Humans are no longer depended on eating readily and obsessively when food is made available to us in an effort to survive thanks to mass agriculture so it is important to be cautious of consumption behaviors. One particular less formal type of dining, often called a buffet, offers a different view of the implications of the positive-incentive theory on diet maintenance. Dietary diversity traditionally is looked upon as a plus with regard to diet maintenance and overall nutritional health (Toray & Cooley, 1997). However, there are also negatives to diet diversity. For example, if a person is presented with a wide variety of high-caloric foods low in nutritional value they will eat more than they normally would if they were only presented with one option (Kennedy, 2004). The same concepts applies from a positive-incentive perspective because the desirability to eat one food drops upon consumption but when presented with a wide variety of food options, such as a cafeteria, the positive-incentive desire indulge in the rest of the foods is not as strong as with the first item, but it still exists and contributes to overeating (Nayga, 2000). However, the pleasure of each food and the positive incentive of the value of taste for each new food decreases (Pinel, 2006). Regardless, the human stomach can hold one liter

of food comfortably, but in many situations, such as being presented with a variety of food options, it is pushed to hold two liters even though there are chemical and stretch receptors that are signaled when overeating occurs resulting in an uncomfortable feeling. (Toray & Cooley, 1997).

With the understanding that there are multitudes of psychological factors that influence diet maintenance in addition to the biological factors it makes the positive-incentive model seems sensible and can also be effectively incorporated into some health psychology behavioral theories.

Positive-Incentive Perspective and Health Behaviors

A person's weight and diet are ultimately their own responsibility. Eating behavior is influenced by social events and environmental factors, but individuals who have self-efficacy regarding their eating habits are less likely to be influenced by these factors (Shannon, Bagby, Qi Wang, & Trenkner, 2001). A person who believes that he or she is responsible for his or her weight gain, loss, or maintenance is more likely to be successful in dieting and exercise patterns and less likely to suffer from weight related disorders such as obesity, anorexia nervosa, or bulimia (Saling, Ricciardelli & McCabe, 2005). What this implies for people, with self-efficacy regarding controlling eating patterns, is that they should recognize that there are a variety of biopsychological factors that influence their eating patterns and by becoming aware of all these factors they may more effectively design personal nutritional plans for themselves. Perhaps they will be able to experience greater successes using individual nutritional plans that incorporate personal tastes, social needs, and natural biological needs cognitive individual eating

decisions are made versus sticking to a more global diet created for the general public (Long & Stevens, 2004).

Theories of reasoned action and planned behavior for diet maintenance

People are constantly making dietary changes and long-term resolutions for their eating patterns and habits each year all with the hopes of losing weight and improving overall health (Costin, 1998). However, many people who do not have self-efficacy regarding their ability to control their eating may find that they always fall short of their goals; in fact, 95% of those who diet regain some of their lost weight within five years (Costin, 1998). Unfortunately, these dieting failures are most often blamed on the set-point theory as the dieters feel they have no control and are destined to return to their body's natural weight (Gabel & Lund, 2002).

However, the weight regain is better explained by the theories of reasoned action and planned behavior. These theories propose to predict behavior with the knowledge and understanding that each person is unique and therefore, has unique attitudes, subjective norms, and intentions (Ajzen & Fishbein, 1980). Everyone has feelings about certain issues and behaviors. An attitude is a personal feeling about certain behavior that has been built upon throughout that person's lifetime based upon experiences, observations, and information they have acquired about the behavior (Higgins & Marcum, 2005). Everyone also has a unique set of subjective norms, which are beliefs about what other people in their social circle such as spouses, neighbors, or peers, would have regarding any given behavior such as dieting or achieving a thin ideal (Ajzen & Holmes, 1974). Intentions are how a person combines his or her attitudes and subjective norms and

thereby determines how to tackle a problem (Ziefelmann, Luszczynska, Lippke, & Schwarzer, 2007).

The theory of planned behavior demonstrates that a person can then take intention and act upon it which thereby results in a specific behavior or outcome (Ajzen & Fishbein, 1980). For example, this would suggest that a person's eating and nutritional behavior is a result of their intention to stay on a diet and that intention is driven by how a person's subjective norms and attitudes affect intention. For example, if a person has an attitude the diets do not work and subjective norms that it is normal to be somewhat overweight it is unlikely that they will have the intention of successfully making a dietary lifestyle change (Armitage, Conner, Loach, & Willetts, 1999). Upon the failure of a diet a person most likely will not look at the outcome as something that could be predicted using theories of reasoned action and planned behavior; rather they may look at it as reaffirmation that the set-point theory, most specifically the lipostatic theory, is correct and that they can not lose weight or maintain their weight loss (Matheson & Crawford-Wright, 2000).

A person's behavior is usually the result of their own internal belief system rather than the influence of an environmental factor (Ajzen & Holmes, 1974). Before a person takes on a lifestyle changing diet an awareness of how the positive-incentive theory interacts with the theory of reasoned action and planned behavior is beneficial. Individuals should assess their attitude towards dieting and eating and realize that if they are taking on a weight reduction program that they will be sacrificing some of the pleasure factors that are associated with eating whatever food they traditionally would consume if they were not dieting (Bagozzi & Warwshaw, 1992). They should also take a

personal inventory of what their subjective norms are with the understanding that they will face social pressure to deviate from their diet plan. Then, if they feel they have the right intentions for dieting they should be more successful as long as there is an understanding that if they restart their previous nutritional behavior they are likely to regain the weight (Ahern & Hetherington, 2006). With the biological understanding of how the digestive system works, the biopsychological knowledge of the out dated set-point theories and the existing hunger and consumption theories, and the behavioral psychological understanding of the theories of reasoned behavior and planned action the positive-incentive theory is clearly the most logical answer to understanding dieting and diet maintenance.

Recommendations

An observation, based upon this research, is that there is a need for an improvement in education surrounding positive-incentive theories. There is an abundance of information available in the Internet, published journals, and books making recommendations on how a person can manage nutritional plans and dieting using a variety of theories. However, there is very little information available regarding positive-incentive theories to be found amongst the mass assumptions and information that is published as fact and available to the public. For example, many websites and online articles educate the reader that the human body should eat as much as desired as long as you are listening to your body, the amount of food consumed is the most critical determining factor in diet maintenance, that the mind is what balances food intake, and that obese people are obese only because they eat more than other non-obese individuals (Ahern & Hetherington, 2006). Additional popular misinformation is the theory that a

person can reduce calories to lose weight, but regardless of efforts or behavior modification the body has its natural weight (set-point) that it will return to its previous weight regardless of any lifestyle changes (Harris, 1991). These theories can be refuted by positive-incentive theories but if the information is not readily available or discussed then the misinformation will continue to be looked upon as fact.

Additional research shows that people, even health professionals do not fully understand their own eating patterns and that their own theories about hunger and consumption when it comes to preventing overeating (Pinel & Lehman, 1998). More detailed educational programs should be introduced into medical schools to help resolve this gap.

A final recommendation is to increase research about positive-incentive theories and perspectives. A random Google search for the terms “positive-incentive” and “theory” results in 44,000 web pages. However, these results are not scholarly, they are most often in the form of a citation from John P. J. Pinel, or they are secondary research. In fact, after the third page of results it is unlikely to see the terms associated with biopsychological topics at all. A similar search in questia.com’s database does not pull up any biopsychological related results; rather the results are focused on design systems. Additionally, using the Ebsco search engines of CINAHL Plus, Clinical Pharmacology, Health Source: Nursing/ Academic Edition, MEDLINE, Mental Measurements Yearbook, PsychARTICLES, PsychINFO, and SocINDEX databases the results for the search terms “positive-incentive theories” and “positive-incentive perspective” yielded zero results. What this suggests is that although the positive-incentive theory is very popular and widely accepted there is not a breadth of academic research available to

substantiate the theory. This could account for the gap in the educational understanding of the concept and an increase in research would be recommended.

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