When the Label Lies: The Impact of Childhood Socioeconomic Environment on Restrictive Eating and Energy Consumption in Adulthood

by

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ABSTRACT

Past research has established a link between low socioeconomic status, childhood unpredictability, and eating in the absence of hunger. The current research explores whether external or internal cues guide food intake and whether or not this is determined by childhood socioeconomic status. The goals were: a) to determine which plays a more important role in one's food regulation: their beliefs about the number of calories they are consuming or the actual number of calories they are consuming; and b) examine whether this is moderated by one's childhood socioeconomic status (CSES). Results demonstrated that for those who grew up in higher income households, food intake is influenced primarily by biological energy need. For those who grew up in lower income households, food intake appears to be relatively unrelated to biological energy need.

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Abstract

Past research has established a link between low socioeconomic status, childhood unpredictability, and eating in the absence of hunger. The current research explores whether external or internal cues guide food intake and whether or not this is determined by childhood socioeconomic status. The goal was a) to determine which plays a more important role in one's food regulation: their beliefs about the number of calories they are consuming or the actual number of calories they are consuming and b) examine whether this is moderated by one's childhood socioeconomic status (CSES). Results demonstrated that for those who grew up in higher income households, food intake is influenced primarily by biological energy need. For those who grew up in lower income households, food intake appears to be relatively unrelated to biological energy need.

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Stacey and Claire recently had a small snack to hold them over until dinner. An hour later, Michael shows up with a sack full of bean burritos from the local Mexican fast-food joint. Claire readily begins eating the burritos although she does not have the biological energy need for them. Stacey begins to wonder why it is that some people are more prone to eating in the absence of hunger while others are not. Is it fate? Biology? Evolution?

Recent research has shown that those who grow up in higher-income homes tend to eat according to their energy need, consuming more calories when hungry, and less when not hungry. However, individuals who grow up in low-income homes tend to eat comparable amounts of calories, regardless of current energy need (Hill, Prokosch, DelPriore, Griskevicius, & Kramer, 2016). Here, we sought to build on this prior research by examining whether there are CSES based differences in the degree to which people use external versus internal cues of energy need to regulate their food intake. We predicted that individuals from higher CSES environments would regulate their food intake based on their actual biological energy need. As their blood glucose increased, we expected their food intake to decrease –even if they were lead to believe that their energy need was greater than it actually was. For those from lower SES environments, on the other hand, we predicted that individuals would eat comparable amounts of food across levels of energy need.

Life History Theory and Body Awareness

Life history theory is an evolutionary biological framework used to predict how and when organisms allocate effort to the various demands of survival and reproduction across the lifespan (Kaplan & Gangestad, 2005; Stearns, 1992). Because energy and somatic resources are inherently limited, life history theory predicts that organisms face important trade-offs in how they allocate these resources to life tasks such as growth, maintenance, reproduction, and parental care. Importantly, resources that are spent developing one life component cannot be spent simultaneously on another. Each organism must therefore ‘choose’ how to invest these resources in order to advance one life component at the expense of others (Ellis, Figueredo, Brumbach, & Schlomer, 2009). How and when organisms resolve these tradeoffs constitutes their *life history strategy*.

Theory and research on human life history strategies suggests that people adjust their investment strategies based on specific features present in their early childhood environments (Belsky et al., 1991; Kuzawa, McDade, Adair, & Lee, 2010). For example, early-life environments characterized by high levels of psychosocial stress and unpredictability (e.g., children growing up in homes with financial insecurity or inconsistent parental investment) promote resource allocation decisions that promote “faster” life history strategies (Belsky, Houts, & Fearon, 2010; Ellis, 2004). These strategies are characterized by expedited physiological and sexual development, preparing the individual for earlier reproduction if ecological conditions remain harsh (Chisholm, et al. 1993; Ellis et al., 2009). Early-life environments that are more benign and predictable, on the other hand, tend to encourage slower life history strategies characterized by a prolonged developmental period, rendering the individuals better able to compete for resources as adults (Ellis et al., 2009; Kaplan & Gangestad, 2005).

More recent research has found evidence that early life resource availability may also have an impact on the mechanisms that regulate the body’s energy supply. Because conditions in early-life provide a blueprint for the types of environments one is likely to encounter in adulthood, life history theory predicts that developmental exposure to conditions typical of low

SES – which tend to be relatively resource scarce – may promote the development of an adult phenotype that is well-adapted to survive in such conditions (Gluckman et al., 2007; Hales & Barker, 1992; Kuzawa, McDade, Adair, & Lee, 2010; West-Eberhard, 2003). Consistent with this hypothesis, research finds that exposure to resource scarcity in utero and in early childhood play an important role calibrating physiological and psychological development, encouraging the development of an adult phenotype characterized by a smaller body size, slower metabolism, and a reduced level of behavioral activity [see e.g. (Barker, 1997; Bateson & Martin, 1999; Bateson et al., 2004; Gluckman & Hanson, 2004; Gluckman et al., 2009)].

Guided by these insights, researchers recently hypothesized that childhood socioeconomic conditions might also play an important role in calibrating the mechanisms that guide food intake. Although mechanisms of homeostatic energy regulation typically develop such that current energy needs play an important role in regulating food intake (Havel, 1999; Woods, Seeley, Porte, & Schwartz, 1998), in low SES environments – where access to food may be unpredictable or scarce – it makes adaptive sense to eat when food is available, even if current need is low. Developmental exposure to the conditions typical of low SES may therefore adaptively undermine the role that current energy needs play in food regulation, promoting eating in the absence of hunger. Although eating in the absence of bodily need is associated with obesity in contemporary food-rich environments (Fisher & Birch, 2002; Herman & Polivy, 1984), it would help promote survivability in environments that are resource-scarce.

Support for this hypothesis has been found in two lines of research. In one series of studies, Hill et al (2016) found evidence of energy dysregulation among college students who grew up in low SES homes. In each of these studies, the researchers gave fasting participants a liquid energy preload: either a Sprite or a cup of water. They were asked to consume the entire beverage and then had their blood glucose measures taken. After a brief waiting period they were offered snacks and were told they could eat as much or as little as they wanted. The researchers ultimately found that individuals who grew up in higher childhood SES environments regulate food intake according to immediate physiological energy need. For those growing up in lower childhood SES environments, however, the relationship between physiological need and food intake was decoupled. These individuals ate comparably high amounts of food regardless of whether energy need was high or low. Follow up work by Proffitt Leyva & Hill (in press) recently extended this work by demonstrating that this pattern is mediated by decreased body awareness among those from lower CSES environments. Specifically, they found in their work that individuals from higher CSES environments exhibit greater body awareness and, in turn, less eating in the absence of hunger. Those from lower CSES environments, on the other hand, exhibit lower body awareness and more eating in the absence of hunger.

Together, this research suggests that individuals from higher CSES environments have greater body awareness and eat according to their bodily energy need (with the opposite being found among those from lower CSES environments). However, one important limitation of this work is that it is possible that individuals from higher CSES backgrounds – rather than being more in tune with their bodily states – may simply be more inclined to regulate their food intake based on calorie estimates. That is, high CSES individuals in the sugar-drink pre-load condition may have simply estimated that they were consuming approximately 200 calories from the sweetened drink and thus downregulated their subsequent food intake accordingly. The current research was designed to test this alternative account of the results from Hill et al., (2016) and Proffitt Leyva & Hill (in press)

The Current Research

The current research seeks to understand whether or not perceptions or reality of the calorie content of a drink pre-load will alter the total number of calories consumed in a taste test. The experiment utilized false drink labels for the pre-load to alter participant's view of the drink they were consuming. This allowed for the control of the effect being from psychological awareness rather than physiological awareness. We predicted that being given the information that a drink was zero calories would convince participants from high SES homes to consume more calories in the following taste test. They were offered two different snacks and ate freely for the duration of the experiment. The leftover snacks were then weighed in grams and converted to calories. A moderated regression analysis was run in order to compare childhood socioeconomic status and the number of total calories consumed by condition.

Method

Participants. One hundred thirteen male (n = 39) and female (n = 80) undergraduate students served as participants with one participant refusing to report their sex. Seven participants were excluded from the analysis due to heightened fasting blood glucose and for failing to consume a majority of the beverage pre-load.

Procedure and Materials. Participants were instructed to attend the session fasting (having not consumed food or beverages besides water for a minimum of 6 hours prior to the session). Participants provided informed consent, then received a briefing describing the cover story ruse, which explained that the experiment would be focusing on how hunger might affect consumer preferences. After the briefing, blood glucose levels were collected from each participant using via a 28 gauge Assure Lance lancet and Breeze2 glucometer. After ensuring the participant's blood glucose met fasting requirements, they were randomly assigned to one of two drink conditions: "diet" Sprite or an equal amount of water. Each drink had a different, unique label. In the "diet" Sprite conditions, participants consumed a full-calorie, sugar sweetened beverage, but were under the impression that it was a zero-calorie drink. After receiving the drink, the researcher instructed the participant to consume the entire contents of the cup and were then asked to complete a survey asking their opinion on the drink. In all conditions the participant was informed that they would be assisting the researcher in testing out a new drink for a beverage company.

Drink labels were designed and presented to reinforce the nutritional information of the drinks and to help solidify the cover story. The label designated to the "diet" Sprite was a lime green label with an illustrated lemon and lime logo, paired with the drink name, "Spark," in bright red across the middle (see Figure 1). There was a line of text at the bottom of the label that read "made with an all-natural, zero-calorie sweetener!" The label for the water was created from the same foundation of the soda labels- it was composed of a lime green background and the same bright red text for the drink name, this time notated as "Spring" as opposed to "Spark." Instead of a lemon and lime logo, this condition had a water droplet as its focus with a tagline of "refreshingly simple" (see Figure 2).

In the first condition the liquid was a lemon-lime soda. They participant was made to believe that the beverage was all-naturally sweetened and had zero calories. The second condition was water. The participants were told simply told that it was a new brand of bottled water. As the participant ingested the drink the researchers took note of how they drank (chugged or sipped) and how long it took them to finish. Participants were then asked questions regarding the appearance of the soda label and how interested they would be in purchasing the beverage at a later date. They were also questioned about what they find most important in the nutritional value of a drink, such as carbohydrate, sugar, and calorie content.

After a ten-minute filler task, the participants blood glucose levels were taken a second time. Following the blood glucose measure, participants were presented 28 grams/130 calories of Goldfish Cheese Crackers and 56 grams/280 calories of Famous Amos Chocolate Chip Cookies. The snacks were presented in identical white, paper bowls and were pre-weighed. Participants were informed that they would again be evaluating the items for a new company. A small bottle of water was also given to cleanse the palate between tastings. The cookies were administered first. They were instructed to examine the cookies and report on their appearance and how much they enjoyed products that looked similar to the ones they were given. The participant was then asked if they felt the serving they were given was too small, too large, or just right. Afterward they were asked how much they thought they would enjoy the product based on appearance alone, as well as how much they wanted to eat the cookie. They were then prompted to taste the cookies and were questioned on how much they enjoyed them. At this point in the experiment participants were encouraged to cleanse their palette with the bottle of water that was provided. They were then handed a bowl of crackers and repeated the exact same procedures as they did with the bowl of cookies. Upon completion of the taste test portion of the study, participants were informed that they were free to eat as much or as little they desired. Participants were then asked to complete several more survey measures and had the opportunity to consume the treats at whatever speed they wished. The amount of food consumed was documented and later translated into number of grams, then calories ingested.

Measures

Early Life Measures.

Socioeconomic Status. SES was measured using subjective measures to inquire about and examine the childhood socioeconomic environment. Childhood SES was analyzed by using a myriad of questions (i.e., “I grew up in a relatively wealthy neighborhood.”, “My family usually had enough money for things when I was growing up.”, I felt relatively wealthy compared to the other kids in my school.” (rated on a 7-point scale as 1= Very poor, 9= Very Wealthy and 1 = Strongly Disagree, 9 = Strongly Agree, respectively).

Results

A moderated regression analysis was conducted to examine the impact of childhood socioeconomic status on calorie consumption by condition. Results revealed that participants reared in lower SES conditions (1 *SD* below the mean), ate a comparable number of calories across drink conditions (water vs. “diet” sprite), b= -19.16, SE = 35.30, t = -.54, p = .59, 95% CI = [-89.11, 50.80]. However, for participants reared in higher SES conditions, (1 *SD* above the mean), there was a significant difference in calories consumed, b= -79.22, SE = 35.06, t = -2.26, p = .03, 95% CI = [-148.71, -9.73], with individuals in the water condition consuming more calories than the “diet” sprite condition.

Discussion

The results provided interesting insight on how people consume foods when presented with false caloric content of a pre-load. Our original hypothesis predicted that those with high CSES would regulate their calorie intake based on their actual biological need and that those with low CSES would consume comparable amounts regardless of their energy need. Our results indicated that a water pre-load led to more calories being consumed in the taste test portion of the experiment. Those in the “diet” Sprite condition consumed less calories even though they were presented with the supposed nutritional information of the drink. Thus, it appears as though high-income childhood homes allow for the ability to eat only when there is a biological energy need. Calorie counting is not a significant factor, but rather the participants listened to the signals their body sent off to notify the brain that there was no longer a need to continue eating. This is not an effect caused by psychological awareness, but rather physiological.

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Figure 1. Drink label used for the “diet” Sprite condition. Participants in condition one were presented with this label and nutritional information to solidify the cover story as well as make them aware of what they were consuming.

Figure 2. Drink label used for the water condition. Participants in condition two were presented with this label and nutritional information to solidify the cover story as well as make them aware of what they were consuming.

Descriptive Statistics

Mean Calorie Consumption by Condition and Participant Sex				
	"Diet" Sprite		Water	
	M	*SD*	***M***	*SD*
Men	**166.13**	31.56	**208.42**	28.39
Women	**169.98**	20.83	**222.83**	21.68

Figure 3. The mean and standard deviations for both the "diet" Sprite and water conditions.

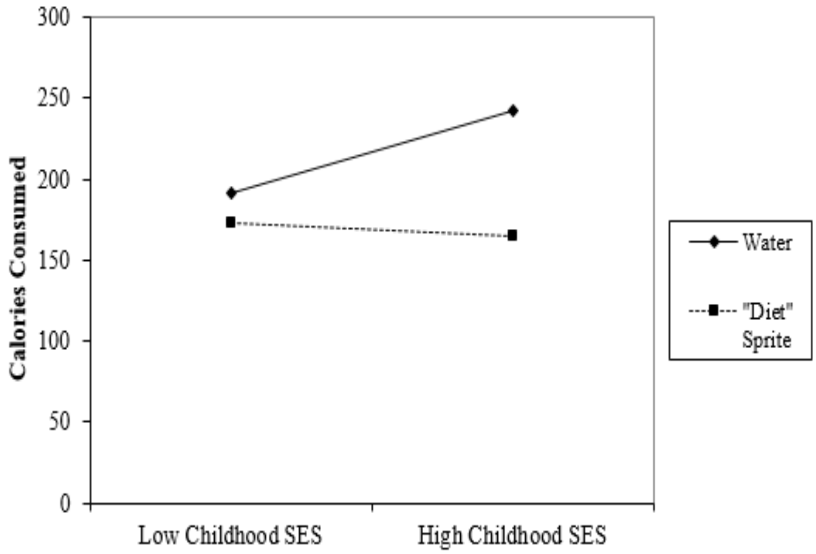

Figure 4. Moderated regression analysis illustrates the mean number of calories consumed, with low childhood SES being one standard deviation below the mean and high childhood SES being one standard deviation above the mean.