Is High-Caloric Food Consumption an Addictive Behavior in Our Modern World of Plenty? a Test of the Relationship Between Performance in a Neuropsychological Positive-Emotion Shifting Task and Everyday Snacking Behavior in Non-Obese Adult Women

Ji Lu, McGill University, Canada
Laurette Dube, McGill University, Canada
Antoine Bechara, University of Southern California

In order to examine the degree to which high caloric food (HCF) consumption conform to an addiction-like model, 132 non-obese adult women engaged in a two-phase study in which they first performed the affective shifting task (AST) and subsequently reported their HCF snacking behavior and craving in an experience sampling study. Individual indices for attentional and inhibitory performance were derived from the AST and served as predictors of the person’s snacking, craving, and the weight of craving carried in snacking. Results showed that a women’s inhibitory performance in AST could account for her everyday HCF snacking consumption.

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Is High-Caloric Food Consumption an Addictive Behavior in Our Modern World of Plenty?

A Test of the Relationship between Inhibitory Performance in a Neuropsychological Positive-Emotion Shifting Task and Everyday Snacking Behavior in Non-Obese Adult Women

Ji Lu, McGill University, Canada
Laurette Dube, McGill University, Canada
Antoine Bechara, University of Southern California, USA

EXTENDED ABSTRACT

Research Background

Eating behavior has evolved over billions of year in an environment of food scarcity. Therefore, in the modern world of plenty, where cues for food and high caloric food (HCF) in particular are ubiquitous, it is reasonable to expect that HCF consumption, even for normal weight consumers, can be viewed to some extent like an addictive behaviour.

There is evidence supporting common mechanisms mediating the rewarding properties of natural rewards like food and addictive drugs. Researches have for long shown that sugar and fat, the two core ingredients in most HCF, do induce more intense pleasure than their counterparts. Furthermore, neuroimaging techniques showed that the HCF cues, compared to low caloric food cues, are associated with more intense reward system responses. In other words, HCF foods are highly rewarding, intensely positively valenced cues that are tempting fruits hard to resist.

In this paper, we propose to test whether everyday HCF consumption conforms to an addiction-like model. This model builds upon the most immediately relevant features of addiction to account for a person’s everyday HCF consumption in the context of modern affluence where the food itself and related cues are ubiquitous. The addiction-like model of HCF consumption lies on three central premises. The first is that HCF are intrinsically pleasurable stimuli tied to a biologically-wired and culturally-reinforced prepotent approach response. The second premise of the addiction-like model of HCF consumption lies in that consumers are not only wired for impulsively react to one’s pleasurable objects and cues in the environment in a passive manner. They are also able to exercise inhibitory control over such impulses and possibly turn to alternative internal or environmental cues, or to alternative goals. The third premise is that, while both impulsive responses and inhibitory control are basic features of the human brain anatomy and processes, there are individual differences in one’s susceptibility to impulses and one’s ability to exercise inhibitory control, and such differences at the neuropsychological level can be linked to a person’s everyday HCF consumption.

Addiction has been tied to two types of psychological mechanism, these being attentional and inhibitory. Thus, building upon recent models of addiction, we see HCF consumption as being due to two related processes: (1) biased attention, upon exposure to the HCF cues, the reward system draws the person’s attention selectively towards the addictive-like stimulus, thereby making its recognition faster and easier and being accompanied by motor preparation in order to move towards the object of addiction; (2) poor inhibitory control, that translates into one’s difficulty to stop or inhibit such motor impulse, as the first step towards a possible controlled responses of maladaptive behaviour and/or a shift to alternative environment cues and goals.

Research Objective

The present study used a computer-administered measure of neuropsychological performance in inhibitory control, namely Affective Shifting Task (AST), which can measure individuals’ attentional/impulsive response to rewarding cues and the ability to inhibit such impulses. By exploring the relationship between individuals’ performance in AST and their everyday eating behavior, the AST is validated as an assessment of individual neurobiological vulnerability to HCF temptations.

Methods

132 non-obese (BMI<30) women enrolled an experience sampling study, in which participants reported their lifestyle behavior six times a day for ten reporting day. The reported eating behavior included whether they had been snacking and craving for food, especially those HCF, in the last two hours.

The same individuals also performed computer-administered AST that assess individual pre-frontal cortex activity in terms of attentional and inhibitory processes to affective stimuli. In the AST, where positive and neutral stimuli were varying in different conditions, participants were put into an environment to focus on the things they want to approach or to shift attention away from them. Similar tasks showed that individuals addicted to highly rewarding objects such as drugs, nicotine and alcohol demonstrated impaired performance. For each participant, performance measures on the AST, including response latency, and parameters reflecting its underlying process, in terms of discriminability and dis/inhibition, were computed. AST parameters used as predictors of everyday HCF snacking were constructed from the within subject differences on these attentional and inhibitory measures between relevant manipulated conditions built into the structure of the AST. Those parameters including (1) the emotional bias, which is a set of indices revealing individual attentional bias to positive cues, (2) the mental flexibility, which reflects participants’ adaptability to changing environment, and (3) mental flexibility reflected in emotional bias, which takes the individual difference of two parts: mental flexibility when positive stimulus were set as attentional targets compared with neutral stimuli as targets.

Results and Conclusions

In series logistic hierarchical models, the individual performances and parameters in AST served as predictors of the everyday eating behaviors reported by participants, specifically, the reported HCF snacking and experienced craving. In a series similar model, the HCF craving was used to predict the snacking, and the predicting power (i.e., the weight of craving carried in snacking behavior) was further explained by the same set of predictors. The results conformed to some extent to the three primary premises of the addiction-like model of eating but there is clearly no perfect mapping with an addiction-like pattern of HCF consumption. The most interesting and robust finding of this study is the critical role played by inhibitory performance on the AST in accounting for a person’s HCF consumption, in particular at the level where the individuals has to show mental flexibility in responding to a environment (task conditions) in which stimulus-reward associations are reversed. At this level, individuals who showed superior inhibitory performance in these conditions, over their own neutral
baseline, were better able to resist to the world of plenty and were less likely to have engaged into HCF snacking. Most importantly, this relationship persisted, even after the effects of other AST parameters had been partialled out in a subsequent analysis that includes all of them. As further evidence of the critical role played by inhibitory performance in this context, compared to attentional measures comes from results of the follow-up analysis in which the signal detection’s measure of inhibitory performance was dissected into its components, CR (an attentional index) and CR, a direct measure of one’s ability to inhibit responses. Here, results showed that superior inhibitory performance on this more direct index remains predictive of lower HCF snacking, while a superior attentional performance, as indexed by CR, was predictive of higher HCF snacking. It is noteworthy that all these effects remained significant after episode-level and individual controls.

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