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An experiment assessing effects of personalized feedback about genetic susceptibility to obesity on attitudes towards diet and exercise

Woo-kyoung Ahn [a, *], Matthew S. Lebowitz [b]

[a] Department of Psychology, Yale University, 2 Hillhouse Avenue, New Haven, CT 06520, United States
[b] Center for Research on Ethical, Legal and Social Implications of Psychiatric, Neurologic and Behavioral Genetics, Department of Psychiatry, Columbia University, NY State Psychiatric Institute, 1051 Riverside Drive, Unit 122, New York, NY 10032, United States

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ABSTRACT

As increasing attention is paid to possible genetic influences on susceptibility to obesity, recent studies have examined how genetic attributions can impact laypeople's weight-related attitudes and eating behavior. Little consideration, however, has been devoted to understanding the potential effects of learning that one does *not* have a genetic predisposition to obesity. The present study investigated the possibility that such feedback might bring about negative consequences by making people feel invulnerable to weight gain, which is termed a genetic invincibility effect. After conducting a saliva test disguised as genetic screening, participants were randomly assigned to be told that there was either a very high or very low chance that they carried genes known to increase one's risk of developing obesity. Participants who were told that they were not genetically predisposed to obesity judged the efficacy of healthy diet and exercise habits to be significantly lower than did those who were told that they were genetically predisposed and those who did not receive any genetic feedback. When prompted to select a meal from a menu of options, participants who were told that they were not genetically predisposed to obesity were also more likely than others to select unhealthy foods. These findings demonstrate the existence of a genetic invincibility effect, suggesting that personalized feedback indicating the absence of a genetic liability could have negative psychological consequences with substantial health-related implications.

1. Introduction

The world is in the midst of a global pandemic of obesity that has intensified in recent decades, affecting men, women, children, and adolescents in both developed and developing countries, causing millions of deaths, and contributing significantly to the global burden of disease, disability, and early mortality (Ng et al., 2014). In light of these alarming developments, there has been a surge of research on psychological factors that determine people's food intake.

In particular, recent studies have examined how laypeople's beliefs and attitudes about the causes of obesity may affect food consumption. For instance, laypeople who attribute obesity to a lack of exercise are more likely to actually be overweight than those who attribute obesity to a poor diet, because the former tend to consume more food (McFerran & Mukhopadhyay, 2013). Although laypeople tend to view lack of willpower, the food environment, and lack of exercise as the most likely causes of obesity, the general public is also becoming more and more aware of the role of genes in obesity's etiology (e.g., Dar-Nimrod, Cheung, Ruby, & Heine, 2014; Singer, Corning, & Lamias, 1998). The current study examines how information about one's genetic predisposition to obesity affects attitudes and behaviors related to diet and exercise, which can in turn affect actual eating behaviors.

Past studies found that more than 40% of respondents attributed obesity to genetic or hereditary factors (e.g., Beeken & Wardle, 2013; Oliver & Lee, 2005). This number is likely to grow as obesity is increasingly explained in terms of genetics (e.g., Albuquerque, Stice, Rodríguez-López, Manco, & Nóbrega, 2015; Locke et al., 2015; Yang, Kelly, & He, 2007). Personalized genotyping has been proposed as a means of someday identifying individuals at risk for severe obesity, who could then be monitored using biotechnology in an effort to reduce the incidence of negative

* Corresponding author.
E-mail addresses: woo-kyoung.ahn@yale.edu (W.-k. Ahn), msl2207@cumc.columbia.edu (M.S. Lebowitz).

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health outcomes associated with obesity (Walley, Blakemore, & Froguel, 2006). Genetic tests that purportedly provide personalized information about a person's genetic susceptibility to obesity are already becoming available (Meisel, Walker, & Wardle, 2012; Segal, 2017). One company even claims that its genetic test "provides physicians with a genetically-matched diet allowing them to make specific recommendations to their patients to help them achieve or maintain a healthy weight" (Pathway Genomics, n.d.).

Recent studies have investigated the effect of construing obesity in terms of genetic etiology. While genetic accounts of obesity can reduce the extent to which people with obesity are blamed for their weight status (Pearl & Lebowitz, 2014), genetic explanations can also have negative consequences. Laypeople tend to hold inaccurate beliefs about genetics, endorsing genetic essentialism, which refers to the belief that genes represent the immutable essences of a person's traits (Dar-Nimrod & Heine, 2011; Ehrlinger, Burnette, Park, Harrold, & Orvidas, 2017). Thus, the increasing emphasis on understanding the genetic bases of health and illness, including obesity, could increase fatalism about health outcomes (Dar-Nimrod & Heine, 2011). Indeed, the more overweight Americans attribute their weight status to biological causes such as genes, the more unchangeable they believe their body weight is (Pearl & Lebowitz, 2014). Genetic explanations have also been shown to decrease self-efficacy and intentions to exercise (Beauchamp, Rhodes, Kreutzer, & Rupert, 2011). Relatedly, Hoyt, Burnette, and Auster-Gussman (2014) found that when people with obesity learned about the American Medical Association's 2013 decision to formally recognize obesity as a disease, they became less concerned about their weight (compared to people who read different information about obesity), which led to them making less healthy food choices. Other research has shown that merely being exposed to genetic explanations for obesity can increase consumption of unhealthy food (Dar-Nimrod et al., 2014). Indeed, the proportion of Americans with overweight and obesity who are trying to lose weight has declined significantly over recent decades (Snook et al., 2017), and increasing genetic attributions could be one possible reason for this trend.

Previous studies of the effects of genetic information on obesity, however, have not specifically examined how learning that one is not genetically predisposed to obesity would affect people's attitudes towards eating and exercise or their choice of foods. Learning that one is not genetically susceptible to an illness or unhealthy condition is good news, which may explain why existing research has generally not focused on possible negative effects of such feedback. However, if people see DNA as the essence of a condition, they may view it not only as sufficient to cause the trait on its own—making them pessimistic about their control over the condition in question—but also as necessary to bring it about. Consequently, people may also hold the misconception that if they do not carry a particular genetic predisposition to obesity, they are likely to be immune to the negative effects of obesogenic dietary habits or inactivity—a misconception that we refer to as a genetic invincibility effect.

Similar phenomena, known as licensing effects or risk compensation, have been documented in other domains. For instance, people who took pills described to them as multivitamins—which in fact were placebo pills—showed greater desire to engage in unhealthy behaviors, such as casual sex, excessive drinking, and smoking (Chiou, Yang, & Wan, 2011). Drivers of vehicles with anti-lock brakes actually drive faster (Sagberg, Fosser, & Sætermo, 1997), and increased helmet use is positively associated with increased bicycle-related fatalities (Rodgers, 1988).

Only a few recent studies have examined the impact of learning that one does not possess a particular genetic liability, and no single clear pattern of effects has emerged. Among individuals who learned that they carried a CDKN2A/p16 mutation (which increases susceptibility to melanoma), adherence to total body skin examinations (TBSE) increased, whereas among non-carriers, it dropped (Aspinwall, Taber, Leaf, Kohlmann, & Leachman, 2013). However, these participants were from families with a history of melanoma, and the decrease among non-carriers may have reflected a reversion to general-population norms (Lakhani, Saraiya, Thompson, King, & Guy, 2014) rather than a true genetic invincibility effect. Furthermore, non-carriers' appraisals of the effectiveness of photoprotection remained as high as carriers' after both groups learned of their carrier status (Aspinwall et al., 2015), potentially suggesting the absence of genetic invincibility effects.

The aforementioned studies, while groundbreaking in their focus on elucidating the effect of learning that one is a non-carrier, are limited in several ways. First, no studies to our knowledge have systematically examined whether learning that one does not have genetic predisposition to obesity would cause them to feel more invincible (i.e., to assume that they will not become obese regardless of their diet or exercise habits). Second, the findings from the aforementioned studies may be difficult to generalize to a larger population because these studies focused on individuals from families with known histories of a disorder. For instance, non-carriers who are aware of such a family history may be less likely than members of the general population to show genetic invincibility effects, as individuals who know that a certain condition runs in their families may be resistant to the assumption that they are invulnerable to it (Aspinwall, Taber, Kohlmann, Leaf, & Leachman, 2014).

The current study offers the first experimental investigation of the genetic invincibility effect in the general population, using obesity as the target condition. We examine whether telling people that they are not genetically predisposed to obesity would cause them to discount the importance of healthy diet and exercise habits, and to select more unhealthy foods. In this study, participants carried out a saliva test disguised as revealing their genetic susceptibility to obesity, and we randomly determined which participants were told that they were not genetically predisposed to obesity. If genetic invincibility effects were to occur, participants told that they lacked a genetic predisposition to obesity would be expected to discount the significance and efficacy of diet and exercise relative to individuals who had not been told anything about their genetic predisposition to obesity.

In addition, the present study also included a randomly selected group of participants who were told that they were genetically predisposed to obesity. These participants might also be expected to discount the significance and efficacy of diet and exercise, if genetic essentialism plays a role, as they might expect the effects of their genes to be deterministic. Alternatively, these participants could have interpreted the genetic feedback non-deterministically because it is well known that diet and exercise affect body weight (e.g., McFerran & Mukhopadhyay, 2013), and these participants might appreciate the benefits of diet and exercise even more, as a means of overcoming their supposed genetic predisposition (Aspinwall et al., 2015).

2. Methods

2.1. Rationale for experimental methods and protection of human subjects

The current study experimentally manipulates the type of genetic feedback participants received through a saliva test disguised as a test for genetic predisposition to obesity. This experimental method has several advantages over correlational studies because it allows for participants to receive different feedback after the