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Beliefs about genetic influences on eating behaviors: Characteristics and associations with weight management confidence

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ABSTRACT

Introduction: The development of precision approaches for customized health interventions is a promising application of genomic discovery. To optimize such weight management interventions, target audiences will need to be engaged in research and implementation efforts. Investigation into approaches that engage these audiences will be required to ensure that genomic information, particularly with respect to genomic influences on endophenotypes like eating behavior, is understood and accepted, and not associated with unintended adverse outcomes. We took steps to characterize healthy individuals' beliefs about genetic influences on eating behavior.
Methods: Data were collected via online survey from 261 participants selected at random from a database.
Results: Respondents infrequently spontaneously identified eating behavior-related factors as running in families. However, those who perceived themselves as overweight and perceived a family history of overweight were more likely to attribute eating behavior to genetics on closed-ended assessments, $\beta = 0.252$, $p = 0.039$. Genetic attributions for eating behaviors were associated with lower confidence in ability to control eating and weight, $\beta = -0.119$, $p = 0.035$.
Conclusions: These exploratory findings shed light on beliefs about genetic influences on eating, a behavioral trait (rather than a disease). This investigation can inform future health intervention efforts.
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1. Introduction

It has long been understood that body weight is highly heritable (Bouchard & Perusse, 1988; Maes, Neale, & Eaves, 1997; Wardle, Carnell, Haworth, & Plomin, 2008). Estimates suggest that between 40 and 70% of one's weight is inherited (Bray et al., 2016). Research efforts have also uncovered several specific genes that influence weight (Early Growth Genetics (EGG) Consortium, 2012; Speliotes et al., 2010). A growing literature further supports the existence of genetic underpinnings for several weight-related behaviors. Central among these are eating behaviors. Indeed, specific genes have been implicated in behaviors like eating in the absence of hunger, food preferences, taste perception, and willingness to try new foods (Wardle, Llewellyn, Sanderson, & Plomin, 2009; Wardle & Cooke, 2008; de Krom, Bauer, Collier, Adan, & La Fleur, 2009; Cooke, Haworth, & Wardle, 2007; Grimm & Steinle, 2011).

Key among the anticipated applications of ongoing genomic discovery is the development of genomics-informed approaches for customized health interventions (Bray et al., 2016). Such personalized approaches will require better understanding of gene-environment and gene-gene interactions that influence health and disease. The high profile Precision Medicine Initiative is the latest, (Collins & Varmus, 2015) most ambitious effort in this regard. However, to make personalized weight management interventions a reality, target audiences will need to be engaged in research and implementation efforts. At present, there is little information available to guide the integration of genomic information into weight management approaches. Investigation into optimal approaches will be required to ensure that genomic information is understood and accepted, and is not associated with unintended adverse outcomes among target populations.

Theory and evidence suggest that individuals' response to the integration of genomic information into weight management programs will be governed in part by their causal beliefs regarding the role of genetics in weight and eating (Cameron & Muller, 2009; Müller & Kersten, 2003; Senior, Marteau, & Peters, 1999). This encompasses not only the extent to which individuals believe that genetic factors are operational, but also their understanding of how, or the mechanism through which, these influences operate (Cameron, Marteau, Brown, Klein, & Sherman, 2012). In general, most people agree that in addition to behavioral

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factors, genetic factors are at least partially responsible for one's body weight (Waters, Muff, & Hamilton, 2014; Sanderson et al., 2012). Importantly, however, genetic factors are frequently discussed as operating primarily on biological processes like metabolism, as opposed to influencing one's food preferences, taste perceptions and other drivers of weight-related behaviors (Genetic influences on weight. WebMD website, 2016). Thus, the extent to which the public endorses genetic underpinnings of eating behaviors is almost entirely unknown.

Eating behaviors are frequently conceptualized as the causal aspects of weight that are under one's volitional control, and are often pitted against genetic causal explanations. Individuals tend to most strongly attribute genetic causes to physical and appearance-related characteristics, and less frequently associate them with mental or behavioral characteristics (Condit, 2010). For example, surveys have demonstrated low endorsement of the notion that genes influence smoking behavior (Houfek et al., 2008; Quaak, Smerecnik, van Schooten, de Vries, & van Schayck, 2012). In addition, studies investigating perceptions of social influences on food intake have found that individuals are often unaware of or unwilling to acknowledge influences on their eating behavior that fall outside common-sense, experiential explanations like hunger and perceptions of how food tastes (Vartanian, Herman, & Wansink, 2008). It is therefore possible that genetic explanations for eating behavior may not be salient, or may even be rejected to the extent that they are perceived to contradict personal experience or notions of personal control (Dar-Nimrod & Heine, 2011). Determining whether this is the case will be essential for optimally communicating genomic influences of eating behavior in future interventions.

It has been suggested that genomics-based personalization of behavior change interventions might add value to current intervention approaches (McBride, Bryan, Bray, Swan, & Green, 2012). Such suggestions have raised concerns that deterministic misunderstandings of genetic influences on health may lead target audiences to become discouraged or fatalistic about the value of behavior change. However, research has typically shown that attribution of weight to genetic factors does not decrease self-efficacy for weight management (Cheera, Klarich, & Hong, 2016). The veracity of these concerns when considering the genetic underpinnings of eating behaviors has not yet been assessed. Research by Cameron and colleagues demonstrated that understanding the mechanisms through which behavior can reduce genetically-conferred risk for health conditions is important for undercutting potential fatalistic responses (Cameron et al., 2012). However, it is unclear how self-efficacy might be influenced when target audiences are told that the very behaviors required to lower obesity risk are also genetically influenced.

The current report takes initial steps in characterizing healthy individuals' beliefs about the notion that there are genetic influences on eating behavior in comparison with beliefs about genetic influences on body weight. We gathered data on eating behavior causal attributions and their correlates as part of a larger survey assessing individuals' eating behavior traits (Bouhlal, McBride, Trevedi, Agurs-Collins, & Persky, 2017). Given the exploratory nature of this project, we developed several research questions:

1. How salient is the concept that factors influencing one's eating behaviors are passed down in the family?
2. To what extent do individuals perceive eating behaviors to be caused by genetics, and how does this compare with perceptions of the extent to which a) eating behaviors are caused by the environment, and b) body weight is caused by genetics?
3. What factors (demographic and perceptual) are associated with individuals' genetic and environmental causal beliefs regarding eating behaviors?
4. How do genetic attributions for eating behaviors relate to variables relevant to future interventions including: confidence in dietary intake and weight control and interest in eating behavior-related genetic testing?

2. Methods

2.1. Procedure and participants

These data were collected as part of a larger survey effort related to assessing eating behavior phenotypes in 2014–2015 (Bouhlal et al., 2017). Participants represented all weight categories and were not selected on the basis of participation in a weight management program. The study was introduced to participants as an effort to better understand individuals' eating behaviors and habits. Participants were contacted from a database of individuals who had indicated previous interest in participating in clinical research though the Patient Recruitment and Public Liaison Office of the National Institutes of Health. Individuals were randomly chosen from the database, and an email introduction was sent with an opportunity to opt out from study material mailings. A week later, a packet including login information for the online survey was sent to the mailing address on file for each participant who did not opt out. Participants were given online access via a unique user ID and password to the survey that they could choose to complete following informed consent procedures. Surveys were incentivized with check or gift card. Two hundred sixty-one participants completed the survey that contained the information reported here. This is indicative of a 23% response rate. This research was approved by the IRB of the National Human Genome Research Institute.

2.2. Measures

2.2.1. Demographics and predictor variables

We collected participants' age, self-reported height and weight (from which we calculated BMI), gender, marital status (dichotomized as married/partnered versus single), parental status (dichotomized as parent versus non-parent), race (collapsed categories into White, or nonwhite), education (dichotomized as college versus no college), perceived weight (collapsed into overweight versus not overweight), and perceived family history of overweight (dichotomized as yes versus no).

2.2.2. Spontaneous beliefs

Participants were asked to respond to the following prompt by generating a list: “Please give examples of health conditions or other characteristics that you think might run in your family”; five response slots were provided. These responses were grouped into five categories by two trained coders who met to resolve discrepancies and achieved kappa levels >0.6.

2.2.3. Prompted beliefs

Participants were asked to indicate their causal beliefs about the influence of genes and of environment on eating behaviors and on body weight with four items: “How much do you think (body weight/eating behavior) is influenced by (a person's genes/the environment we live in)?”. Responses were collected on a four-point scale (not at all, a little, some, or a lot). A “don't know” option was also included.

2.2.4. Intervention-relevant attitudes

We assessed participants' interest in eating behavior-related genetic testing with a single item assessing how interested individuals would be in having a genetic test related to eating habits (1–7 scale from not at all interested to extremely interested; a “don't know” option was also included). Self-efficacy was assessed by averaging two items, one assessing confidence in weight control and the other assessing confidence in controlling dietary intake (1–5 scale, not at all confident to extremely confident; a “don't know” option was also included). These two items were correlated ($r = 0.73$, $p < 0.0001$, $n = 259$).