

Atypical Eating Disinhibition Genotype

Lori E. Arguello, DNP, ANP-BC, Kasuen Mauldin, PhD, RD, and
Deepika Goyal, PhD, FNP-BC

ABSTRACT

This study identified the frequency of 6 eating behavior genotypes in overweight (body mass index 25–29.9 kg/m²) versus obese (body mass index $\geq$ 30 kg/m²) patients. Using a quantitative retrospective design, participant characteristics and genotypes of 6 genes and their associated eating behavior traits were extracted from 698 electronic medical records of patients from 3 medical weight loss clinics. Data were analyzed using descriptive and inferential statistics. Obese patients (n = 582) in this sample were significantly more likely to have the atypical eating disinhibition genotype versus overweight patients (n = 116) ($P < .001$). Nurse practitioners working with obese patients should consider genetic testing as part of obesity prevention.

Keywords: behavior genotypes, eating disinhibition, genetics obesity

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Genetic testing has traditionally been used to identify and provide early intervention for diseases in newborns (eg, cystic fibrosis and sickle cell disease)¹ and identify women at risk for breast or ovarian cancer.² More recently, genetic testing has become part of mainstream medical care and has expanded to identify dementias,³ diabetes,^{4,5} and obesity.⁶ Defined as a body mass index (BMI) of $\geq$ 30 kg/m², obesity is a complex condition that contributes to multiple negative health and psychosocial outcomes.⁷ In the United States, over one third (78.6 million) of adults are classified as obese, per BMI, with higher rates noted in women (38.3%) compared with men (34.3%).⁸ The etiology of obesity is multifactorial, involving a combination of behavioral, environmental, and genetic factors.^{7,9} Behavioral and environmental factors play a large role in the development of obesity and include unhealthy food choices related to food available in stores¹⁰; the increasing number of fast-food restaurants in neighborhoods¹¹; the prevalence of physical inactivity¹²; and the escalating use of smart phones, which can contribute to a sedentary lifestyle.¹³ Nurse practitioners (NPs) often address behavioral and environmental factors as first-line obesity intervention, which are not always the most effective for long-term weight loss.^{14–16}

Specific genes that influence eating behaviors, food perception, and food cravings have been

identified.^{17,18} For example, snacking behavior is linked to atypical genotypes in the receptor for leptin, a necessary hormone for the regulation of food intake. Individuals with the GG genotype in the leptin receptor gene have been shown to exhibit increased snacking behavior compared with individuals with the typical genotype.¹⁹ In addition, the atypical genotype in the neuromedin B gene has been associated with increased feelings of hunger.²⁰ Finally, studies have shown that eating disinhibition is positively associated with weight^{21,22} because eating disinhibition is linked with weight regain in both men and women; however, the majority of prior studies were in women.²³ The atypical genotype in the taste receptor type 2 member 38 gene is associated with increased eating disinhibition in women; however, there is currently not enough evidence to support the association in men.²⁴

In addition to genetics, many other factors, such as socioeconomic status, lifestyle, and clinical state, determine body weight and size. Related to genetics, epigenetic mechanisms play a role in transgenerational epigenetic inheritance and obesity. Epigenetics is the study of the modifications in gene expression without a change in the DNA sequence that occur as a result of environmental factors. Epigenetics differ between each individual because it is determined during early gestation and continues to change as a result of environmental influences throughout the life

span.^{25,26} Although genetic testing has become more widespread, the analysis of an individual's epigenetic changes is still not common in clinical practice.

Research suggests that patients are in favor of genetic testing to determine their risk of obesity. Collins et al²⁷ conducted a review of the literature to identify factors associated with interest in predictive testing for 3 medical conditions (obesity, type II diabetes, and heart disease). Eight studies were included in the review, and findings noted patients who perceived their risk of obesity as high were in favor of predictive genetic testing. Additionally, Conradt et al²⁸ noted patients with a familial predisposition for obesity who were counseled with a focus on genetic factors demonstrated decreased self-blame about eating. Providing patient education regarding genetic predisposition for certain eating behaviors and traits versus learned behaviors could be of great value in obesity prevention and/or intervention.

Given the expanding role of genetics in the prevention and treatment of obesity, the purpose of this study was to identify the frequency of genotypes of genes implicated in determining eating behavior traits among patients attending a medical weight loss clinic. A secondary aim was to identify any differences in genotypes between patients classified as overweight (BMI 25.0–29.9 kg/m²) versus obese (BMI ≥ 30 kg/m²).

METHODS

Design and Participants

With institutional human subjects and clinic approval, a retrospective review of patient electronic medical records (EMRs) was conducted at 3 medical weight loss clinics in Northern California. Inclusion criteria were adults over 18 years of age who participated in a weight loss program and who provided a saliva or serum sample for genetic testing with Pathway Genomics, San Diego, CA, between October 2012 and July 2015. Additionally, only the EMRs of patients who had signed the Pathway Genomics PathwayFit DNA test consent form, which included patient consent for results to be used for research purposes, were included. A deidentified data set was compiled of patients meeting study criteria and included patient age, sex,

race/ethnicity, marital status, baseline BMI (used for categorizing patients for this study), and insurance type (private vs group). The role of the NPs in the 3 clinics focused on providing counseling and education regarding health, nutrition, and genetic testing results.

Genes

The particular genetic testing being used at the 3 weight loss clinics, the PathwayFit DNA test, identifies over 75 genetic markers related to exercise, food reactions, metabolic health, and nutrition and is the one currently being used at the 3 weight loss clinics. For the purpose of this study, we examined the results of genetic markers associated with 6 eating behavior traits. The 6 eating behavior traits included eating disinhibition, food desire, hunger, satiety, snacking, and sweet tooth (Table 1). The genotype coding for each eating behavior trait was characterized as either *typical* or *atypical*. The atypical genotypes are associated with weight-promoting eating behavior traits (Table 1).

Statistics

Descriptive statistics were used to analyze participant characteristics (eg, age, sex, race/ethnicity, marital status, and insurance type) (Table 2). Inferential statistics were used to compare the data between the 2 BMI groups (ie, BMI 25–29.9 kg/m² and BMI ≥ 30 kg/m²). Independent sample *t* tests were used to compare numeric variables, and chi-square tests of independence were used for categorical variables, with significance indicated at a *P* value of .05 or less. Power analyses based on our results and sample size were calculated. The observed power appears in Table 3.

RESULTS

The EMRs of 768 patients were reviewed; 91% (*n* = 698) met the study inclusion criteria. Most participants in both BMI groups were female, white, married, an average of 52 years old, and insured (Table 2). Inferential statistics were also performed to identify demographic differences between the 2 BMI groups. A moderate effect size difference was noted in the sex ratio between the 2 BMI groups; however, further sex-specific statistical analyses indicated no

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