DE GRUYTER J Osteopath Med 2023; 123(9): 415–426

General

Original Article

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The effect of perceived weight status and BMI perception on food attitudes and food relationships

https://doi.org/10.1515/jom-2022-0211
Received November 12, 2022; accepted April 25, 2023;
published online May 24, 2023

Abstract

Context: Obesity has been a national epidemic throughout the United States due to the increasingly sedentary western lifestyle, paired with calorically dense abundant low-nutritional food options. Discussing weight necessitates the conversation of not only the numerical value (body mass index [BMI]) associated with obesity but also the perceived weight or how an individual categorizes their weight, irrespective of their calculated BMI classification. Perceived weight can influence food relationships, overall health, and lifestyle habits.

Objectives: The purpose of this study was to identify differences in dietary habits, lifestyle habits, and food attitudes among three groups: those correctly identifying as "obese" with a BMI >30 (BMI Corrects [BCs]), those incorrectly identifying as "obese" with a BMI <30 (BMI Low Incorrect [BLI]), and those incorrectly identifying as "nonobese" with a BMI >30 (BMI High Incorrect [BHI]).

Methods: An online cross-sectional study was conducted from May 2021 to July 2021. Participants (n=104) responded to a 58-item questionnaire regarding demographics (n=9), health information (n=8), lifestyle habits (n=7), dietary habits (n=28), and food attitudes (n=6). Frequency counts and percentages were tabulated, and analysis of variance (ANOVA) testing was conducted to examine the associations utilizing SPSS V28 at a statistical significance level of p<0.05.

Results: Participants incorrectly identifying as "obese" with a BMI <30 (BLI) had higher food attitude scores, indicating worse food attitudes, behaviors, and relationships with food compared to participants correctly identifying as "obese" with a BMI >30 (BC) and incorrectly identifying as "non-obese" with a BMI >30 (BHI). When comparing BC, BLI, and BHI participants, no statistically significant differences were found in dietary habit scores, lifestyle habit scores, weight change, or nutritional supplement or diet started. However, overall, BLI participants had worse food attitude scores and consumption habits when compared to BC and BHI participants. Even though dietary habit scores were not significant, an examination of specific food items revealed significant findings, in which BLI participants had higher consumption of potato chips/snacks, milk, and olive oil/sunflower oil, compared to BHI participants. BLI participants had higher beer and wine consumption compared to BC participants. Additionally, BLI participants had higher carbonated beverages, low-calorie beverages, and margarine and butter consumption compared to BHI and BC participants. BHI participants had the lowest hard liquor consumption, BC had the second lowest hard liquor consumption, and BLI participants had the highest consumption of hard liquor products.

Conclusions: The findings of this study have shed light on the intricate relationship that exists between perceived weight status from a "nonobese/obese" perspective and attitudes toward food and the overconsumption of particular food items. Participants who perceived their weight status as "obese" despite having a calculated BMI below the CDC threshold and classification for "obesity" had poorer relationships with food, consumption behaviors, and on average consumed food items that were detrimental to overall health. Comprehending a patient's weight status perception and conducting a thorough history of their food intake could play a crucial role in addressing the patient's overall health and medically managing this population.

Obesity has been a national epidemic throughout the United States due to the increasingly sedentary western lifestyle paired with processed cheap, and abundantly available low-nutritional food options [1]. Explanations of why this problem exists include the expenses associated with healthy food options, food deserts, and the overall convenience of fast food.

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According to the CDC, obesity [2] categorized as body mass index (BMI)≥30 kg/m^2. Along with this condition comes many health consequences such as cardiovascular problems [3], insulin resistance [4], and cancer [5] among others that confer debilitating outcomes. This makes the fight against obesity critical to improving mortality and morbidity.

Although BMI provides a strict numerical weight classification scale, it does not accurately depict the entire picture. When discussing weight, it is important to also consider an individual's perceived weight, or how they identify their weight regardless of calculated BMI classification. Due to societal norms, personal preference, or external influence, an individual's perceived weight can vary greatly from their actual BMI on both ends of the spectrum. This raises an interesting conversation about how perceived weight influences aspects of daily life, such as food relationships, overall health, and lifestyle habits.

Prior research has shown that a relationship might exist between weight perception and eating behaviors. One study (n=2,588) demonstrated that individuals under the age of 75 who perceive themselves as overweight are more likely to exhibit dieting behaviors [6]. Another study (n=1,044) examined the same relationship, utilizing an online food exercise to compare participants' results with their BMI and perceived body weight status. The study found that individuals who accurately perceived their weight were 1.7 times (CI: 1.20–2.55) more likely to report dieting than those who underestimated their weight, whereas those who overestimated their weight were 2.7 times (CI: 1.31–5.48) more likely to report dieting than those who underestimated their weight. Furthermore, individuals who overestimated their weight status ordered 46.7 fewer calories ($p<0.02$) in an online calorie food choice exercise than those who underestimated their weight status [7]. Weight perception has a significant impact on various aspects of an individual's life, including more than just food choices and eating behaviors. One study (n=1,238) reported that weight perception is the main mediator between obesity and depression, with a 39.3 % association among participants. Moreover, "obese" participants who perceive themselves as overweight were the most likely group to have depression, whereas "non-obese" participants who perceive themselves as not obese were the least likely to have depression [8]. In terms of lifestyle habits, one study utilized data from the 2003–2008 National Health and Nutrition Examination Survey (NHANES), which included 16,720 non-pregnant adults, to investigate the association between weight perception and weight loss attempts. The study revealed that both women and men who perceived themselves as overweight were more likely to attempt weight loss (women OR: 3.74 [2.96–4.73]; men OR: 2.82 [2.11–3.76]) [9]. These studies elucidate the importance of understanding further how perceived weight can impact individual health.

The aim of this study is to further delineate the relationship between actual BMI and perceived body weight, and how it affects various variables such as overall and mental health, food relationships, and lifestyle habits. Understanding these relationships is important because they can guide proper weight loss management in the future, thereby improving health. If it is found that the perceived weight status varies greatly from calculated BMI and correlates to poorer outcomes regarding these variables, it would be important to find ways to improve body image perceptions while medically managing these patients with better interventions to help improve overall health. We predict that inaccurately perceiving one's body weight as higher than their calculated BMI will correlate with worse overall health outcomes, i.e., lower dietary habit scores, poorer food attitudes and food relationships, and the implementation of beneficial lifestyle modifications to compensate for their perceived weight status.

Methods

Study design and participants

This cross-sectional study was conducted online through Qualtrics (Qualtrics, Provo, UT, USA), an online survey platform, from May to July 2021. Recruitment was voluntary and anonymous and occurred through social media platforms and in-person at the Cardiology Associates (Lanham, MD), a group of practitioners specializing in managing the cardiac conditions and comorbidities affecting the cardiovascular health of their patients. The American Diversity Group, a nonprofit group based in the D.C., Maryland, and Virginia region, and focused on promoting community health via free healthcare screenings, food drives, and flu shot clinics. All patients that came to the practice or events between June 1st and June 25th were asked to participate in the survey and were given the option not to participate. Eligibility for the Qualtrics survey during the COVID-19 pandemic was limited to adults in the United States who were over the age of 18 and able to read in the English language. In-person participants accessed the survey by scanning a QR code on their personal device or on a tablet pre-loaded with the survey. Participants who were recruited online completed the Qualtrics survey via a link on their own devices. Electronic forms in the survey allowed all subjects to provide informed consent for inclusion. Participants in an online survey completed an informed consent form before beginning the survey. The electronic format of the survey allowed participants to read the informed consent in its entirety, including information on the time commitment and purpose of the research. The study participants were given time to review the informed consent section. The participants were required to confirm that they had read and understood the informed consent process before proceeding to the survey.

A total of 339 adults initially participated. After excluding non-responses, incomplete surveys, or those that did not meet the BMI inclusion criteria, the final dataset included 104 participants. All consenting participants had their BMIs calculated via their height and weight [1], and all participants indicated whether they would classify themselves as “obese” or “nonobese”. Utilizing the Centers of Disease Control and Prevention (CDC) classification for the BMI, participant metrics were then utilized to calculate the BMI (body mass [kg]/height [m^2]) of each participant [1]. Among these 339 respondents, 104 fell into one of three categories that were predetermined for the study. Participants were included if they (1) stated that they would be classified as “obese” and had a BMI (>30) that correctly correlated with this classification, (2) stated they were “obese” but had a BMI (<30) that did not correctly correlate with this classification, or (3) stated they were “not obese” but had a BMI (>30) that did not correctly correlate with this classification. Group 1 was the BMI Correct (BC), Group 2 was the BMI Low Incorrect (BLI), and Group 3 was the BMI High Incorrect (BHI). It should be noted that this predetermined survey contained the use of terms such as “obese” and “obesity” to classify its participants. It should also be noted that had the survey been recreated, terms such as “higher weight” or “lower weight” should have been utilized instead. All study protocols were granted ethical approval by Rowan University School of Osteopathic Medicine Institutional Review Board (PRO-2021-434) via exempt review.

Questionnaire

This questionnaire was developed by previous researchers at Rowan University School of Osteopathic Medicine, during which time they examined how the dietary habits of patients with chronic medical conditions changed during the COVID-19 pandemic [10]. This research group utilized the Centers for Medicare and Medicaid Services’ [11] definition of chronic medical conditions to examine the differences between those with and without chronic medical conditions. This current study aims to examine a subset of patients based on whether they classified themselves as “obese” or “not obese” and their BMI calculations to examine their relationship with various other portions of the questionnaire. Participants responded to a 58-item questionnaire (Supplementary Material) regarding demographics (n=9), health information (n=8), lifestyle habits (n=7), dietary habits (n=28), and food attitudes (n=6) [10]. The total length of time to complete the questionnaire was estimated at 10–15 min.

The demographic questions (n=9) included questions about age, sex, race/ethnicity, education level, marital status, employment status, number of household residents, geographic location of residence, and time spent at home since COVID-19 (Table 1). Participants self-reported their health information (n=8) to include their current height reported in feet and inches and weight reported in pounds, along with answering questions about weight changes, health conditions, supplement use, supplements taken, and whether participants followed or started a diet since COVID-19 (Table 2). Participants self-identified their ethnicity or race and sex or gender, which was designated and given by the survey from previous research teams [10, 12]. The participants chose from a traditional group of racial categories and reported all values for race/ethnicity, and of traditional sex and gender-oriented categories, and were given the option to answer in free text.

Lifestyle habits

To assess the impact of the COVID-19 pandemic on social and physical activities, participants were asked to indicate whether their lifestyle habits had increased (+1), decreased (−1), or remained unchanged (0). A score of (−1) was given to statements reflecting unfavorable health practices, including an increase in negative lifestyle habits like excessive eating, TV watching, or smoking, or a decrease in positive habits like exercising, physical activity, sleep quality/quantity, reading/studying, or socialization. Conversely, a score of (+1) was given to statements reflecting favorable health practices, such as a decrease in negative habits such as eating, watching TV, or smoking, or an increase in positive habits, such as exercising, physical activity, sleep amount/quality, reading/studying, or socialization. Total scores were generated on a scale ranging from −7 to +7. Although this lifestyle habits questionnaire has been utilized in different adaptations in previous studies, a validated version was not available at the time [12, 13].

Dietary habits

Dietary habits were assessed by determining total scores based on whether participants increased (+1), decreased (−1), or made no changes (0) to their consumption of specific energy-dense or nutrient-dense foods and beverages during the COVID-19 pandemic [10, 12]. The Dana-Farber Cancer Institute’s Eating Habits Questionnaire [14] initially contained a list of 61 foods and beverages for assessing dietary habits in certain populations. This extensive list was subsequently modified to prevent survey fatigue [15, 16]. A final set of 28 questions was developed for participants to answer and examine their consumption habits for 37 groups of foods and beverages [12].

Energy-dense foods were classified as unfavorable for health and included those high in sodium, added sugars, and total fat, such as cheese, butter/margarine, fruit juice, vegetable/tomato juice, processed meats, red meats, refined grains (e.g., white bread/rice), chips, sweets, alcohol (e.g., beer, wine, spirits), and carbonated beverages with added sugar [17, 18]. An increase in the consumption of ‘energy-dense’ foods or beverages was given a score of −1, whereas a decrease in their consumption was given a score of +1.

Nutrient-dense foods were considered favorable for health and included those low in sodium, added sugars, and total fat, such as milk and yogurt, fresh/frozen/canned fruits and vegetables, chicken and fish, whole grains (e.g., whole wheat/brown bread/rice), water, noncarbonated beverages with no added sugar, immune-enhancing beverages, coffee/tea, and protein shakes [17, 18]. An increase in the consumption of ‘nutrient-dense’ foods or beverages was given a score of +1, whereas a decrease in their consumption was given a score of −1. The total dietary habit scores ranged from −28 to +28 points.

Food attitudes

To assess food attitudes, the survey utilized six statements derived from the validated Yale Food Addiction Scale (17), instead of the original 16, to understand how participants experienced changes regarding this subject. These statements included eating much more than planned, overeating, lethargy after eating, and stress behaviors. The survey calculated the total scores to examine food attitudes based on whether a participant had experienced an increase (+1), decrease (−1), or no change (0) in six statements regarding food attitudes since the COVID-19 pandemic [10, 12]. The food attitude total scores ranged from −6 to +6.

Statistical analysis

The data were analyzed utilizing frequencies, descriptive statistics, and analysis of variance (ANOVA) with post hoc Tukey tests. The level of significance for all tests was set at $p \leq 0.05$. A power analysis was conducted

Table 1: Participant demographics.

Variables	No. of responses (%) n=104			
Sex	BLI (n=14)	BHI (n=58)	BC (n=32)	n=104
Male	10 (71.4 %)	23 (39.7 %)	8 (25.0 %)	41 (39.4 %)
Female	4 (28.6 %)	35 (60.3 %)	24 (75.0 %)	63 (60.6 %)
Other	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Race and ethnicity	n=14	n=58	n=32	n=104
African American	6 (42.9 %)	29 (50.0 %)	19 (59.4 %)	54 (51.9 %)
Asian American	2 (14.3 %)	8 (13.8 %)	4 (12.5 %)	14 (13.5 %)
Caucasian	3 (21.4 %)	10 (17.2 %)	3 (9.4 %)	16 (15.4 %)
Hispanic	3 (21.4 %)	11 (19.0 %)	4 (12.5 %)	18 (17.3 %)
Native American	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Other	0 (0.0 %)	0 (0.0 %)	2 (6.3 %)	2 (1.9 %)
Age	n=14	n=58	n=32	n=104
18–24 years	0 (0.0 %)	1 (1.7 %)	0 (0.0 %)	1 (1.0 %)
25–29 years	1 (7.1 %)	4 (6.9 %)	3 (9.4 %)	8 (7.7 %)
30–49 years	8 (57.1 %)	12 (20.7 %)	6 (18.8 %)	26 (25.0 %)
50–59 years	2 (14.3 %)	15 (25.9 %)	10 (31.3 %)	27 (26.0 %)
60–69 years	3 (21.4 %)	15 (25.9 %)	7 (21.9 %)	25 (24.0 %)
70 and above years	0 (0.0 %)	11 (19.0 %)	6 (18.8 %)	17 (16.3 %)
Education level	n=14	n=58	n=32	n=104
No schooling completed	0 (0.0 %)	4 (6.9 %)	2 (6.3 %)	6 (5.8 %)
Nursery school to 8th grade	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Some high school, no diploma	2 (14.3 %)	3 (5.3 %)	4 (12.5 %)	9 (8.7 %)
High school graduate, diploma, or the equivalent (for example, GED)	1 (7.1 %)	19 (32.8 %)	10 (31.3 %)	31 (28.8 %)
Some college credit, no degree	4 (28.6 %)	8 (13.8 %)	3 (9.4 %)	15 (14.4 %)
Trade/technical/vocational training	1 (7.1 %)	5 (8.6 %)	1 (3.1 %)	7 (6.7 %)
Associate's degree	2 (14.3 %)	2 (3.4 %)	2 (6.3 %)	6 (5.8 %)
Bachelor's degree	4 (28.6 %)	9 (15.5 %)	7 (21.9 %)	20 (19.2 %)
Master's degree	0 (0.0 %)	7 (12.1 %)	1 (3.1 %)	8 (7.7 %)
Professional degree	0 (0.0 %)	1 (1.7 %)	2 (6.3 %)	3 (2.9 %)
Doctorate degree	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Current employment status	n=14	n=58	n=32	n=104
Full-time	8 (57.1 %)	24 (41.4 %)	20 (62.5 %)	52 (50.0 %)
Part-time	5 (35.7 %)	11 (19.0 %)	9 (28.1 %)	25 (24.0 %)
Unemployed	0 (0.0 %)	9 (15.5 %)	1 (3.1 %)	10 (9.6 %)
Other	1 (7.1 %)	14 (24.1 %)	2 (6.3 %)	17 (16.3 %)
Marital status	n=14	n=58	n=32	n=104
Married	10 (71.4 %)	31 (53.4 %)	13 (40.6 %)	54 (51.9 %)
Single	2 (14.3 %)	20 (34.5 %)	11 (34.4 %)	33 (31.7 %)
Widowed	1 (7.1 %)	4 (6.9 %)	3 (9.4 %)	8 (7.7 %)
Divorced	1 (7.1 %)	2 (3.4 %)	3 (9.4 %)	6 (5.8 %)
Other	0 (0.0 %)	1 (1.7 %)	2 (6.3 %)	3 (2.9 %)
People that live in the household besides yourself	n=14	n=58	n=32	n=104
None	1 (7.1 %)	1 (1.7 %)	2 (6.3 %)	4 (3.8 %)
1	1 (7.1 %)	11 (19.0 %)	3 (9.4 %)	15 (14.4 %)
2	4 (28.6 %)	20 (34.5 %)	9 (28.1 %)	33 (31.7 %)
3	2 (14.3 %)	6 (10.3 %)	9 (28.1 %)	17 (16.3 %)
4	2 (14.3 %)	11 (19.0 %)	7 (21.9 %)	20 (19.2 %)
5 or more	4 (28.6 %)	9 (15.5 %)	1 (3.1 %)	15 (14.4 %)
Currently staying at home X% of the time	n=14	n=58	n=32	n=104
Less than 25.0 %	1 (7.1 %)	11 (19.0 %)	4 (12.5 %)	16 (15.4 %)
50.0–74.0 %	9 (64.3 %)	27 (46.6 %)	14 (43.8 %)	50 (48.1 %)

Table 1: (continued)

Variables	No. of responses (%) n=104			
75.0–95.0 %	2 (14.3 %)	18 (31.0 %)	14 (43.8 %)	34 (32.7 %)
Never left the house	2 (14.3 %)	2 (3.4 %)	0 (0.0 %)	4 (3.8 %)
Residence	n=14	n=58	n=32	n=104
New England (Connecticut, Maine, Massachusetts, Rhode Island, Vermont)	0 (0.0 %)	1 (1.7 %)	1 (3.1 %)	2 (1.9 %)
Mid-Atlantic (New Jersey, New York, Pennsylvania)	2 (14.3 %)	16 (27.6 %)	5 (15.6 %)	23 (22.1 %)
South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, Washington DC, West Virginia)	10 (71.4 %)	39 (67.2 %)	26 (81.3 %)	75 (72.1 %)
East North Central (Illinois, Indiana, Michigan, Ohio, Wisconsin)	0 (0.0 %)	1 (1.7 %)	0 (0.0 %)	1 (1.0 %)
East South Central (Alabama, Kentucky, Mississippi, Tennessee)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
West South Central (Arkansas, Louisiana, Texas)	1 (7.1 %)	1 (1.7 %)	0 (0.0 %)	2 (1.9 %)
Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming)	1 (7.1 %)	0 (0.0 %)	0 (0.0 %)	1 (0.9 %)
Pacific (Alaska, California, Hawaii, Oregon, Washington)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)

BC, BMI correct; BLI, BMI low incorrect; BHI, BMI high incorrect; GED, general educational diploma.

utilizing the software G*Power to estimate the necessary sample size. The ANOVA fixed effect, omnibus, one-way, with an effect size of 0.5, an alpha value of 0.05, and a minimum sample of 42 participants, indicated a power of 0.803. The criteria for these values were based on the previous study from which this subanalysis is occurring. From the power analysis, it was shown that a minimum of 14 participants per group was deemed sufficient to examine the population of interest for each group BC, BLI, and BHI. One-way ANOVA testing was utilized in place of two-way ANOVA testing because the BLI, BC, and BHI categorical groups were created based on two factors: calculated BMI, and whether or not a participant identified as "obese." Although these factors could be examined separately in a two-way ANOVA, a one-way test was utilized for a more focused and simpler design.

Normality of the distribution and homogeneity of variance were checked. Skewness values less than 1.0–2.0 indicated that the data were robust with respect to deviations from normality. ANOVA with post hoc Tukey tests were conducted to compare BCs, BLI, and BHIs for the variables of weight change, diet and nutritional supplement implementation, food attitudes, lifestyle habits, and dietary habit scores. The only variables that were recoded or modified were based on patients who self-identified as "obese/a BMI over 30." This subanalysis grouped and distinguished participants based on their responses to whether they classified themselves as "obese" relative to their actual BMI. No other variables were recoded or modified.

Results

Study population and statistically significant different demographics

The sample consisted of 104 respondents, all of whom responded to demographic or health statements. For those who responded to these statements, 51.9 % were African American (54), 60.6 % were female (63), 28.8 % were a high school graduate or held a diploma or the equivalent (31), and 50.0 % were employed full-time (52). The sample's age range varied, with 26.0 % between the ages of 50 and 59 years old (27). In addition, 51.9 % of participants were married (54), 72.1 % lived in the South Atlantic region (75), 31.7 % lived with at least two persons (33), and 48.1 % had stayed in their homes 50.0 %–74.0 % of the time during the pandemic (50) (Table 1). ANOVA revealed statistically significant differences in BMI ($p \leq 0.001$), employment status ($p=0.008$), sex ($p=0.012$), and residence ($p=0.023$) among the groups BC, BLI, and BHI. There were no statistically significant differences for weight change ($p=0.172$), diet implementation ($p=0.715$), nutritional supplementation ($p=0.943$), race/ethnicity ($p=0.361$), education ($p=0.840$), age ($p=0.119$), marital status ($p=0.114$), number of occupants in home ($p=0.847$), or time spent at home during the pandemic between the three groups ($p=0.655$).

Comparison between BC, BLI, and BHI for variables of interest

ANOVA testing with post hoc analysis was conducted on six variables (weight change, diet started, nutritional supplement consumption, food attitudes, lifestyle habits, and dietary habits) between three groups: those with a BMI >30 correctly classifying as "obese" (BC), those with a BMI <30 misclassifying as "obese" (BLI), and those with a BMI >30 misclassifying "nonobese" (Table 3).

Table 2: Participants' general health characteristics and anthropometrics.

Variables				No. of responses, %
BMI, kg/m^2	BLI (n=14)	BHI (n=58)	BC (n=32)	n=104
<18	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
18.5–24.9	4 (28.6 %)	0 (0.0 %)	0 (0.0 %)	4 (3.8 %)
25–29.9	10 (71.4 %)	0 (0.0 %)	0 (0.0 %)	10 (9.6 %)
30–34.9	0 (0.0 %)	44 (75.9 %)	24 (75.0 %)	68 (65.4 %)
35–39.9	0 (0.0 %)	9 (15.5 %)	5 (15.6 %)	14 (13.5 %)
40–44.9	0 (0.0 %)	2 (3.4 %)	1 (3.1 %)	3 (2.9 %)
>45	0 (0.0 %)	3 (5.2 %)	2 (6.3 %)	5 (4.8 %)
Weight change	n=14	n=58	n=32	n=104
No change	2 (14.3 %)	17 (29.3 %)	9 (28.1 %)	27 (25.9 %)
Increased	1 (7.1 %)	28 (48.3 %)	14 (43.8 %)	53 (51.0 %)
Decreased	11 (78.6 %)	13 (22.4 %)	9 (28.1 %)	24 (23.1 %)
Tried a diet	n=14	n=58	n=32	n=104
No	6 (42.9 %)	32 (55.2 %)	17 (53.1 %)	49 (47.1 %)
Yes	8 (57.1 %)	26 (44.8 %)	15 (46.9 %)	55 (52.9 %)
Nutritional supplement intake	n=14	n=58	n=32	n=104
No	7 (50.0 %)	32 (55.2 %)	20 (62.5 %)	59 (56.7 %)
Yes	7 (50.0 %)	26 (44.8 %)	12 (37.5 %)	45 (43.3 %)
Supplements currently taking	n=7	n=26	n=12	n=45
Calcium	0 (0.0 %)	3 (11.5 %)	0 (0.0 %)	3 (6.7 %)
Magnesium	0 (0.0 %)	0 (0.0 %)	1 (8.3 %)	1 (2.2 %)
Multivitamin	2 (28.6 %)	8 (30.8 %)	4 (33.3 %)	14 (31.1 %)
Iron	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Omega 3	1 (14.3 %)	3 (11.5 %)	0 (0.0 %)	4 (8.9 %)
Omega 6	1 (14.3 %)	2 (7.7 %)	0 (0.0 %)	3 (6.7 %)
Protein (bars, shakes, powder)	0 (0.0 %)	2 (7.7 %)	1 (8.3 %)	3 (6.7 %)
Vitamin B complex	2 (28.6 %)	2 (7.7 %)	3 (9.4 %)	7 (15.6 %)
Vitamin C	0 (0.0 %)	1 (3.8 %)	1 (8.3 %)	2 (4.4 %)
Vitamin D	1 (14.3 %)	4 (15.4 %)	2 (16.7 %)	7 (15.6 %)
Other	0 (0.0 %)	1 (3.8 %)	0 (0.0 %)	1 (2.2 %)
Medical conditions	n=14	n=58	n=32	n=104
Chronic kidney disease	0 (0.0 %)	3 (5.2 %)	0 (0.0 %)	3 (2.9 %)
COPD (chronic obstructive pulmonary disease)	0 (0.0 %)	4 (6.9 %)	0 (0.0 %)	4 (3.8 %)
Obesity (BMI of 30 or higher)	14 (100 %)	0 (0.0 %)	32 (100 %)	46 (44.2 %)
Immunocompromised state (weakened immune system) from solid organ transplant	0 (0.0 %)	1 (1.7 %)	0 (0.0 %)	1 (1.0 %)
Serious heart conditions (heart failure, coronary artery disease, or cardiomyopathy)	0 (0.0 %)	22 (37.9 %)	0 (0.0 %)	22 (21.2 %)
Sickle cell disease	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
Type 2 diabetes	0 (0.0 %)	17 (29.3 %)	0 (0.0 %)	17 (16.3 %)
None of the above	0 (0.0 %)	8 (13.8 %)	0 (0.0 %)	8 (7.7 %)
Other	0 (0.0 %)	3 (5.2 %)	0 (0.0 %)	3 (2.9 %)

BC, BMI correct; BLI, BMI low incorrect; BHI, BMI high incorrect; BMI, body mass index; GED, general educational diploma.

There was no statistically significant difference in weight change (p=0.171), dietary implementation (p=0.651), nutritional supplementation (p=0.689), dietary habits scores (p=0.111), and lifestyle habits scores (p=0.147) between the BLI, BC, and BHI participants. However, the BLI participants had statistically significant worse food attitude scores (n=14;

Table 3: ANOVA test with post hoc analysis for BC, BLI, and BHI.

Variable	BC n=32 Mean	BC n=32 SD	BLI n=14 Mean	BLI n=14 SD	BHI n=58 Mean	BHI n=58 SD	F value	DF	p-Value	Point estimate
Food attitude	−0.87	3.290	2.86	3.592	−0.22	3.168	6.669	2	0.002	0.115
Weight change	0.16	0.847	0.64	0.745	0.27	0.800	1.797	2	0.171	0.034
Dietary implementation	0.47	0.507	0.57	0.514	0.43	0.500	0.430	2	0.651	0.008
Nutritional supplements	0.38	0.492	0.50	0.519	0.45	0.502	0.374	2	0.689	0.007
Dietary habits	3.03	4.490	1.07	5.269	4.22	5.471	2.247	2	0.111	0.042
Lifestyle habits	−0.81	2.558	−2.64	3.079	−1.37	3.008	1.954	2	0.147	0.037

Summary of ANOVA test with post hoc analysis for BC, BLI, and BHI. Variables that were compared to each of the 6 major questions pertaining to changes in weight, implementation of a new diet, consumption of nutritional supplements, Food attitudes, Lifestyle habits, and dietary habits. The findings for the BC, BLI, and BHI groups are found in columns 2–7, the F-value was found in column 8, the degrees of freedom are found in column 9, *P* value and the Cohen's D point estimate are found in columns 10–11. BC, BMI correct; BLI, BMI low incorrect; BHI, BMI High Incorrect.

Table 4: ANOVA testing with post hoc analysis for differences between BC, BLI, and BHI for individual food attitude questions.

FA question	BC n=32 Mean	BC n=32 SD	BLI n=14 Mean	BLI n=14 SD	BHI n=58 Mean	BHI n=58 SD	F value	DF	p-Value	Point estimate
FA1: I find that when I start eating certain foods, I end up eating much more than planned	−0.16	0.723	0.50	0.855	0.07	0.710	3.908	2	0.023	0.071
FA2: I find myself continuing to consume certain foods even though I am no longer hungry	0.00	0.803	0.79	0.579	−0.12	0.761	8.189	2	<0.001	0.137
FA3: I eat to the point where I feel physically ill	−0.22	0.792	0.50	0.760	−0.10	0.752	4.514	2	0.013	0.081
FA4: I spend a lot of time feeling sluggish or fatigued from overeating	−0.25	0.718	0.50	0.650	−0.08	0.743	5.311	2	0.006	0.093
FA5: I find myself constantly eating certain foods throughout the day	−0.06	0.840	0.14	0.864	0.03	0.802	0.326	2	0.723	0.006
FA6: My behavior with respect to food and eating causes significant distress	−0.19	0.693	0.43	0.756	−0.02	0.725	3.579	2	0.031	0.065

Summary of ANOVA test with post hoc analysis for each individual question that was asked as a part of the Food Attitudes (FA) portion of the survey and how the means differed between BC, BLI, and BHI. Variables in column 1 are the specific FA questions that differed. The means and standard deviations for BC. BLI, and BHI are in columns 2–7, and these means ranged from −1 (decreased), 0 (no change), or +1(increased). The F-value was found in column 8, the degrees of freedom are found in column 9, *P* value and the Cohen's D point estimate are found in columns 10–11. BC, BMI correct; BLI, BMI low incorrect; BHI, BMI high incorrect.

Table 5: ANOVA test with post hoc analysis for food items that differed between BC, BLI, and BHI.

Food item	BC n=32 Mean	BC n=32 SD	BLI n=14 Mean	BLI n=14 SD	BHI n=58 Mean	BHI n=58 SD	F value	DF	p-Value	Point estimate
Potato chips salty snack	−0.09	0.641	0.29	0.825	−0.35	0.777	4.5	2	0.013	0.080
Oil/olive/sunflower	−0.09	0.818	0.50	0.519	−0.3	0.802	3.157	2	0.047	0.058
Beer wine	−0.06	0.619	0.21	0.699	−0.30	0.671	3.953	2	0.022	0.071
Hard liquor	0.00	0.622	0.36	0.633	−0.40	0.616	10.374	2	<0.001	0.168
Low-calorie beverage	−0.19	0.644	0.430	0.646	−0.17	0.668	5.099	2	0.008	0.090
Carbonated beverage	−0.22	0.659	0.43	0.646	−0.20	0.605	6.242	2	0.003	0.108
Milk	0.00	0.718	0.50	0.650	−0.07	0.756	3.433	2	0.036	0.062
Margarine/butter	−0.09	0.777	0.57	0.646	−0.13	0.700	5.661	2	0.005	0.099

Summary of ANOVA test with post hoc analysis for food items that were statistically significantly different between BC, BLI, and BHI. Variables in column 1 are the specific food items that differed. The means and standard deviations for BC. BLI, and BHI are in columns 2–7 and these means ranged from −1 (decreased), 0 (no change), or +1(increased). The F-value was found in column 8, the degrees of freedom are found in column 9, *P* value and the Cohen's D point estimate are found in columns 10–11. BC, BMI correct; BLI, BMI low incorrect; BHI, BMI high incorrect.

mean, 2.86; SD=3.592; range, −6 to +6) when compared to BC participants (n=32; mean, −0.87; SD=3.290; range, −6 to +6) with a p=0.002, and BHI participants (n=58; mean, −0.22; SD=3.186; range, −6 to +6), with p=0.006.

Subanalysis of food attitude questionnaire

Further examination of the Food Attitudes section shows statistically significant differences and highlights response variations among the three groups (Table 4).

BLI participants (n=14) had statistically significant higher food attitude scores, and worse food behaviors and relationships, for the first question, “I find that when I start eating certain foods, I end up eating much more than planned,” when compared to BC participants (n=32, p=0.017).

Similarly, BLI participants (n=14) had statistically significant higher food attitude scores for the second question, “I find myself continuing to consume certain foods even though I am no longer hungry,” when compared to BC participants (n=32, p=0.003) and to BHI participants (n=58, p≤0.001).

Likewise, BLI participants (n=14) had statistically significant higher food attitude scores for the third question, “I eat to the point where I feel physically ill,” when compared to BC participants (n=32, p=0.013), and to BHI participants (n=58, p=0.029).

Moreover, BLI participants (n=14) had statistically significant higher food attitude scores for the fourth question, “I spend a lot of time feeling sluggish or fatigued from overeating,” when compared to BC participants (n=32, p=0.005), and to BHI participants (n=58, p=0.021).

There were no statistically significant differences for the fifth question, “I find myself constantly eating certain foods throughout the day between the BC, BLI, and BHI participants.

Finally, BLI participants (n=14) had statistically significant higher food attitude scores for the sixth question, “My behavior with respect to food and eating causes significant distress,” when compared to BC participants (n=32, p=0.024).

Comparison between BC, BLI, and BHI for individual food items

Table 5 shows the individual healthy or unhealthy food items that played a role in creating the aggregate dietary habits score among the BHI, BLI, and BC groups.

BLI participants (n=14) had higher consumption of olive and sunflower oil (p=0.049), beer and wine (p=0.027), and low-calorie beverages (p=0.012) compared to the BC participants (n=32). BLI participants (n=14) had statistically significant higher consumption of low-calorie beverages (p=0.008), potato chips/salty snacks (p=0.014), milk consumption (p=0.031) compared to BHI participants (n=58).

BLI participants (n, 14) had statistically significant higher consumption of margarine and butter compared to BC participants (n=32, p=0.013) and to BHI participants (n=58, p=0.004). Furthermore, BLI participants (n=14) had statistically significant higher consumption of carbonated beverages when compared to BC participants (n=32, p=0.005) and to BHI participants (n=58, p=0.003).

BHI participants (n=58) had statistically significant higher hard liquor consumption compared to BLI participants (n=14, p≤0.001) and BC participants (n=32, p=0.011). All other food items examined showed no statistically significant differences (p>0.05) between the BHI, BLI, and BC groups.

Lifestyle habits subanalysis of BC, BLI, and BHI participants

The Lifestyle habits scores for BC, BLI, and BHI participants show no statistically significant differences across all activities including eating frequency (p=0.708), exercise (p=0.343), physical activity (p=0.188), reading and studying (p=0.352), sleep hours and quality (p=0.362), smoking (p=0.136), socialization (p=0.108), and electronic usage (p=0.479).

Further examination of each individual question further adds to this and shows no differences in how participants responded to each social and physical activity being examined (Table 6).

Discussion

The findings above describe a complex relationship between perceived BMI, food attitudes, and daily food and beverage consumption. When comparing the three groups of participants—those with a BMI >30 who adequately identified as “obese” (BC), those with a BMI <30 that improperly identified as “obese” (BLI), and those with a BMI >30 that improperly identified as “nonobese” (BHI)—a worse food attitude was observed among those who have a BMI <30 and labeled themselves as “obese” (BLI). These findings are both statistically significant and significant in the clinical setting because they show a possible negative psychological or social component existing in this group of participants (BLI). By definition of this survey, BLI participants did not meet the CDC criteria for “obesity” but believed and perceived their weight status as being “obese.” Thus, this group, consciously or unconsciously, believed that their weight was much higher than it was in reality. This BLI group had negative results when assessing food attitude statements, such as eating much more than planned, overeating, lethargy after eating, and

Table 6: ANOVA testing with post hoc analysis for differences between BC, BLI, and BHI for questions on individual lifestyle habits.

Variable	BC n=32 Mean	BC n=32 SD	BLI n=14 Mean	BLI n=14 SD	BHI n=58 Mean	BHI n=58 SD	F value	DF	p-Value	Point estimate
Eating frequency	0.22	0.870	0.43	0.756	0.27	0.856	0.347	2	0.708	0.007
Exercising	−0.016	0.920	−0.36	0.745	0.00	0.864	1.080	2	0.343	0.021
Physical activity	0.03	0.897	−0.43	0.852	0.03	0.878	1.699	2	0.188	0.032
Reading/studying	0.09	0.734	−0.14	0.770	−0.15	0.820	1.055	2	0.352	0.020
Sleep hours/quality	0.06	0.801	0.14	0.864	−0.13	0.791	1.027	2	0.362	0.020
Smoking	−0.06	0.435	0.14	0.663	−0.18	0.596	2.033	2	0.136	0.038
Socialization	−0.22	0.751	−0.71	0.469	−0.40	0.764	2.273	2	0.108	0.042
Use of electronics	0.47	0.627	0.57	0.756	0.63	0.581	0.741	2	0.479	0.014

Summary of ANOVA test with post hoc analysis for each individual question that was asked as a part of the lifestyle habits (LH) portion of the survey and how the means differed between BC, BLI, and BHI. Variables in column 1 are the specific LH questions that differed. The means and standard deviations for BC. BLI, and BHI are in columns 2–7, and these means ranged from −1 (decreased), 0 (no change), or +1(increased). The F-value was found in column 8, the degrees of freedom are found in column 9, *P* value and the Cohen's D point estimate are found in columns 10–11. BC, BMI correct; BLI, BMI low incorrect; BHI, BMI high incorrect.

stress behaviors. Additionally, this study found the BLI group to be overindulgent to the point of distress compared to the BC and BHI groups. These results directly contradict the previously mentioned study findings and our hypothesis. Previous research found that those identifying as "obese" with a BMI <30 were more likely to exhibit dieting behavior and had ordered fewer calories on an online food choice exercise [5, 6]. In contrast, a systematic analysis utilizing 78 relevant studies produced findings that paralleled the results from this study [19]. This systematic analysis shows that overweight perception correlates to a desire to eat healthy and exercise. However, there was no evidence suggesting that an individual who perceives themself as overweight would adopt these behaviors over someone who perceives themself as "normal" weight. Additionally, the researchers found that individuals who perceive themselves as overweight are more likely to gain weight in the future [19].

Analyzing the responses for each particular food item also provided significant findings.

The BLI participants, when compared to the BHI and BC participants, showed significantly higher reported consumption of energy-dense foods such as potato chips/salty snacks, margarine/butter, and carbonated beverages. This finding makes sense in the context of the food relationship findings. The BLI group had the worst food relationships out of the three groups, including feeling sluggish and overeating to the point of discomfort. Energy-dense foods such as these are readily available in today's society, making them convenient and accessible to overeat. These foods are also more likely to make one feel sluggish after consumption. Therefore, it is reasonable that the BLI group had poor relationships and high consumption of these energy-dense foods. This finding again brings up the idea that the BLI group may identify as "obese" and correlate this with poor food intake. There were no statistically significant data regarding nutrient-dense foods between the group. These findings were unexpected because previous literature showed that participants with a BMI <30 were more likely to have better consumption habits than those with a BMI >30 [6].

Because all results point to a difference in the BLI group, discussing this cohort and analyzing their behaviors is essential. The BLI was much more likely to consume energy-dense foods and have overall poorer relationships with food. This group was also less likely than the other groups to exhibit lifestyle habit changes. One possible explanation for these findings is the potential confounding variable of eating disorders such as bulimia nervosa, anorexia nervosa, and binge eating disorder. These groups typically have poor relationships with food and are more likely to wrongly identify themselves as "overweight or obese." This cohort of individuals would also be more likely to wrongly overestimate their food consumption and relationship with food due to their own internal biases. The administered survey, unfortunately, did not account for these conditions, so the potential influence is unknown. Future studies, without time constraints, like those of this survey, could utilize a tool such as the Minnesota Multiphasic Personality Inventory-3 (MMPI-3) [20] to elucidate the distinct psychological differences in each group and the impact that this may play on their perception of weight status, along with the variables of interest. Another possible explanation for these results is psychological. Because BLI individuals perceive themselves as "obese," they may be more likely to report worse food relationships because they have a poor outlook on food consumption. Future research should control for possible eating disorders and include a food diary so that an accurate representation of food habits could be appreciated.

Taking the psychological aspect of the participants one step further necessitates discussing a psychotherapeutic approach to body image perception and lifestyle patterns. According to Weiss [21], body perception is intimately connected to the emotional feelings and attitudes of the body. These thoughts are cultivated early in life and set the stage for future self-image pathology. A buildup of criticism as a child from family, culture, and others ultimately drives body image as an adult [21]. Among all the sources of criticism, the parental influence was the most impactful regarding future body image dysfunction [21]. The cohort of BLI participants may have self-image pathology due to unresolved internal conflicts during childhood. Increased criticism from parents regarding weight and food consumption could cultivate these unhealthy food relationships that they carry with them to adulthood.

Results that were not expected but were interesting include the lack of significance among all groups regarding lifestyle habits. The BLI participants, who had the worst food attitudes, did not exhibit any significant lifestyle habit changes indicating compensatory activity. This finding was surprising because previous research suggested increased perceived weight correlated to increased weight loss attempts [9]. Various habits, including sleep, smoking, and physical and social activity, were assessed and provided nonsignificant results. No significant data supported differences in perceived weight change, nutritional supplements, and overall lifestyle habits. Even though these findings were surprising to researchers, they were not novel or supported by previous research [9].

The findings of this study can help guide clinical practice in the future. Providers should openly discuss BMI and weight perception with patients and inform them of positive lifestyle adjustments at all wellness visits. This approach will allow the patient to understand their weight accurately and hopefully mitigate any disordered thinking associated with it. Moving forward, practitioners should discuss a plan with each patient regarding how to utilize exercise and a nutritious diet to optimize well-being. Previous literature has stated that discussing weight class with individuals could encourage disordered eating and poor mental health [19]. Although this is a possible negative consequence, conversations regarding this subject could strengthen the patient–physician relationship to form a trusting and nonjudgmental bond. By addressing tough topics with the patient's best interest in mind, providers can help create a positive change. A therapeutic approach to breaking down this disordered thinking could be beneficial if there is a psychological component. It will help improve both physical and mental health at the community level.

Clinical and osteopathic significance

The osteopathic approach prides itself on a holistic methodology that focuses on all aspects of a patient with the goal of health. Understanding the impact of perceived weight can help toward this goal because weight status can be an underlying area of distress for the patient, causing poor food habits. For example, asking questions to patients about their body weight perception and dietary consumption could help identify populations that may need added support, such as the BLI group from this study. By doing so, practitioners can work to profile their patients based on their understating of their weight and dietary habits. This line of questioning would enable practitioners to take the necessary steps to explain to patients the importance of nourishment and could help improve nutritional status and health while mitigating negative mental health consequences. Moreover, by asking questions of this nature, practitioners can uncover psychosocial components that could be confounding medical care. Understanding the dietary food item consumption habits and the psychosocial components can allow providers to take a more holistic approach when discussing weight management in the clinical setting. This project shows the importance for providers to allot time to examine accurate dietary information from patients so that the providers can necessitate more honest and realistic interventions for their patients. The extra attention to this aspect of patient health will hopefully improve patient habits, satisfaction, and overall care.

Limitations

Due to the online nature of this study, calculating a response rate could not be accomplished. This factor made it improbable to estimate how many individuals saw the link to complete the survey. However, out of 339 responses, 40 did not consent to complete the survey and were prescreened, leaving 299 total responses. The completion rate among those 299 participants was 100 %. Among all 299 responses, only 104 participants met the criteria, and their responses were analyzed.

One limitation of this study is the partial reliance on internet access for the URL code for survey completion. Therefore, our sample was limited to individuals with access to and who could adequately navigate the internet. All participants who completed this survey were assumed to have access to the internet and to be proficient in its use. Although minimal, volunteer bias could be at play due to our sample size, including only those willing to participate. Both limitations can affect generalizability. Additionally, selection bias is possible due to in-person survey collection during the COVID-19 pandemic. Participants completed the study in a hybrid nature with in-person and online participation options. The COVID-19 pandemic may have played an influencing factor in in-person participation and also could have potentially altered the sample pool.

Another limitation is the use of BMI to designate between weight categories. BMI does not consider lean body mass or body habitus. Therefore, someone designated as "obese" by BMI standards might have more muscle mass and less body fat. This factor could skew the results. Additionally, participants and specifically those with eating disorders were not prescreened for mental illnesses before completion; therefore, responses within this population could also impact the data set. Finally, there is a potential sampling bias. The BLI group (n=14), BC (n=32), and BHI (n=58) varied in sample size. The data came from a subset instead of an independent study. The limitations set by the participant criteria likely affected the small sample size and could lead to results that do not accurately portray the population. Future studies should utilize a larger sample size to ensure that the results can be replicated and generalizable to the public. To further investigate this topic, BMI and body fat percentage could be utilized while controlling for psychological or mental health–related issues. When examining body weight and its criteria, it is essential also to consider confounding variables, such as body image, as a potential source of error. Learning more about body image perception is difficult because this study did not directly investigate it. However, further exploring this topic would be valuable for future research studies.

Finally, it is vital to acknowledge the state of the world during this study, because the COVID-19 pandemic has impacted the population's mental health. Although this study did not include COVID-19 within the main design, we acknowledge its potential impact on collected results because previous studies [10] have looked at the impact of the COVID-19 pandemic and its impact on various aspects of a patient's dietary habits.

Conclusions

The findings from this study have brought to light the complex relationship between perceived weight status from a "nonobese/obese" standpoint and attitudes surrounding food and overconsumption of particular food items. Those wrongly identifying as "obese" with a BMI <30 overall had worse food attitudes and increased consumption of energy-dense foods than the other groups. Although these findings contradict the current literature, they are essential because they can have mental health implications and poor health outcomes. Fostering a society focused on body positivity and healthy lifestyles is the best way to combat this issue. This change starts with physicians. Learning how to manage these patients medically poses a significant challenge to physicians and remains the ending question of this study. Integrating a therapeutic and psychological approach can help ensure that these patients reach a state of health in which they view themselves as having an appropriate BMI and mitigate the outside factors affecting their overall health.

Acknowledgments: The authors would like to thank: the Rowan University School of Osteopathic Medicine Summer Medical Research Fellowship for providing the resources to conduct this study; Robert Steer, PhD, for aid with data analysis and guidance on statistical configurations; and Cardiology Associates (Lanham, MD) and American Diversity Group Events (Columbia, MD) for allowing our research team to conduct research in their facilities.
Research funding: None reported.
Author contributions: All authors provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; all authors drafted the article or revised it critically for important intellectual content; all authors contributed to the analysis and interpretation of data; all authors gave final approval of the version of the article to be published; and all authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
Competing interest: None reported.
Informed consent: Participants provided informed consent prior to completing the online survey.
Ethical approval: All study protocols were granted ethical approval by Rowan University School of Osteopathic Medicine Institutional Review Board (PRO-2021-434) and was conducted as an exempt review.

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Supplementary Material: This article contains supplementary material (https://doi.org/10.1515/jom-2022-0211).