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Perceived Discrimination and Food Consumption

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PERCEIVED DISCRIMINATION AND FOOD CONSUMPTION

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ABSTRACT

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Obesity is a public health concern that is associated with numerous life-limiting chronic illnesses such as diabetes and hypertension. Marginalized groups such as Black, Latinos, and Native Americans experience obesity and related illnesses at high rates. Research suggests that diet is one of the causes of these illnesses, and as such understanding the determinants of diet may assist in addressing health disparities in the United States. Literature suggests that diet may be associated with stressors such as perceived discrimination. However, few studies have assessed this relationship within the Native American population, and none have employed ecological momentary assessment (EMA) to measure food intake. This study addresses these gaps in the literature and examines the relationship between perceived discrimination and food intake frequency as measured by an EMA daily diary. It was hypothesized that perceived discrimination would be positively associated with food intake frequency. Results found that discrimination is associated with less frequent eating overall, (estimate = -.1615, SE = .0606, t = -2.66, p = .005, 95% CI:(-.2809, -.0421)). This effect is a function of reduced frequency of meals, not of consumption of snacks or healthy foods. The evidence does not support the hypothesis that perceived discrimination is positively associated with overall food intake.

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TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Obesity and related illnesses are leading causes of morbidity and mortality, and present major challenges to quality of life and public health in the United States. (Center for Disease Control and Prevention, 2021; National Heart, Lung, and Blood Institute, 2013). Obesity is a modifiable risk factor for several chronic illness such as diabetes, cardiovascular disease, and renal disease, all of which contribute considerably to mortality and morbidity. (National Heart, Lung, and Blood Institute, 2013; Hsu et al.,2006)

Although prevalence rates for obesity are high across the country, they are even higher among certain racial and ethnic groups, such as Blacks, Latinos, and Native Americans, who experience obesity and related illnesses at a higher rate than the general population. Native Americans in particular experience a disproportionate disease burden and are almost three times more likely than non-Hispanic whites to be diagnosed with diabetes and 2.5 times more likely to die from diabetes (OMH, 2019). Although, Native Americans experience higher rates of obesity and related health conditions, they also are less represented in the research concerning obesity, despite the fact that high rates of obesity in Native American populations contribute to health disparities (Zamora-Kapoor et al., 2019). An increased focus on the identification and study of the causes of obesity and related illnesses within the Native American population could help address these substantial health disparities.

Though, as with most illnesses, there are many factors that influence the development of overweight and obesity, such as lack of exercise, lack of access to healthful foods, and genetics, researchers have identified food consumption as one of the modifiable factors that contribute to the development and maintenance of obesity (National Heart, Lung, and Blood Institute, 2013). Research suggests patterns of food consumption are associated with obesity, as well as other health outcomes like high blood pressure and high cholesterol (Brug, 2008). Modifying eating behavior can lead to weight loss and improvement in overall health (Braet, 2014; Dassen, 2015; Hasketh, 2005; Jasinska et al., 2012; National Heart, Lung, and Blood Institute, 2013). Changes to unhealthy eating could be used to help prevent obesity and focusing on eating can be a productive way to decrease obesity and related illnesses in the United States and to potentially reduce health disparities (Dassen at al., 2015; Kishi et al., 2006).

Stress and Eating Behavior

Eating is a modifiable behavior, therefore understanding the determinants of eating can help us understand and address some of the sources of obesity, related illnesses, and health disparities. Just as there are many ways that people develop obesity, there are many factors which influence eating behavior such as culture, eating style, and environmental factors (Brug, 2008). Stress is among the factors which are thought to influence eating behavior.

Stress is defined as the subjective experience of not having the required resources to address demands and threats (Lazarus & Folkman, 1984). A stressor could, then, be defined as a demand or threat for which an individual feels unprepared or unequipped to address. It is thought that high levels of stress have a wide range of effects on health outcomes both through endocrinological responses and psychological responses. Stress can produce changes in behaviors that affect health outcomes, known as health behaviors, including sleep, alcohol consumption, exercise, and food consumption. The literature supports the associations between stress and eating behavior, and many studies examine this link.

There are two pathways through which stress is thought to induce changes in eating behavior. One pathway is through physiological stress responses mediated through the hormones associated with the HPA axis of the neuroendocrine system. Stress can trigger the release of hormones such as cortisol, which then can trigger cravings for foods high in fat and sugar (Tomiyama, 2018).

The other pathway through which stress can affect eating is cognitive depletion. Evidence suggests that stress can deplete cognitive resources which can interfere with the cognition resources needed to plan healthy meals or to refuse to act on cravings for sweet and fatty foods (Tomiyama, 2018). Therefore, understanding stress and how it relates to eating can be a productive way to understand why people eat the way they do.

Among the literature examining the relationship between stress and eating behavior, definitions and measurements used for stress and eating behavior vary. Typically, eating behavior is conceptualized as food intake, which tends to fall into the following categories: healthy food, unhealthy food, and overall frequency of

consumption. Measurements of stress also vary in regard to timeframe and origin of stress, such as acute versus chronic stress, and physical threat versus ego threat. Additionally, there are many moderators of the relationship between stress and eating such as eating style (whether that is emotional eating or restrained eating) (Ariswalla, 2018; O'Connor, 200; Scott, 201; Tate, 2015; Yau & Potenza, 2014) personality (O'Connor & O'Connor, 2004; Scott & Johnstone, 2012), or gender (Jaaskelanian st el., 2014; O'Connor et al., 2008).

Despite variations in methodology, there is an overall trend, with some exceptions, supporting the notion that stress is associated with changes in eating, usually presenting as increase in food intake and an increase in unhealthy food intake (Masih et al., 2015; Merali et al., 2013; Scott & Johnstone, 2012; Tomiyama, 2018; Tyron et al., 2013; Wallis & Hetherington, 2004; Yau & Potenza, 2014). This may be especially true for individuals with restrained eating styles and those experiencing ego threat. The evidence suggests that individuals with restrained eating styles may respond to stress by increasing their food intake, compared to their non-restrained counterparts. The quality of stressors is also associated with eating behavior differentially, with ego threat, interpersonal stress, and mild or severe stress appearing to affect the relationship between stress and eating (Cotter, 2018; Scott, 2012; Wallis, 2004; Yau & Potenza, 2014). Furthermore, while stress can often be associated with an increase in eating, this has not always been found to be the case, with some studies reporting a split among participants where 40% increase eating and 40% decrease eating in response to stress (Merali et al., 2013; Scott, 2012; Tomiyama, 2018; Yau & Potenza, 2014). This split may be due to varying stressors, duration of stressor, and individual differences.

Taking all this into consideration, it is reasonable to suspect that there is an association between perceived stress and eating, even as the quality of this association may be affected by type of stress and individuals characteristics such as restrained eating.

Perceived Discrimination and Eating Behavior

Understanding sources of stress that may contribute to obesogenic eating habits may help provide the groundwork to address obesity. Marginalized groups, such as Native Americans, may experience high levels of stress and limited resources to address stressful life events. Discrimination is a particular form of stressor which may be an additional burden to other life stresses. Consequently, whether discrimination is associated with eating has become one of the topics among the literature with the broader goal of addressing health disparities.

Research suggests that the experience of discrimination is associated with multiple aspects of consumption. Some studies have noted a relation with the quality of diet, such as increased fat consumption (Sims, 2015; Forsyth et al., 2014). Other evidence also suggests that perceived discrimination is associated with emotional eating, which while not a measure of food consumption, is a measure of an eating behavior which can be linked to eating more during times of distress (Durso at al., 2012; Hoggard et al., 2019; Johnson et al., 2013). One study done in a population of Native Americans provides evidence that historical loss and perceived discrimination is positively associated with binge eating behavior, thus laying a foundation for future research to continue to study this association within the Native American population (Clark & Winterowd, 2012). Overall, the literature generally provides evidence that supports a

relationship between perceived discrimination and eating, but it is not clear whether the association is specific to decreased healthy eating, increased unhealthy eating, emotion-based eating, or a general increase in food intake. Furthermore, is it not clear whether the type or timing of discrimination affects eating behavior.

Given that marginalized groups, such as Native Americans, disproportionately experience chronic diseases such as obesity and diabetes, and given Native Americans are reported to experience discrimination and high stress, research has examined perceived discrimination as a determinant of eating behavior.

Among studies that examine the link between perceived discrimination and eating behavior, standards for measuring perceived discrimination vary. For example, some studies focused only on work-related discrimination (Johnson et al., 2013) while others included discrimination across a wider range of contexts. Among these, some measured lifetime perceived discrimination and/or past year discrimination, or acute/recent discrimination (Durso et al., 2012; Clark & Winterowd, 2012; Forsyth et al., 2014; O'Connor & O'Connor, 2004). Others assessed impact or burden of the perceived discrimination meaning that participants were asked to report on whether they perceived the discriminatory events to have an impact on their life or well-being (Clark & Winterowd, 2012; Durso at el., 2012; Forsyth et al., 2014). In general, this appears to be one difference by which studies looking at perceived racism can be meaningfully categorized: those which take timeframe and burden into account and those which do not.

Among studies that are interested in examining the link between perceived discrimination and eating behavior, eating behavior has been measured either as eating

response types (emotional eating (Braet, 2004; Hesketh et al., 2005; Hoggard et al., 2019), loss of control eating (Jääskeläinen et al., 2014; Jasinska at al., 2012) or by attempting to measure the quality and/or quantity of food in some way (Brug, 2008; Durso et al., 2012; Johnson et al., 2013; O'Connor & O'Connor, 2004). Some studies use a fruit and vegetable consumption count (Brug, 2008), some ask if participants consume foods on an extensive list ranging from fruits, whole grains, fish, sodium, sugary drinks, and more (Durso et al., 2012; Johnson et al., 2013.), and some break down food consumption into percent daily calories from fat (O'Connor & O'Connor, 2004). The evidence does generally point to an association between perceived discrimination and eating, such as a positive relationship between perceived discrimination and emotional eating, and an increase in eating to manage stress associated with perceived discrimination.

If we take eating habits (specific food consumption) to be a consequential driver of bodily health, then it would follow that having some measure of food intake (as opposed to eating styles such as emotional eating) would be important since eating style cannot give us insight into what was consumed. In addition, while we may ultimately be interested in physical outcomes like BMI as one kind of public health outcome, studying food intake is productive because it allows us to assess if eating is a pathway through which stress affects health outcomes such as BMI, diabetes, or hypertension. When it comes to eating behavior, studies might be meaningfully categorized as those which assess eating behavior as eating response types and those which assess it as food intake.

There have also been limitations in the groups which have been studied. Many studies assessing perceived discrimination and eating behavior recruit exclusively

African-Americans (Braet, 2004; Brug, 2008; Clark, & Winterowd, 2012; Durso et al., 2012; Friederich et al., 2006; Hesketh et al., 2005; O'Connor & O'Connor, 2004) with some focusing more narrowly on either African-American men or women with particular ailments such as obesity or hypertension. Other studies have included Hispanics/Latinos and Asians/Asian-Americans, but very few include American Indians/Alaskan Natives in the sample.

There is supporting evidence that perceived discrimination is a stressor which may contribute to deleterious eating behavior. One study found an association between binge-eating and experiencing racist events, as well as a relationship between binge-eating and emotional distress (Clark & Winterowd, 2012). Zamora-Kapoor (2019) presents the risk factors for obesity within the Native American population, and they find that among a list of risk factors one is psychological distress. This evidence suggests that stressors, and particularly those in the form of racist experiences, may contribute to deleterious eating behaviors.

All previous studies have used either recall surveys or experimental laboratory procedures. None of the studies specifically examining perceived discrimination and eating behavior employed ecological momentary assessment (EMA). The use of ecological momentary assessment (EMA) allows the current study to reduce recall bias and improve ecological validity compared with methods that rely on recall. Recall of past events may be influenced by beliefs about how the world functions and on the eventual outcome of the event and can be biased by the current mood of the participant (Smyth & Stone, 2003; Shiffman, Stone, and Hufford, 2008). Generally, EMA is suited for the evaluation of physiological and psychosocial processes in the natural environment and

provides a degree of strength to our current study. This study employs time-based sampling, which is a more appropriate method for this data because it provides a sample throughout the day so we can understand what is associated with eating meals or snacks versus not eating meals or snacks.

Evidence suggests that recall bias can occur relatively quickly after an event, so daily diaries tend to be less valid than true momentary assessment. Smyth & Stone (2003) make note that when it comes to EMA for coping strategies for stress, evidence suggests that there is little correspondence between recalls of coping and aggregates of momentary assessments of coping. This is relevant for our study as eating behavior is also conceptualized as a potential coping mechanism. Therefore, the use of true momentary EMA in this study is a strength that provides validity to our measure.

Studies have compared the results from recall and EMA oftentimes in an attempt to understand the differences between these methods. However, such comparisons can also provide methodological rigor and interest to studies.

Current Study

This study aims to contribute to understanding the relationship between perceived discrimination and eating behavior within an American Indian/Alaskan Native (AI/AN) sample. The literature suggests that there is an association, though the quality of the relationship between perceived discrimination and eating behavior is not consistent across studies. Eating style, quality of stressor, quality of food intake measurement, and

gender all seem to be among factors which can influence the relationship between perceived discrimination and eating behavior.

Additionally, most studies of this nature focus on African Americans or Latinos, with Native Americans less frequently included in the samples. We aim to expand the understanding of perceived discrimination and eating within the Native American populations, to help improve on information available relevant to this group, and to give more nuance to how the relationship between perceived discrimination and eating may vary among different groups.

Evidence among the literature which does focus on perceived discrimination and eating within the Native American populations suggests that there is an association. There is supporting evidence that perceived discrimination is a stressor which may contribute to deleterious eating behavior, and therefore may be a factor which contributes to health disparities in the Native American population (Clark & Winterowd, 2012; Zamora-Kapoor, 2019).

Taking all this into consideration, we test the following main hypotheses:

1. Overall perceived discrimination will be positively associated with overall food consumption frequency as measured by the food diary.
    a. Overall perceived discrimination will be positively associated with between-meal snacking frequency.

b. Overall perceived discrimination will be negatively associated with frequency of fruit and vegetable consumption.

2. The threat sub-component of perceived discrimination will be negatively associated with overall food consumption as measured by the food diary.
3. The social exclusion sub-component of perceived discrimination will be positively associated with overall food consumption as measured by the food diary.

METHODS

Participants

303 community dwelling Native-Americans residing in Colorado were recruited to complete a survey and complete an Ecological Momentary Assessment (EMA) over the course of one day. 7 of participants were excluded due to incomplete components of relevant survey and EMA questions. 256 participants remained for final analyses. There were 189 females (63.00%) and 111 males (37.00%). The mean age was 43.65 (SD = 14.73) and a range of 18 to 78. The race breakdown was 180 (59.41%) identified as Native American only, 2 (.66%) identified as Asian in addition to Native American, 8 (0.99%) identified as Native Hawaiian or Pacific Islander, 18 (5.94%) identified as White, 34 (11.22%) identified as Black, and 66 (21.78%) identified as Latino/a.

Measures

Perceived Discrimination

Perceived racial discrimination was measured using the Brief Perceived Ethnic Discrimination Questionnaire - Community Version scale with Lifetime and Past Week Discrimination scales (Brondolo et al. 2005). The questionnaire consists of 17 items which assess perceived discrimination within four domains: social exclusion (four items), discrimination at work (four items), threat or harassment (four items), and stigmatization (five items). Participants were prompted to reflect on their experiences from childhood to

the present, and were asked questions beginning with "Because you are Native American, how often…" which were then completed with scenarios pertaining to each domain (e.g., "… have others thought you couldn't do things or handle a job" for the work discrimination subscale). Responses were collected on a 5-point Likert scale ranging from 0 (never) to 4 (very often). The scale was reported to have good psychometric properties and to have an alpha Cronbach of $\alpha = .88$. It was designed to be used with all ethnic groups and was validated for Latino and Black samples {perhaps run alpha Cronbach for this Native American sample}.

Discrimination at work assesses reports of unfair treatment from peers or superiors at school and in the workplace, and can include forms of discrimination such as implying that someone is incompetent due to their race or ethnicity. Social exclusion questions ask participants to report if they have felt excluded or rejected in social contexts. Stigmatization assesses how frequently participants have been made to feel "lazy", "untrustworthy", or otherwise dangerous. Lastly, physical threat or harm assess how frequently participants report that they or their property have been threatened with physical violence or have been physically assaulted.

The Past Week Discrimination scale asks participants to recall discriminatory events over the course of the past seven days. Questions ask about frequency of discriminatory events and ask about different scenarios, such as, "In the past week how often did someone treat you unfairly because of your ethnicity/race?". The scale is scored on a 4-point Likert scale with a value of 0 meaning never in the past week, and 3 meaning three or more times in the past week.

Eating Behavior

Food consumption was measured using an EMA (Ecological Momentary Assessment), where participants had a hand-held device which prompted response every 20 minutes. Participants were asked to report if they had consumed a meal, a snack, or a fruit or vegetable. The answers were not mutually exclusive; therefore, participants could choose to report any combination of food options. For the meal option, participants were presented with an image of a plate with poultry and a fork and knife, for the snack option participants were presented with an image of a soda cup and a bag of chips, for the fruit or vegetable option participants were presented with an image of an apple and a head of broccoli.

Demographic Characteristics

Demographic variables included age (years), race/ethnicity, gender, education, income, employment status, and BMI. Education level was collected and re-coded into two levels: high school or less, and some college or more.

Procedure

All participants were provided with informed consent and were informed of all possible risks and benefits of the study and were compensated for their participation. Participants were asked to complete a series of self-report questionnaires including measures of perceived discrimination, a recall survey of food consumption for the past seven days, and questions on weight and height used to calculate BMI. After completing a laboratory test in which they were asked to describe episodes of discrimination, participants were outfitted with an ambulatory blood pressure monitor and trained to use an electronic diary. The diary asked about posture, mood, behavior, and food consumption every 20 minutes throughout the waking hours. Perceived discrimination and food consumption frequency were analyzed along with sociodemographic characteristics. The Institutional Review Boards (IRB) affiliated with both St. John's University and the University of Colorado Denver approved the original protocol.

RESULTS

Characteristics of the Sample

The majority of participants were above a healthy weight, meaning they were either overweight or obese, with an average BMI of 29.53 (n =258). BMI ranges were categorized according to CDC guidelines as follows: underweight (below 18.5), healthy weight (18.5-24.9), overweight (25.0-29.9), and obese (30.0 and above) (Centers for Disease Control and Prevention, 2020). A total of 97 (32.01%) participants were overweight and 129 (42.57%) were obese. 5 (1.65%) participants were underweight and 72 (23.76%) were of a healthy weight.

Most members of this sample had low socio-economic status, as assessed by education, income, and employment status. Nearly half of participants were not employed (n=121, 47.64%), and another quarter were employed part-time (n=64, 25.20%). The remaining 69 (27.17%) participants were employed full-time. Participants had a range of educational backgrounds as 17 (5.69%) completed college, 118 (39.46%) participants had 1 to 3 years of college, 94 (31.44%) completed high school, and 57 (19.06%) had some high school education. About 86% (n=261) of the sample (n=301) reported an income between $0 - $48,999. More than half of participants (n=162, 53.82%) reported an income of $0 - $16,999, 63 (20.93%) reported income of $17,000-$32,999, and 36 (11.96%) reported income of $33,000-$48,999. The rest of the participants (n=40, 13.29%) report an income of $49,000 or more. Descriptive statistics are included in Table 1.

Average reported score for total perceived discrimination was 1.49 (SD=.79, n=303), indicating that participants experience discrimination at a frequency between rarely and sometimes, across multiple sources of discrimination. The average reported score of past week discrimination was 1.23 (SD=.95, n=303), indicating that participants experienced discrimination in the past week at a frequency just above rarely, across multiple scenarios of discriminatory events.

The average reported score for overall food consumption from the EMA data was .24 (SD = .15, n=261), which corresponds to the within-subject proportion of food diary entries made by a participant where eating was indicated (i.e., the number of diary entries in which the participant indicated eating divided by the total number of diary entries for that participant, averaged across the entire sample). This indicates that on average people indicated they ate on 24% out of the total times that they made a food diary entry.

Preliminary Analysis

Missing Data Analyses

Participants with missing data were compared against those without missing data. No significant differences between the groups were found for total perceived discrimination, threat, social exclusion, overall food consumption, age, gender, and education. The bulk of missing data was due to technical difficulties and participant noncompliance with study protocols. Missingness mainly exists within these diary data

and not within data on participant characteristics. Multilevel modeling programs in SAS are generally robust to missing data (Little, 2006).

Differences in discrimination across covariates

An ANOVA was run to compare the difference in perceived discrimination across selected covariates (i.e., age, gender, race) (Proc GLM, SAS 9.4). There was no difference in the experience of discrimination found between men and women ($F(1, 255) = .02$, $p = .89$, $R^2 = .00$, 95% CI:(-.1909, .2211)). There was a difference found between education groups, with those with more education reporting more experiences of discrimination ($F(1, 255) = 4.35$, $p = .04$, $R^2 = .02$, 95% CI:(.0117, .4057)) compared to those with less education. A linear regression was used to examine the association of age to discrimination and revealed that increasing age is associated with increased levels of discrimination (estimate= 0.010111739, $t = 3.01$, $p=.003$, $R^2=0.34$, 95% CI:(.0035, .0167)).

Differences in reported food consumption across covariates

A mixed effects logistic regression model with an unstructured covariate matrix was used to examine demographic differences in primary outcome associated with food consumption (Proc Glimmix, SAS 9.4). There was an association between gender and overall food consumption frequency with men serving as the reference group. Results indicated women reported higher average food consumption frequency (estimate = .2454,

SE = .1004, t = 2.44, p = .0152, 95% CI:(.0476, .4432)). There was an association found between gender and the frequency of consumption of snacks, with women eating snacks more frequently than men on average (estimate = .3096, SE = .1377, t = 2.25, p = .025, 95% CI:(.0384, .5808)). There were no significant differences found between gender and the frequency of meal consumption (estimate = .1195, SE = .1229, t = .97, p = .33, 95% CI:(-.1225, .3616)), nor between gender and fruit and vegetable consumption ((estimate = .2163, SE = .2387, t = .91, p = .37, 95% CI:(-.2533, .6859).

There were no significant associations between age and overall food consumption frequency (estimate = .0031, SE = .0033, t = .95, p = .34, 95% CI:(-.0034, .0096)), nor between age and the frequency of meal consumption (estimate = .0045, SE = .0040, t = 1.12, p = .26, 95% CI:(-.0034, .0123)), nor between age and frequency of consumption of fruits or vegetables (estimate = .0085, SE = .0078, t = 1.08, p = .2791, 95% CI:(-.0069, .0239). There was also no association found between age and frequency of consumption of snacks (estimate = -.0031, SE = .0044, t = -.69, p = .49, 95% CI:(-.0118, .0057)).

There was a significant association between education level and meal consumption. Individuals with more education reported eating more meals than those with less education (estimate = .3400, SE = .1197, t = 2.84, p = .0048, 95% CI:(.1044, .5756). There was no significant relation of education to overall food consumption frequency (estimate = .0668, SE = .0985, t = .68, p = .50, 95% CI:(-.1272, .2609)). There was no relation of education to frequency of consumption of snacks (estimate = -.0731, SE = .1336, t = -.55, p = .58, 95% CI:(-.3364, .1901)).

As gender and education were associated with at least one measure of consumption, gender and education were included as covariates in subsequent analyses.

Tests of the Main Hypotheses

A mixed effects model logistic regression with unstructured error matrix and random intercept for subjects was used to model the primary hypothesis, that perceived discrimination would be positively associated with frequency of food consumption.

There was a significant negative association found between lifetime discrimination and overall food consumption frequency as assessed in the diary dataset, (estimate = -.1615, SE = .0606, t = -2.66, p = .005, 95% CI:(-.2809, -.0421)). There was also a significant negative association found between lifetime discrimination and meal consumption frequency (estimate = -.2390, SE = .0760, t = -3.14, p = .002, 95% CI:(-.3886, -.0894)). There was no significant association found between discrimination and frequency of fruit or vegetable consumption (estimate = -.1737, SE = .1496, t = -1.16, p = .25, 95% CI:(-.4679, .1205)), nor between discrimination and frequency of snack consumption (estimate = .0709, SE = .0838, t = -.85, p = .3982, 95% CI:(-.2359, .0941)).

We also ran a multilevel logistic model, including all four subscales of perceived discrimination (i.e., threat, social exclusion, stigmatization, work discrimination). When all four subscales are included, there is no association found with overall food intake frequency for threat (estimate = -.0467, SE = .0703, t = -.66, p = .51, 95% CI:(-.1852, .0917)), social exclusion (estimate = .0183, SE = .1078, t = .17, p = .87, 95% CI:(-.1941,

.2307)), stigmatization (estimate = -.0254, SE = .0945, t = -.27, p = .79, 95% CI:(-.2114, .1607)), or work discrimination (estimate = -.1095, SE = .0900, t = -1.22, p = .22, 95% CI:(-.2868, .0678)). It is worth noting that the lack of effects for the model with all subscales may be due to multicollinearity, as there was a high correlation among these sub-scales. Correlations between subscales are included in Table 2.

When included as the sole predictor in a mixed effects model, reported levels of threat were found to be associated with significant declines in overall food intake frequency decreasing with threat (estimate = -.1197, SE = .0508, t = .0192, p = .019, 95% CI:(-.2196, -.0197)). When social exclusion was examined in isolation, the model showed a significant association, with overall food intake frequency decreasing with social exclusion (estimate = -.1224, SE = .0564, t = -2.17, p = .03, 95% CI:(-.2335, -.0112))

A multilevel logistic model with unstructured error matrix using random intercept for subjects was run to test the relationship between past week discrimination and overall food intake frequency. Past week discrimination was not associated with overall food intake frequency (estimate = -.0620, SE = .0511, t = -1.21, p = .23, 95% CI:(-.1625, .0386)).

DISCUSSION

Previous literature generally provides evidence that perceived discrimination is associated with deleterious eating habits. However, very few studies focus on Native-American populations, and none to date have used diary measures to examine eating behavior. This study addresses the gaps in the literature by testing the relationship between perceived discrimination and eating behavior using an EMA food measure in an AI/AN population.

The evidence does not support the hypothesis that perceived discrimination is positively associated with overall food intake or between-meal snacking. Instead, the results indicate that perceived discrimination is associated with less frequent eating overall. This effect is a function of reduced frequency of meals, and not due to effects of consumption of snacks or healthy foods. The association of discrimination with decreased meal consumption frequency could suggest that as perceived discrimination increases ordered or planned eating, such as meals, decreases. This could mean that healthy eating decreases, as meals are a possible source of healthy foods such as protein or whole grains. Considering that most participants ate healthy food infrequently (the fruits and vegetables variable had a skew of 3.87, and the percentage of observations with fruits or vegetables was 4.88%), it could be the case that as meal consumption decreases, the profile of total food consumption shifts from being comprised of both meals and snacks, to a food consumption profile more dominated by snacking. Therefore, while the evidence does not support the theory that perceived discrimination is associated with deleterious eating behavior in the form of increased total food intake and snacking, the

decrease in meal consumption that is associated with perceived discrimination may reflect less structured or planned, and, possibly, less healthy eating.

One possibility is that stressors such as discrimination may undermine the cognitive resources needed to plan meals. Recent studies identified an association between discrimination and reduced executive functioning (Barnes, 2012; Murphy, 2013). Executive functioning is deployed for planning and organization, including the types of planning needed for meal preparation.

Results did support the hypothesis that threat is associated with a decrease in overall food consumption frequency. Results also found an association between the social exclusion subscale and overall food consumption frequency. Though overall discrimination and social exclusion were thought to be associated with hyperphagic responses, and threat with hypophagic responses, it seems that different domains of discrimination all were potentially associated with hypophagic responses in this sample.

No associations were found for past week discrimination and overall food consumption frequency. This may be evidence that lifetime and recent experiences of discrimination operate differently and are associated with eating behaviors differently. Future research may aim to further develop an understanding of the relationship between eating behavior and lifetime versus recent perceived discrimination.

Among covariate analysis, results indicated that women had higher overall consumption frequency scores than men, as a function of higher snacking frequency. There was no difference in consumption for meals and fruits and vegetables between men and women. Furthermore, individuals with more education ate more meals than those

with less education, and there were no other differences in other food consumption variables.

There were no differences in eating behavior variables across income, which was a bit unexpected, as food profile, whether healthy or unhealthy, is typically thought to be different across SES. It is possible that an association may not have been found here because 70% of the sample has an income under $30,000, and 55% under 17,000, creating a floor affect.

The finding that individuals with more education ate more meals than those with less education lends credence to the notion that cognitive resources are related to ordered eating and meal consumption, and therefore that the decrease in meal consumption may be due to perceived discrimination's association with decreased cognitive resources. Additionally, the increase in meal consumption among participants with more education would likely not be a function of income since there was no relationship between income and food consumption.

Limitations and Future Research

To our knowledge, this study was the first of its kind to use EMA food intake measures, as opposed to a single point recall survey or laboratory experiment, to study the association of perceived discrimination and food intake. The use of the EMA measures allowed for the aggregation of data over the course a day, and potentially gives

a more accurate reflection, compared to survey measures, of how frequently consumption occurred.

However, limitations of this study also include aspects of the EMA food intake measure. The EMA food intake measure did not measure the amount of food intake but frequency of food intake. While frequency of food intake could serve as a proxy for amount (given the logical connection between frequency and total amount), ultimately it may not provide a valid measure of overall food intake. Compounding this limitation is the fact that meal reports were not grouped according to time, and therefore we may have overestimated the frequency of meals.

Another limitation of the EMA measure is the possibility that the diary could act as a sort of intervention over the course of the day: individuals who normally overate perhaps became more aware of their eating habits for the course of the day that were asked every 20 minutes what they had ate. This perhaps prompted them to eat less. This may have affected the validity of the outcome measure.

However, it may also be the case that food consumption frequency may not be related with perceived discrimination in the same way that overall quantity of food consumption is. This may be a reason that perceived discrimination was not positively associated with overall food intake. Although, this is difficult to determine from the current study. Future studies might research the validity of EMA food measures by comparing EMA measures to food measures which capture more information about food intake such as those employing food imaging to help ascertain if EMA food measures that mostly collect information on food frequency are a valid method of collecting

information on quantity of food consumption. Additionally, future studies may test shifts in eating profiles (or proportions of healthy vs. unhealthy food), rather than testing whether each single food category decreased or increased.

Future studies may consider using EMA measures which attempt to capture quantity in addition to frequency. This study used time-based sampling to measure food intake, however future studies that employ time-based sampling should avoid counting meal events that occur in close temporal proximity as several meals. For example, 3 reported meals that take place 20 minutes apart from one another may be counted as one meal. Event-based sampling could also be an option to consider when using EMA measures for food intake because it allows participants to report when they perceive a food intake event to have occurred. This in conjunction with capturing more information about the quantity consumed and, if possible, quality of food, would likely help to strengthen the validity of a food intake measure.

Future research may also test the relationship between perceived discrimination and eating behavior by constructing a food consumption profile for each participant, rather than only testing separately the effect on each food consumption variable. This would enable future studies to understand food consumption patterns within participants both in terms of proportion (e.g., proportion of healthy food to unhealthy food) and total quantity.

Studies may also consider testing possible covariates of ordered eating and meal eating, such as marriage status, if the participant lives with family, or if the participant tends to eat with others. These could be protective factors whereby social relationships

and eating within a social context helps to regulate eating in the face of external stressors. Future analyses should examine the contexts in which people eat and the sex differences in these contexts.

Furthermore, this study did not measure restrained or non-restrained eating types or emotional eating types, factors which have previously been associated with discrimination and eating. These eating habits may affect how eating behaviors are associated with perceived discrimination, and future studies may consider measuring and controlling for variables such as these.

CONCLUSION

Previous studies have reported on the relationship between stressors and eating behavior, and specifically the relationship between the stressor of perceived discrimination and food intake. These studies largely provided evidence that perceived discrimination is associated with higher levels of food intake, and more generally with eating patterns that are considered deleterious to health. The current study was the first of its kind to use EMA measurements to assess food intake, and to do so specifically within an American Indian/Alaskan Native population. After controlling for gender and education levels, the main results found that perceived discrimination was negatively associated with total food intake and meal consumption. These findings were unexpected, but possibly indicate a relationship between perceived discrimination and ordered eating. Despite the limitations present in the EMA measure, this study contributes findings and suggestions for future research to build upon.

APPENDICES

Table 1

Descriptive Statistics

Variables	N (%)
Age (years)	
[M (SD) Range]	43.65 (14.73) Range: 18-78
Race	
AI/AN only	180 (59.41%)
AI/AN and Latino/a	66 (21.78%)
AI/AN and Black	34 (11.22%)
AI/AN and White	18 (5.94%)
AI/AN and Asian	2 (0.66%)
AI/AN and Native Hawaiian or Pacific Islander	8(0.99%)
Gender	
Female	189(63.00%)
Male	111(37.00%)

Education Level	
Some College or Less	158 (52.84%)
Some College or more	141 (47.16%)
BMI Group	
Underweight	5(1.65%)
Healthy weight	72(23.76%)
Overweight	97(32.01%
Obese	129(42.57%)
Income	
$0 - $16,999	162(53.82%)
$17,000 - $32,999	63(20.93%)
$33,000 - $48,999	36(11.96%)
$49,000 - $64,999	18(5.98%)
$65,000 - $80,999	9(2.99%)
$81,000 - $96,999	3(1.00%)
$97,000 or more	10(3.32%)

Note. Participant demographics.

Table 2

Pearson correlation matrix for perceived discrimination subscales

Variable	1	2	3
1. Threat	--	--	--
2. Social Exclusion	.64*	--	--
3. Stigmatization	.59*	.79*	--
4. Work	.66*	.77*	.71*

*p<.0001

Table 3

Overall food consumption across variables

Parameter	Estimate	Standard Error	t value	Pr > |t|
Overall Discrimination	-.1615	.0606	-2.66	.005
Past Week Discrimination	-.0620	.0511	-1.21	.23
Threat	-.1197	.0508	.0192	.019
Social Exclusion	-.1224	.0564	-2.17	.03
Age	.0031	.0033	.95	.34
Gender	.2454	.1004	2.44	.02
Education	.0668	.0985	.68	.50

Table 4

Meal consumption across variables

Parameter	Estimate	Standard Error	t value	Pr > |t|
Overall Discrimination	-.2390	.0760	-3.14	.002
Past Week Discrimination	-.1471	.0636	-2.31	.02
Threat	-.1087	.0635	-1.71	.08
Social Exclusion	-.1737	.0698	-2.49	.01
Age	.0045	.0040	1.12	.26
Gender	.1195	.1229	.97	.33
Education	.3400	.1197	2.84	.005

REFERENCES

Arsiwalla, D. D., Arnold, A. W., Teel, K. P., Ulrich, P. V., & Gropper, S. S. (2017). The interactive role of eating regulation and stress in the prediction of weight-related outcomes among college students. *Stress and Health*, *34*(1), 59–71. https://doi.org/10.1002/smi.2760

Barnes, L. L., Lewis, T. T., Begeny, C. T., Yu, L., Bennett, D. A., & Wilson, R. S. (2012). Perceived discrimination and cognition in older African Americans. Journal of the International Neuropsychological Society, 18(5), 856-865.

Braet, C. (2004). Inpatient Treatment for Children With Obesity: Weight Loss, Psychological Well-being, and Eating Behavior. *Journal of Pediatric Psychology*, *29*(7), 519–529. https://doi.org/10.1093/jpepsy/jsh054

Brondolo, E., Kelly, K. P., Coakley, V., Gordon, T., Thompson, S., Levy, E., … Contrada, R. J. (2005). The Perceived Ethnic Discrimination Questionnaire: Development and Preliminary Validation of a Community Version1. *Journal of Applied Social Psychology*, *35*(2), 335–365. https://doi.org/10.1111/j.1559-1816.2005.tb02124.x

Brug, J. (2008). Determinants of healthy eating: motivation, abilities and environmental opportunities. *Family Practice*, *25*(Supplement 1), i50–i55. https://doi.org/10.1093/fampra/cmn063

Centers for Disease Control and Prevention. (2020, September 17). *About Adult BMI*. Centers for Disease Control and Prevention. https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html#InterpretedAdults.

Centers for Disease Control and Prevention. (2021, February 11). *Adult Obesity Facts*. Centers for Disease Control and Prevention. https://www.cdc.gov/obesity/data/adult.html.

Clark, J. D., & Winterowd, C. (2012). Correlates and Predictors of Binge Eating Among Native American Women. *Journal of Multicultural Counseling and Development*, *40*(2), 117–127. https://doi.org/10.1002/j.2161-1912.2012.00011.x

Cotter, E. W., & Kelly, N. R. (2018). Stress-related eating, mindfulness, and obesity. *Health Psychology*, *37*(6), 516–525. https://doi.org/10.1037/hea0000614

Dassen, F. C. M., Houben, K., & Jansen, A. (2015). Time orientation and eating behavior: Unhealthy eaters consider immediate consequences, while healthy eaters

focus on future health. *Appetite*, *91*, 13–19. https://doi.org/10.1016/j.appet.2015.03.020

Durso, L. E., Latner, J. D., & Hayashi, K. (2012). Perceived Discrimination Is Associated with Binge Eating in a Community Sample of Non-Overweight, Overweight, and Obese Adults. *Obesity Facts*, *5*(6), 869–880. https://doi.org/10.1159/000345931

Forsyth, J. M., Schoenthaler, A., Ogedegbe, G., & Ravenell, J. (2014). Perceived Racial Discrimination and Adoption of Health Behaviors in Hypertensive Black Americans: The CAATCH Trial. *Journal of Health Care for the Poor and Underserved*, *25*(1), 276–291. https://doi.org/10.1353/hpu.2014.0053

Friederich, H.-C., Schild, S., Schellberg, D., Quenter, A., Bode, C., Herzog, W., & Zipfel, S. (2005). Cardiac parasympathetic regulation in obese women with binge eating disorder. *International Journal of Obesity*, *30*(3), 534–542. https://doi.org/10.1038/sj.ijo.0803181

Hesketh, K. (2005). Healthy eating, activity, and obesity prevention: a qualitative study of parent and child perceptions in Australia. *Health Promotion International*, *20*(1), 19–26. https://doi.org/10.1093/heapro/dah503

Hoggard, L. S., Volpe, V., Thomas, A., Wallace, E., & Ellis, K. (2019). The role of emotional eating in the links between racial discrimination and physical and mental health. *Journal of Behavioral Medicine*, *42*(6), 1091–1103. https://doi.org/10.1007/s10865-019-00044-1

Hsu, C.-yuan, McCulloch, C. E., Iribarren, C., Darbinian, J., & Go, A. S. (2006). Body Mass Index and Risk for End-Stage Renal Disease. *Annals of Internal Medicine*, *144*(1), 21. https://doi.org/10.7326/0003-4819-144-1-200601030-00006

Jasinska, A. J., Yasuda, M., Burant, C. F., Gregor, N., Khatri, S., Sweet, M., & Falk, E. B. (2012). Impulsivity and inhibitory control deficits are associated with unhealthy eating in young adults. *Appetite*, *59*(3), 738–747. https://doi.org/10.1016/j.appet.2012.08.001

Jääskeläinen, A., Nevanperä, N., Remes, J., Rahkonen, F., Järvelin, M.-R., & Laitinen, J. (2014). Stress-related eating, obesity and associated behavioural traits in adolescents: a prospective population-based cohort study. *BMC Public Health*, *14*(1). https://doi.org/10.1186/1471-2458-14-321

Kishi, T., & Elmquist, J. K. (2005). Body weight is regulated by the brain: a link between feeding and emotion. *Molecular Psychiatry*, *10*(2), 132–146. https://doi.org/10.1038/sj.mp.4001638

Lazarus R. S., Folkman S. (1984). *Stress, Appraisal and Coping*. New York: Springer

Little, R.C., Milliken, G.A., Stroup, W.W., Wolfinger, R.D., & Schabenberger, O. (2006), SAS for Mixed Models. Cary. NC. SAS Institute Inc.

Masih, T., Dimmock, J. A., Epel, E. S., & Guelfi, K. J. (2017). Stress-induced eating and the relaxation response as a potential antidote: A review and hypothesis. *Appetite*, *118*, 136–143. https://doi.org/10.1016/j.appet.2017.08.005

Merali, Z., Graitson, S., MacKay, J. C., & Kent, P. (2013). Stress and eating: a dual role for bombesin-like peptides. *Frontiers in Neuroscience*, *7*. https://doi.org/10.3389/fnins.2013.00193

Murphy, M. C., Richeson, J. A., Shelton, J. N., Rheinschmidt, M. L., & Bergsieker, H. B. (2013). Cognitive costs of contemporary prejudice. Group Processes & Intergroup Relations, 16, 560– 571. https://doi.org/10.1177/1368430212468170

O'Connor, D. B., & O'Connor, R. C. (2004). Perceived changes in food intake in response to stress: the role of conscientiousness. *Stress and Health*, *20*(5), 279–291. https://doi.org/10.1002/smi.1028

O'Connor, D. B., Jones, F., Conner, M., McMillan, B., & Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychology*, *27*(1, Suppl). https://doi.org/10.1037/0278-6133.27.1.s20

Scott, C., & Johnstone, A. M. (2012). Stress and Eating Behaviour: Implications for Obesity. *Obesity Facts*, *5*(2), 277–287. https://doi.org/10.1159/000338340

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological Momentary Assessment. *Annual Review of Clinical Psychology*, *4*(1), 1–32. https://doi.org/10.1146/annurev.clinpsy.3.022806.091415

Sims, M., Diez-Roux, A. V., Gebreab, S. Y., Brenner, A., Dubbert, P., Wyatt, S., … Taylor, H. (2015). Perceived discrimination is associated with health behaviours among African-Americans in the Jackson Heart Study. *Journal of Epidemiology and Community Health*, *70*(2), 187–194. https://doi.org/10.1136/jech-2015-206390

Smyth, J. M., & Stone, A. R. (2003). Ecological Momentary Assessment Research in Behavioral medicine. *Journal of Happiness Studies*, *4*(1), 35–52. https://doi.org/10.1023/a:1023657221954

Tate, E. B., Spruijt-Metz, D., Pickering, T. A., & Pentz, M. A. (2015). Two facets of stress and indirect effects on child diet through emotion-driven eating. *Eating Behaviors*, *18*, 84–90. https://doi.org/10.1016/j.eatbeh.2015.04.006

Tomiyama, A. J. (2019). Stress and Obesity. *Annual Review of Psychology*, *70*(1), 703–718. https://doi.org/10.1146/annurev-psych-010418-102936

Tryon, M. S., DeCant, R., & Laugero, K. D. (2013). Having your cake and eating it too: A habit of comfort food may link chronic social stress exposure and acute stress-induced cortisol hyporesponsiveness. *Physiology & Behavior*, *114-115*, 32–37. https://doi.org/10.1016/j.physbeh.2013.02.018

U.S. Department of Health and Human Services. (2013). *Managing Overweight and Obesity in Adults: Systematic Evidence Review from the Obesity Expert Panel*. National Heart Lung and Blood Institute. https://www.nhlbi.nih.gov/health-topics/managing-overweight-obesity-in-adults.

U.S. Department of Health and Human Services Office of Minority Health, (2019).

Wallis, D. J., & Hetherington, M. M. (2004). Stress and eating: the effects of ego-threat and cognitive demand on food intake in restrained and emotional eaters. *Appetite*, *43*(1), 39–46. https://doi.org/10.1016/j.appet.2004.02.001

Wing, R. R., Goldstein, M. G., Acton, K. J., Birch, L. L., Jakicic, J. M., Sallis, J. F., … Surwit, R. S. (2001). Behavioral Science Research in Diabetes: Lifestyle changes related to obesity, eating behavior, and physical activity. *Diabetes Care*, *24*(1), 117–123. https://doi.org/10.2337/diacare.24.1.117

Yau, Y. H., & Potenza, M. N. (2013). Stress and eating behaviors. *Minerva endocrinologica*, *38*(3), 255–267.

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