Examining Risk and Protective Factors in the Association Between Discrimination Stress and Body Mass Index in a Sample of LatinX Adults

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ABSTRACT

In 2016, the State of Obesity Organization reported that Latinx populations (38.7%) have a higher obesity rate than non-Latinx white populations (25.6%). Discrimination stress is one factor that has been found to be associated with obesity. Studies show that greater discrimination stress is associated with increased obesity in Latinx populations; however, research has not focused on the protective and risk factors that may influence this association, such as depressive symptoms and social support. While depressive symptoms may help in explaining the association between discrimination stress and obesity, protective factors, like social support may buffer this association. The purpose of the present study was to examine depressive symptoms as a mediator and social support as a moderator of the association between discrimination stress and obesity among a sample of Latinx adults. A national sample of Latinx adults (N = 632) was recruited using Qualtrics Panel to participate in an online survey. Discrimination stress, depressive symptoms, social support, and Body Mass Index (BMI), a measure of obesity, was assessed through self-report measures. Discrimination stress was not significantly associated with BMI; however, depressive symptoms fully mediated the association between discrimination stress and BMI. Social support was not found to be a significant moderator. These results suggest that greater discrimination stress is associated with more depressive symptoms, which in turn are associated with a higher BMI among Latinx adults. These findings have implications for the development of culturally sensitive prevention programs.

Introduction

Cardiovascular Disease

Cardiovascular disease (CVD) is defined as any condition that affects the heart or circulatory system. Some of these conditions include arrhythmias, obstructed coronary arteries, and obstructed pumping or ejection of blood into the circulatory system. If not treated, these conditions can worsen and ultimately lead to a heart attack or stroke (NIH, 2017). The Centers for Disease Control and Prevention (2015) reported that CVD accounts for 23.5% of all deaths in the United States making it the nation's number one cause of death. Furthermore, CVD disproportionately impacts marginalized groups such as Latinx adults. According to the United States Census Bureau (2017), one in six individuals in the United States is of Latinx background. By 2035, the Latinx population is expected to grow significantly so much so that one in four individuals will be of Latinx background. Given this population growth, it is expected that CVD rates will also rise making this a public health concern (US Census Bureau, 2017).

Risk factors for CVD

In 2010, the American Heart Association created a "2020 Health Strategy" to reduce the risk for CVD. They targeted seven key risk factors that are attributable to CVD: smoking, Body Mass Index (BMI), diet, physical activity, blood pressure, blood glucose, and total cholesterol. Of these risk factors, the Latinx population is overrepresented in cholesterol, diabetes, and BMI (Table 1).

Table 1: Latinx adults are at risk for High Cholesterol, Type 2 Diabetes, and Obesity, all risk factors for CVD, when compared to non-Latinx white adults.

Risk Factor	Non-Latinx Whites	Latinx
High Cholesterol	37.0%	43.1%
Type 2 Diabetes	10.2%	16.9%
Obesity	**25.6%**	**38.7%**

Of the many leading risk factors for CVD, the present study focuses on obesity. Not only is obesity a leading risk factor for CVD, but the other risk factors listed by the American Heart Association are also associated with obesity. Obesity is defined as having excessive fat that leads to health problems. One indicator of obesity is BMI, which can be calculated by one's weight (kg) divided by the square of one's height (m) (CDC, 2016). According to the World Health Organization (2016), an individual with a BMI of 30 or more is considered obese and a BMI of 25 to 29 is considered overweight. In the United States, about 70% of adults are considered overweight or obese. Obesity has been found to be the leading risk factor for CVD due to its contribution to increased risk of hypertension, coronary artery disease, type 2 diabetes, and more (NIH, 2015). Furthermore, the highest rate of obesity is found among Latinx adults (38.7%) in comparison to non-Hispanic White adults (25.6%) (Holub et al., 2013). The racial and ethnic disparities in obesity have been a major public health concern in the United States and will be the focus of the present study.

Stress and CVD

There is a large amount of literature on the association between psychological stress and CVD; specifically, studies have looked at negative outcomes associated with acute and chronic stress (Holman et al., 2008; Kurd et al., 2013; Matthews et al., 1994). To understand the relationship between stress and CVD, it is important to define what is meant by "stress." Dimsdale (2008) defines the concept of "stress" as the way an organism physiologically responds to challenges or obstacles, not the "stressor" itself. Stress has been linked to physical health outcomes such as myocardial infarction, myocardial ischemia, and wall motion abnormalities. One study found that among healthy middle-aged men and women, high psychological distress predicted an increased risk of future CVD events. In the follow-up visits, it was determined that the likelihood of experiencing a cardiovascular event was increased by 54% in individuals experiencing psychological distress compared to those who did not (Matthews et al., 1994). Another study found that among 60 patients admitted to a hospital for coronary artery bypass graft surgery, about 60% of the patients showed high-stress levels. Thus, they concluded that stress was a significant independent risk factor in patients with coronary heart disease (Kurd et al., 2013).

On a larger scale, Holman et al. (2008) examined the degree to which acute stress due to the 9/11 attack predicted cardiovascular outcomes. The investigators used a national sample of adults (N = 2,729), 95% of whom completed a health survey before and after the attack. Holman et al. concluded that acute stress responses were

associated with 53% increased incidence of cardiovascular complications over a 3-year period after the 9/11 attack. Though it is evident that there is an association between stress and negative physical health outcomes, it is important to evaluate the ramifications of stress solely within minority populations.

Limited literature has examined the consequences of stress among minority groups. For instance, one study examined multiple stress indicators (chronic, perceived, traumatic) in relation to prevalent coronary heart disease among adult Hispanic/Latino adults (N = 5,313). After conducting clinical and sociocultural exams, their results showed that chronic stress burden was related to a higher risk for coronary heart disease. This study suggests that chronic stress is related to higher cardiovascular heart disease in the largest U.S. ethnic minority group – Latinx (Gallo et al., 2015). Frost et al. (2015) also examined stress among a minority group and its relation to physical health outcomes. In a sample of 396 lesbians, gay men, and bisexuals the investigators found that minority stress— specifically stress due to prejudice events—was associated with the onset of various physical health problems such as hypertension (a CVD symptom), flu, and cancer within a 1-year period. Based on these past studies, it is evident that stress among minority groups is common and associated with negative physical outcomes.

Discrimination Stress

Discrimination stress can be defined as the beliefs, attitudes, or institutional arrangement that treat an individual or group as inferior due to their phenotypic characteristics or ethnic/racial background (Clark et al., 1999). Arellano-Morales et al. (2015), reported that 79.5% of their Latinx adult participants (N = 5,000) have encountered discrimination. Thus, identifying discrimination as a significant stressor in the Latinx community. Not only is discrimination a prevalent social stressor in the Latinx community, but Latinx individuals also encounter discrimination more often than other racial/ethnic groups. For instance, Sternthal et al. (2011) sampled a group of Hispanic, Black, and non-Hispanic White individuals (N = 802) and found that when compared to the non-Hispanic White individuals in the sample, Hispanics had greater stress exposure due to discrimination. These findings suggest that a greater attention to discrimination stress among Latinx adults is warranted. Relatedly, discrimination stress has been previously associated with negative mental and physical health outcomes that have been linked to CVD (e.g., elevated blood pressure, heart rate, cortisol secretion). For instance, multiple studies have found that discrimination stress has significant effects on blood pressure; specifically, there has been evidence suggesting an increase in daytime and nocturnal blood pressure when an individual has repeated encounters with discrimination stress (Brondolo et al., 2011; Dolezsar et al., 2014).

Discrimination Stress and Obesity

Taking a step back, general stressors have had a positive correlation to obesity. This association can be explained by both biological and psychological factors. From a biological standpoint, individuals' stress levels can influence their intake of carbohydrates. There are high levels of tryptophan in carbohydrates which are later converted to Serotonin, a neuropeptide. This neuropeptide is responsible for mood regulation and can provide an emotional outlet for individuals that are undergoing chronic stress (Wurtman et al., 1995). Individuals that are experiencing chronic stress are also at risk for excess cortisol in the body. This hormone is involved in managing fat and energy storage. The common side effects of increased levels of cortisol may be increased appetite and cravings for sugary and fatty foods (Bjorntorp et al., 2000).

Another important biological factor to account for is Neuropeptide Y (NPY). Our bodies process food differently when under stress. NPY is released by the sympathetic nerve terminal under stressful conditions. This neuropeptide promotes adipocyte proliferation and induces new capillaries to supply these cells with blood. When an individual is already eating a high fat/sugar diet, Neuropeptide Ys are released at a higher rate (Zukowska-Grojec et al., 1995). Considering the many biological factors that link stress and obesity, it is not surprising to find that stress can manifest psychologically when undergoing different social stressors.

Discrimination stress, a social stressor, has been associated with heightened levels of obesity. For instance, McCubbin and Antonio (2012) reported that discrimination stress (overt and covert) was positively correlated with obesity among a group of Native Hawaiians. Moreover, Johnson et al. (2013) found a similar correlation among a sample of Black women. They reported that the frequency of eating when depressed or coping with stress was significantly higher among individuals that self-reported higher perceived discrimination levels. Thus, discrimination may be a contributor to stress that leads one to eat for reasons other than hunger. In a study that used a multi-ethnic national sample, including Polish, Italians, Jews, and Irish, Haslyn et al. (2009) reported that perceived unfair treatment was associated with increased abdominal obesity. Compared to individuals that were not exposed to perceived chronic discrimination, individuals that encountered perceived chronic discrimination were two to six times more likely to have higher levels of abdominal fat. Discrimination stress has also been linked to obesity among a sample of Latinx immigrants. McClure et al. (2010) sampled 132 immigrant farmworkers in Oregon to investigate the association between perceived discrimination and physiological responses. The investigators reported that high levels of discrimination stress were associated with elevated levels of abdominal fat. Taken together, these findings suggest that discrimination stress may be significantly associated with BMI, an indicator of obesity, among the Latinx adults in the present sample.

Depression

Major depressive disorder or clinical depression are common mood disorders that influence how one feels or how well one accomplishes daily activities. The DSM-5 defines depression by the following nine symptoms: (1) depressed mood for majority of the day, (2) diminished interest or pleasure in activities most of the day, (3) significant weight loss or gain, (4) insomnia or hypersomnia almost every day, (5) psychomotor agitation or retardation nearly every day, (6) fatigue or loss of energy nearly every day, (7) feelings of worthlessness or excessive guilt, (8) diminished ability to think or concentrate, (9) recurrent thoughts of death, recurrent suicidal ideation, or suicide attempt (American Psychiatric Association, 2013).

Depression is one of the leading mental health issues in the United States. Between the years 2013 and 2016, 8.1% of American adults had depression in a given two-week period (Brody et al., 2018). The same study reported that depressive symptoms were more prevalent among minority populations such as Latinx (8.2%) than the non-Latinx White population (7.9%) (Brody et al., 2018). These findings are consistent with a previous meta-analysis study conducted by Mendelson et al. (2008), which found that depressive symptoms were more prevalent among Latinx individuals than non-Latinx Whites. Depressive symptoms are prevalent in the Latinx community and have a bidirectional relationship with multiple chronic health conditions, such as cancer (Chapman et al., 2005), heart disease (Everson-Rose et al., 2005), and diabetes (Stewart et al., 2001).

Depression and Discrimination Stress

Past studies have reported that discrimination stress has negative consequences on one's psychological well-being (self-esteem, depression, anxiety, psychological distress). For instance, Schmitt et al. (2014) performed a meta-analysis study (N = 144,246) to examine the correlation between perceived discrimination and psychological distress. Using a random-effects model, they determined that the mean weighted effect size was negative, indicating that discrimination stress was harmful to the individual's psychological well-being. Furthermore, the effect size was larger for disadvantaged groups, such as minority populations, in comparison to advantaged groups, such as non-Hispanic Whites.

While it is evident that there is an association between discrimination stress and depression, it is important to see how this association manifests among racial/ethnic minority samples. For instance, Tummala-Narra and colleagues (2011) reported a strong positive correlation between discrimination stress and depression among a national sample of Asian Indians in the United States. Another study conducted by Torres et al. (2010) examined the association

between discriminatory acts and depressive symptoms among a sample of 669 Latinx adults. They found that Latinx individuals reported higher levels of depressive symptoms following a discriminatory event. The differential effects of ethnic identity were also reflected within those scores. The more one identified with their ethnic background, the higher the depression score was after a discriminatory event (Torres et al., 2010). Looking at the effects of both depression and discrimination stress on obesity is important because together, they have been associated with adverse health outcomes such as cardiovascular disease and diabetes (Zimmerman et al., 2009).

Depression and Obesity

Depressive symptoms have been positively associated with obesity, one of the leading risk factors for CVD. The prevalence of depression (10%) and obesity (65%) indicates that there is a high possibility that they can co-exist (Stunkard et al., 2003). Many studies have examined this association to determine if these two variables are functionally related. For instance, Simon et al. (2008) evaluated the association between obesity and depression among middle-aged women (N = 4,641). They reported that prevalence of depression (moderate or severe) was strongly associated with obesity. In fact, 25.9% of individuals with a BMI over 35 reported having more depressive symptoms (25.9%) than individuals with a BMI under 25 (6.5%). Another study examined the same association but in general populations of diverse countries. A statistically significant association was observed between obesity and depressive disorders (Scott et al., 2008). These findings indicate that the association between depression and obesity has been observed in differing samples (e.g., middle-aged women and population-level).

Longitudinal studies have also been conducted to look at the association between depressive symptoms and obesity. One study performed by Luppino et al. (2010) showed a bidirectional relationship between obesity and depression. They found that individuals already experiencing depressive symptoms had a 58% increase in weight gain, while obese individuals had a 55% increase in developing depressive symptoms. Conversely, in a longitudinal study, using a sample of adolescents (N = 4,175), Roberts and Duong (2013) found a unidirectional association between depression and obesity. Specifically, they found that adolescents who were already experiencing depressive symptoms were at a higher risk for obesity and other weight-related problems. These results provide support for the depression-to-obesity pathway.

The association between depression and obesity has also been found among multiethnic samples. Blaine et al. (2008), reported that of their multiethnic adult sample (i.e., White, Black, Asian, Hispanic) (N = 33,000), depressed individuals were more likely to have gained weight in a follow-up measurement than non-depressed individuals. Another study revealed that a sample of Australian multiethnic children (i.e., White and Black) with greater stress and depression levels exhibited a higher percentage of body fat (Olive et al., 2017).

Though it has been established that depression is prevalent in the Latinx population, there are limited studies that link depression to obesity among this community. However, past studies have examined the differences in the association between depression and obesity within the Latinx population compared to other racial/ethnic groups. For instance, Heo et al. (2006) reported that exhibiting a depressive mood within a one-month timespan was associated with being overweight or obese. This association was most prominent in Hispanic/Latina women. Conversely, Hickens et al. (2013) found an association between depression and obesity only within non-Hispanic White women. This association was not significant for non-Hispanic Black and Mexican American women. Due to these discrepancies in findings, a closer look at the association between depression and obesity is warranted among Latinx adults.

Previous studies have provided more insight into the possible connection between depression and obesity among Latinx adults when solely examining this population. One study looked at the relationship among cardiovascular disease, obesity, and psychological distress (i.e., depression and anxiety) within a sample of Latinx adults. The investigators found a statistically significant association between psychological distress and obesity only among the Latina females in the sample (Castaneda et al., 2016). Considering this, it is important to further investigate the association between depression and obesity only among the Latinx adult community. In doing so, unique variations seen

among the Latinx community may be unveiled, allowing for the development of culturally sensitive prevention programs.

Social Support

Social support is defined as emotional or instrumental support received by others. Emotional support refers to things that individuals (e.g., family and friends) do to show love or care, which allows for an individual to feel self-worth. This can be done through discussing problems or providing encouragement. Instrumental support refers to tangible support that others can supply (e.g., childcare, transportation, etc.) (Seeman, 2008). There is a large literature base supporting the idea that social support is associated with psychological well-being (e.g., lower risk for depression and psychological distress) (Seeman, 2008). However, the relationship between social support and physical health outcomes are less documented. Some evidence has linked social support, specifically emotional support, to better survival post-myocardial infarction (Berkman et al., 1992; Williams et al., 1992). In one study, the survival rate among elderly patients hospitalized for myocardial infarctions was measured. Out of 194 patients, 39% died in the first six months. Researchers reported that lack of emotional support was positively correlated with the 6-month mortality, even after controlling for factors such as severity of myocardial infarction, smoking, hypertension, and sociodemographic factors (Baerkman et al., 1992). Thus, suggesting that social support is a potential protective factor for negative physical health outcomes. Furthermore, the Latinx culture puts a lot of emphasis on "familismo" or family values, which is classified as social support. Past studies have been able to theoretically measure this concept; however, very few studies have been able to objectively measure social support as a protective factor (Ruiz et al., 2016). For the current study, emotional social support will be measured among a sample of Latinx adults as a potential protective factor in the association between discrimination stress and obesity.

Social Support and Discrimination Stress

It has been established that social support has served as a buffer against stress (Bowen et al., 2014). Unfortunately, most of the evidence supporting this association comes from laboratory studies. There are few studies that examined levels of perceived social support among participants in their natural environment (Bowen et al., 2014). Therefore, it is important to measure the effects of social support regarding real-world stressors. For instance, one study analyzed the association between perceived stress and social support among adolescent African Americans that recently gave birth. They reported that higher levels of perceived stress, due to motherhood at a young age, were associated with lower levels of social support (Campbell-Grossman et al., 2016). Another study aimed to better understand the importance of social support in managing stress among college students. Students that reported less social support were more likely to report more stress. However, students who had a high perception of familial support were less likely to report high levels of stress (Baqutayan, 2011). This suggests that family and professional social support are important factors that can help protect one from stress.

To the investigator's knowledge, there are limited studies that have examined the association between social support and discrimination stress. In fact, only one study was found that examined the role of social support in the association between discrimination stress and mental well-being. Using a national sample of Russian and Estonian immigrants (N = 2,360), Jasinskaja-Lahti et al. (2006) found that discrimination stress was negatively associated with mental well-being. Furthermore, they concluded that social support buffered the impact of perceived discrimination on the mental well-being of the participants (Jasinskaja-Lahti et al., 2006). Given the frequency of discriminatory experiences in the Latinx community. the scarcity of literature that examines the role of social support in buffering the negative effects of discrimination stress on health outcomes is concerning and warrants further attention.

Social Support and Obesity

Research suggests that high perceived social support serves as a protective mechanism against weight gain. In one longitudinal study, BMI and social support levels of parents and their offspring were monitored. All participants' BMI were measured when they reached adulthood (ages 30-35). The investigators reported that levels of social support were significantly and negatively related to BMI. The results suggest that social support protects against the intergenerational transmission of obesity (Serlachius et al., 2016).

Another study looked at the effects of social support on sedentary behavior and physical activity – behaviors associated with obesity – among a sample of adolescent girls (N = 718) (Mercado et al., 2011). The researchers reported that increased family support regarding physical activity had a negative correlation with total minutes of television viewing. These findings suggest that social support acts as a protective factor in relation to various negative physical health outcomes. Mercado et al. (2011) also provide support for the protective effects of social support. In a sample of multi-ethnic bariatric surgery patients (N = 264), the association between postoperative support group attendance and weight loss was observed. They reported that 55.5% of individuals who attended the support group experienced weight loss while only 47.1% of individuals who did not attend the support group experienced weight loss. Though the causal relationship was not clear, the researchers concluded that social support was associated with a greater degree of weight loss (Mercado et al., 2011). These findings suggest that social support may positively influence physical health.

Purpose of Present Study

The purpose of the present study was to examine the association between discrimination stress and BMI among a sample of Latinx adults. Another purpose of this study was to examine depressive symptoms as a mediator and social support (i.e., emotional support) as a moderator of the association between discrimination stress and BMI. The following hypotheses were examined in the present study:

1. Among a sample of Latinx adults, higher levels of discrimination stress will be associated with a higher BMI.
2. The association between discrimination stress and BMI will be mediated by depressive symptoms.
3. Social support will serve as moderator to weaken the positive association between discrimination stress and BMI.

Materials and Methods

Participants

The participants of the present study were part of a larger study that examined socio-cultural factors that influence physical and mental health outcomes. The present study used a nationally representative sample of 632 Latinx adults, between the ages of 18 and 81. Of the 632 participants, 46.2% were female and 31.8% male. Over half of the participants (53%) completed an education level higher than high school or GED. English was reported as the first language for 74.6% of the participants and 80.3% of participants reported being born within the United States. Participants were eligible to participate in the present study if they (1) identified as Hispanic/Latinx, (2) able to read in English or Spanish, and (3) at least 18 years or older.

Measures

Demographic Information. A Demographic and Health Data Questionnaire constructed by the principal investigator of the larger study was used to assess the following self-reported demographics: 1) age, 2) gender, 3) education level, 4) first language, and 5) generational status.

Body Mass Index (BMI). BMI was calculated using self-reported height (inch) and weight (pounds). The following formula was used: $\left(\frac{weight}{height^2}\right) * 703$.

Depressive Symptoms. To assess depressive symptoms, the Patient Health Questionnaire-9 (PHQ-9) was used. The PHQ-9 contains 9 items used to screen for depressive symptoms and psychosocial function severity. The PHQ-9 scores each of the 9 DSM-5 criteria as "0" (*not at all)* to "3" (*nearly every day*). One item from the PHQ-9 was "Trouble concentrating on things, such as reading the newspaper or watching television." Higher scores indicate higher levels of depressive symptoms. For the present study, the Cronbach's alpha was .92.

Discrimination Stress. To assess discrimination stress, the Hispanic Stress Inventory-2 (HSI-2) was used. The HSI-2 contains 17 items examining psychosocial stressors. The HSI-2 consists of seven subscales; however, the present study only utilized the discrimination stress subscale. Items on the HSI-2 are on a five-point scale, ranging from 0 (*Have not experienced*) to 5 (*Extremely worried/ tense)*. One item from the discrimination stress subscale was "I was treated "less than" other Americans because I am Hispanic/Latino." The total score was calculated by summing responses. Higher scores indicate higher levels of worry or stress regarding discrimination. For the present study, the discrimination stress subscale had a Cronbach's alpha of .93.

Social Support. To assess social support, the Brief COPE was used. The Brief COPE has 16 items examining how participants cope with stress. While the Brief COPE has 14 subscales, the present study only examined the emotional support subscale. Items in the Brief COPE are on a four-point scale, ranging from 1 (*I haven't been doing this at all)* to 4 (*I've been doing this a lot)*. One item from the emotional support subscale was "I've been getting comfort and understanding from someone." The total score was calculated by summing responses. Higher scores indicate the individual has a stronger sense of emotional support. For the present study, the emotional support subscale had a Cronbach's alpha of .80.

Procedure

Institutional Review Board (IRB) approval was received from University of Oregon. Potential participants were recruited via email through Qualtrics Panel. The email contained information about the purpose of the study, the risks and benefits, and a link to the survey. Potential participants could choose to review the consent form and complete survey in English or Spanish. Once language was selected, the potential participant reviewed the consent form and provided consent by selecting "I consent to take the survey." Next, the participant completed the survey, which took approximately 20-30 minutes to complete.

Statistical Analysis

All analyses were conducted using IBM SPSS Statistics 24 (Corp., 2016) and the PROCESS macro (Hayes, 2013). Before conducting the analyses, variables were examined for missing data and accuracy. Missing data totaled 5% for both the moderation and mediation models. Those with missing data were excluded list wise from all analyses. All variables in the model were examined to assess if all linear assumptions were met. No assumptions were violated in the present study. For all analyses, unstandardized coefficients were reported.

Moderation model. Model 1 of the PROCESS macro, which examines a moderation model, was used to examine the association between discrimination stress and BMI, as well as the moderating role of social support (i.e., emotional support).

In the model, BMI was entered as the criterion variable. Discrimination stress was included in the model as the independent variable. Social support was included as a moderator. Covariates of the model included: age, gender, education, English as first language, and generational status. All variables included in the model were centered. Significant interactions were plotted using simple slopes through the pick-a-point method in order to examine the nature of the interaction.

Mediation model. The mediation model was conducted using model 4 through the PROCESS macro (Hayes, 2013). The independent variable was discrimination stress, the mediator was depressive symptoms, and the dependent variable was BMI. The covariates in the model were age, gender, education, English as first language, and generational status. To test both the direct and indirect effects of the mediation model, bias-corrected bootstrapping was conducted. Specifically, 1000 samples were run to provide 95% confidence intervals for the significant indirect effect. If the confidence interval for the indirect effect does not include zero, it is suggested that the indirect effect is significant at the .05 level with 95% confidence.

Covariates. The covariates in the present study were selected due to theoretical support, which suggests that these variables are associated with differential obesity-related outcomes. For instance, differences in the prevalence of obesity are found based on age with adults ages 40-59 years exhibiting the highest prevalence rate than those 20-39 years and 60 or older (Flegal et al., 2016). Research also suggests that women and that 2nd and 3rd generation immigrants have higher rates obesity (Bates et al., 2010; Flegal et al., 2016). These covariates were retained in the model regardless of statistical significance.

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Results

Preliminary Analyses

Of the theoretically examined control variables (i.e., age, gender, education, English as first language, and generational status), only age (r = .19, p < .001) and education (r = -.09, p = .036) were significantly associated with BMI (see Table 2).

Table 2: Correlation of Control Variables with BMI

Variables	1	2	3	4	5	6
1. Age	-					
2. Gender	-.14**	-				
3. Education	.06	.06	-			
4. Eng	.08*	-.12**	-.02	-		
5. Gen	.17***	-.04	.04	.48***	-	
6. BMI	.19***	-.03	-.08*	-.02	-.04	-

*p < .05, **p < .01, ***p < .001

Note: Eng= English as first language, Gen= generational status.

Social Support as a Moderator

The regression model for BMI was statistically significant (F (8, 593) = 4.28, $p < .001$, $R^2 = .05$; see Table 3). However, the main effects of discrimination stress and social support were not significantly associated with BMI. The interaction between discrimination stress and support was also not significant.

Table 3. *Regression for Social Support Moderating the Association between Discrimination Stress and BMI*

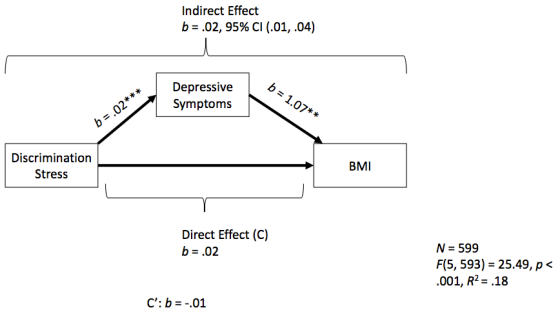
Variables	*b*	SE (b)	95% CI
Age	.10	.02	.06, .13
Gender	.34	.50	-.64, 1.32
Education	-.47	.19	-.85, -.10
Eng	.37	.76	-1.1, 1.9
Gen	-1.1	.81	-2.7, .50
SS	.39	.31	-.22, .99
Discrim	.01	.02	-.03, .05
SS (x) Discrim	-.01	.02	-.06, .03

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Note: Eng= English as first language, Gen= generational status, Discrim= discrimination stress, SS= social support

Depressive Symptoms as a Mediator

Depressive symptoms were examined as a mediator in the association between discrimination stress and BMI. Discrimination stress was positively associated with depressive symptoms ($b = .02$, $p < .001$) and depressive symptoms was positively associated with BMI ($b = .93$, $p = .015$). However, the path between discrimination stress and BMI was not statistically significant, $b = .01$, $p > .05$ (See Figure 1). A significant indirect effect of depressive symptoms was found between discrimination stress and BMI, $b = .02$, 95% CI [.005, .034]. Since the direct path between discrimination stress and BMI was not significant ($b = .00$, $p > .05$), the results suggest a complete mediation by depressive symptoms. Specifically, Latinx participants that had greater discrimination stress experienced increased BMI through higher levels of depressive symptoms.



$^{**}p < .01$, $^{***}p < .001$

Figure 1. *Regression for Depressive Symptoms Mediating the Association between Discrimination Stress & BMI*

Discussion

The purpose of the present study was to examine the association between discrimination stress and BMI among a sample of Latinx adults. Another purpose of this study was to examine depressive symptoms as a mediator and social support (i.e., emotional support) as a moderator of the association between discrimination stress and BMI. The following hypotheses were examined in the present study: (1) Among a sample of Latinx adults, higher levels of discrimination stress will be associated with a higher BMI; (2) The association between discrimination stress and BMI will be mediated by depressive symptoms; (3) Social support will serve as moderator to weaken the positive association between discrimination stress and BMI.

The results showed no significant association between discrimination stress and BMI among this sample of Latinx adults, which failed to support hypothesis one. This finding is quite surprising due to the noted association between discrimination and mental and physical health outcomes (Haslyn et al., 2009; Johnson et al., 2013; McCubbin and Antonio, 2012). One potential explanation for the null finding is that the present study did not use the same measure as previously mentioned studies. For instance, Haslyn et al. (2009) used a five-item version of the Everyday Discrimination Scale, which measures general discrimination experiences whereas the subscale used in the present study (i.e., the discrimination stress subscale of the Hispanic Stress Inventory- 2) was specifically designed to measure discrimination experiences associated with being Hispanic/Latino.

A second potential explanation for the null findings is that Latinx participants may not feel comfortable recounting experiences of discrimination, especially in the current political climate. Due to recent political activity, many of these individuals may potentially feel targeted due to their racial/ethnic background or citizenship status thus influencing their responses to these items on the survey.

A third possible explanation for the null findings is that discrimination stress is one of many types of stressors. From a biological standpoint, chronic stressors have a bigger impact on one's cortisol levels. Cortisol impacts how the body processes carbohydrates, fats, and proteins. Therefore, abnormal levels of cortisol translate into weight gain. Since discrimination is one of many types of stressors, future studies may need to examine additional forms of stress, such as chronic stressors, to identify which stressors play a more significant role on BMI.

Though there was no direct association between discrimination stress and BMI, depressive symptoms completely mediated the association between these indices, which supported hypothesis two. Specifically, there was a positive association between discrimination stress and depressive symptoms, such that higher levels of discrimination stress were associated with more depressive symptoms. Also, greater depressive symptoms were associated with higher BMI. Also, the association of discrimination stress and BMI through depressive symptoms was supported.

Previous studies have shown an association between discrimination and depressive symptoms (Schmott et al., 2014; Torres et al., 2010; Tummala-Narra et al., 2011). For instance, Schmitt et al. (2014) reported that perceptions of discrimination (both personal and group discrimination) are negatively correlated with psychological well-being. Specifically, individuals that experience chronic stressors due to discrimination were more likely to exhibit depression, anxiety, and psychological distress. Past studies have also reported an association between depression and BMI (Blaine et al., 2008; Luppino et al., 2010; Roberts & Duong, 2013). Luppino et al. (2010) reported that depressive symptoms were a predictor of weight gain. Thus, these previous studies support the results from the present study, which suggests that stressful events due to discrimination affect's an individual's mental well-being which then translates into negative physical health outcomes.

Social support did not moderate the association between discrimination stress and BMI. Therefore, social support did not serve as a protective factor in this specific model, which could be partially attributed to the present study only examining emotional support. The selection of emotional support was due to previous studies identifying emotional support as the most influential form of social support. However, these studies were conducted primarily with White adult samples. Thus, examining emotional support may not accurately account for the types of social support most valued within our Latinx sample.

The present study also measured the perception of available emotional social support through a two-question subscale from the Brief COPE questionnaire. Due to the limited number of questions in this subscale, future studies may consider incorporating a more robust measurement of emotional support and including other forms of social support (e.g., instrumental, informational, and appraisal). Future studies should also create a more culturally sensitive measures of social support for use with Latinx adults. For instance, "familismo" (valuing of family) has been theoretically linked to positive outcomes, yet, few empirical studies have been able to evaluate the plausible impact of this form of social support (Katiria Perez & Cruess, 2014), which suggests that culturally sensitive empirical measures of this form of social support and the other forms of social support previously mentioned may provide more useful information about the ability of social support to buffer the negative association between discrimination stress and BMI among Latinx adults.

It is important to highlight the strengths of the present study. First, this study examined the association between discrimination stress and BMI in one population, Latinx adults. Since it is known that Latinx adults are at an increased risk for CVD, it is important to focus on key risk factors that can potentially lead to CVD. Due to Latinx adults' elevated levels of BMI in comparison to non-Latinx White adults, the present study focused on factors that may exacerbate BMI levels among this population. The present study also used a nationally representative sample of Latinx adults, with a fairly even distribution of key demographics represented such as region (i.e., participants matched the percentage of Latinx adults in each region), age (i.e. participants were ages 18-81), and highest level of education completed ranging from elementary to professional/graduate levels. The representation of these diverse characteristics allows for a more generalizable statement regarding US Latinx adults when examining the risk and protective factors associated with discrimination stress and BMI.

Although the present study has reached its aims, there were some unavoidable limitations. First, all data was self-reported. For instance, participants self-reported their height and weight to calculate BMI. This self-reported data may contain several potential sources of bias such as selective memory, telescoping, attribution, and exaggeration. However, self-reported measures are typically used to measure all these constructs (i.e., discrimination stress, BMI, depressive symptoms, and social support). Second, the present study examined the association between discrimination stress and BMI among Latinx adults; however, the Latinx population is not monolithic and contains many subgroups. Thus, future studies should re-examine these associations within specific subgroups such as Mexican American adults only. Third, this is a cross-sectional study; therefore, the present study is unable to make causal inferences about the nature of the association between discrimination stress and BMI due to the measurements only being recorded at one point in time.

Though the present study provides significant contributions to the literature base examining physical health outcomes among Latinx adults, future studies, should expand upon the findings. Specifically, future studies may consider other clinical or laboratory methods to measure stress due to discrimination (e.g., cortisol samples) and BMI (e.g., densitometry) to ensure accuracy. Future studies should also include the development and use of a culturally sensitive measure of social support. Such future research should also focus on obtaining longitudinal data that further examines potential risk and protective factors in the association between discrimination stress and BMI.

The present research has two important implications for CVD interventions. First, BMI is one of the leading risk factors for CVD. Furthermore, Latinx adults have disproportionately increased levels of BMI compared to other ethnic/racial groups. Thus, depressive symptoms may be a significant risk factor to target in future health promotion programs designed for Latinx adults. Second, this study also highlights the connection between mental and physical health. Currently, mental well-being has not been associated with CVD. However, the current study suggests that depressive symptoms may be linked to CVD among Latinx adults through its association with BMI- a significant risk factor of CVD. Accompanied by further research, the results from the present study may help to inform holistic and integrative healthcare practices for CVD.

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