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Obesity-Related Dietary Patterns and Health Status of Diabetes among At-Risk Latino College Students

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Abstract

This study examined within-group differences in obesity-related dietary behaviors and the health status of 156 Latino students at-risk for diabetes due to family history. Approximately 58% of students were overweight/obese, with female students reporting a greater risk for diabetes. Consumption of meats, fried potatoes, breads, and tortillas was associated with higher BMI and diabetes risk indices. Differences in dietary behaviors were found based on students' college profile and sociodemographic characteristics. Implications for university-related intervention health initiatives are discussed.

Keywords

diabetes; dietary patterns; health status; Latino college students

An estimated 2.5 million Latino Americans are currently afflicted with type 2 diabetes, with dramatic increases in prediabetes and diagnosed diabetes occurring among adolescent and college-age individuals (Centers for Disease Control and Prevention [CDC], 2011a, Centers for Disease Control and Prevention [CDC], 2014a; U.S. Department of Health and Human Services [HHS], 2015). Dietary health-related factors associated with the obesity epidemic are primary reasons for the rising prevalence rates of type 2 diabetes among young Latinos (CDC, 2014a; Flegal, Carroll, Kit, & Ogden, 2012; Kposowa, 2013; Nelson, Gortmaker, Subramanian, Cheung, & Wechsler, 2007; Ogden, Carroll, Kit, & Flegal, 2014).

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The present study responds to the Latino diabetes youth health crisis by reporting on the obesity-related eating behaviors and health status of Latino college students who are at a heightened risk for onset diabetes due to family history of the disease. Understanding obesity-related eating habits of vulnerable minorities such as the Latino college student is greatly needed if we are to effectively tackle diabetes as a preventable disease threat in young adults (HHS, 2011). Because Latinos now comprise the largest ethnic minority group within our nation's university college population (Fry & Lopez, 2012; Page, 2014), Hispanic-serving institutions are contextually ideal for examining risky eating behaviors in Latino young adults, and for implementing targeted diabetes preventative health initiatives.

Obesity in College and Latino Students

The transition from adolescence to adulthood—a time typically associated with attending college—is recognized as a risky period for significant weight gain among young adults (Ferrara, 2009; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). In fact, epidemiological studies indicate that the greatest increases in weight and obesity are now observed in persons 18 to 29 years of age (Mokdad et al., 1999; Mokdad et al., 2001; Winkleby & Cubbin, 2004), and that the rates of type 2 diabetes and related health conditions have also increased in this age group (CDC, 2011; Mokdad, Marks, Stroup, & Gerberding, 2004; Morrell, Lofgren, Burke, & Reilly, 2012). Likewise, recent large-scale studies of university students indicate that an estimated 30% to 35% of students are overweight and/or obese (American College Health Association [ACHA], 2011; Huang et al., 2003; Lowry et al., 2000; Lowry, Galuska, Fulton, & Wechsler, 2002), with many at-risk for continued weight gain as they progress through three to four years of college (Gropper, Simmons, Connell, & Ulrich, 2012; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). The greatest increases in weight gain—approximately four pounds—occur during the freshman year (Lloyd-Richardson, Bailey, Fava, & Wing, 2009; Vella-Zarb & Elgar, 2009). Lastly, demographic characteristics associated with being overweight and/or obese in college include being male, single, and older, as well as being of low socioeconomic status and living off-campus (Braithwaite, Delevi, & Fincham, 2010; Brunt & Rhee, 2008; Nelson et al., 2007).

Surprisingly, only one large scale study (comprised of a nationally representative sample of 4-year universities) was found examining ethnic/racial differences in college students' weight status that included Latinos (Nelson et al., 2007). In line with current epidemiological findings of Latino obesity among young adults (Garcia et al., 2012; Ogden et al., 2014), this study found a high incidence rate of obesity in Latino university students (41% were identified as overweight and/or obese) who were also more likely, as a group, to be overweight when compared to White students. Results from the few small-scale university studies conducted to date that included Latino samples also indicate that a sizeable percentage of these students were overweight and/or obese (BMI scores across studies ranged from 32% to 58%), with percentages mirroring or greatly exceeding those reported for the larger US college population (Freedman, 2010; Hu, Taylor, Blow, & Cooper, 2011; Hurtado-Ortiz, Santos, & Reina, 2011). Finally, the study by Hurtado-Ortiz, Santos, and Reina (2011) found that acculturative forces can impact students' health status, with more assimilated Latino students reporting higher BMI indices and a less healthy weight

status—a finding this is consistent with those observed in the general Latino population (Garcia et al., 2012).

Obesity-Related Behaviors in College Students

Heightened stress levels and sleep disturbances, accompanied by poor dietary practices, increased caloric intake, and physical inactivity are often cited as primary culprits for weight gain and diminished health among university students (Ferrara, 2009; Nelson et al., 2008; Patel & Hu, 2008; Serlachius, Hamer, & Wardle, 2007). Specifically, in terms of eating patterns, “all-you-can-eat” dining halls, meal frequency, skipping meals, evening snacking, and consumption of high-fat junk foods are all implicated in weight gain during the first year of college (DeBate, Topping, & Sargent, 2000; Freedman, 2010; Levitsky, Halbmaier, & Mrdjenovic, 2004; Poddar et al., 2009). Furthermore, counter to all dietary recommendations (Adams & Colner, 2008; Thompson & Veneman, 2005), the average college student “typically consumes a diet lacking in fruits, vegetables, and dairy products and high in fat, sodium and sugar” (Brunt et al., 2008, p. 629). Most alarming is the reportedly substantial consumption of sugar-sweetened beverages and fast-food high in fat among college students (Bleich, Wang, Wang, & Gortmaker, 2009; Heidal et al., 2012; Huffman & West, 2007; O’Leary, Hattersley, King, & Allman-Farinelli, 2012; Racette et al., 2005), which are two dietary practices linked to longterm weight gain and a heighted risk for metabolic syndrome, insulin resistance, and type 2 diabetes (Heidal et al., 2012; Hu & Malik, 2010).

Accordingly, sociodemographic and university-related variables have been found to influence eating patterns among students. Previous studies report that college women are more likely to choose foods low in fat, to avoid meats, and to consume less fast-food and sugar-sweetened beverages than male college students (Boek, Bianco-Simeral, Chan, & Goto, 2012; Huffman & West, 2007; Levi, Chan, & Pence, 2006; Mooney & Walbourn, 2001; Poddar et al., 2009; West et al., 2006). Younger-aged undergraduates, when compared to older students, consume more sugar-sweetened beverages (Huffman & West, 2007; West et al., 2006). Furthermore, students with higher incomes report healthier eating patterns in terms of consuming more fruits and vegetables and fewer sweets, fast-food meals, and high-sugar soft drinks (Knight, Killion, & Knight, 2014). In terms of university characteristics, studies indicate that students who live with their parents have healthier eating habits than those living on-campus (Freedman, 2010), and commuter students who pack lunches consumed less on-campus fast-food (Jackson, Berry, & Kennedy, 2009). Likewise, students who live off-campus (not with parents) report consuming a less varied diet of fruits, vegetables, and dairy compared to students residing on-campus (Brunt & Rhee, 2008). Lastly, greater fruit and vegetable consumption is linked to being a full-time student, not single and/or in a committed relationship, and living in a residential hall (Adam & Colner, 2008).

Obesity-Related Behaviors among Latino College Students

The limited research conducted on Latino students suggests that they too tend to make poor dietary choices. For instance, Latino students consume fewer fruits and vegetables than recommended (Evans, Sawyer-Morse, & Betsinger, 2000; Hu, Taylor, Blow, & Cooper,

2011), comparatively less than their White peers, and are more likely to skip meals and consume more fast-food than other ethnic students (Freedman, 2010; Knight et al., 2014). Furthermore, a recent study by Hurtado-Ortiz et al. (2011) examining within-group differences in Latino students' health behaviors found less healthy eating patterns among: 1) Latino men who made fewer efforts to include fruits/vegetables and fiber in their diet, and to minimize animal fats/oils and refined flours; 2) younger-aged Latinos who reported more frequent fast-food consumption and meal-skipping, but were less likely to consume fruits/vegetables and avoid presweetened foods and adding sugar to foods; and 3) third generation plus Latinos who were also less likely to avoid sugars. Although the later study added important new findings to the literature concerning obesity-related eating habits of Latino college students, results for dietary fat, fruit and vegetable intake, and sugar consumption were based on a single item from a brief lifestyle nutrition questionnaire, which arguably provided a somewhat inadequate assessment of actual dietary variety and consumption of the aforementioned foods (Brunt et al., 2008). The present study will attempt to address this limitation.

Purpose of Study

As noted previously, there is scarcity of research regarding the dietary habits of the Latino college student. Because the numbers of type 2 diabetes linked to weight gain and obesity have increased among college-age Latinos, research examining the eating behaviors of university students identified to be at high risk for diabetes, but for whom this disease may still be delayed or prevented, seems especially warranted (Arcury, Skelly, Gesier, & Dougherty, 2004; Hurtado-Ortiz et al., 2011). Hence, one of the primary purposes of this investigation was to provide a more comprehensive examination of obesity-related eating patterns for Latino students, and of the relationship of such eating habits to students' overall health status in terms of BMI, weight status, and Diabetes Risk index. We note that most studies of Latino college students typically only use BMI scores as a health indicator; therefore, this study adds to the literature by also including an index of diabetes risk. In terms of eating habits, we focused on students' dietary fat-related behaviors (i.e. consumption of meats, milk, refined grains, beans, fried foods, cooking fat modifications, and low-fat substitutions) and consumption of fast-food, fruits and vegetables, sugary junk foods high in fat, and sugar-sweetened beverages. Secondly, because demographic and university student variables have both been found to influence eating habits, a second aim of this study was to identify differences among Latino students in obesity-related eating behaviors based on sociocultural background characteristics (age, gender, income, and generational status in the United States) and college student profile (marital status, work status, enrollment status, living arrangement, and class ranking) (Braithwaite et al., 2010; Brunt & Rhee, 2008; Brunt et al., 2008; Hurtado-Ortiz et al., 2011; Knight et al., 2014; Nelson et al., 2007). To our knowledge, no other study has examined obesity–related eating habits and the health status of Latino college students who are at-risk for diabetes that simultaneously considers both sociocultural and college variables in the same analysis. This study will attempt to address this void in the literature.

Methods

Participants

Sociodemographic data was collected from 156 Latino, undergraduate college students (34% male and 66% female) from a Hispanic-serving state university located in Southern California, with participants ranging in age from 18 to 60 years of age (M = 23.3 years, SD = 6.78). The age and gender composition of the sample mirrored that of the Latino students at this university. Participants who had blood relatives afflicted with type 2 diabetes were considered to be at-risk for future diabetes acquisition due to familial genetic predisposition. Approximately 42% of the participants reported having a parent with diabetes, 14.1% a sibling with diabetes, and the remaining a grandparent or aunt/uncle afflicted with this disease. The ethnic distribution of the sample was as follows: 50.4% Mexican, 22.3% Latino, 21.1% Hispanic, and 6.2% Central American. In addition, 65% of the sample indicated that they were second generation Latinos in the United States, and 21% stated that they were first generation. The median family income of participants ranged from US $25,001 to $35,000.

A student profile of the sample based on university characteristics was compiled. In terms of class standing, 17.9% of participants were freshmen, 16.0% sophomores, 33.3% juniors, 27.6% seniors, and 5.1% post-baccalaureates/graduates. Furthermore, 91.7% of sample participants were enrolled in college full-time while only 8.3% attended part-time. A large number of students (62%) stating they lived with parents while in college. The majority of students were single (83.9%), with 14.8% reporting being married or co-habitating, and 1.2% separated or divorced. Lastly, 55.7% of students worked part-time, 15.4% full-time, and 28.9% were not employed.

A health status profile was also collected for the sample. In order to assess whether participants were underweight, normal weight, or obese, BMI scores were calculated. The mean BMI score for the total sample is considered overweight (M = 26.7), with 57.7% of the sample classified as overweight and/or obese, and 56.3% of Latinas and 60.3% of Latinos falling under this classification. A lower percentage of the sample (38.5%) was classified to be at a healthy weight. In addition, to determine future risk for diabetes acquisition, the “Type 2 Diabetes Risk Test” was used (American Diabetes Association, n.d.). This test identifies individuals who are at a low, moderate, or high risk for diabetes. Of the total sample, 30.7% were “low risk,” 44% were “low to moderate risk,” and 25.3% were at “high risk.”

Measures

Sociodemographic and health profile—Participants answered a demographic questionnaire pertaining to their personal background and college student profile (e.g., age, gender, ethnicity, income, generational status, class standing, etc.). Further, a brief health profile questionnaire was administered which allowed computation of participants’ BMI, weight status, and Diabetes Risk Score as measured by American Diabetes Association (n.d.). The latter two measures were used as objective indicators of participants’ health status.

Fat-related habits questionnaire—A modified version of the Fat-Related Habits Questionnaire (Kristal, Shattuck, & Patterson, 1999) was used. This is a two-part, 25 item questionnaire answered on a 5-point rating scale ranging from "*Almost Never (≤ 10%)*" to "*Almost Always (≥ 90%)*," which has been used previously as a fat intake screener with Latino community samples (e.g. Block, Gillespie, Rosenbaum, & Jenson, 2000). Part one assessed participants' eating habits of meat, grains (bread and tortillas), milk, and beans. The second evaluated participants' adherence to a low-fat diet, which provides a total scale score and five subscale scores: 1) Avoid fried foods (e.g., chicken fried or cooked with lard/oil), 2) Avoid adding fat as a flavoring (e.g., add butter, margarine or other fats to potatoes), 3) Modify Foods to be Low in Fat (e.g., choose low-fat milk products), 4) Substitute for low-fat alternatives (e.g., choose low-fat items from sit down or fast-food restaurants), and 5) Eat fruits (e.g., choose fresh fruit as a snack between meals and after dinner).

Fruits and vegetables—Five items were used based on the California Health Interview Survey (CHIS, 2006) Adolescent Questionnaire and the Youth Risk Behavior Surveillance Survey (Eaton et al., 2010) to assess daily intake of fruits and vegetables. Sample items included: During the past week how many servings/or times did you "drink 100% fruit juice?" or "have a green salad?"b The CDC (2014b) recommends about five servings of fruits and vegetables per day to help maintain a healthy dietary lifestyle and reduce the risk of chronic conditions.

Sugar intake—Five items based on the CHIS Adolescent Questionnaire (2006) and the Youth Risk Behavior Surveillance Survey (Eaton et al., 2010) were used to create a total daily sugar intake score. In addition, two subscales were calculated, one which tapped into daily intake of liquid sugars or sugar-sweetened beverages such as sodas, fruit flavored drinks, and blended coffees, and the second which assessed the consumption of high-fat and high-sugar junk foods such as candy bars, ice cream, cakes, and cookies. According to the American Heart Association (2014), women should limit their total daily consumption of added sugars (liquid sweetened beverages and high sugar solid foods such as cookies and desserts) to approximately 100 calories, and men to 150 calories. No more than 450 calories of liquid sugar should be consumed per week (equivalent to 64 daily calories) to avoid weight gain and/or obesity. Earlier reported national health guidelines recommend two or less total servings per day of foods deemed high in fat (e.g., french fries, hot dogs, etc.), which include those high in both fat and sugar (e.g., cakes, donuts, cookies, pies, etc.) (American Cancer Society, 1990; Lowry et al., 2000).

Fast-food consumption—Participants' frequency of fast-food intake on weekdays and on weekends at mainstream (e.g., McDonald's) and ethnic specific (e.g., tacos) eateries was measured using six items (Lowry et al., 2000). A sample item used is: "How many times during the school week (Monday-Friday) do you typically get something to eat at McDonald's, Burger King, Domino's, Pizza Hut, or other fast-food carry out or drive-thru restaurants?" The recommended frequency of fast-food dining is less than two times per week [National Institutes of Health (NIH), HHS, 2004].

Procedure

After participants were recruited, they were screened by phone to ensure that they had a first and/or second degree relative afflicted with type 2 diabetes, which was the criterion for inclusion in the study. Participants were then scheduled for a 45-minute appointment to complete a paper and pencil health dietary habits questionnaire. Participants were paid US $15 for participating in the study. Ethical guidelines stipulated by the American Psychological Association (2010) were followed by the researchers. In addition, informed consent was obtained for all participants, and payment and debriefing was given at the end of the study. As part of the debriefing procedure, participants previewed a brief NIH diabetes film and were given educational brochures about the causes of diabetes and lifestyle changes that can be adopted to delay and/or prevent this disease.

Results

Overview of Data Analyses

Descriptive analyses were first performed on the obesity-related dietary variables examined in this study.[1] ANOVA and t-test procedures were then conducted to assess group differences on the three health indicators—BMI score, weight status (WS), and diabetes risk score (DRS)—and on the obesity-related eating variables based on Latinos' sociocultural background (age, gender, generational status, and income) and college student profile (marital status, work status, college class standing, enrolled part-time/full-time, and residence status). Third, bivariate correlation analyses were executed to determine the relationship between health status indicators and specific obesity-related eating behaviors. Fourth, bivariate analyses among key obesity-related dietary variables were performed in order to identify high risk eating patterns among Latino students.

Descriptive Analyses

An overview of Table 1 indicates that, on average, sample participants reported they often or very often—approximately 50% to 75% or more of the time—consumed meats, milk, beans and refined grains/flours in the form of breads and tortillas and that in general they attempted to follow a low-fat diet (indicated by means approximating 3 to 4 on the Eating Habits Questionnaire subscales and on the Low-Fat Diet Questionnaire and subscales). Furthermore, we note that total daily consumption of fruits and vegetables for the sample averaged only 2.12 servings, which is considered far below the recommended national dietary guideline (ACHA, 2011) of five or more servings per day. Students on average consumed about one daily serving of 100% juice and one serving of vegetables. Furthermore, the average consumption of total sugars was high, with students reporting approximately one serving of liquid sugars (e.g., sodas, sweetened beverages, and coffee drinks) plus one serving of high-sugar high fat junk foods (e.g., cookies, pastries, chocolate bars, ice cream, or frozen desserts) on a daily basis. Lastly, during the course of a typical

[1]To minimize threats to statistical validity, participants identified via SPSS as having an "extreme outlier" response on items related to the daily/weekly consumption of fruits, vegetables, liquid and solid sugars were not included in those specific statistical analyses. It is believed these extreme outlier responses reflected instrumental error.

seven-day week, students reported eating fast-foods 43% of the time (or about three days a week).

Analyses of Health Indicators by Sociodemographic and College Profile Variables

In regard to the health indicators—BMI, WS, and DRS—women reported a higher DRS than men with no others differences observed based on age group, generational status (as reported in Hurtado-Ortiz et al., 2011) or by participants' household income. Likewise, ANOVA and t-test analyses performed on participants' BMI scores, WS, and DRS by the college profile variables showed no differences between groups in terms of students' marital status (single or married/cohabitating), work status (not employed, part-time, full-time), college enrollment status (part-time or full-time), residence status (live with parents or dorm/rent), and class standing (freshman, sophomore, junior, senior and post-baccalaureate).

Analyses of Obesity-Related Dietary Variables by Sociodemographic Variables

The results of the t-test and ANOVA analyses conducted on dietary variables by gender, age group, generational status, and income are presented in Table 2.

Gender—The t-test analyses revealed that women were more likely to adhere to a low-fat diet when compared to their male counterparts. Specifically, Latina women reported avoiding fried foods (i.e., beef, chicken, and fish) more frequently than men did, and were also more likely to modify meats to be low in fat, and to substitute for low-fat alternatives (i.e., low-fat milk products, low-fat items at sit-down restaurants). Although the genders did not differ in their total consumption of fruits and vegetables, women reported a greater daily consumption of vegetables compared to men, whereas men had a higher daily consumption of fruit juice. Finally, college men consumed more beans and refined grains/flours in the form of breads and tortillas than women did.

Age groups—The ANOVA results indicated that older college students (36 years and over) were more likely to choose low-fat alternatives than younger-aged students (18 to 24 year olds) were. Conversely, younger-aged students reported more frequent consumption of meats and fast-foods than their older counterparts (35 year and over) did. Finally, younger college students (18–24 years and 25–35 years) also had a higher total daily consumption of sugars compared to older-aged students; more specifically, this came in the form of daily intake of liquid sugar (i.e., sodas, sugar-sweetened beverages and coffee drinks).

Income—College students with household incomes of $25,000 or less reported a lower daily consumption of fruits and vegetables compared to those earning $55,001 or greater. More explicitly, household incomes of $55,001 or greater consumed more vegetables daily than did household with earnings of $25,000 or less.

Generational status—Immigrant college students were more likely to avoid adding fat as a flavoring (butter to bread and potatoes) when compared to third generation and plus Latino students. Although no differences were found in terms of total daily intake of fruits and vegetables, immigrant and second generation Latinos reported a lower consumption of

vegetables than third generation Latinos did. Finally, immigrant students reported a less frequent consumption of milk, as well as meats, when compared to the later generations.

Analyses of Obesity-Related Dietary Patterns by College Student Profile

Presented in Table 3 are the findings of the t-test and ANOVA analyses conducted on dietary variables by marital status, enrollment status, work status, residence status, and class standing.

Marital status—The t-test results revealed that married/cohabitating college students were more likely to follow a low-fat diet, to modify meats to be low in fat, and to choose low-fat substitutes when compared to single college students. Conversely, students who were single reported a higher daily consumption of total sugars; more specifically, single students drank more liquid sugar (i.e. sodas and high-caloric sweetened beverages) and consumed more fast-food on a weekly basis than married/cohabitating students did.

Enrollment status and work status—Results of the t-test analyses showed that students who attended college part-time were more likely to avoid fried foods than students enrolled full-time. Furthermore, ANOVA results indicated that students who worked full-time reported a lower daily consumption of fruits and vegetables compared to students who were working part-time or not employed. Likewise, students who worked while in college (full-time and part-time) reported a more frequent consumption of breads and tortillas (refined grains/flours) than students who were not employed.

College class ranking and residence status—College freshmen were less likely to substitute for low-fat alternatives when compared to senior and post-baccalaureates students. Likewise, juniors were less likely to substitute for low-fat alternatives when compared to post-baccalaureate. Finally, no differences were observed on the obesity-related variables between students who lived with parents, on-campus or off-campus.

Correlations of BMI scores, WS, and DRS with Dietary Habits

Pearson moment bivariate correlations were performed between participants' BMI score, WS, and DRS with the dietary total scale scores, subscale scores, and individual items. The results showed that frequent consumption of meats–BMI, $r(155) = .146$, $p = .069$; WS, $r(156) = .153$, $p = .057$; DRS, $r(151) = .223$, $p < .007$–and specifically chicken–BMI, $r(155) = .217$, $p < .008$; WS, $r(156) = .206$, $p < .02$; DRS, $r(151) = .267$, $p < .002$–was associated with having a higher BMI score, WS, and DRS among Latino college students. Likewise, a high consumption of breads and tortillas–BMI, r(153) = .232, p < .005; WS, r(154) = .249, p < .003; DRS, r(149) = .181, p < .03–and fried (not avoided) potatoes–BMI, r(153) = −.204, p < .02; WS, r(154) = −.267, p < .002; DRS, r(149) = −.280, p < .002–was related to having poorer health. Furthermore, avoiding fried foods in general, $r(151) = -.146$, $p = .073$, was associated with having a lower WS. Interestingly, the consumption of beans correlated positively with BMI scores, $r(154) = .144$, $p = .074$, and WS, $r(155) = .162$, $p < .05$; however, we note that the consumption of beans correlated negatively with avoiding cooking beans in oil/lard, $r(154) = -.279$, $p < .001$, and when participants did avoid fried beans, it was related to having a lower WS, $r(155) = -.150$, $p = .063$. Likewise, consuming fruits

mixed with other foods (cereal or yogurt) was associated with having a higher BMI, $r(152) = .226$, $p < .006$, and WS, $r(153) = .184$, $p < .03$; however, fruit eaten in this manner was also positively associated with a higher daily consumption of high-fat, sugary junk foods, $r(150) = .238$, $p < .004$, and total sugars overall among participants, $r(142) = .169$, $p < .05$, which may explain this seemingly incongruent association.

Pertaining solely to DRS, we found that adhering to a low-fat diet [$r(139) = -.150$, $p = .078$] and avoiding adding fat as a flavoring [$r(147) = -.284$, $p < .001$] was associated with having a lower risk score for future diabetes onset. Furthermore, daily consumption of 100% juice [$r(142) = -.150$, $p = .075$] and eating fresh fruit as a snack in between meals or after dinner [$r(151) = -.246$, $p < .003$] was also associated with a lower DRS. Finally, a higher DRS was positively associated with more frequent fast-food consumption [$r(150) = .191$, $p < .02$] (as reported in Hurtado-Ortiz et al., 2011). We note that the consumption of fruits in either juice or solid form was not associated with a greater consumption of sugar intake (total daily sugars: $p > .05$) in participants, as was fruits mixed with other foods. This points to the importance of eating fruits by themselves and not added as a condiment to other foods, as well as consuming 100% fruit juices with no added sugars in order to obtain a health benefit.

Correlations between Consuming Meats, a Low-Fat Diet, and Fast-Foods with Other Dietary Habits

Frequent consumption of meats was positively associated with eating more breads/tortillas [$r(154) = .214$, $p < .009$], drinking milk [$r(155) = .145$, $p = .072$], a higher daily intake of total sugars [$r(143) = .268$, $p < .002$], and weekly fast-food consumption [$r(155) = .286$, $p < .001$]. Conversely, frequent eating of meats was negatively associated with adhering to low-fat diet [$r(143) = -.316$, $p < .001$].

Adherence to a low-fat habit diet was positively associated with a higher daily intake of fruits and vegetables [$r(131) = .275$, $p < .002$], less frequent consumption of breads/tortillas [$r(143) = -.291$, $p < .001$], less fast-foods [$r(142) = -.435$, $p < .001$], less total sugars [$r(131) = -.357$, $p < .001$] in solid junk foods [$r(139) = -.257$, $p < .003$], and liquid sugar-sweetened beverages [$r(133) = -.296$, $p < .002$].

Lastly, weekly fast-food consumption correlated negatively with all four subscales of the Fat Habit Questionnaire: avoiding fried foods such as fried chicken, beef, fish, potatoes, tortillas, and beans [$r(150) = -.391$, $p < .01$], modifying meats to be low in fat [$r(154) = -.192$, $p < .02$], avoiding fat as a flavoring [$r(150) = -.284$, $p < .001$], substituting for low-fat alternatives [$r(151) = -.254$, $p < .003$], and eating fruits as a snack in between meals or after dinner [$r(155) = -.230$, $p < .005$]. Conversely, frequent fast-food consumption was positively associated with a higher total daily intake of sugars [$r(143) = .454$, $p < .001$], in both liquid form such as sodas and other sugar-sweetened beverages [$r(145) = .382$, $p < .001$], and solid junk foods such as cookies, chocolate bars, doughnuts, ice cream or frozen desserts [$r(151) = .331$, $p < .001$].

Discussion

This study is the first to simultaneously examine the influences of sociocultural and university-related factors on eating behaviors, dietary patterns, and health status indicators of Latino college students who are at a heightened risk for future diabetes onset. The general picture to emerge from this study is that counter to all dietary recommendations (ACHA, 2011), Latino college students in our sample follow an unhealthy diet comprised of few fruits and vegetables, excessive fast-food consumption, as well as a high ingestion of sugar-sweetened beverages, high-sugar fatty junk foods, refined flours (such as breads/tortillas) and meats. These findings mirror those reported in other studies of university students (Adam & Colner, 2008; Block, Gillman, Linakis, & Goldman, 2013; Byrd-Bredbenner et al., 2012; Cohen, Sturn, Scott, Farley, & Bluthenthal, 2010; Evan et al., 2000; Hu et al., 2011; Larson et al., 2008). The above mentioned dietary behaviors are generally linked to excess weight gain and increased risk for diabetes in young adults and college students (Heidal et al., 2012; Huffman & West, 2007; O'Leary et al., 2012; Racette et al., 2005).

More specifically, in reference to students' health status we found that a large percentage (57.7%) of Latinos in our study were indeed overweight and/or obese, exceeding the numbers observed in national studies of US Latino adults and university samples (ACHA, 2011; Huang et al., 2003; Lowry et al., 2000; Lowry et al., 2002; Nelson et al., 2007). Further, we note that Latina participants were at a greater risk for developing diabetes than Latino males, as indicated by their higher DRS (as reported previously by Hurtado-Ortiz et al., 2011), being the only within-group difference observed in regards to the three health indicators (BMI, WS, and DRS). Unlike prior research based on predominately White university students, we did not find an unhealthy weight status (BMI scores and WS) to be greater among Latino students who were older, male, of a lower income, single, and living off campus (but not with parents), suggesting that our sample was relatively homogenous across sociodemographic and college characteristics (Braithwaite et al., 2010; Brunt et al., 2008; Nelson et al., 2007). In sum, the findings generally pointed to a poor health status (as indicated by BMI scores and DRS) among Latino college students, regardless of their sociodemographic profile or college-related factors.

Previous researchers have attempted to identity which specific foods or eating behaviors contribute to a poor health status among college students (Brunt et al., 2008; Poddar et al., 2009). Our findings suggest that a diet that included a high intake of meats (especially poultry), or a regular consumption of fried potatoes and fried beans, as well as breads and tortillas, was linked to having a poorer health status—based on BMI scores, WS, and DRS—among Latino college students. Moreover, a diet generally high in fat, as well as frequent fast-food consumption, (Hurtado-Ortiz et al., 2011) contributed to an increased risk for diabetes among sample participants, a result consistent with findings on food habits in other studies associated with obesity (Brunt et al., 2008; Knight et al., 2014; Poddar et al., 2009). Conversely, students who generally adhered to a low-fat diet that included fruits, specifically 100% fruit juice and fruits as snacks (between meals and after dinner), were at a lower risk for developing diabetes. This finding underscores the importance for students at-risk for developing diabetes to increase their daily intake of fresh fruits while lowering their overall

consumption of fatty foods (Carter, Gray, Troughton, Khunti & Davies, 2010), as well as breads/tortillas made with refined flours which have a low nutritional value.

In addition, within-group differences based on Latino students' sociodemographic characteristics were analyzed in regards to their dietary choices. Consistent with prior research, we found that women were more likely to adhere to a low-fat diet and to consume more vegetables than men were (Boek et al., 2012; Hurtado et al., 2011), yet Latino males daily intake of fruit juice was higher. Furthermore, similar to studies of White students, we found that younger-aged Latino college students exhibited poorer dietary behaviors in regards to drinking more high-caloric, sugar-sweetened beverages and were less likely to include low-fat alternatives in their diet compared to older-aged Latino students (CDC, 2014a; Wang, Bleich, & Gortmaker, 2008). Likewise, as reported in another study with Latino students (Knight et al., 2014), we also found that lower-income students consumed less fruits and vegetables, a difference we believe can be attributed in part to the higher cost of such foods (i.e., salad and fruit bars) when sold on college campuses. Lastly, generational status in the US was also an important factor influencing dietary choices in students, with immigrant Latinos being less likely to add fat such as butter to foods for flavor, and to report a lower consumption of milk and meats in their diet when compared to later generations. These findings are similar to other studies that also reported generational differences among Mexican-Americans (Hurtado-Ortiz et al., 2011; Neuhouser, Thompson, Coronado, & Solomon, 2004).

Similarly, examination of within-group variations based on participants' college profile also revealed important group differences in terms of healthy and unhealthy eating behaviors among Latinos. Students who were single, when compared to married/cohabitating Latinos, were less likely to follow a low-fat diet by modifying meats to be less fatty or choosing low-fat alternatives as part of their diet. This finding is consistent with previous research indicating that married persons tend to consume more nutritious meals (Braithwaite et al., 2010; Koball, Moiduddin, Henderson, Goesling, & Besculides, 2010). Upperclassmen were also found to be more likely to choose low-fat alternatives when making dietary choices than Latino freshmen and juniors were. This finding is similar to earlier research that points to poorer dietary behaviors, such as a higher consumption of junk foods and sugar-sweetened beverages, among lower-ranking students (Huffman & West, 2007; Levitsky et al., 2004). A plausible explanation is that upper-ranking and married/cohabitating students are more likely older, with greater life-related health experiences and education (i.e., completed a general studies health course), which enabled them to make healthier dietary choices when compared to lower classmen and single students. Furthermore, we found that students who were employed or enrolled in college full-time engaged in poorer dietary behaviors, such as consuming more fried foods, breads and tortillas, and eating fewer fruits and vegetables, supporting the link reported in the literature between hours worked weekly and less healthy eating among young adults (Escoto, Laska, Larson, Neumark-Sztainer, & Hannan, 2012). It is clear that students who are employed or enrolled in college full-time have less time to prepare nutritious meals; yet, they are constantly surrounded by unhealthy, yet economical "grab and go" fast-food options that are high in fat and sugars (Larson et al., 2006; Pelletier & Laska, 2013; Rydell et al., 2008).

Accordingly, the literature indicates that negative obesity-related dietary behaviors tend to cluster together to form poor eating patterns in college students (Nelson et al., 2008; Reyes-Velázquez, & Hoffman, 2011). Unfortunately, frequent fast-food consumption is a common practice among young adults (Heidal et al., 2012; Racette et al., 2005), which was also linked to other unhealthy dietary choices, such as drinking high caloric sugar-sweetened beverages and eating sugary, fatty snacks and desserts (junk foods) in our student sample. Such foods are typically packaged together as a "combo meal," with their regular consumption leading to significant longterm weight gain in persons and increased risk for diabetes and other chronic diseases (Hu & Malik, 2010). Likewise, eating fast-foods was also associated with other poor dietary behaviors, such as a higher ingestion of meats, breads, tortillas, fried foods, and added fats for flavor (such as butter), but fewer fruits as a nutritious snack. Indeed, earlier research with community Latino samples and White students also report that a diet high in fat tends to be associated with eating less fruits and vegetables (Larson et al., 2008; Neuhouser et al., 2004). Hence, Latino students in our study who engaged in one poor eating behavior, such as regularly eating fast-foods, were also more likely to be making other unhealthy dietary choices, thereby increasing their overall accumulated risk for becoming obese (Chen, Pegram, Adcock, & Johnson, 2014; Hendricks, Herbold & Fung, 2004; Jackson et al., 2009).

Arguably, the risky eating patterns observed among Latino college students points to the intersection between American and Latino acculturative forces. For example, the diet of Latino students in our study included frequent consumption of fried beans and fried potatoes, as well as breads and tortillas. Fried potatoes are a very common side dish in most American meals at fast-food establishments and sit down restaurants, as including fried beans as a side dish is in Latino cooking. Likewise, bread is a common compliment in American meals as tortillas are in Mexican dishes. Indeed, we found that consuming fried beans was associated with eating more tortillas among Latino students, which is said to reflect the "traditional Mexican diet" by Carrera Gao, and Tucker (2007). Furthermore, other more Americanized dietary habits observed in Latino students, such as adding butter to foods for flavor and consuming few fruits and vegetables, are contrary to the traditional Latino diet (Neuhouser et al., 2004). Unfortunately, the incorporation of more Americanized unhealthy eating behaviors coupled with common, poor Latino dietary practices (i.e. cooking beans in lard/oil and a high consumption of tortillas) explains in part why a large percentage of this student sample was overweight and/or obese (Neuhouser et al., 2004; Perez-Escamilla & Putnik, 2007).

Accordingly, it is apparent that Latino students' unhealthy diet is only exacerbated by the highly accessible, low cost fast-foods present within and outside the university context relative to healthy food options (Jackson et al., 2009). Hence, it is of paramount importance "that university food services" take a more active role in offering healthier and more affordable "taste satisfying food choices… on campus [that] promote healthy eating behaviors" among students (Jackson et al., 2009, paragraph 30). This is especially relevant in the case of Latino students who tend to report greater levels of psychological distress when compared to White peers in juggling academic demands with work and familial obligations (Rowland, 2008). As noted in a recent qualitative study conducted by LaCaille, Dauner, Krambeer, and Pedersen (2011), college students state that the high cost of healthy

foods, coupled with limited nutritious options and meal-time preparation, all contribute to their current unhealthy eating patterns.

Limitations and Conclusions

A limitation of the present study, albeit always a concern with retrospective self-report data, is that participants' memories of their eating behaviors could have been biased or inaccurate. Secondly, we note the possibility of a Type I error occurring given the number of statistical analyses performed (t-tests, ANOVAs, and bivariate correlations). Furthermore, the findings are based on a single-sample of Latino students recruited from one university. Although the study site is designated as a Hispanic-serving, four-year institution, it is also a commuter campus with limited on-campus apartment housing available, and with most students driving to the university to attend classes and participate in activities. Hence, the results may have differed if sample participants were recruited from a more traditional, larger university site or a smaller institution. This sampling weakness speaks to issues related to external validity and the importance of replicating this work using a multisite design that encompasses a larger cross-section of Latino college students. Notwithstanding this single-sample, single-institution limitation, it is argued that given the scarcity of research on obesity, diabetes, and Latino college students, the results afford an important and relevant contribution to our understanding of health-related life experiences of Latino students from a moderate-sized, Hispanic-serving institution situated in a large metropolitan area in Southern California. Finally, the above sampling concern is further mitigated by the fact that the reported findings were largely in line with former studies of ethnic-others as well as Latino college students, which increases our confidence in the validity and generalizability of the results.

To conclude, the typical Latino student in this study consumed a diet detrimental to longterm health and linked to obesity in young adults (Heidal et al., 2012; Huffman & West, 2007; O'Leary et al., 2012; Racette et al., 2005). Likewise, the negative obesity-related dietary behaviors observed in Latino students tended to cluster together to form an overall unhealthy lifestyle eating pattern. These findings are particularly troubling considering that the Latinos in this study were identified as having a familial genetic predisposition for type 2 diabetes, yet approximately 58% were overweight/or obese, further augmenting their risk for early onset of this disease. Although past research has signaled emerging adulthood as a time marked by "adverse changes in diet… and weight," it is also a critical period for disease prevention where lasting healthy dietary patterns can be learned and established (Nelson et al., 2008, p. 2205). Hence, in line with goals set forth by Healthy People 2020, Hispanic-serving institutions can play a pivotal role in addressing ethnic health disparities by serving as agents of change during this critical developmental stage through campus health initiatives that promote healthy lifestyle changes among young Latinos, which can lead to longterm positive health outcomes in preventing chronic diseases such as type 2 diabetes (HHS, 2011).

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Table 1

Descriptive Statistics on Dietary Variables

Variables	Mean	Min	Max	SD
Eating Habits Questionnaire				
Meat subscale	3.02	1.00	5.00	0.87
Refined flour (bread & tortillas) subscale	3.07	1.00	5.00	0.95
Milk	3.66	1.00	5.00	1.30
Beans	3.52	1.00	5.00	1.23
Low-Fat Diet Questionnaire	3.47	1.81	4.69	0.64
Avoid fried food subscale	3.91	1.33	5.00	0.76
Avoid adding fat as flavoring subscale	3.76	1.00	5.00	1.16
Modify meat to be low in fat subscale	3.52	1.00	5.00	1.29
Substitute for low-fat foods subscale	2.80	1.00	5.00	0.96
Eat fresh fruit as snack or in-between meals	2.98	1.00	5.00	1.24
Total daily fruit and vegetables	2.12	.00	5.57	1.19
Daily 100% fruit juice subscale	0.66	.00	3.43	0.61
Daily vegetable subscale	0.83	.00	3.00	0.63
Total daily sugar consumption	1.62	.00	5.43	0.99
Daily liquid sugar subscale	0.91	.00	3.43	0.68
Daily solid sugar subscale (junk foods)	0.72	.00	3.57	0.59
Weekly fast-food consumption	3.26	.00	10.00	2.10

Table 2

Mean Differences on Dietary Variables by Gender, Age Group, Generational Status and Income

Dietary Variables	Demographics	Variable Levels			Statistical Test
	Gender	Male		Female	
Avoid fried food		3.73		4.00	$t(149) = 2.09$, $p = .038$
Sub. low-fat		2.57		2.91	$t(150) = 2.09$, $p = .038$
Breads/tortillas		3.34		2.94	$t(152) = -2.49$, $p = .008$
Beans		3.79		3.39	$t(153) = -1.93$, $p = .055$
Daily vegetables		0.70		0.90	$t(148) = 1.81$, $p = .072$
Daily fruit juice		0.96		0.50	$t(145) = -4.74$, $p = .001$
	Age	18–24	25–35	36 +	
Meats		3.06	3.11	2.36	$F(2,153) = 3.49$, $p = .033$
Sub. low-fat		2.70	3.00	3.40	$F(2,149) = 3.20$, $p = .043$
Weekly fast-food		3.47	2.79	2.18	$F(2,152) = 2.84$, $p = .062$
Total sugar intake		1.71	1.47	0.10	$F(2,140) = 3.00$, $p = .053$
	Generation	1st	2nd	3rd	
Avoid adding fat		4.03	3.77	3.28	$F(2,146) = 2.67$, $p = .073$
Vegetables		0.73	0.80	1.17	$F(2,145) = 3.57$, $p = .031$
Milk		3.26	3.82	3.48	$F(2,150) = 2.51$, $p = .085$
Meats		2.63	3.10	3.15	$F(2,151) = 4.03$, $p = .020$
	Income	<$25 K	$25 – 55K	$55 K +	
Daily F/V		2.01	1.97	2.60	$F(2,130) = 2.93$, $p = .057$
Daily vegetables		0.71	0.86	1.11	$F(2,139) = 4.25$, $p = .016$

Note. Avoid add fat = avoid adding fat as a flavoring; F/V = daily total fruits and vegetables; Sub. low-fat = substitute for low-fat foods.

Table 3

Mean Differences on Dietary Variables by Marital Status, College Enrollment, Work Status, and Class Ranking

Dietary Variables	Demographics	Variable Levels					Statistical Test
	Marital Status	**Single**		**Married/Cohabitating**			
Low-fat diet		3.41		3.75			$t(139) = -2.37$, $p = .019$
Modify meats		3.45		3.99			$t(150) = -1.83$, $p = .069$
Sub. low-fat		2.68		3.36			$t(147) = -3.18$, $p = .012$
Total sugar intake		1.70		1.21			$t(138) = 2.12$, $p = .036$
Daily liquid sugar		0.98		0.06			$t(140) = 2.26$, $p = .025$
Weekly fast-food		3.42		2.57			$t(150) = 1.82$, $p = .071$
	Enrolled Status	PT		FT			
Avoid fried foods		4.24		3.88			$t(149) = 1.68$, $p = .095$
	Work Status	No		PT		FT	
Daily F/V		2.45		2.05		1.81	$F(2,133) = 2.35$, $p = .099$
Bread/tortillas		2.76		3.23		3.17	$F(2,144) = 3.51$, $p = .033$
	Class Ranking	FM	SP	JN	SN	PB	
Sub. low-fat		2.45	2.78	2.76	2.95	3.50	$F(4,147) = 2.24$, $p = .067$

Note. Avoid adding fat = avoid adding fat as a flavoring; F/V = total daily fruits and vegetables; Sub. low-fat = substitute for low fat foods; Enrolled Status & Work Status: PT = part-time, FT = full-time; Class Ranking: FM = freshman, SP = sophomore, JN = junior, SN = senior, PB = post-baccalaureate.