Peanut consumption in adolescents is associated with improved weight status

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ABSTRACT

Studies have shown an association between nut consumption and health benefits in adults such as lower lipid levels, lower body mass indices, and reduced risk of coronary artery disease. Few studies have demonstrated these health benefits in children. To determine the association between peanut consumption and weight, intake of nutrients of concern, high-density lipoprotein, low-density lipoprotein, and cholesterol in Mexican American children, baseline data from 262 sixth-grade students (48% female) in a school-based weight management program were analyzed to compare differences between peanut and non-peanut eaters. It was hypothesized that Mexican American children who consume peanuts will be less overweight and have a better nutrient and lipid profile when compared to those who do not eat peanuts. Participants completed a food frequency questionnaire as a baseline dietary assessment before beginning the program. Children were identified as either a peanut consumer (n = 100) or non-peanut consumer (n = 162). Body mass index measurements were taken on all participants. A smaller sample of participants submitted blood for lipid analysis. Analyses revealed that children in the peanut consumer group were less likely to be overweight or obese than children in the non-peanut consumer group (χ² = 13.9, P = .001), had significantly higher intakes of several vitamins and micronutrients (i.e., magnesium, vitamin E), and had lower low-density lipoprotein and total cholesterol levels. These results illustrate that consumption of peanuts and/or peanut butter is associated with lower weight status, improved diet, and lipid levels among Mexican American children. Future research is needed to clarify the role of peanut consumption in children’s overall health.

1. Introduction

Obesity is a growing epidemic in the United States, particularly among Mexican Americans [1]. Currently, 32% of all children and 39% of Mexican American children are classified as overweight or obese [1]. The prevalence rates in Mexican American adults are twice that of Mexican American children [2]. Not only are Mexican Americans more overweight, but the degree of overweight is greater [1,3]. This is concerning because obesity is associated with increased risk for multiple health problems such as hypertension, dyslipidemia, type 2 diabetes, sleep apnea, orthopedic complications, and fatty
liver disease [4-7]. Additionally, Mexican-American children are at increased risk for developing many of these associated conditions [4,8].

Although increased rates of obesity are one plausible explanation for Mexican American’s increased risk for comorbid conditions, other factors may also play a role. Mexican Americans are prone to deficiencies in important nutrients such as magnesium [9] which plays a critical role in carbohydrate metabolism, lipid metabolism, platelet aggregation, elevated markers of inflammation, and blood pressure [10]. These deficiencies may be another reason why Mexican Americans are at greater risk for type 2 diabetes and cardiovascular disease [10-12].

Dietary changes such as consuming foods high in magnesium is one way to address these nutritional deficiencies [13]. In fact, increasing consumption of foods such as peanuts, which are an excellent source of magnesium, results in improved levels of magnesium in adults [11]. The consumption of peanuts in adults is also thought to decrease the risk of cardiovascular disease, improve glycemic control, and decrease inflammatory markers [14,15]. Peanuts may have other health benefits as well such as decreasing risk for obesity and promoting healthier weight status [16].

The idea that peanuts are beneficial for those with obesity or diabetes is not a new concept. In fact, this concept dates back to 1894. Recommendations based on these experiments supported the use of peanuts with individuals who are obese and diabetic stating that, “From its richness in protein and its low proportion of carbohydrate elements (starch, sugar, etc.), it is especially adapted to the use of persons suffering from obesity, and may be made to enlarge in a most welcome degree the restricted menu of patients under treatment for excessive fatness or diabetes” [17].

While there is clear support for the health benefits of peanuts in adults, there is little evidence of the health benefits in children. Exploring the health benefits of peanut consumption in children may have important implications. This may be especially true in Mexican Americans who are at greater risk for obesity and associated conditions.

The rationale for this study was to extend the literature base on nut consumption with minority children. The objective of this study was to examine the association between peanut consumption and health status in Mexican American children. In accordance with previous research with adults, we hypothesized that Mexican American children who consumed peanuts will be less overweight, have a healthier lipid profile and have increased values for nutrients of concern (vitamin E, magnesium, calcium, potassium, fiber) when compared to children who did not consume peanuts. The present study divided children into 2 groups, peanut and non-peanut eaters, to test this hypothesis.

2. Methods and materials

2.1. Participants

Self-identified Mexican American children in the sixth grade (mean age 11.9 years) were recruited from a metropolitan charter school in Houston, TX, USA, for a school-based weight management program. This school serves an urban student population that is 95% Mexican American. Students attending this school are primarily from families of low socioeconomic status with 85% of the students qualifying for free or reduced price lunch. Fifty-five percent of the participants were overweight or obese, which is consistent with national norms [1]. All 262 students (48% female) assented and returned parental consent forms and demographics surveys (English or Spanish as preferred) for a response rate of 100%.

2.2. Methods

Baseline data from the weight management program were analyzed for the purposes of this study. Data were collected during a class period and included height and weight measurements, the Block Dietary Data Systems (BDDS) questionnaire [18], and blood lipid analyses. From the BDDS, children were classified as being either a peanut consumer (PC; n = 100) or a non-peanut consumer (NPC; n = 162). Children were considered to be peanut consumers if they reported eating peanuts or peanut butter at least once during the previous week. A subset of the sample (17 PC; 40 NPC) agreed to provide a blood sample for lipid analysis. Submitting a blood sample was not required to participate in the study. These procedures were approved by the institutional review board of Baylor College of Medicine.

2.3. Measurements

2.3.1. Body mass index

Trained research staff measured height using a Seca model Road Rod 214 portable stadiometer, and obtained weight with a calibrated Tanita model TBF-310 digital scale. Children were instructed to wear light clothing and no footwear at the time of the measurements. Body mass index (BMI) was calculated [weight (kg)/height (m)²] and transformed into a standardized score (zBMI) using age and gender normative data [19].

2.3.2. Block Dietary Data Systems (BDDS)

The BDDS is a 150-item food frequency questionnaire designed for use with children ages 10 to 17 years [18]. Under the supervision of a trained research staff member, students reported the number of days in the last 7 days they have consumed common food and drink items as well as the portion size. In addition, supplemental intake of nutrients was taken into account. Portion sizes were assessed using visual representations of varied size bowls and plates to increase accuracy of reporting. Participants reported the portion size of peanuts and peanut butter consumed by choosing from pictures of a bowl or a plate containing 1/4 cup, 1/2 cup, or 1 cup of food. Adequate reliability and validity has been reported for the BDDS when used with adolescents [18]. The scoring system was developed by BDDS and has been shown to be accurate for children. Nutrient intake values were calculated from this assessment. The specific nutrients examined included calcium, potassium, fiber, magnesium, and vitamin E. Reliability estimates for these nutrients were greater than 0.9 suggesting excellent reliability. These nutrients are considered nutrients of concern for children and adults.
adolescents according to the US Department of Agriculture Dietary Guidelines for Americans [20].

2.3.3. Biomarkers
Informed consent and assent were obtained prior to obtaining venous blood samples. Venous blood samples were collected in the morning (0700–0800) following an overnight (>10-hour) fast by a trained research nurse or phlebotomist. Blood samples were EDTA-treated and were analyzed for total cholesterol, triglycerides, high-density lipoprotein (HDL) cholesterol, and calculated low-density lipoprotein (LDL) using an automated analyzer (Hitachi; Tokyo, Japan). Values were compared against national norms [21]. All inter- and intra-assay coefficients of variation were less than 9.7% and 6.9%, respectively. All analyses were completed at a research laboratory at the University of Houston.

2.4. Statistical analyses
Statistical analyses were conducted using SPSS (version 20.0.1; SPSS Inc, Chicago, IL, USA). Variables that may be associated with the primary hypothesis were examined to determine possible confounders to the data. Total calories, percentage from fat, servings of vegetables, fruit, milk, and fats were examined. Demographic variables that were compared between groups included age, family yearly income, and number of people living in the home. Independent-samples t tests and follow-up χ² analyses were used to evaluate study hypotheses. The variables of interest included zBMI, nutrient profile, and blood lipids. Because multiple nutrients of concern were being examined, a multivariate analysis of variance was conducted to reduce the likelihood of a Type II error occurring. The variables examined were normally distributed. See the Table for a listing of means and standard deviations for all variables.

### 3. Results

3.1. Preliminary analyses

The PC group reported consuming significantly more servings of vegetables than the NPC group. In addition, a higher percentage of females were in the PC group. Based on these differences, servings of vegetables and gender were used as covariates for all analyses. Finally, to be conservative, as intake of energy could be a potential confounder, we included total calories as a covariate. No other significant differences between groups were found.

3.2. Weight analyses

Children in the PC group had a significantly lower BMI percentile and zBMI than children in the NPC group (F = 7.1, P = .008 and F = 11.1, P = .001 respectively). Furthermore, a significant chi square revealed that children in the PC group were less likely to be overweight or obese than children in the NPC group (χ² = 13.9, P = .001) with 36% of the PC group being overweight compared to 64% of the NPC group.

3.3. Nutrient profile analyses

A total of 80 participants in the PC group reported eating peanuts or peanut butter 1 time per week, 15 participants reported 2 times per week, and 5 reported eating peanuts and peanut butter 3 or more times per week (P = .049). A multivariate analysis of variance was conducted to examine differences between the PC and NPC groups using total calories, servings of vegetables, and gender as covariates. Significant differences for nutrient intake were found between the PC and NPC groups (P = .04). Post hoc analyses were

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<th>Table – Characteristics of participants</th>
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<td>Variable</td>
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<td>Gender (% female)</td>
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<td>Family yearly income ($)</td>
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<td>Fat percentage (% kcal from fat)</td>
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<td>Calories (kcal)</td>
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Values are means ± SD or %.

a P values for testing differences between peanut consumers and non-peanut consumers (independent samples t-tests and follow up chi square analyses were conducted).

b Total N = 57; PC = 17, NPC = 40

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conducted to determine differences for specific variables. A significant difference was found between the PC and NPC groups for vitamin E and magnesium, with the PC group having greater nutrient intakes of vitamin E and magnesium (213 mg, \( P = .02 \) and 6.11 mg, \( P = .04 \) respectively) compared to the NPC group (173 mg, \( P = .04 \) and 4.4 mg, \( P = .02 \) respectively). Refer to the Table for a listing of means and standard deviations for all variables. There were no significant differences between groups for calcium, potassium and fiber (\( P = .19, P = .10, P = .07 \) respectively).

3.4. Blood lipid analyses

The PC group had significantly lower total cholesterol (\( F = 5.8, P = .02 \)) than the NPC group. Triglycerides and HDL were not significant (\( P = .26 \) and \( P = .12 \) respectively), and LDL approached significance (\( P = .05 \)). See Table for a listing of means and standard deviations for all variables. The covariates, total calories, servings of vegetables, and gender did not account for statistically significant variance in this model (\( P = .92, P = .53, P = .49 \), respectively).

4. Discussion

Considerable research shows that even small dietary modifications can have an impact on disease progression and overweight and obesity [1,8]. This is especially important for Mexican-American children who are one of the highest risk groups for developing obesity and its comorbidities [1,8]. The hypothesis that Mexican American children who consume peanuts will be less overweight and have a better nutrient and lipid profile when compared to those who do not eat peanuts was accepted. Consistent with our hypothesis, the results of this study suggest that peanut intake is associated with reduced obesity and has positive effects on weight, intake of nutrients of concern, and cholesterol. Participants who consumed peanut products were less likely to be overweight. Furthermore, they exhibited lower BMI and total cholesterol levels, less LDL cholesterol and had a higher vitamin and mineral intake than the non-peanut consumers. Unexpectedly, HDL cholesterol was lower among peanut consumers. A few studies have found an unexpected relationship like this [22-24]. It may be that the cholesteremic effects of peanuts are too small to be recorded or do not extend to HDL levels. Additional research is needed to clarify this relationship as peanut consumption may be a marker for other healthy behaviors. Overall, the findings indicate a better health profile for participants who consumed peanuts eaters and demonstrate a need to further examine the effects of peanut consumption.

Our results are consistent with other studies detailing the many health benefits of peanuts. For example, peanut consumption may support healthier BMIs by promoting satiety, and thereby reducing overall food intake [25,26]. Additionally, the high monounsaturated fat and protein composition of peanuts is suspected to increase resting energy expenditure [26,27]. Some studies have also shown that the antioxidant quantity in peanuts may promote LDL reduction as well as a reduced risk of cardiovascular disease and its related risk factors [28-30]. While the current study did not examine the mechanism by which peanuts lead to improved health status, further examination of these processes is needed. Although studies have taken place with adults and other ethnicities, few studies address Mexican American children and their relationship to peanut intake. Based on these results, it appears that intake of nuts may have similar benefits for Mexican American children. Consumption of peanuts is shown to be a marker for Mexican American children to eat a more plant based diet. This also provides further evidence that a plant based diet may be beneficial for adolescents.

Based on the results of this study, we cannot say that the improved health profiles observed in the peanut consuming group are specifically due to their consumption of peanuts. However, this study was designed to explore whether significant differences in markers of health could be observed based on the presence or absence of peanut products in the diet. It is possible that the consumption of peanuts may be a marker of other healthful behaviors which contribute to improved health profiles. Another limitation of the study is the use of self-report data to assess peanut consumption due to the tendency to underreport food intake [31,32]. In terms of differences in lipids, the reduced sample size for these analyses was a limiting factor. Despite these limitations, this study provides preliminary evidence that peanut consumption can have a significant impact on factors related to overweight and obesity in Mexican American youth.

Children at high risk for disease in adulthood have become the target of many public health programs. Low cost and easily implemented interventions such as increasing peanut consumption may be one way to address health risks in at risk populations. Efforts directed toward Mexican Americans should consider the feasibility of adding peanuts to a Mexican American diet, as peanuts are not commonly consumed in this cuisine. Future investigation of these findings may serve as the foundation for a promising youth obesity prevention program and may be expanded to advocate for the enforcement of small dietary changes to reduce disease risk.

Acknowledgment

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REFERENCES


