

# Nutrition Knowledge Predicts Eating Behavior of All Food Groups *Except* Fruits and Vegetables among Adults in the Paso del Norte Region: Qué Sabrosa Vida



Continuing Education Questionnaire available at [www.sne.org/](http://www.sne.org/) Meets Learning Need Codes for RDs and DTRs 1040, 4000, 4010, and 4040.

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## ABSTRACT

**Objective:** To examine the association between nutrition knowledge and eating behavior in a predominantly Mexican American population on the Texas-Mexico border.

**Design:** Cross-sectional using data from the baseline survey of the Qué Sabrosa Vida community nutrition initiative.

**Setting:** El Paso and surrounding counties in Texas.

**Participants:** Data gathered in 2000 using random-digit dialing telephone survey. Response rate was 42.6% and final sample size was 963.

**Main Outcome Measures:** Knowledge of recommended servings of food items was the independent variable and number of servings of food items consumed was the dependent variable.

**Data analysis:** Multiple logistic regression was used to examine the association between nutrition knowledge and eating behavior.

**Results:** 74% of the population was Mexican American. Nutrition knowledge was a significant predictor of eating behavior for grains (odds ratio [OR] = 6.42; 95% confidence interval [CI]: 2.4, 17.1), dairy (OR = 2.25; 95% CI: 1.5, 3.4), meats (OR = 2.02; 95% CI: 1.5, 2.8), beans (OR = 8.18; 95% CI: 5.1, 13.0), water (OR = 2.49; 95% CI: 1.7, 3.6), but not for fruits and (nonstarchy) vegetables (OR = 1.69; 95% CI: 0.89, 3.2).

**Conclusions and Implications:** Nutrition knowledge predicts eating behavior for all food groups except fruits and vegetables. The role of cultural factors in eating behavior should be investigated to elucidate this finding. Results have implications for developing nutrition education programs for Mexican Americans.

**Key Words:** fruits and vegetables, food groups, dietary intake, knowledge of recommended servings, Mexican American

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## INTRODUCTION

Knowledge can be defined as factual and interpretive information leading to understanding or useful for taking informed action.<sup>1</sup> The Social Cognitive Theory (SCT) emphasizes that an individual's behavior is determined by the

interaction of personal as well as environmental factors.<sup>2</sup> Social Cognitive Theory suggests that if a person is to perform a particular behavior, he or she must know what the behavior is (knowledge of the behavior) and how to perform it (skill). A task typically cannot be performed if it has not been learned yet. Thus, knowledge appears to be an important factor that drives behavior.

As of 2005, 14% of the United States population was Hispanic,<sup>3</sup> and by 2020, Hispanics are expected to account for 16% of the US population.<sup>4</sup> Currently 37% of the Hispanic population in the US is obese.<sup>5</sup> Counties with the highest proportion of Hispanics in the US are along the Texas-Mexico border. The Behavioral Risk Factor Surveillance System (BRFSS) of El Paso, a Texas-Mexico border county that is 74% Mexican American, has shown that the

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prevalence of obesity (Body Mass Index [BMI]  $\geq 30$ ) was 21% in 2002, which increased to 28% in 2006.<sup>6</sup> Almost 20% of Mexican Americans in El Paso have been diagnosed with hypertension and 8.6% with cardiovascular problems.<sup>6</sup>

The rising prevalence of chronic diseases in Mexican Americans in El Paso could be partially attributable to poor eating behaviors. The components of a typical Mexican American diet include carbohydrates such as beans and tortillas; heavy consumption of meats, fats, oils, and sugar; and low consumption of fruits and vegetables.<sup>7,8</sup> This finding was first documented in the Hispanic Health and Nutrition Examination Survey (HHANES), conducted from 1982-1984, which reported a low intake of fruits and vegetables and high intake of fats among Hispanic Americans.<sup>9,10</sup> This high consumption of fat coupled with low consumption of fruits and vegetables could be contributing to the prevalence of obesity and related chronic diseases in the region.

Nutrition knowledge might be one of the key factors to improving eating behavior in adults. Adequate nutrition is essential for growth and development, health, and overall well-being.<sup>11</sup> Behaviors to develop healthful eating habits should start early and continue through life. Poor eating behavior could lead to many chronic diseases and preventable causes of death, such as cardiovascular disease, obesity, type 2 diabetes, stroke, and osteoporosis in elderly and postmenopausal women.<sup>12</sup> Several studies have found a positive association between nutrition knowledge and eating behavior.<sup>13-28</sup> However, none has examined these associations in a predominantly Mexican American population. The rising prevalence of chronic disease coupled with poor dietary practices warrant this investigation among Mexican Americans.

This paper aims to examine the cross-sectional association between nutrition knowledge and dietary intake of food groups in the Paso del Norte (PDN) region (El Paso and surrounding counties). Assessing the knowledge of recommended number of servings of various food groups and their association with dietary intake has implications for development of nutrition education programs geared toward teaching healthful eating habits in this population.

## METHODS

The data for this research were obtained from the PDN region in 2000. This region includes El Paso County and three counties in New Mexico: Doña Ana, Otero, and Hudspeth. The data were gathered in 2000 to serve as the baseline for a community nutrition intervention program entitled "Qué Sabrosa Vida" (QSV) (Translation: What a Delicious Life). This program aims to improve long-term dietary intake behaviors in residents and to aid in prevention of chronic disease in the El Paso region. Approval to conduct the study was obtained from the University of Texas Health Science Center at Houston, Committee for the Protection of Human Subjects.

## Sampling Methodology

Data were gathered from a telephone survey using random-digit dialing methodology to ensure proportional representation of demographic subgroups. A probability sample of phone numbers was purchased for the survey to ensure adequate representation of the El Paso region on age, sex, and ethnicity with appropriate statistical weighting based on the year 2000 population figures. One person from each contacted household was interviewed; any nonmilitary person over the age of 18 and under the age of 60 was eligible to participate. The age of 60 years was used as the cutoff age for inclusion in the study because dietary intake of the elderly and factors influencing intake vary with those of adults.<sup>29</sup> Kish sampling procedures were used to randomly select the household respondent using age and sex as factors.<sup>30</sup> It was estimated that 1000 completed surveys were needed for weighting; 1007 participants actually completed the survey, with an overall response rate of 42.6%. Of the 1007 completed surveys, 18 were excluded from the weighted analysis owing to missing data for the weighting variables on ethnicity, sex, or age. Twenty-six persons who reported an intake of fewer than 500 calories or greater than 5000 calories per day based on the Food Frequency Questionnaire (FFQ), were excluded as outliers from the final analysis, yielding a final sample of 963. Informed consent was obtained from all participants prior to the start of the study.

**Selection bias.** At the time of this survey, cell phones were not being used in the community as the typical mode of communication; land lines were still predominant, thus cell phones were hence not included in the sampling strategy. Because of the predominantly low-income population of border communities, there was a relatively high percentage of households without land-line phones (about 10%, based on 1990 census data). Thus, face-to-face interviews of 100 persons in El Paso County without a telephone were conducted to assess whether households with phones were different in their responses to the survey than those without phones. The responses obtained for the door-to-door sample were compared to the unweighted telephone sample using Pearson's chi-square and showed no significant differences on selected behavior and knowledge variables (personal communication, RS Day).

**Data collection.** Focus group discussions with residents of the El Paso region were used to obtain information on the structural and cultural beliefs related to diet in this population. Using these data, a food guide pyramid called the "QSV Guide to Healthy Living" was developed for the QSV program based on the 2000 United States Department of Agriculture Food Guide Pyramid, with adaptations reflecting the food choices of Mexican Americans in the PDN region. This pyramid was the foundation of the QSV intervention program and provided food consumption recommendations.

Additionally, an interviewer-administered, bilingual questionnaire was developed and pilot-tested in this region. The questionnaire contained 83 items on nutrition knowledge, eating behavior, knowledge of serving sizes for various food items, and stages of change for each food group.

For nutrition knowledge, participants were asked the minimum number of recommended servings of various food groups such as grains, meats, beans, fruits and vegetables, dairy, and water. For example: "What is the minimum number of servings of \_\_\_\_\_ people should choose each day?" Subjects were asked to provide 1 number as a response. Eating behavior and dietary Stages of Change (pre-contemplation, contemplation, preparation, action, and maintenance)<sup>31</sup> were also assessed for all the food groups in the QSV Guide to Healthy Living. This procedure allowed for assessment of the participants' readiness to make dietary changes. Dietary behaviors and stages of change related to these behaviors have been validated in previous studies as an effective method of evaluating readiness to change dietary behaviors in adults.<sup>32-36</sup> The present survey instrument was developed from these studies, which indicate that self-assessment of diet using standard staging questions can be an accurate reflection of intake. Participants were staged according to responses to the following questions: "How many servings of \_\_\_\_\_ do you usually eat in a day? Have you been eating this amount for more than 6 months? In the future, do you intend to increase this amount, decrease this amount, or stay the same?" and "Do you intend to make this change in the next 6 months?" For the purpose of this study, the authors used only the items measuring the number of servings of various food items eaten per day.

Pilot-testing and focus groups affirmed understanding of question terminology in the survey and did not report any problems with the determination of what their perception of a serving was for the various food groups.

The survey also included a food frequency questionnaire validated for Mexican Americans, which was modified to update the food list for this population during the pilot-test using interviews, 24-hour recalls for food sources, and focus groups (personal communication, Day, RS).<sup>37,38</sup>

Interviewers were bilingual community residents trained by the investigators using a standardized protocol outlined in the manual of procedures. Supervisors on site conducted a 100% verification of sampling protocol and a random verification of selected survey questions with respondents at the close of interviews. Data from surveys were double-entered and cross-checked, with error rates of < 1%. Demographic data were collected on age, sex, and ethnicity.

## Data Analysis

All statistical analysis was conducted using STATA, statistical analysis software, version 9.0 (STATA Corp., College Station, TX, 2006). Sampling weights were de-

termined using age, sex, and ethnicity and applied to generate population-representative estimates to adjust for oversampling, variable probabilities of selections, and response rates. The weighted percentage of the population giving correct and incorrect responses for nutrition knowledge and eating behavior was calculated separately for sex, ethnicity, and age (younger = 18-34 years; older = 35-60 years). Age was dichotomized into these categories to examine general differences in the younger versus older adults. Pearson's chi-square was used to test for differences in the nutrition knowledge and eating behavior for age, sex, and ethnicity. Logistic regression for survey data was used to examine the associations of interest after adjusting for age (as a continuous variable), sex, and ethnicity to give odds ratios (OR) and 95% confidence intervals (CI). Nutrition knowledge was dichotomized as a 0/1 variable—those with incorrect knowledge and correct knowledge respectively, based on the QSV Guide to Healthy Living. Eating behavior was also dichotomized as a 0/1 variable—incorrect and correct eating behavior based on the number of servings per day recommended by the QSV Guide to Healthy Living.

## RESULTS

Table 1 presents the profile of El Paso County and the survey respondents. The population is predominantly Mexican American, with an almost equal number of males and females. The data shows that survey respondents had a profile similar to El Paso County except for sex, with a higher percentage of female participants in the survey.

Table 2 presents the average minimum number of servings perceived as recommended per day and the average number of servings they actually consumed. Results show that overall, the PDN population had a higher perception of the minimum number of servings recommended than the number of servings they actually consumed for each food group. Table 3 presents the weighted percentage of the population having correct knowledge of the recommended minimum serving of food based on the QSV Guide to Healthy Living. One third of the PDN population had correct knowledge of recommended servings for different food groups (grains, meats, beans, fruits and vegetables, dairy), whereas 55% had correct knowledge of recommended servings for water. Stratified analysis using Pearson's chi-square showed a significant difference between males and females on knowledge of minimum serving for fruits and vegetables, beans, and water. Overall, non-Mexican American females and older people had more knowledge of the recommended servings as compared to Mexican Americans, males, and younger people, respectively.

Table 4 presents the weighted percentage of the population reporting to consume the recommended servings of food based on the QSV Guide to Healthy Living. Overall, 40% or less of the PDN population were eating the recom-

**Table 1.** Characteristics of El Paso County and the Survey Respondents, 2000

Characteristics	Profile of El Paso County	Profile of survey respondents	
	Percentage (%) Population	n	Percentage (%)
Male	49.1	373	38.7
Female	50.9	590	61.3
Mexican American	74.0	695	72.2
Non-Mexican American	26.0	268	27.8
Age (y)			
18-24	19.9	150	15.6
25-34	29.4	251	26.1
35-44	24.8	266	27.6
45-54	18.6	193	20.0
55-60	7.3	103	10.7

y indicates years.

mended servings of the different food groups, and only 29% were drinking the recommended servings of water. Stratified analysis using Pearson’s chi-square showed that females were more likely to consume the recommended servings of fruits and vegetables as compared to males ( $P = .007$ ). Non-Mexican Americans were more likely to consume the recommended servings of grains ( $P = .011$ ), dairy ( $P = .014$ ), and fruits and vegetables ( $P < .001$ ) as compared to Mexican Americans, whereas Mexican Americans were more likely to eat the recommended servings of beans ( $P < .001$ ). Finally, younger people were more likely to eat the recommended servings of meat as compared to older people ( $p = 0.001$ ), but there were no other trends between age groups.

Table 5 presents the adjusted OR and 95% CI (adjusted for age, sex, and ethnicity) for knowledge and eating behavior. Nutrition knowledge was a strong predictor of eating behavior for all food groups *except* fruits and vegetables. The strongest associations were observed for grains (adjusted OR: 6.4, 95% CI: 2.4, 17.1) and beans (adjusted OR: 8.2, 95% CI: 5.1, 13.0). For fruits and vegetables, the association had a positive trend but was not statistically significant (adjusted OR: 1.7, 95% CI: 0.89, 3.2).

**DISCUSSION**

Less than half the population was eating the recommended servings of food and less than one third of the population knew the number of servings recommended. Additionally, more females and non-Mexican Americans knew the minimum recommended servings of food items as compared to males and Mexican Americans. These results indicate a significant lack of nutrition knowledge in this population, especially among Mexican American males. This finding could be attributable to the fact that typically in a Mexican American household, most of the cooking and grocery shopping is done by women.<sup>7</sup> However, the food preparers seem to impact the dietary habits of the family, as the percentage eating according to guidelines was quite similar between sexes in the present study. In this study, nutrition knowledge was low across sexes, and the overall eating behavior was similar among males and females. This finding indicates that nutrition education programs targeting women could impact the whole family and need to be emphasized.

Regression analysis showed that nutrition knowledge was a strong predictor of eating behavior for all food groups

**Table 2.** Mean Minimum Number of Servings Perceived as Recommended per Day and Mean Number of Servings Consumed by the PDN Population (N = 963)

Pyramid Group	Perceived Minimum Number of Servings	Number of Servings Consumed
	Recommended (Mean ± SE)	(mean ± SE)
Grains (servings/d)	4.8 ± 0.53	2.2 ± 0.00
Fruits and vegetables (servings/d)	4.4 ± 0.34	2.5 ± 0.00
Dairy (servings/d)	3.5 ± 0.35	1.9 ± 0.00
Meats (servings/d)	2.9 ± 0.39	1.5 ± 0.00
Beans (d/wk)	5.2 ± 0.39	3.0 ± 0.00
Water (glasses/d)	6.9 ± 0.12	5.5 ± 0.01

PDN indicates Paso del Norte; SE, standard error; d, day; wk, week.



**Table 4.** Percentage of PDN Population Currently Meeting the Recommendations for Servings of Food per Day Based on the QSV Guide to Healthy Living

Food group (QSV recommended servings)	All	Males (M)	Female (F)	P Value (M & F)*	Mexican-American (MA)	Non-MA	P Value (MA & Non-MA)*	Age		P Value (Y & O)*
								18-34 (Y)	35-60 (O)	
Grains (6-11 servings <sup>3</sup> /day)	3.9	3.2	4.5	.654	2.8	7.1	.011	4.3	3.5	.301
Fruits & Vegetables (5+ servings/day)	8.2	5.5	10.8	.007	5.8	15	.000	7.9	8.5	.739
Dairy (3-4 servings/day)	19.8	19.6	20.0	.291	18.0	25.1	.014	22.6	17.1	.130
Meats (2-3 servings/day)	40.4	40.5	40.3	.076	38.2	46.7	.069	47.7	33.3	.001
Beans (1+ servings/day)	14.5	17.5	12.7	.075	18.3	5.8	.000	13.7	16.4	.3341
Water (8+ servings/day)	28.9	30.6	27.3	.332	28.0	29.4	.591	30.2	28.5	.649

O indicates older; PDN, Paso del Norte; QSV, Qué Sabrosa Vida; Y, younger.  
 \*Based on Pearson's chi-square; significance level set at  $P < .05$ .

potentially be one of the factors predisposing this population to obesity and cardiovascular disease.

Unlike the results found in this study, a few studies have shown that knowledge of the number of servings of fruits and vegetables specified in the Food Guide Pyramid is associated with fruit and vegetable consumption.<sup>8,13,19,20</sup> However, these studies were not done in a Mexican American population. Factors such as attitudes toward fruit and vegetable consumption and lack of skills in preparing them may be contributing to this poor eating behavior and lack of association between knowledge and fruit and vegetable intake, as seen in the present study. Other factors such as socioeconomic status (SES) might be influencing fruit and vegetable consumption since most of the border population belongs to lower SES.<sup>23</sup>

Given the fact that that the PDN population had a higher perception of the minimum number of recommended servings as compared to the number of servings they actually ate, it appears that the influence of psychosocial and environmental factors possibly extends to the other food groups as well and would be worthy of further exploration.

Acculturation could be another factor adding to this increased fat and fast food intake and decreased fruits and vegetable intake among Mexican Americans. Literature has shown that the dietary intake of Mexican Americans becomes less healthful with increased acculturation.<sup>42,43</sup> Smith et al evaluated the association between heritage retention as a proxy for acculturation and dietary fiber intake among Mexican American mothers who participated in the QSV survey.<sup>44</sup> Results showed a strong association between heritage retention and bean intake, which were correlated to dietary fiber intake in this population. Beans, a traditional part of the Mexican diet, are considered to be a complex carbohydrate that is also a good source of protein and fiber. The results show that only 15% of the PDN population is consuming the recommended servings for beans, suggesting a trend away from the traditional Mexican American diet in this population. Interventions that include cultural elements aimed at increasing the consumption of traditional foods are recommended.

**Table 5.** Association Between Knowledge of Minimum Recommended Servings of Food Groups and Eating Behavior of Those Food Items

Food Groups	Odds Ratio (95% CI)*
Grains	6.4 (2.4, 17.1) <sup>†</sup>
Fruits and vegetables	1.7 (0.89, 3.2)
Dairy	2.3 (1.5, 3.4) <sup>†</sup>
Meats	2.0 (1.5, 2.8) <sup>†</sup>
Beans	8.2 (5.1, 13.0) <sup>†</sup>
Water	2.5 (1.7, 3.6) <sup>†</sup>

CI indicates confidence interval.

\*Multivariable logistic regression adjusted for age (continuous), sex (male/female), and ethnicity (Hispanic/Non-Hispanic).

<sup>†</sup>Significant at  $P < .05$ .

The strengths of the study include the large sample size and the weighted data that provide one of the first population-based datasets available on Mexican Americans and nutrition knowledge and behavior. As a result, there is good generalizability of the results to the Hispanic American population in the PDN region and other border populations.

These strengths notwithstanding, the present study also has its limitations. First, an absolute value for knowledge of minimum recommended servings was used versus a range, as seen in the USDA Food Guide Pyramid. However, this absolute value could only have biased the results toward the null. Second, nutrition knowledge was dichotomized into correct/incorrect knowledge of recommended servings, which could have potentially limited the investigators' ability to explore the percentage of participants who over- and underestimated the number of servings. However, because the participants had to respond to the questions by stating an absolute value (minimum number of recommended servings), the authors decided to dichotomize knowledge to determine the percentage of the population with correct and incorrect knowledge of the number of servings. Also, knowing the exact number of servings reflects on the participants' exposure to the Food Guide Pyramid and other nutrition information campaigns. Third, the study was conducted along Mexican Americans living in the Texas-Mexico border area. Thus, the results might not be generalizable to other Hispanics living in the US, such as Central Americans, Cuban Americans, Puerto Rican Americans, and so on. Another limitation was that the study evaluated only the number of servings of food without assessing portion sizes, which is also an important component of measuring dietary intake. Finally, the cross-sectional nature of this study design does not allow the establishment of causal relationships.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

Based on the results of this study, it is the authors' recommendation that health education programs on the Texas-Mexico border should aim to improve knowledge of food recommendations as part of a strategy for increasing fruit and vegetable consumption, as well as other healthful foods. Also, although knowledge might be a strong predictor of eating behavior for most food, there could be other factors that need to be explored, such as acculturation, psychosocial, and environmental factors that influence fruit and vegetable intake in this population. These results, coupled with the rising prevalence of cardiovascular risk factors such as obesity<sup>45</sup> in the Mexican American population, warrant culturally appropriate health education/health promotion programs to increase nutrition knowledge and promote healthful eating behaviors.

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