Acculturation and Dietary Change in Mexican-American Immigrant Women

Maria Isabel Ortega-Velez¹*, Pedro Alejandro Castañeda-Pacheco²

¹Centro de Investigación en Alimentación y Desarrollo, A.C. División de Nutrición, Hermosillo, Mexico
²Universidad de Sonora, Hermosillo, Mexico
Email: *iortega@ciad.mx, pedroalejandro@gmail.com

Abstract

Our study explored the process of acculturation among Mexican women living in southwest U.S., and the consequences regarding dietary risk factors associated to health. The cross-sectional study included face to face interviews with 150 migrant women and 150 non-migrant women. Interviews consisted of two non-consecutive 24-hour recalls, and data on anthropometry, acculturation, dietary change and lifestyle. Multiple regression analysis showed that consumption of calories from saturated fat and body mass index (BMI) were significantly higher in migrant women compared to non-migrant women, even after adjusting for other lifestyle and diet related variables. Overall, acculturation seems to be associated with more access to food rather than with a change in consumption of dietary risk components. Furthermore, acculturation was associated positively with socioeconomic status, indicating interplay of socioeconomic and cultural variables related to eating behavior in Mexican immigrant women. Positive association of BMI with acculturation and of acculturation with socioeconomic status suggests that health risk factors among Mexican immigrant women follow similar trends of those of women in their born country.

Keywords

Acculturation, Immigrant Women, Diet, Dietary Change, Obesity

1. Introduction

We are experiencing an era where the shift in focus from communicable to chronic diseases is challenging not only the current perspectives of health education, but also the priorities of health care. However, results from interventions to change health-related behaviors that considered lifestyle as short-term practices

have been quite unsuccessful. Behaviors resulting from different lifestyles are understood not as isolated acts controlled by the individual, but as acts that are socially conditioned, culturally embedded, and economically constrained. (Green and Kreuter, 1991; CSDH, 2008) [1] [2].

Concurring with the above perspective, being sensitive to how individuals define and understand health according to their cultural orientation will facilitate the health promoter's work. The more a health promoter knows about the beliefs, attitudes, traditions and practices of a given cultural group and how they change within a new cultural setting, the more his/her activities will improve and become effective. Health facilitators that have an understanding and respect for the community's ways could be more easily involved in a program intended to improve its health (González *et al.*, 1991; Cyril *et al.*, 2015) [3] [4]. At a national level, it is also imperative to be aware of the needs that different sub-groups in a society can have given their economic and cultural differences.

According to the document Healthy Border 2020: A Prevention & Health Promotion Initiative (2010) [5], the main risk factors for obesity and diabetes among the population of the U.S. and Mexico border communities are physical inactivity, poor diet (high caloric intake), poverty, genes (non-modifiable determinants), lack of breastfeeding, and education/lack of information. Most of this determinants have been documented higher in Hispanics populations compared to White populations (Willey *et al.*, 2012; Siega-Riz *et al.*, 2014) [6] [7].

Not only Hispanics are one of the largest ethnic minority groups in the U.S. (Cortes-Bergoderi *et al.*, 2013) [8], but the number of Hispanics is increasing almost four times as fast as the rest of the population, totaling 47,435,002 million according to the U.S Census Bureau, (2010) [9]. Nationally, Mexicans are the largest Hispanic origin group, making up 64.6% of all Hispanics (Brown and López, 2013) [10]. The largest concentrations of Mexican Americans are in the Western states, notably California and Texas, with others growing rapidly, namely in Arizona and New Mexico. California, Texas, New México and Arizona have 32%, 33%, 30% and 27% of Mexican origin population respectively (Brown and López, 2013) [10].

Regional information on Mexican Americans' health has been concentrated in those states with the largest numbers of Mexican Americans, such as California and Texas. There is, however, a growing interest in exploring other places in which the Mexican population is increasing. It is also imperative to understand the differences in the lifestyle and living conditions of Mexican Americans as a result of different historic development of their communities (Robinson, 1998; Roberts, 1995) [11] [12]. In this context, it is also worth exploring the challenges and strategies related to health and nutrition that Mexican-Americans are facing in those places, as well as the geographic, socioeconomic, demographic, and cultural characteristics of the environment that shape their lifestyles (Ayala *et al.*, 2008) [13].

Examining the data related to health status among Mexican Americans, it is notable that even though this group belongs to a minority group often classified

as low income, it has a health prognosis that is related to variables somewhat different from other low income minority groups. Several studies and review papers, have explored the relationship between socioeconomic status (mainly through income, education and occupation) and health risk factors (*i.e.* obesity, smoking) (Sobal and Stunkard, 1989; Belcher, *et al.*, 1993; Kumanyika and Golden 1991; Maurer *et al.*, 1989; Samet *et al.*, 1988; Hanis *et al.*, 1983; Stern *et al.*, 1981; Liao *et al.*, 2007; Cortes-Bergoderi *et al.*, 2013) [8] [14]-[21], and concluded that not only is socioeconomic status related to the presence of more health risk factors, but other variables are also involved in the process of dietary behavior. Acculturation has been frequently associated to health risk factors and dietary behavior among Latino and Hispanic populations in the U.S., however several studies proposed that such association may be mediated by other variables such a place of origin, and residence, access to and use of health care facilities, awareness of the diet-health relationship, the importance of physical exercise, and adaptation to new environments (Ayala *et al.*, 2008; Pérez-Escamilla R, 2011) [13] [22].

Within the aforementioned, it is the aim of this study to further the understanding of the present social, cultural, and economic characteristics that shape the lifestyle, and as a consequence, the dietary pattern of a group of Mexican Americans in the border region of Arizona.

Conceptual Framework

The theoretical framework used to guide the present study is based on two ecosystem perspectives. It integrates the conceptual systems from the model of communication-acculturation developed by Kim (1991) [23], and the ecological perspective on nutrition proposed by Pelto (1981) [24], and Sims (1972) [25].

The conceptual framework, incorporates an attempt to examine how *differentiation* (defined as the extent of the presence of dietary risk factors) in dietary behavior and food consumption among Mexican American families is related to the level of acculturation, socioeconomic, and demographic characteristics. Consequently, the dependent or outcome variables of the study were food consumption and dietary change, which are the main components of dietary behavior. Additional outcomes resulting from differentiated dietary behaviors and food consumption included an obesity indicator or Body Mass Index (BMI), and body fat distribution (from measures of waist-hip circumferences ratio). Some other variables that can affect the dependent variables were also explored such as smoking behavior, physical activity, alcohol consumption and stress.

2. Sample and Methods

Although the data analyzed for this study was collected during the summer of 1994 to spring of 1995, some arguments support its current validity. First, The Hispanic Paradox hypothesis documented from evidence that Hispanics living in the US have higher prevalence of several CV risk factors but lower mortality (Ayala *et al.*, 2008; Cortes-Bergoderi *et al.*, 2013) [8] [13]; this paradox has been

related to differentiated nutritional, psychosocial and genetic factors. Second, studies on the effect of acculturation on dietary intake and health risk factors among Hispanics and Latinos in the U.S., have reported that conclusive evidence is still lacking (Pérez-Escamilla, 2011) [22]. Third, the urgent need for more information regarding obesity and chronic degenerative disease risk factors, such as poor diet, across the U.S. and Mexico border (Healthy Border 2020: A Prevention & Health Promotion Initiative (2010) [5].

2.1. Study Design and Sampling

The type of research was cross-sectional and included a purposive site selection from which systematic random selection of units of study (women) were enrolled. Two populations were of interest for this study; migrant Mexican American families (FM) living in Yuma County, Arizona, and low-income non-migrant Mexican families (NM) from Hermosillo, Sonora, Mexico. This last group was considered as a reference group for nutritional variables as dietary intake, obesity and body composition indicators. Sample size was calculated using general formulas for group comparison and association analysis (Bowner *et al.*, 1988) [26], and resulted in 129 families per group; we interviewed 150 women in each group. The selection of women was carried out at The WIC Clinic in Yuma, Arizona and at a Public Health Center in Hermosillo, México. As women were waiting for their turn to see a doctor or routine evaluation, we selected each 10th woman in line that met the eligibility criteria (age ≥ 18 years, at least one year of residence in Hermosillo or Yuma, having preschool children, and willingness to participate in the study). Each participating women signed an informed consent. This study was carried out in accordance with the recommendations of the University Committee on Human Subjects from Cornell University in 1994.

2.2. First and Second Face-to-Face Interviews

The first interview was conducted at the clinic and lasted 45 to 105 minutes; it consisted of a semi-structured 20-page questionnaire that included a 24-hour recall, a semiquantitative food frequency questionnaire (data not-shown, except for alcohol intake), validated scales for acculturation and emotional stress, dietary change and food preparation, behavioral health risk factors (smoking behavior, physical activity, weight concern, and health care), migration, employment, and educational background (Appendix A). We also collected anthropometric data. The second interview involved a 24-hour recall conducted at least one month from the first interview at the participant's home, and lasted 20 to 30 mins (Conway *et al.*, 2003) [27]. Quantitative estimation of food was supported by the use of common food containers, spoons, glasses, and cups.

Food components were calculated by using a food dictionary containing foods and beverages consumed by women at two sites. The dictionary included foods from the USDA food data bank (Geghardt and Matthews, 1988) [28], traditional Mexican foods from the INN (National Institute of Nutrition) Food Composi-

tion Data for Mexican Populations (Hernández and Chávez, 1980) [29] and the Regional Food Composition Databank provided by C.I.A.D. in Hermosillo, Mexico (Grijalva, *et al.*, 1995) [30].

2.3. Dietary Change

Concepts such as retention or addition of foods to common dietary practices among Mexican Americans were used to measure dietary change (Dewey *et al.*, 1984; Romero *et al.*, 1993) [31] [32]. Common dietary changes during the year before to the interview and during the last five years were also recorded, as well as reasons for reported changes (Sanjur in 1995) [33].

2.4. Overweight and Body Composition

Weight and height were measured according to established protocols (Cameron, 1986) [34], with a calibrated digital scale (Kubota, KA-10-HB; 0-150 ± 0.5 kg) and a Holtain stadiometer (Holtain LTD, UK; 0-205 ± 0.1 cm). For waist and hip circumferences we used a fiberglass tape (Kissebah and Krakower, 1994) [35]. From height and weight measurements we calculated the Body Mass Index (BMI). We used the WHO categories to define weight status (WHO, 1995) [36]. Waist and hip circumferences were used to construct adiposity ratios (WHO, 2008) [37].

2.5. Acculturation

Acculturation was operationalized through a score obtained by using an acculturation scale developed from selected variables in Kim's (1988) [23] model of communication/acculturation (language preference and use, ethnic identity, and social networks, as well as perceived discrimination) and from the scale of acculturation for Mexican Americans developed by Cuellar (1980) [38] (language preference and use, ethnic identity and social networks).

2.6. Other Health Related Variables

In the present study, only current smokers were considered; operationalization of alcohol consumption was described from the data in the food frequency questionnaire. From the daily activities reported in the pilot study done in the summer of 1993 in Arizona, an index of heavy, moderate, and light physical activity (PAL) was developed and registered depending on the activities reported by women. A modified scale developed by Krause and and Goldenhar (1992) [39] was used to measure stress and acculturation in a sample of elderly Hispanics. This scale involved the domains of financial strain, social isolation, and effects of depression. From our previous 1993 pilot study in Yuma, items such as concern about children's behavior and communication with relatives in Mexico were added. A total score of stress was derived.

2.7. Ethnography

In addition to the cross-sectional research described before, an ethnographic

study was conducted in both studied communities (Patton, 1990) [40]. The purpose of this qualitative work was to characterize the communities and to explore food related issues among families in order to further the understanding and support the cross-sectional research with participant observation, and informal talks with key informants.

2.8. Statistical Analysis

Questions belonging to dietary practices and socioeconomic and demographic variables were coded and input using the SAS and SPSS statistical software [41] [42] were used on exploratory (multicollinearity, frequency distributions, plot analysis) and descriptive data analysis (means, standard deviations, skewness, kurtosis). The analysis of association and group comparisons were performed using multiple regression analysis and the Pearson product-moment correlation. Chi-square analysis was also used to compare proportions.

3. Results

152 migrant women from Yuma County, and 157 non-migrant women from Hermosillo, Mexico were interviewed. Nineteen (12%) of the migrant women (Yuma) and 28 (18%) of the non-migrant women (Hermosillo) were pregnant at the time of the interview, and 9% and 13% (respectively) were lactating.

3.1. Socioeconomic and Demographic Characteristics

Table 1 contains data on the main socioeconomic and demographic characteristics of participant women. There were no significant differences (tested by one way ANOVA) between migrant women and non-migrant women concerning family size mother's and father's age, and level of schooling. However, there was a substantial difference in the family structure between the two groups. Migrant families had a higher percentage of female heads of household than did non-migrant families. Since more than three quarters of migrant and non-migrant women were homemakers, they were not performing paid work during the pe-

Table 1. Selected sociodemographic characteristics among migrant and non-migrant families.

	Migrants		Non-migrants	
	X ± SD	Range	X ± SD	Range
Family size*	5.2 ± 2.0	2 - 15	4.9 ± 1.8	2 - 15
Mother's age*	30.0 ± 5.7	19 - 48	27.5 ± 5.4	18 - 45
Father's age*	32.4 ± 6.2	22 - 55	30.8 ± 6.5	18 - 48
Level of schooling*	8.9 ± 3.1	2 - >15	8.1 ± 2.9	0 - >15
Type of Family	Total	%	Total	%
Male head of household	100	67.5	135	90
Female head of household	49	32.5	15	10

*Significant differences at p < 0.05.

riod of the first interview. Migrant women were more likely to work in agriculture in Yuma County and as clerks before they migrated.

3.2. Acculturation of Migrant Women

The acculturation scale included 11 items which represented the proficiency of language use and preference of language (7 items), social networks (3 items) and identity (1 item). A test of reliability resulted in a Cronbach's alpha [43] of 0.77, indicating a moderately reliable scale.

Scale range varied from 15 points (which indicated that women preferred and used Spanish language at all times, had friends and neighbors only of Mexican descent, attended social gatherings only with Mexican individuals, and identified themselves always as Mexican) to 77 points (which indicated that women used and preferred to speak English, attended social gatherings with American individuals only, and identified themselves always as American). Some of the items in the scale were not relevant for women that reported that they did not listen to the radio, read books, or magazines, or go to parties or social gatherings. Items that were not applicable were coded as 0. Percentages of women who had one, two or three not applicable items were as follows: 30 (20%) for 1 item, 12 (8%) for 2 items and 1 (0.6%) for 3 items.

3.3. Food Consumption/Meal Patterns

Migrant and non-migrant women's meal patterns were described using two criteria proposed by Sanjur (1995) [33]: the presence of each food item, and the usual combination of food items within their common cultural foodways. Typical meal patterns included foods consumed by at least 30% of the women in each group. Variations to the main meal pattern involved foods consumed by at least 10% of the women in each group. Comparison of typical meal patterns among migrants and non-migrants reflect the inclusion of very similar food items and meal patterns (breakfast, lunch, dinner, and snack). However, migrant women's lunch included beef as part of the usual meal pattern. In non-migrants diets beef is present for lunch, but just as a variation of the usual lunch pattern. In addition, beef is again included for dinner within the main meal pattern of migrant women and constitutes a more elaborate meal than among non-migrant women. An explanation for this pattern could be that even when lunch is still the main meal of the day, dinner could become the main meal for those women that follow the American meal pattern. This is true especially when their families and they follow a work schedule in the U.S. Migrant and non-migrant women's fruits and vegetables intake was scarce. Tomatoes and onions were the only vegetables consumed by more than 50% of the sample; however, they were used just as condiments or in very small quantities when cooking foods.

There were no significant differences in mean consumption of total energy, energy from fat, saturated fat, and carbohydrates, as well as cholesterol, sodium, fiber, vitamin A, vitamin C, iron, and calcium intake between migrant and non-migrant women. Energy from total fat is over the recommendations in both

studied groups, as well as saturated fat consumption in migrant women. On the other hand, fiber consumption seems to be high in both studied groups when compared to mean consumption in the total adult US population (≈17 g/day) (Storey and Anderson, 2014) [44].

3.4. Food Consumption/Dietary Change

Dietary change considered: a) perceived dietary change in the last year and in the last five years and the main reasons to change, and b) actual change in the consumption of 34 food items after migration for migrant women. Whether women's food consumption increased, decreased, did not change or they never tried three different sets of food items (eleven *basic* foods, twelve *traditional* foods, and eleven *processed* foods) was assessed as the percentage of women in every category. In addition, a total score of change was computed for each category.

Among migrants 17% and 23.2% of women responded that they have made some change in their food consumption or cooking methods during the last year and last five years, respectively. Among non-migrants, the percentages were quite similar, with 19% and 18% of respondents stating that they have made some change in the foods they eat or the ways of cooking it. Migrant women's main reasons for dietary change were driven by a change in legal status (*i.e.* marriage, 5%), more knowledge about cooking (3%), or the presence of an extended family member (*i.e.* mother-in-law, 2%). Only 8% of migrant women responded that they had made changes because of migration, 16% because of health reasons, and 2% because of food cost, which were originally expected to be the main reasons for dietary change.

Table 2 shows the percentage of migrant women that answered according to the different categories of increased, decreased, did not change, or never tried for each food item. As we can see for *basic* foods, the trends in change (shadow areas) show that more migrant women have increased their consumption of *basic* foods or that the consumption of *basic* foods has stayed the same after migration. In other words, the highest percentages of migrant women's responses to change are distributed in the categories of "increase" and "no change" for *basic* foods. Interestingly, almost half of migrant women (48%) stated that they had increased their consumption of vegetables and milk, as well as 45% and 44% for fruit and chicken. However, high percentages of migrant women have not changed their *basic* food consumption (especially for eggs, rice, pasta, and oil).

Regarding change in traditional food consumption, the trend is distributed mainly among "decrease" and "stayed the same" categories. Traditional foods such as Mexican sweet bread, nopal (cactus), chicharrón (pork rinds) and tamales were foods that more than 40% of migrant women reported diminishing their intake. Except for Mexican sweet bread, *nopal*, *chicharrón*, and *tamales* are *traditional* foods that are not part of the daily consumption of foods among Mexicans, but are eaten during weekends or special events within the Mexican cultural heritage. *Traditional* foods that constitute part of the basic cultural eat-

Table 2. Dietary changes among migrant women: increase, decrease, or no change in basic, traditional, and processed foods after migration.

Basic foods					
Increased	**%**	**Decreased**	**%**	**Same**	**%**
Milk	48.0	Pork	31	Eggs	62.0
Vegetables	48.0	Cheese	22.7	Rice	62.0
Fruit	44.7	Eggs	17.3	Pasta	59.3
Chicken	44.0	Pasta	14.7	Beef	58.0
Beef	32.0	Fruit	14.0	Oil	56.7
Oil	28.7	Vegetables	12.0	Cheese	49.3
Cheese	27.3	Rice	12.0	Chicken	48.7
Rice	26.0	Beef	10.0	Milk	44.7
Pasta	20.0	Oil	10.0	Vegetables	40.0
Eggs	16.7	Chicken	7.3	Fruit	38.7
Pork	15.3	Milk	6.7	Pork	23.3
Mean	**31.9**		**13.4**		**44.0**
Traditional foods					
Increased	**%**	**Decreased**	**%**	**Same**	**%**
Licuado	27.3	Sweet Mex. bread	50.7	Beans	72
Lemonade	20.0	*Nopal*	44.6	Tortilla	63.3
Chorizo	16.7	*Tamales*	40.7	Chile	58.7
Stuffed peppers	14.7	Pork rinds	40.0	Lemonade	46.0
Tamales	14.0	Lard	38.7	*Chorizo*	42.0
Chile	9.3	Stuffed peppers	32.7	*Tamales*	39.3
Sweet Mex. bread	9.3	Tortilla	27.3	Stuffed peppers	36.7
Beans	8.7	Chile	23.3	*Licuado*	32.0
Tortilla	8.7	*Chorizo*	23.3	Lard	30.7
Nopal	8.7	*Licuado*	20.0	Sweet Mex. bread	30.7
Lard	3.3	Beans	19.3	*Nopal*	20.7
Pork rinds	2.0	Lemonade	18.0	Pork rinds	16.7
Mean	**11.9**		**31.5**		**40.7**
Processed foods					
Increased	**%**	**Decreased**	**%**	**Same**	**%**
Cereal	68.7	Soda	18.7	Jello	37.3
Ice cream	50.7	Chips	17.3	Soda	34
Instant soup	48.0	Jello	12.7	Chips	33.3
Canned fruit	44.0	Canned vegetables	9.3	Ice cream	30.7
Canned vegetables	42.0	Canned fruit	9.3	Canned vegetables	29.3
Turkey	39.3	Instant soup	9.3	Cereal	22.7
Soda	39.3	Frozen vegetables	8.7	Instant soup	16.0
Frozen Vegetables	34.0	Ice cream	7.3	Turkey	16.0
Jello	32.7	Turkey	6.7	Canned fruit	14.7
Chips	31.3	Spam	5.3	Spam	6.7
Spam	28.0	Cereal	4.7	Frozen vegetables	5.3
Mean	**41.6**		**9.9**		**22.3**

ing patterns of Mexicans, such as beans, tortillas, and chili, were reported by high percentages of migrant women (72%, 63%, and 59%, respectively) as "stayed the same." This suggests that even after migration the majority of women (and, consequently, migrant families) continued to consume main *traditional* Mexican foods. Regarding *processed* foods intake, the trend was distributed mainly within the categories of "increased" and "stayed the same." Percentages of women that increased *processed* foods consumption were, however, higher across all food items (cold dry cereals, ice cream, instant soup, and canned fruit).

3.5. Nutritional Status: Anthropometry

According to different categories of BMI, 37% of migrant women and 36% of non-migrant women were in the overweight range. However, more migrant women (32%) were categorized as obese, as compared with 19% among non-migrant women. Migrant women exhibit an even higher degree in the category of extreme obesity (4%) as compared to non-migrant women (1%). Regarding waist/hip circumference ratios among migrant and non-migrant women, and using the cut-off point of 0.8%, 52% and 42% of migrant and non-migrant women were at some risk of cardiovascular disease according to their body fat distribution pattern.

3.6. Physical Activity

Migrant women showed physical activity level (PAL) ranging from light to moderate levels, while non-migrant women had moderate and heavy PAL levels. Conversely, migrant women were more likely to be engaged in some kind of regular physical exercise (36%) than non-migrant women (13%). In general, however, high percentages of women in both migrant (64%) and non-migrant (87%) groups did not report engaging in any kind of regular physical exercise.

3.7. Smoking and Alcohol Consumption

Smoking did not appear as a prevalent health risk among the study sample, since only a small percentage of women reported being current smokers in both migrant and non-migrant groups (10 and 12% respectively). Among migrant women 16% (1% daily, 3% weekly, 4% monthly, and 6% yearly) consumed some kind of alcoholic beverage (beer, any kind of liquor, or wine). Among non-migrant women, 22% consumed alcoholic beverages (6% weekly, 7% monthly, and 8% yearly).

3.8. Stress (Only Migrant Women)

Among migrant women, the reliability test revealed a moderately reliable stress scale (Cronbach's alpha = 0.66) with a point range of 9 to 18. Mean score of stress for migrant women was 12.6 ± 2.2.

3.9. Multivariate Analysis

Comparisons of BMI, total energy, energy from total fat, saturated fat and car-

bohydrates were done between migrant and non-migrant women, after adjusting for some socioeconomic and demographic variables. Variables included for adjustments were age, education, type of family, physical activity level, energy consumption (for BMI), lactation, pregnancy, and smoking.

Table 3 shows the estimated regression coefficients, significance of variables, R^2, and model significance, which show significant higher BMI among migrant women. In the case of total energy, energy from total fat and saturated fat and carbohydrates (Table 4), results comparing migrant and non-migrant women's diets indicate that migrant women were consuming significantly less total energy compared to non-migrant women. Also, that there were no differences between migrant and non-migrant women regarding energy from total fat consumption. Migrant women, however, consumed significantly more calories from saturated fat and fewer calories from carbohydrates than non-migrant women.

3.10. Determinants of Risk Factors among Migrant Women

Table 5 shows the predictor variables considered to explain the variation of BMI and waist/hip ratios among migrant women. It also shows the "best fitting" models for the same indicators. From the analysis of the models presented for BMI, it seems the exposure to the American culture (represented by age at migration) became an important variable in explaining differences in BMI in migrant women. The more exposure to the American culture the women have, the more likely they are to increase their BMI. This is explained by the negative direction of regression coefficient for age at migration in the model; when age at migration was not considered, acculturation was significantly and positively related to BMI. Other significant variables in the model were age, consumption of energy and physical activity level. In the case of fat distribution, the full model was not significant in explaining the differences in waist/hip ratios among migrant women. However in the "best" fitting model, acculturation was marginally

Table 3. Estimated regression coefficients and significance of predictor variables for BMIs (log): comparing migrant and non-migrant women.

Predictor variables	Estimated regression coefficients	p value
Constant	1.511	0.0000
Centered age	0.0021	0.0262
Centered age^2	0.0001	0.2876
Physical Activity level	−0.0151	0.0359
Smoking	0.0036	0.8226
Education	−0.0038	0.0274
Type of family	0.0073	0.5690
Lactation	0.0045	0.7850
Energy	−0.00001	0.0348
Migration status	0.0248	0.0245
$R^2 = 0.11$ Sig. F = 0.0002		

Table 4. Comparing migrant and non-migrant women: estimated regression coefficients and significance of predictor variables for total energy, energy from total and saturated fat, and carbohydrates consumption (squared root).

Predictor variables	Estimated regression coefficients (total energy)	p value	Estimated regression coefficients (total fat)	p value	Estimated regression coefficients (saturated fat)	p value	Estimated regression coefficients (carbohydrates)	p value
Constant	2054.4	0.0000	5.37	0.0000	2.90	0.0000	7.658	0.0000
Centered age	−8.39	0.2493	−0.0009	0.9538	−0.0004	0.9666	0.0113	0.4883
Centered age^2	0.7148	0.4277	−0.0031	0.1087	−0.0016	0.1807	−0.0057	0.0047
Physical Activity level	−107.6	0.0526	0.1663	0.1601	0.0930	0.2093	0.2601	0.0362
Smoking	−119.2	0.3288	0.4237	0.1130	0.2020	0.2271	0.1677	0.5480
Education	0.3120	0.3120	0.0168	0.5504	0.0129	0.4641	−0.0253	0.3910
Type of family	0.3299	0.3299	−0.4530	0.0316	−0.2284	0.0831	−0.0974	0.6573
Pregnancy	0.3173	0.3173	0.2195	0.3320	0.1942	0.1709	−0.0772	0.7442
Lactation	415.9	0.001	−0.2170	0.4276	−0.0863	0.6140	0.1992	0.4864
Migration status	−197.4	0.0171	0.0611	0.7283	0.322	0.0037	−0.7091	0.0001
	$R^2 = 0.10$ Sig. F = 0.0003		$R^2 = 0.05$ Sig. F = 0.1116		$R^2 = 0.08$ Sig. F = 0.0062		$R^2 = 0.11$ Sig. F = 0.0002	

Table 5. Predictor variables for BMIs and waist/hip ratio among migrant women: (full and "best fitting" model).

Variables		"Best fitting" models	
Acculturation		β (BMI)	p
Age	Constant	1.621	0.0000
Age^2	Age	0.0057	0.0000
Education	PAL	−0.0229	0.0242
Family income	Age at migration	−0.0038	0.0002
Smoking	Energy	−0.00002	0.0291
Stress			
Type of family		$R^2 = 0.21$ Signif. F = 0.0000	
Score basic			
Score processed			
Score traditional		β (Waist/Hip)	p
Food stamps $	Constant	0.7412	0.0000
Lactation	Acculturation	0.1062	0.0787
Work status	Age	0.0039	0.0131
Family size	Education	−0.0044	0.0981
Age at migration			
Energy		$R^2 = 0.09$ Signif. F = 0.011	
Physical Activity level (PAL)			

significant. In addition to acculturation, education was significant in the same model, indicating that the variation in waist/hip ratio is also related to socioeconomic status.

3.11. Dietary Risk Factors and Acculturation

One of the main dietary risk factors for chronic diseases is, as referred earlier, high levels of total energy and fat intake, and especially the proportion of total energy from fat. In this study, intake of fat and calories provided by fat and saturated fat are thought to be influenced by dietary change, and in particular by that change related to the process of migration and exposure to a new culture. In this context, the variation in consumption of total energy, energy from total and saturated fat, and carbohydrates was explored mainly as a function of acculturation, controlling for socioeconomic, demographic, and health related variables. The three sub-scales related to dietary change were also included in the model as was proposed initially in the conceptual model.

The full model presented in Table 6 was not significant as to explain energy consumption. The "best" fitting model, however, seems to explain, though in a

Table 6. Predictor variables, estimated regression coefficients and significance of variables for total energy, energy from total and saturated fat and carbohydrates among migrant women.

Predictor variables Full model	Predictor variables "best fitting" models	Estimated regression coefficients	p value	Predictor variables "best fitting" models	Estimated regression coefficients	p value
Constant	**Energy**			**Saturated fat**		
Log Acculturation	Constant	1104.5	0.0139	Constant	3.03	0.0000
Centered age	Acculturation	858.1	0.0274	Physical activity level	0.1523	0.0994
Centered age^2	Physical activity level	−215.3	0.0039			
Physical activity level						
Age at migration	**$R^2 = 0.08$ Signif. F = 0.0048**			**$R^2 = 0.02$ Signif. F = 0.099**		
Education						
Family Income						
Smoking	**Carbohydrates**					
Lactation	Constant	7.215	0.0000			
Pregnancy	Centered age^2	−0.0045	0.0755			
Score basic						
Score processed	**$R^2 = 0.02$ Signif. F = 0.07**					
Score traditional						
Food stamps $						
Stress						
Family size						
Work status						
Type of family						

smaller magnitude, some of the variance in energy consumption. Acculturation was positively and significantly related to energy consumption. Physical activity level as well was significantly, but negatively, related to energy consumption. Upon further exploring the association of the socioeconomic, demographic and health-related variables and calories provided by total fat and saturated fat consumption, the full model did not explain significantly the variation in consumption of these nutrients. However, there is a trend that shows that saturated fat intake increases as the level of physical activity level rises. The R^2 for this model indicates, however, that the magnitude of variance explained is very small. In summary, it seems that the more acculturated migrant women are, the more energy they consume. Having a higher BMI seems to be associated with the exposure to the new culture, as well as to lower levels of physical activity.

Although the data shows that energy consumption is negatively associated to BMI, when one separates the group of migrant women into women with BMI ≥ 30 and women with BMI < 30, the association of mean energy consumption and BMI behaves differently. Women with BMI < 30 showed a BMI that is negatively and significantly associated with energy consumption ($p = 0.001$). On the other hand, for women with BMI ≥ 30 the association is positive and significant ($p = 0.041$). If we look at the association of BMI with energy consumption, and adjusting for physical activity, women with BMI < 30 continue to show a significant and negative association; meanwhile in women with a BMI ≥ 30 association is no longer significant ($p = 0.07$). These results could mean interplay of effects of physical activity on the association of energy consumption and BMI. In addition, it seems that none of the socioeconomic, demographic, or cultural variables were associated with fat or saturated fat consumption. Fat consumption, however, could be associated to some other health-related variables or lifestyle characteristics not explored in our models.

3.12. Predictors of Acculturation

Table 7 presents the estimated regression coefficients and significance of predictor variables for acculturation. The full model contains socioeconomic, demographic, family context, and a self-identity related variable (perceived discrimination). The full model explained 41% of the variation in acculturation and was highly significant. However, a careful interpretation of the R^2 value should be done, since the model contained three variables with condition indexes higher than 30. The same variables that were significant in the full model became even more significant in the "best" fitting model. The proportion of variance explained by this model was still of good magnitude (38%) and significant.

Based on present findings, it seems that the variance in acculturation is explained by a set of variables representing different domains: family context variables, socioeconomic, and demographic variables. The model seems to indicate that having a father born in the U.S. affects the process of acculturation negatively, while having a grandmother born in the U.S. influences acculturation positively. The more acculturated the women are, they depend less on food stamps.

Table 7. Estimated regression coefficients and significance of predictor variables for Acculturation (log): Full and "best fitting" model.

Predictor variables Full model	Estimated regression coefficients	p value	Predictor variables "best" fitting model	Estimated regression coefficients	p value
Constant	1.135	0.0000	Constant	1.031	0.0000
Centered age	0.0026	0.1982	Father born in U.S.	−0.1454	0.0099
Age at migration	−0.0101	0.0000	Grandmother (mother) born in U.S.	0.1720	0.0432
Education	0.0059	0.0970	$ from food stamps	−0.0005	0.0353
Family Income	0.0430	0.0269	Work status	0.0607	0.0113
Food stamps $	−0.0004	0.0266	Education	0.0069	0.0455
Family size	0.0169	0.0068	Age at migration	−0.0095	0.0000
Work status	0.0596	0.0201	Family size	0.0159	0.0068
Type of family	−0.0310	0.2411	Family income	0.0402	0.0183
Grandmother (mother) born in U.S.	0.1586	0.0731			
Grandfather (mother) born in U.S.	−0.0094	0.8667			
Grandmother (father) born in U.S.	−0.0341	0.6767			
Grandfather (father) born in U.S.	0.0446	0.6118			
Father born in U.S.	−0.1475	0.0274			
Mother born in U.S.	0.0314	0.7533			
Family size when in Mexico	−0.0030	0.4425			
Perceived discrimination	−0.0391	0.1656			
Work status when in Mexico	−0.0190	0.4056			
Husband born in U.S.	0.0196	0.3936			
$R^2 = 0.415$ Sig. F = 0.0000			$R^2 = 0.387$ Sig. F = 0.0000		

Also, if a mother works, education increases, the family has income, and they are likely to be more acculturated. Surely, these variables could have an impact on the magnitude of social interactions and consequently on the extent of exposure to the U.S. culture.

4. Discussion

Regarding dietary risk factors, this study suggests that they were higher in the population of migrant women when compared to non-migrant women. Findings also suggest that careful attention should be paid to a potential decrease in the consumption of complex carbohydrates among migrant women, which could potentially imply a "substitution effect" of an increase in consumption of fat, and perhaps saturated fat. According to the overall data from the multiple regression analysis, consumption of calories from saturated fat and BMI seem to be significantly higher in migrant women, compared to non-migrant women, even after adjusting for other weight and diet related variables such as smoking, lactation and pregnancy. There are other variables that in addition to energy are asso-

ciated with BMI in migrant women, for example physical activity level. This may indicate that in addition to diet, lifestyle characteristics of migrant women contribute to the differences found in BMI. This difference could well be related to a better economic situation of migrant families and consequently more access to often expensive foods such as beef.

Differences in dietary patterns among migrant and non-migrant women seem to be related to social and cultural ways within the host country. Even when lunch is still the main meal of the day, dinner could become the main meal for those women that follow the American meal pattern. This is true especially when they and their families follow a work schedule in the U.S. This cultural adaptation could have strong consequences for dietary change since women could end up consuming two elaborate meals instead of one.

These changes in meal patterns that affect nutrient consumption have been reported by Sanjur (1995) [33] among Hispanics in the U.S. and specifically in Mexican Americans. This author discusses that "although indigenous food habits of any population group are deeply rooted in local environment as well as local culture, food habits constantly change and are influenced by many factors".

In the context of dietary risk and protective factors, it is worth noting that dietary change carries the presence of both components during the process of change. Increase in the consumption of *basic* foods, such as vegetables and fruit, could mean a positive change and a contribution to the presence of protective food components as vitamins, minerals, and fiber. On the other hand, increased consumption of foods with a high content of fat, sugar, and sodium, increases health risk factors. The presence of these components can be particularly noted in the higher consumption of whole milk, ice cream, instant soup, and canned fruit, whose consumption is reported as being increased by migrant women. Similar results have been reported by, Dewey *et al.*, (1984), Romero *et al.*, (1993), and Sanjur (1995) [31] [32] [33].

It is also important to highlight the continued consumption of beans and tortillas, whose supply of complex carbohydrates and fiber to Mexicans is well recognized. These findings are consistent with the apparent similarities of meal patterns among migrants and non-migrants, the largest percentage of calories coming from carbohydrates, and with the high consumption of fiber among both groups. From our own participant observation study we learned that even after migration, Mexican American families continue to consume Mexican food at home. They find the food ingredients from grocery stores in Yuma County, or they bring the indigenous ingredients from the closest Mexican border town (San Luis, Mexico).

According to Pelto (1981) [24], family, with its particular composition and structure, is the central unit in which lifestyle is shaped. Different lifestyles come from different contexts of household structure and composition, and Pelto maintains that families with *similar lifestyles* will have similar *dietary* behaviors. In a similar way, Sims (1972) [25] proposed that, "food intake is a result of transactional patterns between resources which may enter the family from the

distal environment, and the family's use of such resources, will vary as a result of that family's decision-making and valuing process." Information that the mother gets from the media, social institutions in the community, interpersonal relationships, and from the members of her family, in addition to physical resources, can be utilized in different ways and can be transformed into specific behavior according to each type of family.

Overall, acculturation seems to be associated mostly with access to food rather than with change in consumption of dietary risk components. This is supported by the data relative to dietary change and from ethnographic fieldwork in the migrant community. Although there is an increase in consumption of processed foods and basic foods, traditional foods such as beans and tortillas are kept in the diets of migrant women. Informants reported having an increase in total consumption of foods after migration, while keeping their Mexican cooking customs. Finding ingredients was not a constraint to their dietary practices given the closeness to their home country and the frequent interaction with relatives in Mexico. Furthermore, acculturation was positively associated with socioeconomic status, indicating that interplay of socioeconomic and cultural variables is associated with food behavior in this group of Mexican immigrants. A study by Gregory-Mercado *et al*. (2006) [45], reported a negative association of fruit and vegetables (FV) intake and acculturation among older low socioeconomic status Mexican American women in Arizona; they also reported that persistent low FV intake increased BMI risk in this sample of Mexican-American women. These authors discussed, that socioeconomic status, as well as education, among other social and cultural variables, could modify the relationship of acculturation and dietary change among the Mexican American population; and stressed the need for studies that include dietary patterns, food availability, social structure, health concern, purchasing power, and food preparation responsibilities to make adequate inferences in this population.

On the other hand, several studies have reported contrasting results on the relationship of acculturation and BMI. Khan *et al*. (1997) [46] found that an increased use of English language (as a measure of acculturation) was associated with a decrease in BMI among Mexican American women. Their analysis, however, included first, second and third generation Mexican Americans from the HHANES (1982-84) national study. Pérez-Escamilla (2011) [22] in a review of studies on acculturation, nutrition and health disparities of Latino populations in the U.S., reported that most of the reviewed studies found a positive relationship of acculturation and obesity; however, this author suggests that to reach appropriate conclusions on the cause-effect of this association, a comparison group of Latino-born population must be included, "since obesity rates change as a function of age and have increased across time in immigrant and native-born minority populations". Pérez-Escamilla concludes that to better understand the effect of acculturation on health risks factors, "a cohort study should include a parallel group of the immigrant's home Country".

In this study, the relationship of acculturation with BMI was positive, but

women in the sample were by design first generation Mexican immigrants exclusively; they represent a group that is located in the first part of the curve of acculturation and BMI. Moreover, we found that immigrant women had higher BMI than non-migrant women living in Mexico.

For this study sample, there is better access to food than there was in Mexico. It is, still, however, a low income population whose closeness to its country of origin, together with its primarily Mexican cultural heritage, allows it to keep, to a large extent, traditional food consumption patterns, while having better access to food in general. Their socioeconomic status, while low to U.S. standards, may still signify an improvement over what they previously had in Mexico.

5. Practical Implications

Some implications of the findings of this study for future sensitive and culturally appropriate nutritional interventions follow. There are subgroups of population living in the US region that based on their cultural heritage and socioeconomic characteristics should be thought of more as a native Mexican population than as a bicultural or acculturated population. The overall behavioral health and nutrition promotion programs should continue encouraging to reduce smoking and alcohol consumption, as well as the consumption of fiber-rich traditional foods as part of good health practices. Physical exercise should be part of the same programs since the data from this study supports the association between physical activity level and BMI. Physical exercise should also be promoted since both groups of women expressed a desire to lose weight.

6. Study Limitations and Future Research

Some study limitations should be noted. Collection of data was performed in the mid-late nineties; however, published research data on the study matter is limited in such border region, as well as studies that include comparison data from migrant's country of birth. Sampling locations in both study sites differ; in Yuma County the WIC clinic offered nutritional counseling and food aid to immigrant women, but in Hermosillo, Mexico, women attended a doctor's appointment which did not include any nutritional guidance.

Finally, it is recommended that in the same areas of the United States, the intergenerational food-related behavior should be studied. For research purposes, the collection and analysis of information within these groups living close to Mexico can improve understanding of food-related behavior and acculturation of future generations. For community-based studies, understanding dietary change and examining points for interventions that differ from those needed by first generation Mexican Americans will greatly improve the effectiveness of strategies for nutritional interventions.

Acknowledgements

research. This study has benefited from the financial support of CSRS/US Department of Agriculture Grant No. 94-34324-0987.

References

[1] Green, W.L. and Kreuter, M.W. (1991) Health Promotion Today and a Framework for Planning. In: *Health Promotion Planning: An Educational and Environmental Approach*, Mayfield Publishing Co. Mountain View, 1-31.

[2] Commission on Social Determinants of Health (CSDH) (2008) Closing the Gap in a Generation: Health Equity through Action on the Social Determinants of Health. Final Report of the Commission on Social Determinants of Health, World Health Organization, Geneva.

[3] González, V.M., González, J.T., Freeman, V. and Howard-Pitney, B. (1991) Health Promotion in Diverse Cultural Communities: Practical Guidelines for Working in and with Diverse Cultural Communities. Health Promotion Resource Center, Stanford Center for Research in Disease Prevention, Palo Alto, CA.

[4] Cyril, S., Smith, B.J., Possamai-Inesedy, A. and Renzaho, A.M.N. (2015) Exploring the Role of Community Engagement in Improving the Health of Disadvantaged Populations: A Systematic Review. *Glob Health Action*, **8**, Article ID: 29842.
https://doi.org/10.3402/gha.v8.29842

[5] United States-Mexico Border Health Commission (2010) Healthy Border 2020: A Prevention & Health Promotion Initiative. El Paso, Texas, and Tijuana Mexico, 18-20.

[6] Willey, J.Z., Rodriguez, C.J., Park Moon, Y., Paik, M.C., Di Tullio, M.R., Homma, S., Sacco, R.L. and Elkind, M.S.V. (2012) Coronary Death and Myocardial Infarction among Hispanics in the Northern Manhattan Study: *Exploring the Hispanic Paradox*.

[7] Siega-Riz A.M., Sotres-Alvarez, D., Ayala, G.X., Ginsberg, M., Himes, J.H., Liu, K., Loria, C.M., Mossavar-Rahmani, Y., Rock, C.L., Rodriguez, B., Gellman, M.D. and Van Horn, L. (2014) Food-Group and Nutrient-Density Intakes by Hispanic and Latino Backgrounds in the Hispanic Community Health Study/Study of Latinos. *American Journal of Clinical Nutrition*, **99**, 1487-1498.
https://doi.org/10.3945/ajcn.113.082685

[8] Cortes-Bergoderi, M., Goel, K., Murad, M.H., Allison, T., Somers, V.K., Erwin, P.J., Sochor, O. and Lopez-Jimenez, F. (2013) Cardiovascular Mortality in Hispanics Compared to Non-Hispanic Whites: A Systematic Review and Meta-Analysis of the Hispanic Paradox. *European Journal of Internal Medicine*, **24**, 791-799.
https://doi.org/10.1016/j.ejim.2013.09.003

[9] US Bureau (2010) https://www.census.gov/2010census/

[10] Brown, A. and López, M.H. (2013) Mapping the Latino Population, by State, County and City.
http://www.pewhispanic.org/2013/08/29/mapping-the-latino-population-by-state-county-and-city

[11] Robinson, L. (1998) U.S. News and World Report.

[12] Roberts, B.R. (1995) Socially Expected Durations and the Economic Adjustment of Immigrants. In: Portes, A., Ed., *The Economic Sociology of Immigration*, Russel Sage Foundation, New York, 43.

[13] Ayala, G.X., Baquero, B. and Klinger, S. (2008) A Systematic Review of the Relationship between Acculturation and Diet among Latinos in the United States: Implications for Future Research. *Journal of the American Dietetic Association*, **108**,

1330-1344.

[14] Sobal, J. and Stunkard, A. (1989) Socioeconomic Status and Obesity: A Review of the Literature. *Psychological Bulletin*, **105**, 260-275.
https://doi.org/10.1037/0033-2909.105.2.260

[15] Belcher, J.D., Ellison, R.C., Shepard, W.E., Bigelow, C., Webber, L.S., Wilmore, J.H., Parcell, G.S., Zucker, D.M. and Luepker, R.V. (1993) Lipid and Lipoprotein Distributions in Children by Ethnic Group, Gender, and Geographic Location: Preliminary Findings of the Child and Adolescent Trial for Cardiovascular Health (CATCH). *Preventive Medicine*, **22**, 143-153.
https://doi.org/10.1006/pmed.1993.1012

[16] Kumanyika, S.K. and Golden, P.M. (1991) Cross-Sectional Differences in Health Status in US Racial/Ethnic Minority Groups: Potential Influence of Temporal Changes, Disease, and Life-Style Transitions. *Ethnicity & Disease*, **1**, 50-59.

[17] Maurer, K.R., Everhart, J.E., Ezzati, T.M., Johannes, R.S., Knowler, W.C., Larson, D.L. and Roth, H.P. (1989) Prevalence of Gallstone Disease in Hispanic Populations in the United States. *Gastroenterology*, **96**, 487-492.
https://doi.org/10.1016/0016-5085(89)91575-8

[18] Samet, J.M., Coultas, D.B., Howard, C.A., Skipper, B.J. and Hanis, C.L. (1988) Diabetes, Gallbladder Disease, Obesity, and Hypertension among Hispanics in New Mexico. *American Journal of Epidemiology*, **128**, 1302-1311.
https://doi.org/10.1093/oxfordjournals.aje.a115083

[19] Hanis, C.L., Ferrel, R.E., Barton, S.A., Aguilar, L., Garza-Ibarra, A., Tulloch, B.R., Garcia, C.A. and Schull, W.J. (1983) Diabetes among Mexican Americans in Starr County, Texas. *American Journal of Epidemiology*, **118**, 659-672.
https://doi.org/10.1093/oxfordjournals.aje.a113677

[20] Stern, M.P., Gaskill, S.P., Allen, C.L., Garza, V., González, J.L. and Waldrop, R.H. (1981) Cardiovascular Risk Factors in Mexican Americans in Laredo, Texas. Prevalence of Overweight and Diabetes and Distributions of Serum Lipids. *American Journal of Epidemiology*, **113**, 546-555.
https://doi.org/10.1093/oxfordjournals.aje.a113131

[21] Liao, Y., Cooper, R.S., Cao, G., Kaufman, J.S., Long, A.E. and McGee, D.L. (1997) Mortality from Coronary Heart Disease and Cardiovascular Disease among Adult US Hispanics: Findings from the National Health Interview Survey (1986 to 1994). *Journal of the American College of Cardiology*, **30**, 1200-1205.
https://doi.org/10.1016/S0735-1097(97)00278-7

[22] Pérez-Escamilla, R. (2011) Acculturation, Nutrition, and Health Disparities in Latinos. *American Journal of Clinical Nutrition*, **93**, 1163S-1167S.
https://doi.org/10.3945/ajcn.110.003467

[23] Kim, Y.Y. (1991) Communication and Cross-Cultural Adaptation. In: Samovar, L.A. and Porter, R.E., Eds., *Intercultural Communication,* Wadsworth Publishing, Co., Belmont, CA, 383-390.

[24] Pelto, G.H. (1981) Anthropological Contributions to Nutrition Education Research. *Journal of Nutrition Education*, **13**, s2-s8.
https://doi.org/10.1016/S0022-3182(81)80003-9

[25] Sims, L.S., Paolucci, B. and Morris, P.M. (1972) A Theoretical Model for the Study of Nutritional Status: An Ecosystem Approach. *Ecology of Food and Nutrition*, **1**, 197-205. https://doi.org/10.1080/03670244.1972.9990290

[26] Bowner, W.S., Black, D., Newman, T.B. and Hulley, S.B. (1988) Estimating Sample Size and Power. In: Hulley, S.B., Cummings, S.V., Collins, N. and Eckhart, C., Eds., *Designing Clinical Research*, Cap. 13, Williams & Williams, Baltimore, MD, 139-

150.

[27] Conway, J.M., Ingwersen, L.A., Vinyard, B.T. and Moshfegh, A.J. (2003) Effectiveness of the US Department of Agriculture 5-Step Multiple-Pass Method in Assessing Food Intake in Obese and Nonobese Women. *The American Journal of Clinical Nutrition*, **77**, 1171-1178.

[28] Geghardt, S.E. and Matthews, R.H. (1981) Nutritive Value of Foods. USDA. Vol. 72, Home and Garden Bulletin, Washington DC, 1-72.

[29] Hernández, M., Chávez, A. and Bourges, H. (1980) Nutritive Value of Mexican Foods. Practical Guidance Tables. 8th Edition, Nutrition Division Publications of National Institute of Nutrition, Mexico, 6-31.

[30] Grijalva, M.I., Caire, G., Sánchez, A. and Valencia, M.E. (1995) Chemical Composition, Dietary Fiber and Mineral Content of Frequently Consumed Foods in Northwest Mexico. *Archivos Latinoamericanos de Nutrición*, **45**, 145-150.

[31] Dewey, K.G., Strode, M.A. and Ruiz, Y. (1984) Dietary Change among Migrant and Non-Migrant Mexican-American Families in Northern California. *Ecology of Food and Nutrition*, **14**, 11-24.

[32] Romero-Gwynn, E., Gwynn, D., Grivetti, L., McDonald, R., Stanford, G., Turner, B., West, E. and Williamson, E. (1993) Dietary Acculturation among Latinos of Mexican Descent. *Nutrition Today*, 6-12.
https://doi.org/10.1097/00017285-199307000-00003

[33] Sanjur, D. (1995) Mexican-American Diets and Nutrient Intake. In: *Hispanics Foodways Nutrition and Health*, Prentice Hall Inc., 36-43, Englewood Cliffs, NJ, 64-107.

[34] Cameron, N. (1986) The Methods of Auxological Anthropometry in Human Growth. In: Falkner, F. and Tanner, J.M., Eds., *Methodology, Ecological, Genetic, and Nutritional Effects on Growth*, Vol. 3, Plenum Press, New York, 16-18, 26-28.

[35] Kissebah, A.H. and Krakower, G.R. (1994) Regional Adiposity and Morbidity. *Physiological Reviews*, **74**, 761-812.

[36] World Health Organization (1995) Expert Committee on Physical Status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee, WHO Technical Report Series, 854, Geneva.

[37] World Health Organization (2008) Waist Circumference and Waist-Hip Ratio. Report of WHO Expert Consultation, Geneva, 8-11.

[38] Cuellar, I., Harris, L.C. and Jasso, R. (1980) An Acculturation Scale for Mexican American Normal and Clinical Populations. *Hispanic Journal of Behavioral Sciences*, **2**, 199-217.

[39] Krause, N. and Goldenhar, L.M. (1992) Acculturation and Psychological Distress in Three Groups of Elderly Hispanics. *Journal of Gerontology: Social Sciences*, **47**, s279-s288. https://doi.org/10.1093/geronj/47.6.s279

[40] Patton, M.Q. (1990) Qualitative Evaluation and Research Methods. 2nd Ed., Sage Publications, Inc. Newbury Park, California, 91320, 67-68, 88, 136, 153, 215, 241, 425.

[41] SAS Software. Copyright © (1997) SAS Institute Inc. SAS and All Other SAS Institute Inc. Product or Service Names Are Registered Trademarks or Trademarks of SAS Institute Inc., Cary, NC, USA.

[42] SPSS Inc., Released 2005. Statistics for Windows, Version 14.0. SPSS Inc., Chicago.

[43] Carmines, G.E. and Zeller, R.A. (1979) Assessing Reliability. In: *Reliability and Validity Assessment*, Sage University Paper Series on Quantitative Applications in the Social Sciences, Series no. 07-017, Newbury Park, California, 91320.

https://doi.org/10.4135/9781412985642.n4

[44] Storey, M. and Anderson, P. (2014) Income and Race/Ethnicity Influence Dietary Fiber Intake and Vegetable Consumption. *Nutrition Research*, **34**, 844-850. https://doi.org/10.1016/j.nutres.2014.08.016

[45] Gregory-Mercado, K.Y., Staten, L.K., Ranger-Moore, J., Thomson, C.A., Will, J.C., Ford, E.S., Guillen, J., Larkey, L.K., Giuliano, A.R. and Marshall, J. (2006) Fruit and Vegetable Consumption of Older Mexican-American Women Is Associated with Their Acculturation Level. *Ethnicity & Disease*, **16**, 89-95.

[46] Khan, L.K., Sobal, J. and Martorell, R. (1997) Acculturation, Socioeconomic Status, and Obesity in Mexican Americans, Cuban Americans, and Puerto Ricans. *International Journal of Obesity*, **21**, 91-96. https://doi.org/10.1038/sj.ijo.0800367

Appendix A

QUESTIONNAIRES

INTERVIEWER_____ CODE_____ DATE_____

SOCIODEMOGRAPHICS

1. How many persons are now living in your house?

   Circle: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15+

2. Household composition

NAME	SEX	AGE	OCCUPATION	CITY, STATE, AND COUNTRY OF BIRTH

24-HOUR RECALL QUESTIONNAIRE

24-Hour Recall						
NAME: _____						
Hour	Food description	Where	Food Preparation	Portion Consumed	Grams	Code

1. Do you usually eat like this? Yes: _____ No: _____
2. Why? _____
3. Are you taking any supplement or vitamin? Yes: _____ No: _____
4. Type _____
5. How often do you take it?   Daily _____   Weekly_____ Rarely _____
6. Are you on a special diet?   No_____ Weight loss _____ Low salt _____

   Medical condition _____ Vegetarian_____

   Low Cholesterol_____ Weight gain_____

ANTHROPOMETRIC MEASURES

MEASURES	MOTHER	CHILD
HEIGHT		
WEIGHT		

TRICIPITAL SKINFOLD		
SUBSCAPULAR SKINFOLD		
WAIST CIRCUMFERENCE		
HIP CIRCUMFERENCE		
BLOOD PRESSURE		
BIRTHDATE		

7. Are you pregnant? _____   1. Yes_____   2. No_____

8. Are you breastfeeding? _____   1. Yes_____   2. No_____

FOOD FREQUENCY QUESTIONNAIRE

FOOD FREQUENCY QUESTIONNAIRE											
	MEDIUM SERVING	SERVING SIZE				HOW OFTEN?					CODE
FRUITS		S	M	L		D	W	M	Y	R	
1. Apples	1 medium										
2. Pears	1 medium										
3. Bananas	1 medium										
4. Peaches, nectarines (C,F,D)	1 medium										
5. Cantaloupe (in season)	¼ medium										
6. etc…											
This questionnaire included 125 food items categorized into: FRUITS; VEGETABLES; MEAT, MIXED DISHES, LUNCH ITEMS; BREADS/SALTY SNACKS/SPREADS; SWEETS; DAIRY PRODUCTS; BEVERAGES.											

Note: This questionnaire will be available by the authors upon request.

ACCULTURATION

9. Which language do you prefer to use in daily life?

___1.Spanish all the time

___2.Spanish mostly

___3.Spanish/English equally

___4.English mostly

___5.English all the time

10. What language do you speak:

	At home	Work/school	W/friends
1. Spanish all the time			
2. Spanish mostly			
3. Spanish/English equally			
4. English mostly			
5. English all the time			

11. In what language are:

	T.V. programs	Radio stations	Books/ magazines
1. Spanish all the time			
2. Spanish mostly			
3. Spanish/English equally			
4. English mostly			
5. English all the time			

12. Can you read Spanish?   ___1.Yes ____2.No
13. Can you read English?   ___1.Yes ____2.No
14. Which do you read better?

      ___1.Spanish better than English

      ___2.Spanish and English equally

      ___3.English better than Spanish

15. Can you write in English?   ___1.Yes ___2. No
16. Can you write in Spanish   ___1.Yes ___2. No
17. Which do you write better?

      ___1. Spanish better than English

      ___2. Spanish and English equally

      ___3. English better than Spanish

18. In which country were you and relatives born?

	Mexico	U.S. State	Other
Respondent			
Spouse			
Father			
Mother			
Father's father			
Father's mother			
Mother's father			
Mother's mother			

19. How do you identify yourself?

___1. Mexican or Mexicano   ___5. Latino

___2. Chicano   ___6. Spanish American

___3. Mexican American   ___7. American

___4. American of Mexican descent

20. If you were born in Mexico, at what age moved permanently to U.S.?

_____yrs.

21. Are your friends mostly of Mexican or American descent?

___1.Only Mexican   ___4.Mostly American

___2.Mostly Mexican   ___5.Only American

___3.Equally Mexican and American

22. Are your neighbors mostly of Mexican or American descent?

___1.Only Mexican   ___4.Mostly American

___2.Mostly Mexican   ___5.Only American

___3.Equally Mexican and American

23. Are the people at the places where you go to have fun and to relax (at parties, dances, picnics) mostly Mexican or American?

___1.Only Mexican   ___4.Mostly American

___2.Mostly Mexican   ___5.Only American

___3.Equally Mexican and American

24. What do you think about the following American institutions?

Public schools_____

Why?_____

Religion_____

Why?_____

Family_____

Why?_____

25. Have you ever been discriminated against because you are of Mexican descent?   Yes___   No___

26. In what ways have you been discriminated against?

_____

DIETARY CHANGE AND FOOD PREPARATION

27. Was there any change in the way you cook and prepare foods in the last year?   Yes___   No___   or five years? Yes___No___

28. Why did you change?_____

29. Which of these methods do you usually use to cook foods?

Frying _____   Boiling_____   Grilling_____   Baking _____

30. If frying, what kind of fat do you use?

Lard _____   Margarine_____   Vegetable oil_____

Butter_____   Beef lard_____   Vegetable lard_____

O_____

31. How often do you...?

	Often/Always	Sometimes	Seldom/Never
Remove the skin from chicken			
Trim the fat off your meat			
Eat eggs			
Use salad dressings/mayonnaise			
Drink whole milk			
Eat cream/sour cream			
Add sugar to cereal			
Eat Ice cream			
Eat pies			
Eat pastries			
Add sugar to coffee			
Drink soda pop			
Use canned foods			
Add salt to foods when cooking			
Add salt to foods at the table			
Eat lunch meats/frankfurters			
Eat Commercial french fries			
Eat Chinesse foods			

32. If you trim the fat off your meat or remove the skin from chicken, what is the reason?

_____

33. Could you tell me if after you came to the United States you eat more, less, the same or never tried the following foods?

Food	More	Less	Same	Never tried
Basic				
Beef				
Pork				
Chicken				
Milk				
Eggs				
Cheese				
Fruits				
Vegetables				
Pasta				
Rice				
Oil				
Traditional				
Beans				
Tortilla				
Chili				
Lard				
Sweet bread				
"Licuados"				
Lemonade				
"Nopales"				
"Chorizo"				
"Chicharrón"				
"Tamales"				
Stuffed peppers				
New				
Breakfast cereals				
Canned Vegetables				
Frozen Vegetables				
Canned fruit				
Instant soup				

Canned meat (Spam)				
Turkey				
Soda				
Ice cream				
Chips (snack)				
Jello				

Comments_____

MIGRATION HISTORY AND SOCIOECONOMIC INFORMATION

34. What year did you first come to the U.S.?_____

35. Have you:
    ___1. Stayed in the U.S. since then
    ___2. Moved back to Mexico for a while and then returned to the U.S.

36. Why did you come to U.S.?_____

37. How many family members were in your family when you were in Mexico?

    Circle: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 +15

38. Did you work in Mexico?   ___1.Yes   ___2.No

39. What was your last job there?_____

40. Do you work now?   ___1.Yes   ___2.No

41. What kind of work do you do?_____
_____

42. In what range is your family weekly income?
    ___1. 100 - 200 dlls.   ___3. 401 - 600 dlls
    ___2. 201 - 400 dlls.   ___4. +600 dlls

43. What other jobs have you had, and where?_____

44. What is your highest grade you completed at school?
    Circle: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15+

45. Was it in: ___1. Mexico   ___2. U.S.

LIFESTYLE

46. Have you smoked at least 100 cigarettes in your entire life?

Yes___   No___

47. If yes in number 46: about how old were you when you first started smoking cigarettes fairly regularly?_____

48. On the average of the entire time you smoked, how many cigarettes did you smoke per day?_____

49. Do you smoke cigarettes now?   Yes___   No___

50. If not: How old were you when you stopped smoking? _____yrs.

51. If yes: On the average, about how many cigarettes a day do you smoke now? _____ cigarettes

52. Do you exercise regularly?   Yes___   No___

53. If yes: What kind of exercise?

_____

54. If not, why not?

_____

55. Which are your usual activities in a normal day?

___1. Light housework   ___4. Walking
___2. Medium housework   ___5. Aerobics
___3. Heavy housework   ___6. Agricultural work

56. Do you think your current weight is:

___1. Too high   ___2. Too low   ___3. About right

57. Would you like to:

___1. Gain weight   ___2. Lose weight   ___3. Stay the same

58. When was the last time you saw a doctor?

_____

59. Which was the reason(s) to see the doctor?

_____

60. Do you have medical insurance?   Yes___   No___

61. If yes: What type?

_____

STRESS

62. Is not having enough money to live a serious problem?

Yes___ No___

63. Are medical bills a serious problem for you/your family?

Yes___ No___

64. During the past two weeks, did you get together socially (including eating) with friends and neighbors?

Yes___ No___

65. Have you talked with or received any news/letters from relatives in Mexico in the last month?

Yes___ No___

66. Have you argued seriously with your children recently?

Yes___ No___

67. Are you frequently worried about your children's behavior?

Yes___ No___

68. In the past few weeks, have you felt depressed and very unhappy?

Yes___ No___

69. Is being anxious and worried a serious problem?

Yes___ No___

70. In the last few weeks, have you felt that things were going your way?

Yes___ No___

Comments: _____

EATING OUT

71. How often do you eat out?

HOUSEHOLD MEMBERS	B	L	D	S	WHERE	HOW OFTEN? D W M R		
HOMEMAKER								

B: Breakfast D: Dinner D: Daily M: Monthly
L: Lunch S: Snack W: Weekly R: Rarely

72. Weekly mean Expenses when eating out _____ dlls.

73. Reason (s) for eating out: _____

Comments _____

FOOD PURCHASING

74. Where do you usually buy your food/groceries? _____
_____

75. Why do you buy there?

   ___1. Inexpensive   ___4. Quality of foods

   ___2. Closer   ___5. Variety

   ___3. Convenient   ___6. Other_____

76. What foods do you almost always buy? _____
_____
_____

77. Have you changed the foods you buy in the last year? Yes___   No____

   Or five years? Yes___   No____

78. In what way have you changed?_____

79. Are you eligible for food stamps   Yes___   No___

80. Do you get and use food stamps?   Yes___   No___

81. How much do you receive in food stamps?_____ dlls/week

FOOD PREFERENCES

82. Could you tell me how much do you and your child like the following foods?

FOOD	MOTHER						CHILD				
	VL	L	N	D	VD		VL	L	N	D	VD
1. Cheese											
2. Red meat											
3. Whole milk											
4. 2% milk											
5. French fries											
6. Ice cream											
7. Pies											
8. "Chorizo"											
9. Beans											
10. Lemonade											
11. Burritos											
12. Chili beans											
13. Macarroni and cheese											

14. Spam										
15. Soda										
16. Hamburguers										
17. Hot dogs										
18. Hot salsa										
19. Tacos										
20. Tortilla										

83. Which are you and your child's five favorite, most disliked, and never tasted foods?

Subject	5 favorite foods	5 most disliked foods	5 never tasted foods
Mother			
1			
2			
etc.			
Child			
1			
2			
etc.			

84. Does your child speak English?　　　　　___Yes　___No

85. What programs does he/she watch on T.V. _____

86. Are your child's friends from Mexican or American descent?
　___1.Only Mexican　　　　　___4.Mostly American
　___2.Mostly Mexican　　　　　___5.Only American
　___3.Equally Mexican and American

Comments_____