



Acculturation and dietary intake pattern among Jamaican immigrants in the US[☆]

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ARTICLE INFO

Keywords:

Dietary patterns
Acculturation
Cardiovascular risk
Jamaican

ABSTRACT

Information on dietary intakes of Jamaican immigrants in the United States is sparse. Understanding factors that influence diet is important since diet is associated with chronic diseases. This study examined the association between acculturation, socio-cultural factors, and dietary pattern among Jamaican immigrants in Florida. Jamaican persons 25–64 years who resided in two South Florida counties were recruited for participation. A health questionnaire that assessed acculturation, dietary pattern, and risk factors for cardiovascular disease was administered to participants. Generalized Estimating Equations were used to determine associations. Acculturation score was not significantly associated with dietary intake pattern ($\beta = -0.02$ $p = 0.07$). Age at migration was positively associated with traditional dietary pattern ($\beta = 0.02$ $p < 0.01$). Persons with 12 or fewer years of education ($\beta = -0.55$ $p < 0.001$), divorced ($\beta = -0.26$ $p = 0.001$), or engaged in less physical activity ($\beta = -0.07$ $p = 0.01$) were more likely to adhere to a traditional diet. Although acculturation was not a statistically significant predictor of dietary intake, findings show the role of demographic and lifestyle characteristics in understanding factors associated with dietary patterns among Jamaicans. Findings point to the need to measure traditional dietary intakes among Jamaicans and other immigrant groups. Accurate assessment of disease risk among immigrant groups will lead to more accurate diet-disease risk assessment and development of effective intervention programs.

1. Introduction

Few studies have examined the influence of acculturation on dietary intakes among black Caribbean immigrants to the United States, though previous studies have documented this association in other immigrant groups (Dekker et al., 2011; FB et al., 2000; Keys, 1980; Maki, 2004; Voutilainen et al., 2001). In addition, some validated and widely used food frequency questionnaires used to assess usual intake do not include traditional foods consumed by immigrants, precluding the ability to examine influences on dietary intakes in these populations (Block et al., 1986; Fraser, 1999; Willett, 1998). Prior findings, many of which were conducted among Hispanic-origin groups, show increasing

prevalence of diet-related chronic diseases such as cardiovascular disease, hypertension and diabetes with increased time spent in the United States (Wilks et al., 1998, 1999; Forrester et al., 1998).

Western dietary pattern has been found to play a role in the increased prevalence of chronic conditions observed among immigrant populations. The Western diet consists of processed foods, is high in fat and simple carbohydrates, and is high in sugar. Studies have shown deleterious effects associated with changes in traditional dietary intakes to a more Western or acculturated diet among many immigrant subgroups (Oza-Frank et al., 2011; Perez-Escamilla, 2011; Sanou et al., 2014; Steffen et al., 2006). For example, evidence shows that Mexican-Americans who adhere to a Western diet have higher prevalence of

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<https://doi.org/10.1016/j.pmedr.2017.12.007>

Received 4 April 2017; Received in revised form 4 December 2017; Accepted 18 December 2017

Available online 21 December 2017

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cardiovascular risk factors such as obesity, hypertension, and impaired glucose tolerance (Denova-Gutiérrez et al., 2016; Rodríguez-Morán et al., 2009). It is also well established that traditional dietary patterns that are rich in fruits and vegetables, whole grains, low-fat dairy, and low in saturated fats are associated with lower prevalence of risk factors for chronic disease (Gardener et al., 2011; Shen and Takeuchi, 2001). The changes in dietary pattern and the observed increase in chronic disease risk factor prevalence underscore the importance of understanding the factors that contribute to changes in dietary intake pattern post migration.

A large body of literature demonstrates the pivotal role of acculturation in the development of cardiovascular risk factors among immigrant groups in the US (Abraido-Lanza et al., 2005; Diez-Roux et al., 2005; Koya and Egede, 2007; Mooteri et al., 2004; Rosenthal, 2014; Steffen et al., 2006). Overall, findings show lower rates of diet-related chronic conditions and risk factors compared to those who emigrate to the US, implicating post-migration changes in lifestyle behaviors (Forrester et al., 1998; Lizarzaburu and Palinkas, 2002). These findings have primarily been observed among Mexican immigrants, who have been the focus of acculturation and health studies. More recent studies conducted among other Hispanic populations, including Puerto Rican and Dominican subgroups, show consistent findings (Kershaw et al., 2016; Lin et al., 2003; Pérez-Escamilla and Putnik, 2007). Two known studies conducted among non-Hispanic Caribbean immigrants show mixed findings (Allen et al., 2014a; Ayala et al., 2008; Huffman et al., 2014). One study showed an association between lower acculturation and poor diet quality/less healthful intakes, while the other found that more acculturated persons had poorer dietary quality (Allen et al., 2014b; Huffman et al., 2014). The mixed findings likely reflect differences in quality and type of food intakes attributed to diverse regions or urbanicity within in the country of origin and varied measurement of acculturation.

Most studies of acculturation and health outcomes utilize temporal proxy measures such as length of time in the US and age of migration or language use (Celenk and Van de Vijver, 2011; Margarita, 2009; Thomson and Hoffman-Goetz, 2009). Though these measures have increased our understanding of how acculturation affects the health of immigrants, they fail to capture multiple dimensions of acculturation (Celenk and Van de Vijver, 2011; Margarita, 2009). The proximity of the Caribbean to the US mainland, and presence of ethnic enclaves along the Eastern seaboard make temporal measures impractical for some Caribbean immigrant groups. The use of language preference to capture acculturation is also limited to immigrants for whom English is not their primary language.

Our study sought to determine the influence of acculturation on dietary intake pattern among Jamaican immigrants, a growing immigrant population for whom little is known about diet-related chronic disease risk. In contrast to a Western diet, the traditional Jamaican diet consists of unprocessed foods, mixed dishes, root vegetables, spices and herbs, and a variety of meats and fish. Foods that are typically eaten include one pot meals that include meat and vegetables (e.g. stews and soups), yam, rice and peas, pumpkin, banana, porridges, codfish, and calaloo, a green leaf vegetable similar to spinach. We hypothesized that Jamaican immigrants who were less acculturated and who lived in a Jamaican enclave would be more likely to adhere to a traditional diet. Given the limitations associated with commonly used acculturation measures, we used a measure that captures multidimensional aspects of acculturation that excluded language use and dietary preference to examine associations with dietary intake pattern (i.e. traditional vs. acculturated diet).

2. Methods

2.1. Sample

The *Jamaicans Migrating to the United States* study (JAMUS) was a

cross-sectional study conducted to examine associations between acculturation, dietary intake pattern, and risk factors for heart disease among Jamaican immigrants in South Florida, home to a large Jamaican population (Thompson and Byers, 1994). A two-staged cluster sampling design was used to select participants for the JAMUS study. First, we enumerated churches and community organizations in Palm Beach and Broward counties for potential recruitment into the JAMUS study. A total of 12 organizations and churches were contacted for recruitment, of which eight agreed to participate in the study.

We obtained membership lists from churches and organizations to select individuals for participation. A random sample of Jamaican immigrants ages 25–64 was obtained from the eight participating community organizations and churches. Individuals were eligible if they: 1) were born in Jamaica, 2) self-identified as black, 3) had no history of absence from the US for > 6 months, and 4) had lived in the US for at least one year. The overall response rate was 64%, similar to prior studies conducted among Jamaican immigrants (Sharma et al., 1999). The study was approved by the University of South Florida Institutional Review Board (protocol # 00002078).

2.2. Procedures

Potential participants were contacted by telephone and invited to participate in the study. Individuals who agreed to participate in the study were asked to complete an in-person interviewer-administered health questionnaire and 24-hour diet recall. After informed consent, interviews were conducted at a place of the participants choosing. A total of 91 persons, 45 of whom also completed a 24-hour recall for different study aim, consented to participate and completed the health questionnaire. Participants were asked demographic questions, including questions on risk factors for chronic illness, height, and weight, and completed an acculturation scale that was adapted from existing validated measures (Phinney, 1992; Tsai et al., 2000).

2.3. Measures

2.3.1. Acculturation

The acculturation scale was adapted from the abridged General Ethnicity Questionnaire (GEQ) and the Multigroup Ethnic Identity Measure (MEIM) (Phinney, 1992; Tsai et al., 2000). Questions were adapted to capture social and cultural dimensions of acculturation, including cultural values and norms that are most relevant to Jamaicans. The scale covered social and cultural characteristics (e.g. socialization with other Jamaicans, traditional values, celebrations, upbringing) that assessed a person's attitude toward cultural patterns of the host country and the level of social contact with persons from one's own ethnic group. These dimensions were chosen in order to distinguish different levels of acculturation among this English-speaking population, as most proxy measures are hypothesized to be ineffective in this population. Participants were asked to respond on a scale of 1 (strongly disagree) to 4 (strongly agree) to demonstrate their agreement with the questions. The acculturation scale was scored according to the standard scoring used for Likert response options. A score was calculated for both social and cultural dimensions of acculturation, by summing the responses over items assessing each dimension.

2.3.2. Dietary intake pattern

The outcome, dietary intake pattern, was defined as traditional or acculturated. Traditional and acculturated dietary intake pattern was measured by the frequency of consumption of traditional vs. acculturated or Western foods. Study participants were asked to indicate on average how many days each week they ate foods they considered to be traditional Jamaican foods. This question was used to classify persons as having a more or less traditional (i.e. traditional vs. acculturated) eating pattern and has been found to clearly distinguish these eating patterns in a previous study (Sharma et al., 1999). Foods reported as

traditional had historical roots in Jamaica and were commonly served at Jamaican restaurants and in Jamaican homes. The latter determination was based on observation of foods served at local restaurants and the investigators own cultural background. Results from previous research conducted among Caribbean immigrants in Great Britain showed that the distribution of consumption of Caribbean food follows a bimodal distribution (Sharma et al., 1999). The distribution showed that most participants either consumed Caribbean foods infrequently or frequently.

2.3.3. Covariates

In addition to the main variables of interest, we also collected factors associated with both dietary intake and acculturation. The interview included questions about age, sex, marital status, employment status, and educational attainment. We also obtained information on physical activity, which was measured by the average number of days participants engaged in any type of physical activity. Body mass index status was determined using the following cut off points: below 18.5-underweight, 18.5–24.9 normal weight, 25.0–29.9-overweight, and 30.0 and above-obese. Other covariates included sociocultural factors such as age at migration to the US, length of time in the US, socialization with other Jamaicans, residence in an Jamaican enclave, availability of Caribbean or Jamaican food stores, availability of Caribbean or Jamaican restaurants, and residence of children under 18 years in the home.

2.4. Analyses

Dietary intake was treated as both a dichotomous and a count variable in analyses. For descriptive analyses, dietary intake pattern was measured as a dichotomous variable based on observed natural breaks in the distribution of the variable. In contrast, dietary intake pattern was measured as the number of days per week that traditional foods were consumed in multivariate analyses. Based on the distribution of the outcome variable, traditional dietary pattern was defined as consumption of traditional foods four or more days per week and acculturated dietary pattern as three or fewer days for descriptive analyses.

Descriptive statistics were calculated to examine the distribution of study variables, frequencies, and to assess the degree of missing values for variables. Data for two participants who had missing data on the acculturation scale was excluded from the final model. Otherwise, data for all 91 participants were used for descriptive and bivariate analyses. Household income was excluded from all analyses due to a high number of missing values.

We conducted univariate analyses to examine the relationship between each independent variable and dietary intake pattern (measured as the number of days participants reported consuming traditional foods). Variables that were statistically significant in bivariate analyses were included in the final regression model. Variables that were not statistically significant were excluded from the model with the exception of demographic variables and variables shown in previous work to influence the outcome. We also examined correlations between acculturation measures that were included in the survey (age at migration and length of time in the US) to assess multicollinearity and to inform inclusion of these variables in the final model.

We used generalized estimating equation (GEE) modeling for multivariate analyses to model the outcome dietary intake pattern. This method was used to adjust for the clustered nature of the data and to obtain more robust standard errors. We performed initial analyses using linear regression treating the responses as independent, and GEE method modeling, which treated responses as dependent. Results were compared with previous results, not adjusting for possible correlation between individuals, to determine if the clustering effect resulted in vastly different parameter effects. The comparison showed the generalized estimating equation model more accurately estimated

Table 1
Participant characteristics (n = 91), Jamaicans immigrants in Florida, 2008–2011.

Characteristic	Traditional dietary pattern (n = 23) (n) %	Acculturated dietary pattern (n = 66) (n) %
Age (mean, SD)	46 (10.4)	46 (10.6)
Age at migration (mean, SD)	28 (10.6)	24 (11.3)
Mean years in US, (mean, SD)	17 (10.0)	21 (9.8)
Mean acculturation (mean, SD)	26 (5.7)	26 (5.4)
Body mass index status		
Underweight	1 (4.4)	1 (1.5)
Normal	7 (30.4)	13 (19.1)
Overweight	8 (34.8)	32 (47.1)
Obese	7 (30.4)	22 (32.3)
Men	11 (47.8)	34 (50.0)
Married, %	17 (73.9)	36 (52.9)
Single/widowed, %	3 (13.0)	13 (19.1)
Divorced/separated, %	3 (13.0)	19 (27.9)
College graduated +, %	6 (26.1)	37 (54.4)
Some college, %	4 (17.4)	21 (30.9)
0–12 years education, %	13 (56.5)	10 (14.7)
Employed	20 (87.0)	3 (91.2)

Note: SD = standard deviation.

parameter estimates and had smaller standard errors compared to the linear regression model. The GEE model specified a Poisson distribution and a log link function.

The variables included in the final model were age, sex, employment status, educational attainment, age at migration, socializing with other Jamaicans, presence of children under 18 years in the home, marital status, physical activity, availability of Jamaican grocers and restaurants, and residence in a Jamaican enclave. Analyses were conducted using SAS Statistical Software version 9 of the SAS system for Windows.

3. Results

3.1. Sample characteristics

A total of 91 participants completed the interview between January 2008 and March 2010. Twenty-three percent of participants had a traditional diet while 68% had an acculturated diet. Table 1 presents the demographic characteristics of study participants.

The mean acculturation score was similar for both traditional and acculturated groups. Other proxy measures of acculturation were also similar for both groups; persons with a traditional diet were older at migration and had shorter length of time in the US. Results also showed that a higher proportion of persons with a traditional diet had less education and were married compared to those with an acculturated diet. The proportion of overweight and obese persons was greater among persons with an acculturated diet. Mean age and marital status categories were similar across traditional and acculturated dietary patterns. We evaluated the representativeness of our sample by comparing age and educational attainment distribution between our sample to estimates obtained from published reports that include Jamaicans. The distribution of educational attainment in the current study was comparable to national estimates (Thomas, 2012).

3.2. Bivariate results

Table 2 presents the results of univariate model analyses examining the association between key study variables and the outcome variable dietary intake pattern (measured as the number of days that traditional food was consumed). Measures of acculturation had a statistically significant association with dietary intake pattern. For every 1 unit

Table 2
Bivariate association between dietary intake pattern and sociodemographic characteristics (n = 91), Jamaican immigrants in Florida, 2008–2010.

Characteristic	Estimate	p-Value
Acculturation score	− 0.03	0.04
Age	0.01	0.56
Sex ^a	0.03	0.81
Socialize with other Jamaicans ^b	0.08	0.39
Persons living in neighborhood not Jamaican ^c	− 0.22	0.04
Stores available to buy Jamaican groceries	− 0.07	0.77
Availability of Jamaican Restaurants ^d	− 0.17	0.19
Educational attainment		
0–12 years	0.57	< 0.001
Some college	− 0.16	0.08
Number of children < 18 years old	0.14	0.07
Age at migration to US	0.01	< 0.001
Marital status		
Divorced/separated	− 0.26	0.11
Single	− 0.11	0.64
Physical activity	− 0.06	0.16

Note: bold text indicates a statistically significant result.

^a Referent = men.

^b Referent = persons who reported socializing with other Jamaicans.

^c Referent = persons who did not reside in predominantly Jamaican neighborhoods.

Referent = persons who did not have stores available to purchase Jamaican groceries.

^d Referent = persons who disagreed to having restaurants available to purchase Jamaican foods.

increase in age at migration, the number of days traditional food was consumed increased by 0.01 ($p < 0.001$). Similarly, more acculturated persons were found to consume traditional foods fewer days per week compared to less acculturated persons ($\beta = -0.03, p = 0.04$). Educational attainment (0–12 years) was also a statistically significant predictor of dietary intake pattern. Persons with 0–12 years of education consumed traditional foods more days compared to persons with a college education ($\beta = 0.57, p \leq 0.001$).

3.3. Multivariate results

Table 3 shows the results of the multivariate GEE model regressing

Table 3
Generalized estimating equation model results for acculturation and dietary intake pattern, Jamaican immigrants in Florida, 2008–2010.

Variable	Estimate	p-Value	Confidence interval
Acculturation score ^a	− 0.02	0.07	− 0.05 to 0.00
Age	0.00	0.87	− 0.02 to 0.02
Sex ^b	0.19	0.23	− 0.12 to 0.49
Persons living in neighborhood not Jamaican	0.08	0.67	− 0.30 to 0.47
Stores available to buy Jamaican groceries ^c	0.05	0.84	− 0.47 to 0.57
Availability of Jamaican restaurants ^e	− 0.30	0.07	− 0.63 to 0.03
Educational attainment			
0–12 years ^d	− 0.55	< 0.001	0.36 to 0.74
Some college	− 0.03	0.82	− 0.28 to 0.22
Number of children < 18 years old	− 0.03	0.70	− 0.16 to 0.11
Age at migration to US ^a	0.02	0.01	0.00 to 0.03
Socialize with other Jamaicans ^d			− 0.16 to 0.33
Marital status			
Divorced/separated	− 0.26 ^a	0.001	− 0.42 to − 0.10
Single	− 0.16	0.53	− 0.67 to 0.35
Physical activity	− 0.07 ^a	0.01	− 0.12 to − 0.01

^a Statistically significant.

^b Referent = men.

^c Referent = persons who did not reside in predominantly Jamaican neighborhoods.

^d Referent = persons who reported socializing with other Jamaicans.

^e Referent = persons who disagreed to having restaurants available to purchase Jamaican foods.

acculturation on the outcome frequency of traditional food consumption. Dietary intake was defined as a count in multivariate analyses. We modeled dietary intake pattern as the number of days per week traditional foods were consumed in the GEE model. Level of acculturation was not a statistically significant predictor of dietary intake (Table 3). After accounting for covariates, results showed that persons with higher acculturation consumed traditional foods fewer days per week compared to less acculturated persons ($\beta = -0.02, p = 0.07$). However, age at migration had a statistically significant positive association with consumption of traditional foods ($\beta = 0.02, p = 0.01$). Persons with 0–12 years of education reported greater consumption of traditional foods per week compared to persons with a college education or higher ($\beta = 0.55, p < 0.001$). Marital status was also a statistically significant predictor of dietary pattern. Divorced persons consumed traditional foods fewer days per week compared to those who were married ($\beta = -0.26, p = 0.001$). Finally, physical activity was negatively associated with consumption of traditional foods showing that persons who exercised more days per week consumed traditional foods less often compared to those who exercised fewer days per week.

4. Discussion

This study sought to determine the influence of acculturation, and other sociocultural factors known to be associated with dietary intake, on the consumption of traditional Jamaican foods by Jamaican immigrants. Jamaicans are one of many black immigrant populations in the US for whom little is known about dietary patterns and the role of acculturation in influencing dietary intake patterns. The current study findings varied in consistency with previous findings, most of which are based on studies conducted among Hispanic populations.

Contrary to our hypothesis, our acculturation score was not a statistically significant predictor of dietary intake pattern (measured by number of days traditional food was consumed). However, the direction of the association was consistent with previous findings that show more acculturated persons are less likely to adhere to a traditional dietary pattern (Burmudez et al., 2000; Himmelgreen et al., 2005). Small sample size may have precluded the ability to observe a statistically significant association. The direction of the association, however, suggests that less acculturated persons, many of whom had low educational attainment, consumed traditional foods despite their higher cost. A similar finding was observed in a study conducted by Sharma et al. (1999) that observed higher consumption among persons of lower socio-economic status despite higher costs for traditional Jamaican foods (Sharma et al., 1999).

Age at migration, a proxy measure of acculturation, was significantly associated with consumption of traditional foods while the acculturation scale score was not found to be statistically significant. We conducted a sensitivity analysis to determine the potential mediating effect of age of migration and results were not statistically significant. This disparate finding suggests that the non-significant finding for the acculturation scale may be due to the small sample size or rather the inability of the scale to accurately capture dimensions of acculturation that are most relevant to Jamaicans. This speaks to the need to develop measures of acculturation specific to English-speaking black populations, since most of the existing measures were developed for use among Hispanic Spanish-speaking immigrants. The scale used in the current study was adapted from two other scales validated for use in multi-ethnic populations, however, they may still lack the specificity to capture aspects of the acculturation phenomenon in this Jamaican sample. Most acculturation measures were developed for use in specific target populations (i.e. populations of Hispanic descent) and are therefore limited in their ability to capture diverse acculturative experiences. Other measures developed or used in multi-ethnic populations, such as the ones used in the current study, may lack specificity and fail to capture this phenomenon (i.e. acculturation) in some immigrant groups.

Other findings showed that less educated persons tended to adhere to a traditional dietary pattern, which suggests two things: 1) persons with less education were likely not exposed to other cultural foods or people; 2) persons with less education may not have been exposed to culturally diverse environments/neighborhoods. The acculturation process may therefore be different for persons with lower educational attainment. We examined the interaction between educational attainment and level of acculturation. Results showed that educational attainment moderates the association between acculturation and dietary intake pattern. This statistically significant finding supports the notion that persons with less education were likely immersed in Jamaican culture and therefore less acculturated resulting in more frequent consumption of traditional foods. Findings among other immigrant populations were also consistent with the current finding (A et al., 2007).

Another important finding was that persons who are divorced are less likely to consume traditional foods compared to those who were married. Prior work has shown that the consumption of traditional foods may depend on the presence of other adult family members (Lee et al., 1999; Lv and Brown, 2010). The preparation of traditional foods is time consuming and may not be viewed worthwhile in the absence of a spouse or larger family. The finding that persons who engaged in more frequent physical activity consumed a less traditional diet suggests that these persons are more acculturated and highly educated since culturally, structured physical activity is typically observed among more affluent persons.

Limitations of the study included the small sample size and potential differences between responders and non-responders. The small sample size precluded the inclusion of other explanatory variables (e.g. smoking, BMI, time available to prepare traditional meals) that have been found to be associated with acculturation and dietary intakes. This study also did not include measures of migration experience, pre-migration socioeconomic status, and environmental/contextual factors that can influence acculturation and dietary intakes.

To our knowledge, this study was the first to examine social and cultural factors that are associated with dietary intake of Jamaican immigrants, a sub-population whose dietary intakes are not reflected in national survey data. Having a better understanding of the determinants of dietary pattern among Jamaicans and other immigrant subgroups is important for disease prevention and intervention efforts. Study results helped to elucidate social factors that are associated with dietary intake pattern among Jamaicans. This study suggests that educational attainment, age at migration, marital status and physical activity are important predictors of dietary pattern among Jamaican immigrants.

Our findings have significant implications for dietary data collection efforts and acculturation measurement. Current data collection methods preclude the ability to capture traditional food intakes for certain immigrant groups, including Jamaicans. Failure to capture traditional intakes may lead to inaccurate assessment of diet-related cardiovascular risk among immigrant groups. Population-specific dietary assessment methodologies are needed to accurately monitor the health of immigrant groups. In addition, the inclusion of traditional foods for non-Hispanic immigrant groups in national surveys would expand our ability to evaluate diet-related disparities across racial/ethnic groups. The result of these efforts will be useful for clinical prevention efforts.

Limitations in the ability of current measures to capture the acculturation process in specific immigrant populations suggests the need for formative work to identify domains that accurately capture experiences relevant for Jamaican and other Anglophone immigrant populations. The expansion of current measurement approaches beyond the inclusion of language use is an area prime for future work. The growing diversity of the US population and demonstrated link between acculturation and health make this work imperative. Future research will focus on understanding domains of acculturation that are relevant

to the development of risk factors for chronic disease in this population. We will also extend the current work to evaluate the quality of dietary intake patterns.

Acknowledgements

This research was supported by the Yale CTSA grant UL1TR000142 from the National Center for Advancing Translational Science (NCATS), Yale School of Medicine, and the National Institute on Minority Health and Health Disparities through the Yale Transdisciplinary Collaborative Center for Health Disparities Research focused on Precision Medicine (Yale-TCC)–U54MD010711.

References

- Bersamin, A., Zidenberg-Cherr, S., Stern, J.S., Luick, B.R., 2007. Nutrient intakes are associated with adherence to a traditional diet among Yup'ik Eskimos living in remote Alaska Native communities: the CANHR Study. *Int. J. Circumpolar Health* 66 (1), 62–70.
- Abraido-Lanza, A.F., Chao, M.T., Florez, K.R., 2005. Do healthy behaviors decline with greater acculturation? Implications for the Latino mortality paradox. *Soc. Sci. Med.* 61 (6), 1243–1255.
- Allen, J.D., Caspi, C., Yang, M., et al., 2014a. Pathways between acculturation and health behaviors among residents of low-income housing: the mediating role of social and contextual factors. *Soc. Sci. Med.* 123, 26–36.
- Allen, J.D., Caspi, C., Yang, M., et al., 2014b. Pathways between acculturation and health behaviors among residents of low-income housing: the mediating role of social and contextual factors. *Soc. Sci. Med.* 123 (Supplement C), 26–36.
- Ayala, G.X., Baquero, B., Klinger, S.A., 2008. Systematic review of the relationship between acculturation and diet among Latinos in the United States: implications for future research. *J. Am. Diet. Assoc.* 108 (8), 1330–1344.
- Block, G., Hartman, A.M., Dresser, C.M., Carroll, M.D., Gannon, J., Gardner, L., 1986. A data-based approach to diet questionnaire design and testing. *Am. J. Epidemiol.* 124 (3), 453–469.
- Burmudez, O., Falcon, L., Tucker, K., 2000. Intake and food sources of macronutrients among older Hispanic adults: association with ethnicity, acculturation, and length of residence in the United States. *J. Am. Diet. Assoc.* 100 (6), 665–673.
- Celenk, O., Van de Vijver, F.J., 2011. Assessment of acculturation: issues and overview of measures. *Online Read. Psychol. Cult.* 8 (1), 10.
- Dekker, L., Snijder, M., Beukers, M., et al., 2011. A prospective cohort study of dietary patterns of non-Western migrants in the Netherlands in relation to risk factors for cardiovascular diseases: HELIUS-Dietary Patterns. *BMC Public Health* 11 (1), 441.
- Denova-Gutiérrez, E., Tucker, K.L., Flores, M., Barquera, S., Salmerón, J., 2016. Dietary patterns are associated with predicted cardiovascular disease risk in an urban Mexican adult population. *J. Nutr.* 146 (1), 90–97.
- Diez-Roux, A.V., Detrano, R., Jackson, S., et al., 2005. Acculturation and socioeconomic position as predictors of coronary calcification in a multiethnic sample. *Circulation* 112 (11), 1557–1565.
- FB, Hu, Rimm, E.B., Stampfer, M.J., Ascherio, A., Spiegelman, D., Willett, W.C., 2000. Prospective study of major dietary patterns and risk of coronary heart disease in men. *Am. J. Clin. Nutr.* 72 (4), 912–921.
- Forrester, T., Cooper, R.S., Weatherall, D., 1998. Emergence of Western diseases in the tropical world: the experience with chronic cardiovascular diseases. *Br. Med. Bull.* 54 (2), 463–473.
- Fraser, G.E., 1999. Diet as primordial prevention in seventh-day adventists. *Prev. Med.* 29 (6), S18–S23.
- Gardener, H., Wright, C.B., Gu, Y., et al., 2011. Mediterranean-style diet and risk of ischemic stroke, myocardial infarction, and vascular death: the Northern Manhattan Study. *Am. J. Clin. Nutr.* 94 (6), 1458–1464.
- Himmelgreen, D., Perez-Escamilla, R., Brettnall, A., Peng, Y., Burmudez, A., 2005. Birth place, length of time in U.S., and language are associated with diet among inner-city Puerto Rican women. *Ecol. Food Nutr.* 44 (2), 105–122.
- Huffman, F.G., Vaccaro, J.A., Zarini, G.G., Dixon, Z., 2014. Comparison of two indices of diet quality with acculturation factors and demographics in Haitian Americans. *Ecol. Food Nutr.* 53 (1), 42–57.
- Kershaw, K.N., Giacinto, R.E., Gonzalez, F., et al., 2016. Relationships of nativity and length of residence in the U.S. with favorable cardiovascular health among Hispanics/Latinos: the Hispanic Community Health Study/Study of Latinos (HCHS/SOL). *Prev. Med.* 89 (Supplement C), 84–89.
- Keys, A., 1980. Coronary heart disease, serum cholesterol, and the diet. *Acta Med. Scand.* 207 (3), 153–160.
- Koya, D.L., Egede, L.E., 2007. Association between length of residence and cardiovascular disease risk factors among an ethnically diverse group of United States immigrants. *J. Gen. Intern. Med.* 22 (6), 841–846.
- Lee, S., Sobal, J., Frongillo, E., 1999. Acculturation, food consumption, and diet-related factors among Korean Americans. *J. Nutr. Educ.* 31, 321–330.
- Lin, H., Bermudez, O.L., Tucker, K.L., 2003. Dietary patterns of Hispanic elders are associated with acculturation and obesity. *J. Nutr.* 133 (11), 3651–3657.
- Lizarzaburu, J., Palinkas, L., 2002. Immigration, acculturation, and risk factors for obesity and cardiovascular disease: a comparison between Latinos of Peruvian descent in Peru and in the United States. *Ethn. Dis.* 12 (3), 342–352.

- Lv, N., Brown, J.L., 2010. Chinese American family food systems: impact of Western influences. *J. Nutr. Educ. Behav.* 42 (2), 106–114.
- Maki, K.C., 2004. Dietary factors in the prevention of diabetes mellitus and coronary artery disease associated with the metabolic syndrome. *Am. J. Cardiol.* 93 (11, Supplement 1), 12–17.
- Margarita, A., 2009. The challenge of acculturation measures: what are we missing? A commentary on Thomson & Hoffman-Goetz. *Soc. Sci. Med.* 69 (7), 996–998.
- Mooteri, S.N., Petersen, F., Dagubati, R., Pai, R.G., 2004. Duration of residence in the United States as a new risk factor for coronary artery disease (The Konkani Heart Study). *Am. J. Cardiol.* 93 (3), 359–361.
- Oza-Frank, R., Stephenson, R., Venkat Narayan, K.M., 2011. Diabetes prevalence by length of residence among US immigrants. *J. Immigr. Minor. Health* 13 (1), 1–8.
- Perez-Escamilla, R., 2011. Acculturation, nutrition, and health disparities in Latinos. *Am. J. Clin. Nutr.* 93 (5), 1163S–1167S.
- Pérez-Escamilla, R., Putnik, P., 2007. The role of acculturation in nutrition, lifestyle, and incidence of type 2 diabetes among Latinos. *J. Nutr.* 137 (4), 860–870.
- Phinney, J., 1992. The Multigroup Ethnic Identity Measure: a new scale for use with adolescents and young adults from diverse groups. *J. Adolesc. Res.* 7, 156–176.
- Rodríguez-Morán, M., Guerrero-Romero, F., Rascón-Pacheco, R.A., 2009. Dietary factors related to the increase of cardiovascular risk factors in traditional Tepehuano communities from Mexico. A 10 year follow-up study. *Nutr. Metab. Cardiovasc. Dis.* 19 (6), 409–416.
- Rosenthal, T., 2014. The effect of migration on hypertension and other cardiovascular risk factors: a review. *J. Am. Soc. Hypertens.* 8 (3), 171–191.
- Sanou, D., O'Reilly, E., Ngnie-Teta, I., et al., 2014. Acculturation and nutritional health of immigrants in Canada: a scoping review. *J. Immigr. Minor. Health* 16 (1), 24–34.
- Sharma, S., Cade, J., Riste, L., Cruickshank, K., 1999. Nutrient intake trends among African-Caribbeans in Britain: a migrant population and its second generation. *Public Health Nutr.* 24 (4), 469–476.
- Shen, B.-J., Takeuchi, D.T., 2001. A structural model of acculturation and mental health status among Chinese Americans. *Am. J. Community Psychol.* V29 (3), 387–418.
- Steffen, P.R., Smith, T.B., Larson, M., Butler, L., 2006. Acculturation to Western society as a risk factor for high blood pressure: a meta-analytic review. *Psychosom. Med.* 68 (3), 386–397.
- Thomas, K., 2012. Demographic Profile of Black Caribbean Immigrants in the United States. Migration Policy Institute, Washington, DC.
- Thompson, F.E., Byers, T., 1994. Dietary assessment resource manual. *J. Nutr.* 124 (11_Suppl) 2245s-2317.
- Thomson, M.D., Hoffman-Goetz, L., 2009. Defining and measuring acculturation: a systematic review of public health studies with Hispanic populations in the United States. *Soc. Sci. Med.* 69 (7), 983–991.
- Tsai, J.L., Ying, Y.W., Lee, P.A., 2000. The meaning of “being Chinese” and “being American” - variation among Chinese American young adults. *J. Cross-Cult. Psychol.* 31 (3), 302–332.
- Voutilainen, S., Rissanen, T.H., Virtanen, J., Lakka, T.A., Salonen, J.T., 2001. Low dietary folate intake is associated with an excess incidence of acute coronary events: the Kuopio ischemic heart disease risk factor study. *Circulation* 103 (22), 2674–2680.
- Wilks, R., Bennett, F., Forrester, T., McFarlane-Anderson, N., 1998. Chronic diseases: the new epidemic. *West Indian Med. J.* 47 (Suppl. 4), 40–44.
- Wilks, R., Rotimi, C., Bennett, F., et al., 1999. Diabetes in the Caribbean: results of a population survey from Spanish Town, Jamaica. *Diabet. Med.* 16 (10), 875–883.
- Willett, W.C., 1998. *Nutritional Epidemiology*, 2nd ed. Oxford University Press, New York.