Published in final edited form as:

West J Nurs Res. 2018 July ; 40(7): 942–960. doi:10.1177/0193945917692305.

Acculturation and Physical Activity among Latinas enrolled in a 12-month Walking Intervention

Rodney P. Joseph^a, Tanya J. Benitez^a, Barbara E. Ainsworth^b, Michael Todd^a, and Colleen Keller^a

^aArizona State University College of Nursing and Health Innovation, 500 N 3rd Street, Phoenix, AZ 85004

^bDepartment of Exercise Science and Health Promotion at the Arizona State University School of Nutrition and Health Promotion, College of Health Solutions, 550 N 3rd Street, Phoenix, AZ 85004

Abstract

This report evaluates the relationship between acculturation and assimilation with the physical activity outcomes of a 12-month walking intervention for postpartum Latinas ($n=81$, M age =29.2, M BMI = 30.0). Physical activity was measured by ActiGraph GT1M accelerometers.

Acculturation and assimilation were measured by the Hazuda Acculturation and Assimilation Scales. Data were collected at baseline, 6-months, and 12-months. Results showed a trend for participants classified in the least acculturated groups to engage in more moderate-to-vigorous physical activity than participants classified in the higher acculturated/assimilated groups for two dimensions of acculturation (Adult Proficiency in English vs. Spanish, $p=.002$; Adult Pattern of English Language vs. Spanish Language, $p=.001$) and two dimensions of assimilation (Childhood Interaction with Members of Mainstream Society, $p=.028$; Adult Functional Integration into Mainstream Society, $p<.001$). No other significant effects were observed. Findings highlight the continued need to understand the context in which acculturation and assimilation influence PA.

Keywords

Acculturation; Postpartum Period; Female; Hispanic Americans; Physical Activity

Physical activity (PA) is beneficial for the prevention and treatment of chronic disease conditions. To achieve optimal health benefits from PA, national guidelines suggest adults engage in a minimum of 150 minutes per week of moderate intensity PA or 75 minutes of vigorous intensity PA and engage in strengthening activities at least twice a week (US Department of Health and Human Services, 2008). These guidelines further assert that moderate and vigorous intensity PA levels should be performed in bouts of at least 10 minutes or greater to receive health benefits. However, many adults, including Latinas, remain insufficiently active. The most recent nationally representative data using accelerometers to examine the PA profiles of Latinas was published in 2008 by Troiano and colleagues (2008). Using data from the 2003–2004 National Health and Nutrition Examination Survey (NHANES), Troiano and colleagues (2008) reported that Mexican-American women aged 20–59 performed, on average, a total of 21.7 minutes/day of

moderate intensity PA and 22.1 minutes/day of combined moderate-to-vigorous PA (MVPA). However, when considering only MVPA performed in bouts of 10 minutes or greater (coinciding with the national PA recommendations), these estimates dropped to 5.6 minutes/day of moderate intensity PA, and 6.1 minutes/day of combined MVPA; equating to weekly totals of 32.9 minutes/week of moderate PA and 42.7 minutes/week of MVPA. Thus, falling substantially lower than the national recommendations. Moreover, while national-level data on the PA patterns of postpartum women are not available, studies have consistently shown that women are less active in postpartum (i.e., <12 months postpartum) than before their pregnancy (Albright, Maddock, & Nigg, 2005; Pereira et al., 2007; Coll et al., 2016). Given PA during postpartum period has shown to improve mood, reduce depressive symptoms, enhance cardiorespiratory fitness, and promote weight loss (Evenson, Mottola, Owe, Rousham, & Brown, 2014), intervention efforts are needed to successfully promote PA during postpartum, as well as throughout the lifespan.

The Influence of Acculturation and Assimilation on the Physical Activity Patterns of Latinas

Intervening to successfully increase the PA levels of Latinas requires in-depth understanding of the sociocultural factors that influence Latinas' participation in PA. Two important sociocultural factors that appear to influence PA engagement among Latinas include acculturation and assimilation. Acculturation refers to the process of cultural and psychological change stemming from the interaction between two or more cultural groups (Sam & Berry, 2010), often resulting in changes in values, attitudes and behaviors (Cuéllar, Arnold, & Gonzalez, 1995). Acculturation is often viewed as a single dimension under the broader concept of assimilation (Gordon, 1964, 1975). Assimilation refers to a multidimensional concept that refers to the process in which members of a minority group become integrated into the dominant or mainstream society (Hirschman, 1983; Teske & Nelson, 1974). While various types and dimensions of assimilation have been identified in the literature, frequently cited dimensions include: 1) cultural assimilation or acculturation (i.e., change of cultural patterns to those of host society), 2) structural assimilation (i.e., entrance into cliques and social organizations/institutions, 3) marital assimilation (i.e., intermarriage), 4) identificational assimilation (i.e., development of a sense of community based exclusively on the host society), 5) attitude receptional assimilation (i.e., absence of prejudice), 6) behavior receptional assimilation (i.e., absence of discrimination), and 7) civic assimilation (i.e., absence of value and power conflict) (Gordon, 1964, 1975).

A breadth of literature has examined the relationship between acculturation and the PA levels of Latinas (Benitez, Dodgson, Coe, & Keller, 2016). However, the extent to which these constructs influence PA is not fully understood. A 2016 review (Benitez et al., 2016) examining the relationship between acculturation and the PA levels of Latinas highlights the inconclusive evidence on this topic. Among the 28 quantitative studies reviewed by the authors, half (50%, n=14) reported a positive relationship between acculturation and PA, 7% (n=2) reported a negative relationship, and 18% (n=5) reported no association. The remaining 25% (n=7) of studies reported the association between acculturation and PA varied according to PA domain (i.e., leisure-time PA vs. non-leisure-time PA) and

generation. These inconsistent associations between acculturation and PA may, in part, be due to the method used to assess PA, as self-report methods often underestimate PA levels of Latinas when compared to non-Hispanic adults (Ham & Ainsworth, 2010). The broad conceptualization of acculturation by authors and numerous measures used to assess acculturation further compounds understanding the acculturation-PA relationship (Benitez et al., 2016). It is also important to point out that while acculturation has been broadly examined in PA research, research on the association between the concept of assimilation and PA in Latinas remains limited.

While the extant literature suggests that acculturation and assimilation may be important factors influencing PA among Latinas, further research is necessary to explore the inconsistent findings in published literature. In particular, the use of objective PA measures, longer-term studies, and robust measures of acculturation and assimilation have been recommended to help provide a greater understanding of how these constructs influence PA in Latinas (Benitez et al., 2016). Such knowledge can help researchers and health practitioners intervene and increase PA levels of Latinas.

Purpose

This purpose of this research was to evaluate the relationship between acculturation and assimilation with accelerometer-measured physical activity outcomes of a 12-month, culturally relevant, social support-mediated intervention designed to increase walking behavior among postpartum Latinas. We hypothesized that lower levels of acculturation and assimilation will be associated with greater PA levels over the 12-month intervention.

Methods

Participants

Participants of this study were postpartum Latinas enrolled in the *Madres para la Salud* study, a 12-month, two-arm randomized controlled trial evaluating a social support-mediated walking intervention to promote postpartum weight loss. For a detailed description of the *Madres para la Salud* study design and primary outcomes (i.e., social support, PA, body composition), readers are referred to previously published articles (Keller et al., 2011, 2014). Inclusion criteria for the study included: (a) habitually sedentary (< 2.5 hours of moderate-intensity PA per week as assessed by the Stanford Brief Activity Survey questionnaire) but able to participate in moderate-intensity walking, (b) self-identified as Latina, (c) 18 to 40 years of age, (d) 6-weeks to 6-months post birth, and (e) BMI of 25 to 35 kg/m². Exclusion criteria were: (a) severe musculoskeletal or cardiorespiratory problems that would preclude participating in PA, (b) currently pregnant or plans to become pregnant within the next 12 months, (c) current use of antidepressants, anticoagulants, or herbal remedies that affect coagulation, (d) infectious illness, acute or chronic systemic inflammation, (e) regularly taking high doses of oral steroid medication, or (f) osteoporosis at baseline (bone mineral density $\geq$ 2.5 SD below the average for this age group). The original baseline sample of the *Madres para la Salud* cohort consisted of 139 Latinas. Data presented in this report are from the 81 women completing the study and providing sufficient data for inclusion in data analysis.

Measures

Demographic and anthropometric characteristics—A short demographic questionnaire developed for the current study was used to collect demographic data of participants. Information collected included: age, marital status, country of origin, education level, annual household income, employment status, and number of individuals living in the household where participants reside. To calculate BMI (weight in kg/height in m²), weight was measured in kilograms using a standardized scale and height was measured in centimeters by a trained research technician at the baseline study assessment.

Physical activity—Physical activity was measured by the ActiGraph GT1M accelerometer (ActiGraph LLC, Pensacola, FL). The GT1M is a small, battery operated, lightweight, electronic solid state motion sensor designed to measure the rate and magnitude of body movement on a vertical plane. Data collected by the GT1M are digitized at a rate of thirty times per second with intensity data recorded in one minute epochs (sampling interval). Output data are presented as counts per minute, with the higher number of counts reflecting a higher intensity of movement. These counts were based on: a) the frequency of acceleration deflections, and b) the duration of the sustained period of the deflections. Study protocol required participants to wear the GT1M on their right hip for a consecutive 7-day period. To constitute as a valid assessment and to be included in analyses, participants had to wear the accelerometer for at least three days during the seven day assessment period. They also were required to wear the accelerometer for at least 10 hours/day for each of the three or more days. The GT1M accelerometer data were scored using the Freedson cut-point of 1,952 counts per minute or greater (Freedson, Melanson, & Sirard, 1998) to estimate minutes per day of MVPA.

Acculturation and assimilation—The Hazuda Acculturation and Assimilation Scales (Hazuda, Stern, & Haffner, 1988) were used to measure acculturation and structural assimilation. These scales assess 5 dimensions of acculturation: Childhood Experience with English vs. Spanish, Adult Proficiency in English, Adult Pattern of English vs. Spanish Language usage, Value Placed on Preserving Mexican Cultural Origin, and Attitude toward Traditional Family Structure and Sex-role Orientation; and 3 dimensions of structural assimilation into mainstream society: Childhood Interaction with Members of Mainstream Society, Adult Interaction with Members of Mainstream Society, and Adult Functional Integration with Mainstream Society. Table 1 describes key concepts measured by each subscale and provides an abbreviated name for each subscale that will be subsequently used in this article. The Hazuda Scales were originally developed as part of the San Antonio Heart Study and tested among a sample of 3,078 (n=1,861 Latino; n=1,217 non-Hispanic Whites) community-dwelling San Antonio, Texas residents. Subscales measuring each dimension of acculturation and assimilation were derived from a critical review of acculturation theory, prior published research in the field of acculturation and cardiovascular disease, and previous work conducted by Hazuda and colleagues (Hazuda et al., 1988). Validity of the subscales was established through a series of psychometric analyses that included multiple criterion and discriminant measures (readers are referred to the original validation article by Hazuda et al. (Hazuda et al., 1988) for a comprehensive description of extensive validation procedures). In the original validation study, inter-item reliability

estimates for each subscale were moderate-to-high (i.e., range .70 to .97), with most subscales demonstrating Cronbach's alphas $>.80$ (Hazuda et al., 1988). Among our sample of Latinas, inter-item reliability estimates for each subscale were as follows: English Proficiency $\alpha=.94$, Adult Language Pattern $\alpha=.89$, Preserving Culture $\alpha=.81$, Family Structure $\alpha=.67$, Childhood Interaction with Mainstream Society $\alpha=.94$, Adult Interaction with Mainstream Society $\alpha=.51$, and Functional Integration $\alpha=.68$.

When scoring the Hazuda Scales, each dimension of acculturation and assimilation is scored separately. Thus, as opposed to providing a unidimensional or global assessment of acculturation and assimilation, Hazuda's individual subscales provide a multi-dimensional assessment of acculturation and assimilation. The scales are scored by categorizing participant responses on into four categories, rank ordered from least to most acculturated levels. A score of 1 represents the lowest level of acculturation or assimilation and a score of 4 represents the high level of acculturation or assimilation. For example, women who score a 4 on the English Proficiency subscale are highly proficient in understanding, speaking, and writing English. Conversely, women who score a 1 have limited ability to speak, understand, and write in English. The Hazuda Scales were selected for the current study due to their multifaceted approach to assess acculturation and assimilation, which aligns with our theoretical perspective on how these phenomena should be operationalized and measured.

Data Collection and Procedures

Participants completed a total of 3 assessments throughout the 12-month intervention (baseline, 6-months, and 12-months). Each study assessment required participants to attend two data collection visits spaced approximately one week apart. At the baseline visit, participants completed the demographic questionnaire (in either English or Spanish according to their language preference), had their height and weight measured, and were given an ActiGraph GT1M accelerometer to wear for the next seven days. After the seven day period, participants returned their accelerometer to the study coordinator who downloaded the data into the study database. Six- and 12-month data collection procedures were similar to baseline procedures with participants wearing the accelerometer for an approximate 7-day period. Acculturation and assimilation were measured at a single time point at the 12-month assessment, as these phenomena have shown to remain relatively stable over a 1-year period (Ahern, 2009). Study procedures were approved by the Arizona State University Institutional Review Board and the Maricopa Integrated Health System Protection of Human Subjects review committee. Data were collected between February 2010 and February 2012. Trial registration is with Clinicaltrials.gov, identifier NCT01908959.

Statistical Analysis

An Acculturation/Assimilation $\times$ Group $\times$ Time repeated measures mixed model approach was used to examine the association between acculturation and assimilation subscale with accelerometer-measured MVPA. Full factorial models were used to test for overall main effects and interaction terms among study variables. Significant models for predicting MVPA were followed by planned comparisons. The independent variables of models were: a) ordinal acculturation and assimilation subscales (i.e., Hazuda subscales of: Childhood

Language English Proficiency, Language Pattern, Preserving Culture, Family Structure, Childhood Interaction with Mainstream Society, Adult Interaction with Mainstream Society, and Functional Integration), b) study group assignment (i.e., intervention vs. control), and c) study assessment period (i.e., baseline, 6-months, 12-months). The dependent variable for all models was accelerometer-measured MVPA.

In preliminary analyses, a limited number of women were classified into the highest level of acculturation or assimilation (i.e., classified as a level 4) for five of the Hazuda Subscales: Language Pattern ($n=3$), Preserving Culture ($n=4$), Family Structure ($n=3$), Childhood Interaction with Mainstream Society ($n=1$), and Adult Interaction with Mainstream Society ($n=0$). Therefore, scores of 4 were collapsed with scores of 3 for these subscales to maximize power and quality of estimates from our mixed model analyses; resulting in a final response range of 1 to 3 for these five subscales. Preliminary analyses also showed that 92.5% of participants were classified as a 1 on the Childhood Language subscale (i.e., only 6 participants were classified as either a 2 or a 3), indicating that Spanish was first language learned during childhood and was the language predominantly spoken as a child. Therefore, we dropped this subscale from our analysis due to the homogeneity of the sample. Lastly, since the walking intervention specifically targeted social support as a behavioral mediator, we explored potential associations between social support for exercise (assessed by an adapted measure from Sallis, Grossman, Pinski, Patterson, & Nader, 1987) and the Hazuda subscale scores, as this relationship could potentially confound the relationship between the acculturation/assimilation subscales and PA. No significant associations were observed. Therefore, social support for exercise was not included as a covariate in outcome analyses.

Results

Participant Characteristics

Participants had a mean age of 29.2 ($SD = 5.7$) and were mostly overweight-to-obese ($BMI\ M = 30.0$, $SD = 3.6$). The majority had a high school (42%) or below high school education level (35.8%) and were married (53.1%) or living with a significant other (32.1%). Three-quarters of the women were unemployed or never employed (77.8%). Most were born in Mexico ($n = 67$, 83.7%), 7 were born in the U.S. (8.5%), and 7 were born in Central America (8.5%). Among women not born in the U.S., years living in the U.S. ranged from 2 to 37 years with half (50.7%) residing in the U.S. for less than 10 years. Approximately 60% of women had 3 or fewer children under the age of 12 living in their household.

Changes in Physical Activity over the 12-month Intervention

The average accelerometer wear time was 848 minutes/day ($SD=142$) at baseline, 849 minutes/day ($SD=128.9$) at the 6-month assessment, and 888 minutes ($SD=167.0$) at the 12 month assessment. No significant differences in wear time across the three assessment periods were observed ($p=.140$). A significant Group $\times$ Time effect ($p=.022$) on accelerometer-measured MVPA was observed with participants in the walking intervention group engaging in significantly more MVPA than participants in the control group at 6-months and 12 months ($p=.023$ and $p<.001$, respectively). No differences in MVPA between the two study groups were observed at the baseline assessment ($p=.173$). Figure 1

illustrates MVPA levels by group assignment for all 3 assessment periods. Table 2 shows statistical outcomes for main and interaction effects for group assignment (i.e., Group) and assessment period (i.e., Time) on MVPA.

Relationship between Acculturation Subscales and Physical Activity Outcomes

Main effects on MVPA were observed for two acculturation subscales: English Proficiency ($p=.002$) and Language Pattern ($p=.001$) subscales. For both of these subscales, there was a trend for women classified in the least acculturated category (i.e., score of 1) to engage in more MVPA than women in the higher acculturation groups (see Online Supplementary Material Figures 1 and 2). Main effect models for the acculturation subscales of Preserving Culture or Family Structure were not significant ($p's>.05$) for predicting MVPA outcomes (see Online Supplementary Material Figures 3 and 4). No three-way Acculturation Subscale $\times$ Group $\times$ Time models or two-way Acculturation Subscale $\times$ Group models were significant for predicting MVPA (all $p's>.05$; see Table 2).

Relationship between Assimilation Subscales and Physical Activity Outcomes

Main effects on MVPA were observed for two of the assimilation subscales: Childhood Interaction with Mainstream Society ($p=.028$) and Functional Integration ($p<.001$). Women classified in the lowest level of assimilation (i.e., scores of 1) on the Childhood Interaction with Mainstream Society and Functional Integration subscales engaged in more MVPA than more assimilated women (see Online Supplementary Material Figures 5 and 6). No main effect on MVPA was observed for the subscale of Adult Interaction with Mainstream Society ($p<.05$; see Online Supplementary Material Figure 7). Similar to models examining the acculturation subscales, no three-way Assimilation Subscale $\times$ Group $\times$ Time or two-way Assimilation Subscale $\times$ Group models were significant in predicting MVPA outcomes over the 12-month intervention (all $p's>.05$; see Table 2).

Discussion

This study examined the association between multiple dimensions of acculturation and assimilation with the objectively measured PA outcomes of Latinas enrolled in a 12-month PA intervention designed to increase walking behaviors. Results showed that among four (i.e., English Proficiency, Language Pattern, Childhood Interaction with Mainstream Society, and Functional Integration) of the seven dimensions of acculturation and assimilation assessed, Latinas classified into the lower acculturated or assimilated categories engaged in more accelerometer-measured MVPA than those classified into the higher acculturated or assimilated categories. No association between the other three dimensions of acculturation and assimilation with accelerometer-measured MVPA were observed (i.e., Preserving Culture, Family Structure, and Adult Interaction with Mainstream Society). Findings highlight the importance of using a multidimensional approach when examining the influence that acculturation and assimilation have on PA patterns of Latinas and provide practical insight on how these concepts may influence the PA patterns of Latinas.

Participants classified in the least acculturated groups for subscales of English Proficiency and Language Pattern (referring to language usually used with spouse, children, parents,

etc.; holidays and gatherings; and television and radio language preferences) engaged in significantly more MVPA than their more highly acculturated counterparts. These outcomes mirror the results of a study conducted by Marquez and McAuley (2006), which found that Latinas classified in the lowest acculturated group according to the Short Acculturation Scale for Hispanics (Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987), a scale that predominately measures language patterns as a proxy measure acculturation, performed more accelerometer-measured MVPA than their more highly acculturated counterparts. Our results are also comparable with the results of studies examining the association between English language use and subjectively measured non-leisure time PA in Latinas, which have consistently reported that as acculturation increased, non-leisure time PA (i.e., occupational, household, transportation) decreased (Afable-Munsuz, Ponce, Rodriguez, & Perez-Stable, 2010; Berrigan, Dodd, Troiano, Reeve, & Ballard-Barbash, 2006; Ham, Yore, Kruger, Heath, & Moeti, 2007; Marquez & McAuley, 2006; S. M. Martinez et al., 2011). Together, these findings may suggest that women with lower English language proficiency have more labor intensive occupations (i.e., residential cleaning, industrial housekeeping/janitorial services, food service jobs) than Latinas who were more fluent in the English language. Results from a recent report analyzing data from the U.S. Census Bureau, 2013 American Community Survey, and the 1990 and 2000 Decennial Census (Zong & Batalova, 2015) support this notion, as the authors reported that women with lower English language proficiency were much more likely to work in service and personal care occupations than those who are more fluent in the English language. In the context of the current study, it is important to point-out that while only 22% of our sample reported being employed, promotoras reported that many participants engaged in non-traditional work environments (i.e., Avon ® and Herbalife ® sales), often earning cash income. Accordingly, these activities were not likely reflected in our employment data. We speculate that these occupational activities would require greater mobility and transportation to get to work (e.g., walking to bus stop, getting to sales locations); thus, in combination with childcare, these activities helped contribute to the higher PA levels among women with lower English proficiency.

Outcomes for the assimilation subscale of Functional Integration further reinforce the importance of understanding the context in which language use may influence behavior. Functional Integration refers to the degree to which Latinas have attained sufficient English language skills to enable them to function effectively in mainstream U.S. society (Hazuda et al., 1988). This had an inverse relationship with accelerometer-measured MVPA (i.e., lower acculturation levels were associated higher MVPA levels). While limited research has examined the influence of this dimension of assimilation on the PA patterns of Latinas, results provide further insight into how English language proficiency may influence functional integration, and ultimately PA engagement. Data from the American Community Survey 2007–2009 (U.S. Census Bureau, 2011) showed that among the five zip code areas where participants resided, 81.6% of residents were Hispanic or Latino and 71.5% spoke a language other than English at home. Perhaps, lack of English language skills served as a barrier to other resources that can promote more sedentary lifestyles (e.g., Latinas less likely to secure a white collar office/desk job than non-Hispanic women (Gonzales, 2008)). Findings from previous qualitative studies, although few in number, also support this notion

(J. L. Martinez, Latimer, Rivers, & Salovey, 2012; Parra-Medina & Hilfinger Messias, 2011; Sussner, Lindsay, Greaney, & Peterson, 2008). Another factor that may have influenced Functional Integration was immigration status. During the time the study was conducted, the State of Arizona passed House Bill 1070, one of the strictest anti-immigration legislations in U.S. history. As a result, many participants reported that being “hidden” from mainstream society was important for their safety. While we did not collect data on immigration status, findings from the American Community Survey 2007–2009 (U.S. Census Bureau, 2011) showed that 87% of residents from where our sample resided were not legal residents. Together, these findings suggest that while participants may have been able to integrate with others in their immediate neighborhoods, the lack of English language skills, immigration status, and fear of immigration officials may have prevented them integrating into other communities and the broader U.S. society. However, additional research is needed to further elucidate and expand the context of our findings.

The inverse relationship between the assimilation subscale of Childhood Interaction with Mainstream Society and MVPA suggests that Latinas with limited interaction with U.S. society during childhood engaged in more MVPA as adults than Latinas with higher levels of integration during childhood. Literature suggest that many lifelong behaviors (although not PA specific) are established during childhood, often through parental modelling (Lau, Quadrel, & Hartman, 1990). Although Latinas born outside of the U.S. have reported a lack of leisure-time physical activity role models (Parra-Medina & Hilfinger Messias, 2011) and being discouraged from physical activities other than those relating to family and household responsibilities during their childhoods (Evenson, Sarmiento, Macon, Tawney, & Ammerman, 2002), it may be that women with limited exposure to U.S. society during childhood observed their female role models engage in more physically active occupational, household, and caretaking activities (i.e., physically laborious jobs, household cleaning, etc.) than their more assimilated counterparts. As a result, these women may perform many of the same physically active tasks as adults that were modeled for them during childhood. Qualitative data collected during the same time periods our study was conducted supports the assumption (Fluery, Keller, & Perez, 2009), as first generation Latinas have reported that being physically active was a “way of life” and that their caretaking and household responsibilities afford them opportunities to be active. It may be that structured PA has become more accepted in Latino culture in recent years and that women with limited childhood experience with U.S. society are bringing their more physically active lifestyles with them. However, due to the limited research examining how parental PA behaviors influence the lifelong PA patterns of their children, this relationship remains speculative and should be explored in future qualitative and quantitative research.

Three of the acculturation and assimilation subscales examined, Adult Interaction with Mainstream Society, Preserving Culture, and Family Structure, were not significantly associated with the MVPA outcomes of the study. These outcomes were somewhat unexpected given the inverse relationships observed between MVPA and the other Hazuda subscales examined. While it may be that these factors are not salient influences on the PA patterns of Latina women, these findings should be interpreted with caution due to the limited amount of research using these subscales to examine PA behaviors in Latinas. Future

research is needed to further explore and determine the potential influence of these dimensions of acculturation on the PA patterns of Latinas.

The current study is not without limitations. Participants were a convenience sample of Latinas predominately of Mexican descent from a single geographic region of the U.S. Thus, our results may not be generalizable to women residing outside of the Southwestern region of the U.S. and among women who are not of Mexican descent. Similarly, participants were recruited on the premise of participating in research study for PA. We don't know if their PA patterns and levels of acculturation/assimilation are representative of Latinas not wanting to participate in a PA program. Despite these limitations, the current study has several strengths. PA were assessed at multiple intervals over a 12-month period, which provided greater insight than cross-sectional data often reported in published literature evaluating the association between PA and acculturation and assimilation in this population. The use of accelerometer-measured PA is another strength and adds to the limited amount of research that has examined the association between acculturation and PA among Latinas. A third strength was the use of a multidimensional measure of acculturation and assimilation that was developed and tested specifically for use in Mexican-Americans; this addresses the lack of conceptualization of constructs found in much of the literature on acculturation and assimilation in PA research.

Results highlight that there is a continued need to understand the context in which acculturation and assimilation influence PA. While researchers are unable to modify the degree to which Mexican-Americans integrate into mainstream society, intervening to reduce PA related health disparities requires a greater understanding of the mechanism in which acculturation and assimilation influence PA. Based on our findings and the current status of research examining the relationship between acculturation and PA behaviors of Latinas, future research is needed to: 1) identify the behaviors low acculturated women perform that enable them to be physically active, 2) examine how these behaviors can be maintained throughout the continuum of acculturation and assimilation to mainstream culture, 3) evaluate PA levels of Latinas before, during, and after pregnancy to provide insight on how PA level may change over time, and 4) develop and test culturally appropriate interventions that leverage sociocultural strategies for increasing and maintaining PA in Latinas. Such research will further assist in reducing PA-related health disparities among Latinas.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

We are thankful to Dr. Helen Hazuda for her guidance on the scoring procedures for the Hazuda Acculturation and Assimilations Scales.

Funding

Data for this study were collected with support from the National Institutes of Health/National Institute of Nursing Research, award NIH/NINR 1 R01NR010356-01A2, Madres para la Salud (C. Keller, P.I.). Support for data analysis and manuscript preparation was provided by the National Institutes of Health/National Heart, Lung, and Blood

Institute (NIH/NHLBI), award K99 HL129012-01 (R. Joseph, P.I.) and the National Institutes of Health/National Institute on Nursing Research (NIH/NINR), award T32 1T32NR012718-01 Transdisciplinary Training in Health Disparities Science (C. Keller, P.I.). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH, NHLBI, or NINR.

References

- Afable-Munsuz A, Ponce NA, Rodriguez M, Perez-Stable EJ. Immigrant generation and physical activity among Mexican, Chinese & Filipino adults in the US. *Social Science & Medicine*. 2010; 70(12):1997–2005. DOI: 10.1016/j.socscimed.2010.02.026 [PubMed: 20378226]
- Ahern DA. A longitudinal exploration of factors that influence acculturation and enculturation patterns of first-generation Mexican immigrant women. All Graduate Theses and Dissertations, Paper. 2009; 473:1–120. Utah State University, DigitalCommons@USU.
- Albright C, Maddock JE, Nigg CR. Physical activity before pregnancy and following childbirth in a multiethnic sample of healthy women in Hawaii. *Women's Health*. 2005; 42(3):95–110.
- Benitez TJ, Dodgson JE, Coe K, Keller C. Utility of acculturation in physical activity research in Latina adults: An integrative review of literature. *Health Education & Behavior*. 2016; 43(3):256–270. DOI: 10.1177/1090198115601042 [PubMed: 27178493]
- Berrigan D, Dodd K, Troiano RP, Reeve BB, Ballard-Barbash R. Physical activity and acculturation among adult Hispanics in the United States. *Research Quarterly for Exercise and Sport*. 2006; 77(2): 147–157. [PubMed: 16898271]
- Coll C, Domingues M, Santos I, Matijasevich A, Horta BL, Hallal PC. Changes in leisure-time physical activity from the prepregnancy to the postpartum period: 2004 Pelotas (Brazil) Birth Cohort Study. *Journal of Physical Activity and Health*. 2016; 13(4):361–365. DOI: 10.1123/jpah.2015-0324 [PubMed: 26383057]
- Cuellar I, Arnold B, Gonzalez G. Cognitive referents of acculturation: Assessment of cultural constructs in Mexican Americans. *Journal of Community Psychology*. 1995; 23(3):339–356.
- Evenson KR, Mottola MF, Owe KM, Rousham EK, Brown WJ. Summary of international guidelines for physical activity after pregnancy. *Obstetrical & Gynecological Survey*. 2014; 69(7):407–414. DOI: 10.1097/ogx.0000000000000077 [PubMed: 25112589]
- Evenson KR, Sarmiento OL, Macon ML, Tawney KW, Ammerman AS. Environmental, policy, and cultural factors related to physical activity among Latina immigrants. *Women & Health*. 2002; 36(2):43–57. DOI: 10.1300/J013v36n02_04
- Fleury J, Keller C, Perez A. Exploring resources for physical activity in Hispanic women, using photo elicitation. *Qualitative Health Research*. 2009; 19(5):677–686. DOI: 10.1177/1049732309334471 [PubMed: 19380503]
- Freedson PS, Melanson E, Sirard J. Calibration of the Computer Science and Applications, Inc. accelerometer. *Medicine & Science in Sports & Exercise*. 1998; 30(5):777–781. [PubMed: 9588623]
- Gonzales, F. Hispanic women in the United States. Washington, DC: Pew Hispanic Center; 2008. Retrieved from <http://www.pewhispanic.org/files/2011/08/42.pdf>
- Gordon, M. Assimilation in American Life. New York, NY: Oxford University Press; 1964.
- Gordon, M. Towards a general theory of racial and ethnic group relations. In: Glazer, N., Moynihan, DP., editors. *Ethnicity: Theory and experience*. Cambridge, MA: Harvard University Press; 1975. p. 84–110.
- Ham SA, Ainsworth BE. Disparities in data on Healthy People 2010 physical activity objectives collected by accelerometry and self-report. *American Journal of Public Health*. 2010; 100(Suppl 1):S263–S268. DOI: 10.2105/ajph.2009.180075 [PubMed: 20147669]
- Ham SA, Yore MM, Kruger J, Heath GW, Moeti R. Physical activity patterns among Latinos in the United States: Putting the pieces together. *Preventing Chronic Disease*. 2007; 4(4):A92. [PubMed: 17875267]
- Hazuda HP, Stern MP, Haffner SM. Acculturation and assimilation among Mexican Americans: Scales and population-based data. *Social Science Quarterly*. 1988; 69(3):687–706.
- Hirschman C. America's melting pot reconsidered. *Annual Review of Sociology*. 1983; 9:397–423.

- Keller C, Ainsworth B, Records K, Todd M, Belyea M, Vega-López S, ... Nagle-Williams A. A comparison of a social support physical activity intervention in weight management among postpartum Latinas. *BMC Public Health*. 2014; 14:971.doi: 10.1186/1471-2458-14-971 [PubMed: 25233867]
- Keller C, Records K, Ainsworth B, Belyea MJ, Permana P, Coonrod D, ... Nagle-Williams A. Madres para la Salud: Design of a theory-based intervention for postpartum Latinas. *Contemporary Clinical Trials*. 2011; 32(3):418–427. DOI: 10.1016/j.cct.2011.01.003 [PubMed: 21238614]
- Lau RR, Quadrel MJ, Hartman KA. development and change of young adults' preventive health beliefs and behavior: Influence from parents and peers. *Journal of Health and Social Behavior*. 1990; 31(3):240–259. DOI: 10.2307/2136890 [PubMed: 2133479]
- Marin G, Sabogal F, Marin BV, Otero-Sabogal R, Perez-Stable EJ. Development of a Short Acculturation Scale for Hispanics. *Hispanic Journal of Behavioral Sciences*. 1987; 9(2):183–205. DOI: 10.1177/07399863870092005
- Marquez DX, McAuley E. Gender and acculturation influences on physical activity in Latino adults. *Annals of Behavioral Medicine*. 2006; 31(2):138–144. DOI: 10.1207/s15324796abm3102_5 [PubMed: 16542128]
- Martinez JL, Latimer AE, Rivers SE, Salovey P. Formative research for a community-based message-framing intervention. *American Journal of Health Behavior*. 2012; 36(3):335–347. DOI: 10.5993/ajhb.36.3.5
- Martinez SM, Arredondo EM, Roesch S, Patrick K, Ayala GX, Elder JP. Walking for transportation among Latino adults in San Diego County: who meets physical activity guidelines? *Journal of Physical Activity & Health*. 2011; 8(7):898–906. [PubMed: 21885880]
- Parra-Medina D, Hilfinger Messias DK. Promotion of physical activity among Mexican-origin women in Texas and South Carolina: An examination of social, cultural, economic, and environmental factors. *Quest*. 2011; 63(1):100–117. [PubMed: 21731409]
- Pereira MA, Rifas-Shiman SL, Kleinman KP, Rich-Edwards JW, Peterson KE, Gillman MW. Predictors of change in physical activity during and after pregnancy: Project Viva. *American Journal of Preventive Medicine*. 2007; 32(4):312–319. DOI: 10.1016/j.amepre.2006.12.017 [PubMed: 17383562]
- Sallis JF, Grossman RM, Pinski RB, Patterson TL, Nader PR. The development of scales to measure social support for diet and exercise behaviors. *Preventive Medicine*. 1987; 16(6):825–836. [PubMed: 3432232]
- Sam DL, Berry JW. Acculturation: When individuals and groups of different cultural backgrounds meet. *Perspectives on Psychological Science*. 2010; 5(4):472–481. DOI: 10.1177/1745691610373075
- Sussner KM, Lindsay AC, Greaney ML, Peterson KE. The influence of immigrant status and acculturation on the development of overweight in Latino families: A qualitative study. *Journal of Immigrant and Minority*. 2008; 10(6):497–505. DOI: 10.1007/s10903-008-9137-3
- Teske RH, Nelson BH. Acculturation and assimilation: A clarification. *American Ethnologist*. 1974; 1(2):351–367.
- Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Medicine & Science in Sports & Exercise*. 2008; 40(1):181–188. DOI: 10.1249/mss.0b013e31815a51b3 [PubMed: 18091006]
- U.S. Census Bureau. Selected social characteristics in the united states: 2007–2009 American Community Survey (ACS) 3-year estimates. 2011. Retrieved from https://www.census.gov/newsroom/releases/archives/american_community_survey_acs/2011-01-11_acs.html
- U.S. Department of Health and Human Services. 2008 physical activity guidelines for Americans. Hyattsville, MD: US Department of Health and Human Services; 2008.
- Zong, J., Batalova, J. The limited English proficient population in the United States. 2015. Retrieved from <http://www.migrationpolicy.org/article/limited-english-proficient-population-united-states>

Figure 1. Physical activity outcomes (mean minutes/week) by intervention group at each study assessment period.

Table 1

Overview of the Hazuda Acculturation and Assimilation Subscales.

Abbreviated Subscale Name	Full Subscale Name	Major Concepts Assessed
<i>Acculturation Subscales</i>		
Childhood Language	Childhood Experience with English vs. Spanish	Language most commonly spoken as a child.
English Proficiency	Adult Proficiency in English	Ability to speak, read, and understand the English language.
Language Pattern	Adult Pattern of English vs. Spanish Language usage	The language (i.e., English or Spanish) commonly used as an adult.
Preserving Culture	Value Placed on Preserving Mexican Cultural Origin	Importance of children knowing the history and customs of Mexico.
Family Structure	Attitude toward Traditional Family Structure and Sex-role Orientation	Importance of family history, knowing family members, and the authoritative/protective role that men play the family structure.
<i>Assimilation Subscales</i>		
Childhood Interaction with Mainstream Society	Childhood interaction with Members of Mainstream Society	The primary ethnic background (i.e., Anglo or Mexican) of one's social circle during childhood (i.e., neighbors, schoolmates, friends).
Adult Interaction with Mainstream Society	Adult Interaction with Members of Mainstream society	The ethnic background (i.e., Anglo or Mexican.) of one's social circle as an adult (i.e., friends, neighbors, coworkers).
Functional Integration	Adult Functional Integration with Mainstream Society	Composite higher-order measure of assimilation. The following 3 subscales are combined to form this measure: 1) Adult Proficiency in English, 2) Adult Pattern of English vs. Spanish Language usage, and 3) Adult Interaction with Members of Mainstream society.

Table 2
Group, Time, Acculturation, and Assimilation effects on Daily Accelerometer-measured moderate-to-vigorous PA.

	Group	Time	Dimension of Acculturation/Assimilation	P-values		
				Group × Time	Group × Dimension of Acculturation/Assimilation	Group × Time × Dimension of Acculturation/Assimilation
Dimensions of Acculturation						
English Proficiency	.004	<.001	.002	.087	.289	.916
Language Pattern	.008	.006	.011	.081	.417	.819
Preserving Culture	.008	<.001	.989	.047	.624	.837
Family Structure	<.001	<.001	.135	.014	.135	.827
Dimensions of Assimilation						
Childhood Interaction with Mainstream Society	.471	.188	.028	.092	.129	.766
Adult Interaction with mainstream Society	.007	.069	.972	.213	.680	.523
Functional Integration	<.001	<.001	<.001	.017	.711	.819