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Garcia, Aileen; Takahashi, Shinya; Anderson-Knott, Mindy; and Dev, Dipti, "Determinants of Physical Activity for Latino and White Middle School-Aged Children" (2019). *Faculty Publications, Department of Child, Youth, and Family Studies*. 235.
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Determinants of Physical Activity for Latino and White Middle School-Aged Children

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Abstract

Background: Physical activity (PA) has long been acknowledged to contribute health benefits among children. However, research has consistently shown that PA declines as children grow older. Thus, this study examined the factors which are associated to children's PA in order to identify potential barriers to PA.

Methods: Using data from the KidQuest Program, we conducted bivariate and

Published in *Journal of School Health* 89:1 (January 2019), pp 3-10.
doi 10.1111/josh.12706
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Submitted February 11, 2017; accepted September 28, 2018.

multivariate analyses on survey data collected from fifth to seventh grade students in a small Midwestern city.

Results: We found that food knowledge, eating breakfast, and talking with family about eating healthy foods, are positively related to PA. On the other hand, screen time is negatively related to PA. In addition, our results evinced differences between ethnicities and found that Latino children's screen time affects their PA levels more than their white counterpart.

Conclusions: There are different factors which can be tapped to increase PA among middle school-aged children. Given the differences between the Latino and white samples especially in screen time, schools should consider individualized intervention, rather than a "one size fits all" program, to increase PA participation.

Keywords: physical activity; middle school children; Latino child health; screen time; KidQuest Program.

Physical activity (PA) refers to any body movement produced by the contraction of skeletal muscles which requires energy expenditure. Research has consistently linked PA and an active lifestyle to various health benefits among children. For example, PA positively impacts body composition, metabolism,[1,2] and psychosocial health[3] which, in turn, help control childhood obesity.[4,5] Engaging in recommended PA levels also reduces cardiovascular diseases risk factors[3] and mental health problems such as depression and anxiety.[6] Moreover, the positive effects of regular PA in childhood persist unto adolescence and adulthood.[7] On the other hand, lack of PA in childhood and adolescence is related to elevated blood pressure and insulin resistance in adulthood.[8] In addition, less PA is associated with lower levels of self-esteem, as well as lower cognitive functioning across different age groups.[6]

PA has been the focus of various programs designed to combat obesity and to prevent the known decline of PA among older children in middle school.[7] As PA is also linked to the improvement of children's fine and gross motor skills necessary to succeed in academics,[9] and as children spend a considerable amount of time in schools, schools are particularly encouraged to promote PA through play and physical education.[10] The National Association of Sport and Physical Education (NASPE) has recommended that children aged 5 to 12 years old engage in at least 60 minutes of appropriate PA per day.[11] To be considered active, boys should take 15,000 to 17,499 steps whereas girls should take 12,000 to 14,999 steps per day.[12] It is also important for young adolescents going through

puberty to engage in a mix of aerobic, and muscle- and bone-strengthening activities as bone mass gains peak during this stage.[13] However, even with all the benefits linked to PA, children are not as active as recommended.[14] PA, as measured by steps per day, declines for boys and girls, from 6 years old onward (from 14,000 to 11,000 for boys and 13,000 to 8000 for girls).[12] Additionally, research has shown that children spend significantly more hours watching television than the endorsed 1 to 2 hours viewing time per day.[15] These alarming statistics, coupled with the digital age's prevalent sedentary lifestyle, warrant an investigation of the barriers to engaging PA in order to develop appropriate intervention measures for school-aged children.

There are several factors which have been identified specifically affecting children's PA participation. These determinants include individual factors (i.e., age, sex, weight status, socioeconomic status), interpersonal factors (i.e., cultural and social), and environmental factors (i.e., screen time, accessibility to sports equipment and playground).[1,16] As mentioned earlier, studies have shown that a decline in PA is prominent with age, and an increase in sedentary behaviors during adolescent years.[17–19] Differences in PA patterns are inconsistent among boys and girls. When PA was objectively measured with activity count devices, PA patterns were different between boys and girls aged 8 to 12.[19,20] Boys had greater moderate-vigorous PA compared to girls.[17] Meanwhile, when sedentary behaviors were measured subjectively, the patterns did not show significant differences between the sexes.[18] Existing studies also show that weight status has an inverse relationship with sedentary behaviors such as screen time and physically active lifestyle patterns.[21,22]

Differences Between Latino and White Children

Disparities in the characteristics and experiences between Latino and white populations are well documented in the literature.[23] For instance, Latino families are overrepresented in the lower socioeconomic strata.[24] As such, they are also more susceptible to live in high-crime neighborhoods and have lower educational attainment compared to Caucasians.[25,26] On the other hand, Latino families tend to be more intact such that Latino children tend to come from 2-parent households and reportedly have more access to social support.[27] All these contextual factors potentially influence children's developmental outcomes. With regard to health and nutrition literature, white children and youth were

also found to more likely meet the recommended screen time and PA guidelines compared to their peers with other ethnic backgrounds.[16,28] Although Latino youth demonstrate lower levels of PA, interventions have been found to have positive effects. For example, a study found that Latino youth would be motivated to participate in an after school organized team activity, and those who participated in an afterschool activity would be more likely to meet PA guidelines.[29,30] Studies directly comparing Latino and white children are limited; nonetheless, there are findings which revealed that considerable ethnic differences exist in PA participation patterns. Latino Americans, for instance, have higher obesity rates compared to non-Hispanic Whites.[31] A study on sixth grade students also revealed that Latino children exhibited lower levels of moderate-to-vigorous intensity PA compared to other racial or ethnic groups.[32] These differences have been attributed to disparities in socioeconomic status,[33] neighborhood characteristics,[34] and acculturation rates.[35] These findings are helpful; however, studies on how other determinants affect the PA of this underserved population remain scarce.[29,36] It is critical to understand how specific determinants affect Latino and white children's PA participation patterns and sedentary behaviors to develop a childhood obesity intervention program.

There are several reasons why adolescence is critical age group to focus. First, it is worth to recognize that PA emphasis shifts from motor skills to health/fitness-related outcomes during adolescence.[37] Therefore, it is a critical time to learn and practice lifelong PA habits. Second, the middle school-aged population has shown an onset of declined vigorous PA.[38,39] Third, only 21.6% of 6- to 19-year-old US children have met the US Physical Activity guidelines.[40] Fourth, a study has indicated that a PE class may be an only opportunity for many adolescents to engage in regular PA.[41] These data led us to investigate in this population specifically. Further, although numerous studies[29,42] have shown the linkage between sedentary or physically active behaviors and biological, psychological and the previously mentioned determinants in adolescents; data examined relationships between PA and children's food knowledge/dietary practice are limited.[21,43] Both physically active lifestyle and healthy eating habits are equally important to optimize one's well-being. Understanding the relationship between PA and adolescents' food knowledge and eating practice will further enhance the obesity prevention community's knowledge to tackle the global epidemic. Therefore,

the main purpose of this investigation was to examine the relationships between PA and middle-school-aged adolescents' food knowledge and eating habits to further enhance our knowledge. Furthermore, the study examined how such factors were different between Latino children and white counterparts.

Methods

Data Collection

Participants for this study include fifth, sixth, and seventh grade students in 2 schools in a small Midwestern city, who participated in the KidQuest (KQ) program. The KQ program is a nutritional and PA curriculum which aims to help students in their goal-setting and self-monitoring in terms of accomplishing nutrition-related challenges.[44] The program was implemented with all students in these grade levels. Surveys were completed before and after participating in the KQ program during the 2014- 2015 school year. In addition, a follow-up survey was completed. Baseline surveys were administered prior to beginning the KQ program (N=756), with posttest surveys administered approximately 4 months later after program implementation was completed (N=727). The schools included in the analysis were the targeted local school district's single school serving the fifth and sixth grade population and the single school serving seventh and eighth grades. The baseline and postsurveys were collected from the fifth and sixth grade school, while the follow-up surveys were expanded to include the middle school to follow students moving to that school. A census was conducted with all students in the targeted classes and refusals to participate were minimal, so nearly all students in the targeted classrooms participated in the data collection. Additionally, the 2 targeted schools serve a diverse population including a high proportion of Latino and low-income students. Approximately half of the participants (51.9% at baseline, 51.8% at post) were white, while one fourth (25.4% at baseline, 26.4% at post) were Latino. Ages ranged from 10 to 14, with an even representation of boys and girls (48.8% male at baseline, 50.1% male at post).

Instruments

The surveys included close-ended, multiple-choice questions about students' demographics, food habits, physical activities, dietary guidelines, types of food eaten, activities with family, and program satisfaction. The survey was modified slightly from the original KQ survey developed by South Dakota State University.[44] The modified version was tested using cognitive interviewing. The variables of interest for the current study include a measure of PA (During the past 7 days, how many days were you physically active for at least 1 hour?), a measure of healthy food knowledge (sum of correct responses on identification of whole grain, amount of fruits/vegetables, and amount of milk that should be consumed daily), communication with family about healthy eating (In the past week, how often have you talked with any member of your family about eating healthier foods?), eating breakfast (How many of the past 7 days did you eat breakfast?), and screen time (How many hours a day do you spend watching TV, playing electronic games, or using a computer for something that is not school work?). Responses on sex and ethnicity were also included.

Data Analysis

As we are interested in potential differences between Latino and white children in terms of the variables of interest, we first performed 1-way analysis of variance (ANOVA) to compare the Latino and the white sample. Next, basic correlations were conducted for the whole sample, followed by hierarchical regression analysis using SPSS version 19 (IBM Corporation, Armonk, NY).

For this study, we used posttest data with a sample of 727 to examine the more current behaviors or knowledge of the participants. However, as we are interested in examining only the differences between Latino and white children, we excluded cases of other racial/ethnic backgrounds in the analyses, resulting to a total of 564 children.

Table 1. Descriptive Statistics (N=564)

Variable	*Latino (N=190) M (SD)*	*White (N=374) M (SD)*	*Whole Sample (N=564) M (SD)*	*Min.*	*Max.*	*Scale Range*
Child's age	12.38 (.96)	12.02 (.851)	12.16 (.92)	11	15	
Child's sex (male)	53.7%	47.1%	49.3%			
Physical activity*	4.30 (1.99)	5.05 (1.92)	4.80 (1.97)	0	7	0-7
Food knowledge*	1.61 (.80)	1.79 (.75)	1.73 (.77)	0	3	0-3
Eating breakfast*	5.30 (2.30)	5.91 (1.99)	5.70 (2.11)	1	5	1-5
Talking with family	.79 (.854)	.69 (.81)	.72 (.82)	0	3	0-3
Screen time*	2.57 (1.36)	2.27 (1.25)	2.37 (1.30)	1	5	1-5

*Significant difference between the 2 groups.

Results

Table 1 presents the descriptive statistics of the variables, including the Latino and white subgroup information. ANOVA results showed that white children have longer duration of PA, $F(1, 557)=18.14$, $p<.001$, scored higher in food knowledge, $F(1, 555)=7.03$, $p<.05$, and eat breakfast more often, $F(1, 554)=10.54$, $p<.001$. On the other hand, results showed that Latino children engage in more screen time, $F(1, 553)=6.59$, $p<.05$. There is no significant difference between the 2 groups in terms of talking with family about healthier foods and sex composition. Table 2 presents the preliminary relations among the predictors and PA levels.

Table 2. Correlations Among Study Variables for the Whole Sample

Variable	*1*	*2*	*3*	*4*	*6*	*7*	*8*
1. Physical activity	—						
2. Ethnicity	−.178**	—					
3. Child sex	−.039	−.064	—				
4. Food knowledge	.175**	−.112*	.037	—			
6. Eating breakfast	.177**	−.137**	−.050	.115*	—		
7. Talking with family	.130**	.059	.053	.017	.021	—	
8. Screen time	−.233**	.109**	−.038	.050	−.139**	−.110**	—

* p<.05

** p<.01

Ethnicity and child Sex were coded (0 =white; 1 =Latino; 0 =boy; 1 =girl).

Table 3. Regression Coefficients, SE Estimates, and *p*-Values for the Regression Coefficients in the Regression Model

Predictor	*B*	*β*	*SE*	*p-Value*
(Constant)	4.048		.341	<.001
Child sex	−.209	−.054	.161	.193
School	.303	.064	.208	.146
Ethnicity	−.565	−.137	.177	<.001
Food knowledge	.371	.145	.107	<.001
Eating breakfast	.131	.142	.040	<.001
Talking with family	.283	.117	.100	<.005
Screen time	−.283	−.186	.064	<.001

Child sex was coded (1 =male; 2 =female)
School was coded (1 =School A; 2 =School B)
Ethnicity was coded (0 =white; 1 =Latino).

Next, multiple regression analyses were conducted to examine the relations among the variables. Given their significant correlation with PA, we entered ethnicity, food knowledge, eating breakfast, talking with family, and screen time as predictors in the model. Child sex and school were also entered as covariates to control for their potential effects (Table 3). Table 4 presents the unstandardized and standardized regression coefficients, standard error estimates, and p-values of the estimates in the model. The standardized regression coefficients reflect the effect size, which measures the magnitude of the effect and can be interpreted as follows: ".10 or smaller" = Small; ".10 to .30" = Medium; ".50 or greater" = Large. The model was significant, $F(7,520)=11.25$, $p<.001$, and the 5 predictors accounted for 13.2% of the variance in PA (adjusted R-square=.120). In the regression model, ethnicity was negatively related to PA, thus, children from the Latino group have shorter PA duration. Food knowledge, eating breakfast, and talking to family members about eating healthier foods were positively related to PA, suggesting that more food knowledge, and eating breakfast and talking to family members more often are related to longer duration of PA. On the other hand, screen time was negatively related to PA, meaning, children who have longer screen time have shorter PA duration. The effects of sex and the school are not significant.

Table 4. Regression Coefficients, SE Estimates, and *p*-Values for the Regression Coefficients in the Regression Model With Interaction Terms

Predictor	*B*	*β*	*SE*	*p-Value*
(Constant)	4.048	.341	<.001	
Child sex	−.229	−.059	.160	.154
School	.270	.057	.208	.194
Ethnicity	−1.696	−.411	.694	<.05
Food knowledge	.376	.147	.133	<.005
Eating breakfast	.119	.129	.051	<.05
Talking with family	.253	.105	.123	<.05
Screen time	−.416	−.274	.079	<.001
Ethnicity × food knowledge	−.039	−.018	.218	.859
Ethnicity × eating breakfast	.031	.045	.078	.692
Ethnicity × talking with family	.134	.041	.209	.523
Ethnicity × screen time	.379	.280	.133	<.001

Child sex was coded (1 =male; 2 =female)
School was coded (1 =School A; 2 =School B)
Ethnicity was coded (0 =white; 1 =Latino)

As ethnicity is significantly related to PA duration and to better examine the differences between the 2 groups, we ran a second model using hierarchical regression to test for the potential interaction effects of ethnicity with the other predictors (see Table 4). This model was also significant, $F(11,516)= 7.960$, $p<.001$, and accounted for 14.5% of the variance (adjusted R-square=.127). However, the R-square change between the first and second model was not significant, R-square change=.014, $F(4,516)= 2.043$, $p=.087$, suggesting that the second model is not significantly different from the first model. Nonetheless, the second model revealed additional findings. The predictors remained to be significant after the interaction terms were included in the model. Moreover, the interaction between ethnicity and screen time was significant, ($B=.379$, $\beta =.280$, $p<.005$). To better understand this interaction, simple slopes analysis was conducted and the interaction effect is plotted in Figure 1. For white children, their screen time level is related to PA levels such that the higher their screen time, the lower their PA level, and vice versa. On the other hand, for Latino children, their PA level tends to be lower compared to their white counterparts whether they have low or high screen time. The effects of the 3 other interaction terms were not significant.

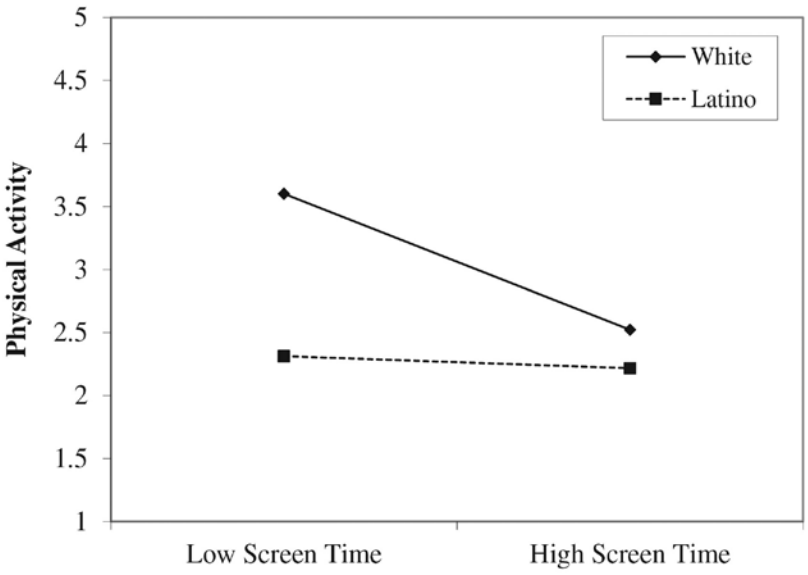

Figure 1. The Interaction Effect Between Ethnicity and Screen Time on Physical Activity

Discussion

Our findings show that there are several variables which are linked to children's PA. Whereas previous research has linked PA duration to proximal factors such as knowledge and beliefs about PA and sedentary behaviors,[45] our study investigated variables which may not be immediately associated to PA but are essentially related, including food knowledge, talking with family about eating healthy foods, eating breakfast, and screen time. Overall, we found that children who have more knowledge about healthy foods also engage in at least 1 hour of PA in a week. Previous studies which utilized the social cognitive theory as a framework maintained that an individual's cognition, such as knowledge of health risk and beliefs about the importance of PA, is precursor to behavior change.[34,46,47] Our findings support this notion. Moreover, our results imply that children's food knowledge could also spillover to other aspects of nutrition such as engaging in PA. Therefore, parents, teachers, and intervention programs targeting to increase PA should also consider increasing children's knowledge on healthy foods. This may also mean that when we teach about healthy foods, we are also teaching the students about the value of PA. This implies that it is likely worthwhile to include both key messages together.

Results also showed that children who talk with their families about healthy foods have higher PA duration. Parental and family support, particularly facilitation, or providing opportunities for the child to be physically active, has been found to be highly predictive of PA frequency and duration.[9,35] In this study, results showed that children who talk with their families about healthy food can also positively influence children's PA levels. This highlights the important and influential role of family in supporting children's healthy behavior.[48] Thus, parents and family members should be highly encouraged to initiate and engage their children even in simple conversations of health-related topics, such as eating healthier foods. This also speaks to the importance of a family environment that is supportive of healthy lifestyles.

Children who eat breakfast more often also engage in PA more frequently. Although a few studies previously found that daily breakfast was not significantly associated with PA,[49,50] breakfast consumption has also been regarded as a protective factor for obesity[46] and has been linked to longer PA,[51] and our findings lean toward this direction. PA intervention programs should thus consider targeting to increase breakfast consumption among school-aged children. This is especially important because breakfast consumption also decreases in adolescence.[50] Lastly, consistent with existing research,[6,14,18] our results showed that screen time negatively affects PA in that more hours spent in front of the television or the computer means less time for PA. PA and obesity prevention programs should continue to discourage excessive screen time among school-aged children.

In addition to the aforementioned findings, we found that ethnicity is a predictor of PA, implying that programs should not treat participants as homogenous. Specifically, being white is associated with higher PA levels, being Latino is associated with lower PA levels. Many social, environmental, and cultural factors such as residing in lower-income neighborhoods with increased availability of fast food restaurants,[52] limited access to affordable healthy foods in schools,[53,54] increased screen time[55] can predispose Latino youth to higher risk of obesity. To effectively address this issue, future research is needed to determine the links between nutrition, PA, obesity among Latino youth including the influence of their social and cultural environments and federal school policies related to the availability and cost of healthy foods. Specifically, additional research is warranted to determine the impact of school food and PA environments on Latino children's food choices and PA levels.

Further, Latinos can come from many different countries, with different cultural practices and may have adapted the American culture at a varying degree. Therefore, research is also needed to determine the influence of both American acculturation and traditional Latino culture based on their country of origin on food choices and PA. Finally, it is important to determine the most effective components of multilevel interventions for Latino youth (e.g., culturally relevant by accommodation of language preferences [Spanish and English], traditional foods and PA activities chosen by children, family meals and including the whole family) to develop targeted interventions and prevent obesity.

Limitations

The findings of this study should be interpreted considering its limitations. First, we used a single-timepoint data in analyzing the variables, and the lack of temporal precedence precludes establishing causality among the variables. Second, we relied on self-report data and asked recall questions which are susceptible to social desirability and recall and reporting biases. Having objective measures (e.g., pedometer, accelerometer) and an additional informant (e.g., teacher, parent) can help ensure the validity of the data. Third, as some of the variables in this study were measured using a single item, the interpretation of the findings is limited to how the constructs were operationalized. Last, we used postevaluation data for this study. Thus, it is possible that the collected responses were due to the impact of the program and do not reflect the actual behavior or knowledge of the participants on a regular basis.

Conclusion

Determining factors that impact middle school children's PA is the first step to develop targeted interventions to promote PA and prevent childhood obesity. The present study identified unique factors including increased food knowledge, talking with family about eating healthy foods, eating breakfast, and reduced screen time that were associated with increase in the duration of children's PA. Further, these results varied for white and Latino children. These new insights emphasize the importance of developing individualized interventions that focus on both

improving nutrition and PA practices for enhanced PA child-level outcomes. Further, adapting the interventions based on ethnicity will help channel resources effectively and develop culturally sensitive and effective childhood obesity prevention programs.

Implications for School Health

Based on our findings, when a healthy-lifestyle intervention program is designed and implemented, an individualized and comprehensive approach should be emphasized for greater success. An intervention planner should be sensitive about participants' cultural and ethnic diversity in PA preferences and practice. A one-size-fits-all approach must be discouraged. For example, our results showed the negative relation between screen time and PA levels among the white children. The higher screen time resulted to less PA time or vice versa. This trend was not seen in the Latino children. Regardless the amount of screen time spent, the Latino children's PA time was lower than that of white children, and the amount of the PA time was not influenced by the screen time. Limiting screen time as a part of an intervention may be more effective for white children. An obesogenic environment exists during most of school days. Although it is understandable, students are encouraged to be quiet and seated in a classroom for an extended period of time. Thus, it is logical and promising to promote healthy-lifestyle intervention programs after school hours and in other ways. Given our findings, programs can also focus on multiple aspects of a healthy lifestyle, including healthy eating, less sedentary behavior, and family support.

Regardless children's ethnicity, regular PA is an essential part of children's healthy lifestyles. Our overall results showed that both white and Latino children's healthy food knowledge, eating breakfast, and communication with family about healthy eating all had statistically significant positive correlations with PA. Children's PA participation may be promoted by these 3 factors that are related to healthy lifestyle other than PA itself: food knowledge, healthy eating practice, and family support. For example, when "healthy food choices" is a selected topic of a lesson plan for children, perhaps the most effective lesson plan should include not only providing informative healthy food choices but also cooking demonstration and a cooking practice with the children's parent(s).

This may require a kitchen with several cooking spaces, dishes, silverware, and kitchen ware. Future design of school infrastructure should address the kitchen space which can accommodate several families to learn healthy eating and cooking skills.

Human Subjects Approval Statement — This study was approved by the University of Nebraska-Lincoln Institutional Review Board at the expedited level (approval number 20131113574EP).

Acknowledgement — This work was supported by the Agriculture and Food Research Initiative (AFRI) Grant no. 2011-67002-30202 from the USDA National Institute of Food and Agriculture. Childhood Obesity Prevention: Transdisciplinary Graduate Education and Training in Nutrition and Family Sciences or Child Development or Related Fields to Prevent Childhood Obesity-A2121.

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