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The influence of "westernization" on nutrition and physical activity behaviors of adolescents in New Delhi, India: Are we exporting an epidemic of obesity?

Melissa Harrell
The University of Texas School of Public Health, melissa.b.harrell@uth.tmc.edu

Emily Ussery
The University of Texas School of Public Health, yzv4@cdc.gov

Blanche Greene-Cramer
The University of Texas School of Public Health, Blanche.j.greenecramer@uth.tmc.edu

Nalini Ranjit
The University of Texas School of Public Health, nalini.ranjit@uth.tmc.edu

Shreela V. Sharma
The University of Texas School of Public Health, shreela.v.sharma@uth.tmc.edu

See next page for additional authors

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Authors
Melissa Harrell, Emily Ussery, Blanche Greene-Cramer, Nalini Ranjit, Shreela V. Sharma, and Monika Arora

INTRODUCTION

Like many emerging economies worldwide, India is changing quickly, and the "westernization" of this country is difficult to ignore. Traditional shopping markets must now compete with upscale shopping malls, the likes of which are booming in big cities, like Delhi. Traditional Indian foods, like curries, rice, and dal, must now contend with Maharaja Macs, a vegetarian version of the Big Mac sold in hundreds of McDonalds "family restaurants" that are now common throughout India.[1,2] English language movies, music, and TV shows are quite prevalent in India now, as are Western brands of food and drink (e.g., Lays, Pepsi), clothing (e.g., Gap), and other consumer products (e.g., cars, electronics, and other household goods). Opportunities to consume Western goods and thus Western culture are plentiful. Multinational companies promote Western lifestyles in their advertising campaigns as a status symbol that is especially appealing to a growing middle class and large numbers of teenagers in India.[3] Culture has become a commodity in this context.[3,4]

Arnett argues the central consequence of globalization or "westernization," as it relates to culture, is that it influences issues of identity. He suggests "… most people in the world now develop a bi-cultural identity, in which part of their identity is rooted in their local culture, while another part stems from their awareness of their relation to global culture."[5] Arnett's argument is informed by modern perspectives in acculturation research, which also support a bi-dimensional model for immigrant populations in the West.[5–11] Arnett focuses on adolescents because they are integrally involved in and affected by this process of globalization, or "westernization." Compared to children or adults, teenagers are more exposed to specific types of media (e.g., music, movies, television) that are used to facilitate the exchange of global ideas and information, which makes subsequent changes in beliefs and behaviors possible.[12] Teens are also typically the target of specific marketing efforts, which are increasingly focused on selling "global brands," the large majority of which originate in the West (e.g., Nike, Coca Cola). These marketing efforts often reflect and capitalize on developmental tasks of adolescence, such as identity formation, especially if local role models (e.g., Bollywood film stars, cricket stars) are used to sell these "global brands." This practice is common in India today.[4,13]

Although the body of literature on the effect of globalization, or "westernization," on health is growing,[14–22] few studies have examined the impact this has had on the health or health behaviors of young people.[16] This target population is important to consider for the reasons outlined above. Also, the onset of key behaviors that put people at risk for future

chronic disease, like tobacco use, poor nutrition, alcohol use, and physical inactivity, begin in childhood and adolescence and track into adulthood.[23–30] Driven by many of these behavioral risk factors, India is in the midst of a rapid epidemiologic transition characterized by rising rates of chronic disease.[21,29,31–36] Its nutrition transition is well-documented,[37–40] and trend data from three studies across the country show the prevalence of obesity among young people has been increasing steadily over the last five years.[40–42] Recent estimates from a multi-city study suggest 20 million adolescents nationwide in India are either overweight or obese.[38] In India, obesity is a problem of the rich, not the poor,[32] and it is in the big cities, like Delhi and Mumbai, that the affluent are affected most.[32,33] In a recent study of ours, 1 in 4 adolescents attending private schools (which cater to higher socioeconomic status (SES) families) in Delhi were overweight or obese,[43] a figure on par with many countries in the West.[44] Notably, the negative health consequences of obesity in India, like diabetes, occur at least a decade earlier in the life course and at much lower BMI values compared to countries in the West like the United States and the United Kingdom.[45–48] Therefore, the impact of this emerging epidemic may someday be larger than that which is currently being experienced in the West, magnified by India's enormous population, which now exceeds one billion persons.

The purpose of this study is to investigate the relationship between "westernization" and obesity among adolescents in India. Obesity is a disorder with strong environmental links. Societal changes, including urbanization, westernization (modernization), and globalization are common affluence-related traits that underlie the obesity epidemic.[49] A bi-dimensional model of "westernization" is used to reflect the bi-cultural identity referred to by Arnett. It measures young people's identification with Western *and* Indian ways of living. In this way, the relationship between a young person's sense of ethnic (i.e., Indian) identity and obesity can also be explored.. In addition to studying the direct effect of these cultural orientations on weight status and BMI, we also examined the potential impact they may have on related nutrition, physical activity, sedentary, and dieting behaviors known to influence obesity.[50–53] Although the effect of "westernization" on nutrition is often explored in studies like these,[15,18,38,39] its effects on other behaviors, like physical activity and sedentary behavior, remains under-investigated. In another study of ours from India, the impact of "westernization" on teen tobacco use was entirely negative.[16] Identification with Western ways of living was related to more tobacco use, including the use of tobacco products that are native to India (e.g., gutkha) and newer in the country (e.g., cigarettes). In contrast,

identification with Indian ways of living (or, more simply, having a strong sense of ethnic identity) was protective and inversely related to tobacco use, especially for boys and older adolescents. Thus, for this study, we hypothesized that the impact of "westernization" on obesity and related behaviors would be, like our previous study, wholly negative.

METHODS

STUDY DESIGN

This study is cross-sectional by design. Eight secondary schools in Delhi, India were recruited to participate in this study of the epidemiology and etiology of obesity among school-going youth in this setting. Four were private schools (and cater to middle-upper SES families) and four were government schools (and cater to lower SES families). The schools were chosen as a convenience sample, but are representative of the types of schools in this setting that are commonly used in research studies like these.[16,43,54,55] Ethical clearances were obtained from the appropriate institutional review boards in India and the United States, which required passive parental consent and active student assent for young people to participate. Height and weight were measured objectively and two self-reported surveys were administered to all participants.

DATA COLLECTION

Data were collected during usual school hours by two-person teams of trained research staff. The confidentiality of students' responses was assured. A unique student identification number not recognizable to the student or school staff was used to track the administration of the surveys and link them together to the anthropometric data. Surveys were administered in English in the private schools and Hindi in the government schools, based on their medium of instruction. Both surveys underwent a rigorous pilot procedure with more than 200 students to ensure each measure's reliability and validity.[43] As part of this pilot, surveys were translated from English to Hindi, and translated back from Hindi to English, then compared for translation reliability.

Anthropometrics. Anthropometric data (i.e., height and weight) were collected using standardized protocols[56] adapted to meet needs specific to India. Measured height and weight were used to compute BMI (kg/m^2). Using BMI, weight status was derived using age- and gender-specific BMI cut-points provided by the World Health Organization and recommended for use as an international standard for comparison and appropriate for adolescents in India.[57,58] Weight status was dichotomized to reflect obese/overweight versus normal weight students. For the purposes of this study, underweight students were excluded from analysis.

Westernization. Our measure of "westernization" is consistent with Arnett's theory[5], which is driven by contemporary perspectives in acculturation research.[7,59] Two dimensions of "westernization" were measured: (a) identification with the culture of origin (i.e., Indian) and (b) identification with the culture being introduced (i.e., Western). Within each dimension, four domains were assessed, including young people's preferences for (a) language, (b) media, (c) food, and (d) consumer goods. A mirror technique was used to evaluate these domains across both dimensions. That is, all questions were asked from both Indian and Western perspectives. The two scales representing these two dimensions are behaviorally-based, consistent with an orthogonal approach to cultural identification[10,60], and reliable. Table 1 provides further details. Scores on the Western scale were significantly higher for older students, 10th graders, and private school students, compared to younger students, 8th graders, and government school students (p<0.01). Scores on the Indian scale were only significantly higher for 10th graders, as compared to 8th graders (p<0.01). No differences in either scale's score were noted by gender. The piloting procedure with 200 students noted above helped ensure the face validity of these questions, through extensive cognitive interviews with these youths.

Table 1. Bi-dimensional Measure of "Westernization" That Includes a Western Scale and Indian Scale.

a. Western scale (n=12 items, range 0-36, mean=16.38, SD=7.30, Cronbach's α=0.86)[a]

Language preferences	How often do you speak with your mother or father in English?
	How often do you speak with your siblings in English?
	How often do you speak with your friends in English?
Media preferences	How often do you watch English TV shows?
	How often do you watch English movies or films?
	How often do you listen to English music?
Preferences for food	How often do you eat English food for lunch or dinner (such as pizza, burgers, etc.)?
	How often do you eat English food for a snack (such as potato chips, French fries, garlic bread, etc.)?
	How often do you eat English food for dessert (such as cakes, puddings, pastries, etc.)?
Other consumer goods	How often do you wear Western clothing (such as jeans, t-shirts, and skirts)?
	How often do you go out to a Western coffee house (such as Café Coffee Day, Barista)?
	How often do you go for shopping to a Western-type shopping mall (such as Ansal Plaza, Big Bazaar, etc.)?

b. Indian scale (n=12 items, range 0-36, mean=22.01, SD=6.66, Cronbach's α=0.81)[a]

Language preferences	How often do you speak with your mother or father in your mother tongue (Hindi, or other Indian language)?
	How often do you speak with your siblings in your mother tongue (Hindi, or other Indian language)?
	How often do you speak with your friends in your mother tongue (Hindi, or other Indian language)?
Media preferences	How often do you watch Hindi (or other Indian language) TV shows?
	How often do you watch Hindi (or other Indian language) movies or films?
	How often do you listen to Hindi (or other Indian language) music?
Preferences for food	How often do you eat Indian food for lunch or dinner (such as roti, rice, dal, vegetables, dosa, etc.)?
	How often do you eat Indian food for a snack (such as

	namkeen, rusk, etc.)?
	How often do you eat Indian food for dessert (such as kulfi, halwah, milk sweets, etc.)?
Other consumer goods	How often do you wear traditional Indian clothing (such as salwar kameez/sari for girls; kurta pajama for boys)?
	How often do you go out to a traditional Indian coffee house (such as Coffee Home)?
	How often do you go for shopping to traditional Indian markets (such as Karol Bagh, Chandni Chowk, etc.)?

[a]Response options for each item were on a 4-point Likert scale: (1) never, (2) sometimes, (3) often, (4) very often, summed to create overall measure.

Nutrition and physical activity. Measures of a variety of nutrition behaviors, physical activity behaviors, sedentary behaviors, and dieting behaviors were also included on the survey. All measures were adapted from similar survey instruments that had been used in the United States in prior related research studies.[61–63] To measure frequency of food consumption, we considered daily breakfast (>=1/day), fruit (>=1/day) and vegetable (>=1/day) consumption, and weekly family meals (>=1). For unhealthy dietary intake, we measured weekly fast food, soft drink, squash (a type of sugar-sweetened beverage common in India), and fried food consumption (>=1 week). To measure physical activity, we considered students' self-reported mild and moderate-to-vigorous intensity exercise for at least one-half hour/day in a usual week, and whether students had participated in one or more sports teams at school in the last year. For sedentary behaviors, we considered the time students spent viewing television, working/playing on the computer, and studying on weekdays and weekends (>=2 hours/day). An index of healthy dieting behaviors was created to measure whether students engaged in one or more of these behaviors in the last year in order to lose weight and/or avoid gaining weight: exercising more, eating more fruits and vegetables, eating less sweets, or eating less high-fat foods. Likewise, an index of unhealthy dieting behaviors was created to measure whether students had engaged in one or more of these behaviors in the last year in order to lose weight and/or avoid gaining weight: fasting, eating little food, skipping meals, taking diet pills, vomiting, or using food substitutes.

Psycho-social constructs. In addition to these behaviors, we also measured several psycho-social constructs based on prior surveys.[61–63] Two questions were used to measure receptivity to marketing. Students were asked if they had a favorite advertisement for food (Yes/No) and a favorite advertisement for soft drinks (Yes/No). Four scales were created to measure values, beliefs, and social support related to nutrition and

physical activity. The Values Scale measured the perceived importance of being healthy, eating healthy food, exercising, controlling weight, physical looks, doing well in sports, and doing well in school. Each item was rated on a 4-point scale from "not at all important" to "very important" (Cronbach's α = 0.76). The Beliefs Scale measured the perceived benefits of healthy eating, including whether it affects one's overall health, appearance, weight, achievement in sports, and academic achievement. Agreement with each of these items was rated on a 4-point scale from "surely no" to "surely yes" (Cronbach's α = 0.84). The Peer Social Support Scale and Parental Social Support Scale measured whether students perceived that their friends and parents cared about them eating healthy food, staying fit and exercising, and maintaining a healthy weight, and whether friends and parents encouraged the student to do these things. For both scales, each of these six items was rated on a 4-point scale from "surely no" to "surely yes" (Peer Scale: Cronbach's α = 0.89; Parent Scale: Cronbach's α = 0.91). The items on each of these scales were summed separately to create a score for each construct. A higher score indicates more positive values, more positive beliefs, and stronger social support. Finally, a single item was used to measure these students' satisfaction with their bodies.

DATA ANALYSIS

Mixed-effects regression models were employed to examine the association between "westernization" and BMI and weight status; nutrition, physical activity, sedentary, and dieting behaviors; and other psychosocial constructs. This type of regression model is appropriate for our study design since students were sampled and therefore nested within schools.[64] School was specified as a nested random effect. The Western scale and the Indian scale were included as independent variables in all regression models so that the effect of one dimension of "westernization" (e.g., Western) would always be adjusted for the effect of the other (e.g., Indian), given the bi-dimensional approach to measurement adopted here.[65] All other variables were used as dependent measures in separate logistic or linear regression models. Gender, school type (i.e., SES), and grade level were first considered as possible effect modifiers. No differences in the relationships reported here for all students were noted by these variables. Thus, all models were adjusted for these variables to reduce any potential confounding factors.. All analyses were conducted in STATA v.11 using maximum likelihood estimation methods.[66]

RESULTS

All students enrolled in the 8th and 10th grades in the selected schools were eligible for the study and invited to participate (n=2339). Response rates for the anthropometric measures, nutrition and physical activity survey, and the "westernization" survey were 87.2%, 88.6% and 95.2%, respectively. Non-participants across these components included parent refusals (<1%), student refusals (<1%), and student absentees (7-11%). The analysis sample includes 1818 students who participated in all three of the data collection efforts. Among these, 60% were boys (v. girls), 52% attended a private (v. government) school, and 55% were in 8th (v. 10th) grade. The mean age of these 8th and 10th graders was 13.9 years and 15.8 years, respectively. Of the entire sample, 52.9% were classified as normal weight, 33% were underweight, and 13.6% were overweight or obese.[58] Students in government schools were more likely to be underweight, while students in private schools were more likely to be overweight or obese.[58] The prevalence of overweight/obesity in private schools was 22% in this sample. [58]

No direct relationship between the Western scale score and BMI or weight status was noted ($p>0.05$). Neither was there a direct relationship between the Indian scale score and these variables ($p>0.05$). However, significant direct relationships between the Western and Indian scale scores and relevant behaviors and psychosocial constructs were observed ($p<0.05$).

Table 2 presents the results of the analyses for nutrition and dieting behaviors. A higher score on the Western scale was related to both unhealthy and healthy nutrition and dieting behaviors, and more behaviors overall compared to scores on the Indian scale. Specifically, higher scores on the Western scale were directly related to increased frequency of daily fruit and vegetable consumption ($p<0.01$), and increased weekly consumption of fast food ($p<0.001$), fried food ($p<0.001$), soft drinks ($p<0.001$), and squash ($p<0.05$). A higher score on the Western scale was also directly related to engaging in both healthy ($p<0.001$) and unhealthy ($p<0.001$) dieting behaviors to lose weight or avoid gaining weight in the last year. By comparison, however, a higher score on the Indian scale was only directly related to increased intake of fried food ($p<0.01$) and increased frequency of shared family meals ($p<0.01$), common in this context.

The results of the analyses for physical activity and sedentary behaviors are provided in Table 3. Again, a higher score on the Western scale was associated with both unhealthy and healthy behaviors. A higher score on the Western scale was directly related to increased time spent in

moderate (p<0.01) and vigorous (p<0.01) intensity physical activity and participation on school sports teams (p<0.001). A higher score on the Western scale was also directly related to increased time spent on computers (p<0.001). A higher score on the Indian scale was directly related to more time spent in moderate intensity physical activity (p<0.01), but not with vigorous intensity activity or participation on school sports teams (p>0.05). A higher score on the Indian scale was related to increased time viewing TV (p<0.01) and time studying (p<0.001).

Table 2. Association Between "Westernization"[a] and Nutrition and Dieting Behaviors; Delhi, India (n=1818).

	Western scale[a]				Indian scale[a]		
	β	(SE)	p-value[b]		β	(SE)	p-value[b]
Healthy nutrition behaviors							
Breakfast (daily)	0.010	(0.009)	0.240		0.002	(0.009)	0.785
Fruits (≥ 1/day)	0.024	(0.008)	0.004		-0.003	(0.008)	0.733
Vegetables (≥ 1/day)	0.027	(0.008)	0.001		0.010	(0.008)	0.232
Family meals (≥ 1/week)	0.018	(0.013)	0.173		0.045	(0.012)	<0.001
Unhealthy nutrition behaviors							
Fast food (≥ 1/week)	0.084	(0.009)	<0.001		-0.012	(0.008)	0.156
Soft drinks (≥ 1/week)	0.074	(0.008)	<0.001		-0.008	(0.008)	0.328
Squash (≥ 1/week)	0.053	(0.008)	<0.001		0.005	(0.008)	0.540
Fried foods (≥ 1/week)	0.020	(0.010)	0.037		0.022	(0.009)	0.022
Dieting behaviors							
Healthy dieting index (≥ 1/behavior in last year)	0.019	(0.004)	<0.001		0.006	(0.004)	0.129
Unhealthy dieting index (≥ 1/behavior in last year)	0.050	(0.004)	<0.001		-0.0003	(0.004)	0.951

[a] Models adjust for the effect of one dimension of "westernization" (e.g., Western) on outcomes, when considering the effect of the other (e.g., Indian).

[b] p-value represents test of the association using a random intercept mixed effects regression model, adjusted for gender, grade and school type (i.e., SES).

Table 3. Association Between "Westernization"[a] and Physical Activity and Sedentary Behaviors; Delhi, India (n=1818).

	Western scale [a]				Indian scale [a]		
	β	**(SE)**	**p-value [b]**		**β**	**(SE)**	**p-value [b]**
Physical activity behaviors							
Vigorous intensity (≥ ½ hour/day)	0.046	(0.011)	0.001		0.009	(0.010)	0.350
Moderate intensity (≥ ½ hour/day)	0.039	(0.012)	0.001		0.026	(0.011)	0.017
Mild intensity (≥ ½ hour/day)	0.015	(0.009)	0.101		0.012	(0.009)	0.177
School sports teams (≥ 1 sports team)	0.052	(0.008)	<0.001		-0.010	(0.008)	0.228
Sedentary behaviors							
TV viewing (≥ 2 hours/day)	0.008	(0.008)	0.352		0.028	(0.008)	0.001
Time spent on computer (≥ 2 hours/day)	0.070	(0.008)	<0.001		0.0003	(0.008)	0.967
Time spent studying (≥ 2 hours/day)	-0.007	(0.010)	0.484		0.042	(0.010)	<0.001

[a] Models adjust for the effect of one dimension of "westernization" (e.g., Western) on outcomes, when considering the effect of the other (e.g., Indian).

[b] p-value represents test of the association using a random intercept mixed effects regression model, adjusted for sex, grade and school type (SES).

Table 4. Association Between "Westernization"[a] and Selected Psychosocial Variables[c]; Delhi, India (n=1818).

	Western scale[a]				Indian scale[a]		
	β	**(SE)**	**p-value[b]**		**β**	**(SE)**	**p-value[b]**
Values[c]	-0.030	(0.013)	0.022		0.038	(0.013)	0.004
Beliefs[c]	0.005	(0.016)	0.743		0.079	(0.016)	<0.001
Peer social support[c]	0.017	(0.019)	0.361		0.088	(0.019)	<0.001
Parental social support[c]	0.020	(0.017)	0.241		0.108	(0.017)	<0.001
Favorite food ad[c]	0.033	(0.010)	0.001		0.009	(0.010)	0.377
Favorite soft drink ad[c]	0.025	(0.009)	0.004		0.016	(0.009)	0.077
Body satisfaction[c]	-0.002	(0.015)	0.881		- 0.046	(0.015)	0.002

[a] Models adjust for the effect of one dimension of "westernization" (e.g., Western) on outcomes, when considering the effect of the other (e.g., Indian).

[b] p-value represents test of the association using a random intercept mixed effects regression model, adjusted for sex, grade and school type (SES).

[c] A higher score on all of these scales/items indicates an increase in each construct (e.g., more social support, more body satisfaction, more favorite ads, etc).

For the psychosocial constructs considered here, more relationships were observed with the Indian scale than with the Western scale. A higher score on the Indian scale was directly related to values (p<0.01) and beliefs (p<0.001) supportive of a healthy weight status, as well as increased peer (p<0.001) and parental (p<0.001) support for the same. In contrast, a higher score on the Western scale was inversely associated with values supportive of a healthy weight status (p<0.05). A higher score on the Western scale was directly related to having a favorite food (p<0.01) and soft drink ad, as well (p<0.01). Finally, a higher score on the Indian scale was also directly related to being less satisfied with one's body type and composition (p<0.01).

DISCUSSION

This study investigated the relationship between "westernization" and obesity among older adolescents in 8th and 10th grades in Delhi, India. In addition to measured BMI and weight status, the association between "westernization" and a variety of health behaviors related to obesity, like nutrition, physical activity, sedentary, and dieting behaviors, were considered. The results were mixed. No direct relationship was observed between "westernization" and being overweight or obese. However, students' identification with Western ways of living was strongly and consistently related to many nutrition, physical activity, sedentary, and dieting behaviors that may place them at higher risk for obesity in the future. However, contrary to our hypothesis, "westernization" was related not only to unhealthy behaviors (e.g., fast food intake), but healthy behaviors (e.g., fruit and vegetable intake), too. In contrast, students' strong sense of (Indian) ethnic identity was less often associated with these health behaviors and more often related to protective factors that are typically targeted in preventive interventions, such as peer and parental support for maintaining a healthy weight status. These direct effects of a strong ethnic identity, in turn, might have positive indirect effects on behavior or weight status not considered here. Prior studies of the effects of "westernization" on these various behaviors have only employed a one-dimensional model of acculturation, assuming assimilation into the new culture.[67–69] Thus, this study extends this body of literature by demonstrating that there are independent effects related to these adolescents' identification with both the new culture being introduced (i.e., Western) and maintaining one's sense of (Indian) ethnic identity. The use of a bi-cultural measure in this study is a strength.

It is difficult to integrate this study with others in the literature because the body of research on the effects of "westernization" on adolescent behavior in non-immigrant populations is very limited to date; there are only a handful of studies. However, this study could be seen as analogous to research that examines the impact of acculturation on health in immigrant populations. The number of studies and literature is much larger by comparison. There are already strong reviews of more than 50 and 100 studies, respectively, specific to Asian[60] and Hispanic[9] immigrant populations around the globe. For adolescents, and adults alike, these studies consistently indicate that acculturation has a negative effect on multiple nutrition behaviors, including decreased consumption of fruits and vegetables, decreased intake of daily breakfast, and increased consumption of fast foods.[22,37,70,71] Some of our findings are consistent with this research and show that "westernization" is related to increased intake of sugar-sweetened beverages and fast food among these adolescents in India. The former is a known risk factor for obesity in the West,[72] and the latter is a key marker of the nutrition transition in Asia.[2] Another marker of the nutrition transition is increased intake of temperate-zone products, including specific fruits (e.g., apples) and vegetables (e.g., potatoes). Although we did not inquire about the types of fruits and vegetables these youth consumed, our study is consistent with findings from the Food and Agriculture Organization (FAO).[21] Fortunately, later stages of the nutrition transition are characterized by health promoting behaviors. India is moving this way [19, 20, 21], but intensive intervention efforts will be required to nurture and reinforce future health behaviors.

Compared to literature on nutrition behaviors, far fewer studies have been conducted specific to the effects of acculturation or "westernization" on physical activity, sedentary, or dieting behaviors. Studies of immigrant populations suggest acculturation is associated with increased sedentary behaviors like TV viewing and computer usage, and decreased physical activity.[71,73,74] Although our findings on sedentary behaviors were mixed, "westernization" was associated with increased time spent in moderate and vigorous intensity exercise. This positive effect has not yet been documented in the literature. In a study of Chinese, Chinese Australian, and Australian adolescents, dieting behaviors were least prevalent among Chinese immigrants.[75] In our study, "westernization" was related to an increased frequency of healthy and unhealthy dieting behaviors. It is unclear how this intersects with body satisfaction, which was negatively related to their sense of ethnic (Indian) identity. These topics are worthy of additional study, as weight concerns and weight control practices are common among overweight youth in India.[43]

Because this is a cross-sectional study, the directionality of the relationships described here cannot be confirmed. "Westernization" is likely a dynamic process that varies across time and space.[6] Additional longitudinal studies are needed to further understand the mechanism by which "westernization" unfolds and exerts itself on adolescent identity and related health behaviors. Qualitative studies may also be useful in providing the necessary context with which to enrich this body of research. The sample of schools selected for study is not a random one, although it is representative of the different schools in Delhi and includes boys and girls, students from lower and higher SES schools, and students from two grade levels. Differences between lower and higher SES settings were investigated, but not observed. A more refined measure of SES may yield different findings. The findings from this study are also limited to the health outcomes and health behaviors investigated here and may not generalize to other outcomes or other populations of adolescents. Studies of acculturation and health suggest effects vary across different dimensions of health and population groups.[9,60]

CONCLUSION

India is home to more children and adolescents than any other country worldwide.[76] At present, this country is in the midst of a rapid epidemiologic transition, characterized by rising rates of non-communicable, chronic diseases that are driven by modifiable risk factors like obesity and related nutrition and physical activity behaviors.[23,32,33] This study examined the impact that "westernization" may be having on these health outcomes and health behaviors among adolescents in Delhi. To date, this topic has been understudied among young people worldwide. Using a bi-dimensional model of acculturation, the results suggest the impact of "westernization" may not be wholly negative, and that adolescents' strong sense of ethnic identity may be protective. Interventions designed to promote healthy eating and active living among adolescents in India should be aware of these findings and utilize them where possible when developing new programs or policies in this setting. For example, reinforcing ethnic (i.e., Indian) pride and customs, such as family meals, may help to strengthen values and beliefs supportive of a healthy weight status, which, in turn, could build a stronger foundation for health and health enhancing behaviors by these adolescents. "Westernization," or globalization more generally, is a powerful force that will continue to shape adolescents' lives for many decades to come. Future research should continue to explore the mechanisms by which "westernization" changes adolescent behaviors, and how it impacts

current cultural practices of a given society, in order to get a robust picture of the dynamics of this rapid evolution across the globe. Additional research is needed to drive an advocacy-based solution to the problem of obesity in this setting. Contextual elements, like “westernization,” should be considered in future studies.

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