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ORIGINAL PAPER

Acculturation is Associated with Dietary Patterns in South Asians in America

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Abstract

Acculturation may influence diet pattern, a risk factor for cardiometabolic disease. We assessed whether strength of traditional cultural beliefs and practices, a robust measure of acculturation, affects diet pattern among South Asians in America. With data from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) cohort, we used ordinal logistic regression to assess the association between strength of traditional cultural beliefs, 6 cultural practices and diet pattern. Of 892 participants, 47% were women. Weaker traditional cultural beliefs [OR(95%CI) 1.07(1.04,1.10)] and cultural practices ($p < 0.05$) were associated with consuming more of the Animal Protein dietary pattern and less [0.95(0.93,0.97)] of the Fried snacks, Sweets, High-fat dairy (FSHD) pattern ($P < 0.05$). South Asians in America with stronger traditional cultural beliefs and practices were more likely to consume the FSHD pattern. Prevention programs may consider dietary pattern modification as part of comprehensive risk reduction in South Asians.

Keywords South asian · Dietary patterns · Acculturation

Introduction

Cultural beliefs and practices are intimately tied to dietary intake in South Asian cultures [1]. Celebrations and life events have particular culinary traditions in South Asia, whose geographic area includes India, Pakistan, Bangladesh, Nepal and Sri Lanka [2]. These culinary traditions, including consumption of prayer and festival-related sweets and fried foods, and a trend towards lacto-vegetarianism in Hindu populations, persist after immigration to the United States, but are affected by a variety of factors including socioeconomic status, exposure to health messaging, level of health literacy and length of time spent in the country.

Acculturation is the adjustment of cultural traditions to adapt to a host country. In non-South Asian racial and ethnic groups, migration to the United States and greater levels of acculturation have been associated with poorer dietary quality [3–5]. In prior studies of South Asian immigrants, migration and acculturation to the United States and Canada has been associated with detrimental changes in diet, including an increase in added sugars, saturated fat and animal protein consumption, lower diet quality and variable fruit and vegetable intake [6, 7]. Measures of acculturation in these studies have mainly focused on length of residence in the United States, and their effects on diet patterns are limited to the consumption of certain food groups rather than overall dietary intake.

Investigation into the impact of acculturation on dietary patterns of South Asians in the United States is limited, and dietary patterns are associated with risk factors for cardiometabolic disease [8–10]. Therefore, in this analysis, we aimed to determine whether the strength of cultural beliefs and practices affects choice of dietary patterns unique to South Asians in the United States using data from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study.

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Methods

We conducted a cross-sectional investigation of 906 South Asians who participated in the MASALA community-based cohort study [11]. Briefly, MASALA is a prospective cohort study which included community-dwelling individuals living in the San Francisco Bay Area and the greater Chicago areas recruited between 2010 and 2013. Participants self-identified as having South Asian ancestry, were aged 40–84 years, and had no known cardiovascular disease. Those on nitroglycerin, with active cancer, with impaired cognitive ability, a life expectancy less than 5 years, who lived in a nursing home, or who had plans to relocate, were excluded. The Institutional Review Boards at the University of California, San Francisco and Northwestern University approved the study protocol and all study participants provided written informed consent.

All visits were conducted by trained bilingual study staff, and all consent forms were translated into Hindi and Urdu. Each participant underwent in-person interviews to determine age, sex, medical history and smoking status. Food group intake was collected with the Study of Health Assessment and Risk in Ethnic (SHARE) groups South Asian Food Frequency Questionnaire, which was developed and validated in South Asians in Canada [12]. The food frequency questionnaire included 163 items, with 61 items unique to the South Asian diet, and assessed usual eating habits, frequency and serving sizes over the past 12 months [12]. Individual food items from the SHARE food frequency questionnaire were divided into 29 predefined subgroups reflecting likeness, underlying nutrient composition and culinary usage in the Asian Indian diet. Several foods (e.g. coffee) were kept as individual categories given their high reported intake. We excluded 1 individual with incomplete food frequency questionnaire data and another 13 who did not meet a priori criteria of daily caloric ranges for males (800–4200 kcal/24H) and females (500–3500 kcal/24H). 892 remaining participants were included in our analysis. A separate "vegetarian" diet variable was determined a priori by a response of "0" to questions on the food frequency questionnaire corresponding to intake of animal protein (including fish, poultry, meat and excluding eggs and dairy).

The independent variable was acculturation, defined by two scales: "Cultural Beliefs" and "Cultural Practices." A 7-item scale, previously developed in the MASALA pilot study by Kanaya et al. was used to assess "Cultural Beliefs." [13] The base question was "How much would you wish these South Asian traditions would be practiced in America? The seven items included: (i) Performing religious ceremonies; (ii) serving sweets at ceremonies; (iii) fasting on specific occasions; (iv) living in a joint family; (v) having an arranged marriage; (vi) eating a staple diet of rice, *chapatis*, vegetables, and yogurt; (vii) using spices for health and healing. The items were scored on a Likert scale with higher scores representing weaker traditional cultural beliefs. The Cronbach's alpha for this scale was 0.83 with similar reliability in both men and women. For analyses, we compared those with weak traditional beliefs with those with moderate or strong traditional beliefs. To assess "Traditional Cultural Practices," we used six different questions, graded either from 1 ("Always") to 6 ("Never") characterizing the frequency of practices performed by participants or 1 ("Strong South Asian") to 6 ("Weak South Asian"). The questions were: "How often do you fast? How often do you eat out? How often do you shop at South Asian markets? What kind of food do you eat at home? What kind of food do you eat in restaurants? Which ethnic group do your friends belong to?".

Our outcome was adherence to previously characterized and empirically-derived diet patterns, the alternative healthy eating index (AHEI) score and a vegetarian diet pattern. In prior analyses [14], we identified the three most prevalent diet patterns in this population and named them according to their major components: Animal Protein; Fried snacks, Sweets, High-Fat dairy; Fruits, Vegetables, Nuts, Legumes [8, 9]. Each participant was assigned a factor score for each dietary pattern based on the correlation of his or her food frequency questionnaire data with the food groupings in the two prevalent patterns. We analyzed associations of the factor score as a continuous variable for each dietary pattern. The AHEI score [10] is an empirically-derived dietary rating system scored from 2.5 to 87.5 with 87.5 representing a diet of the highest quality. The AHEI was calculated from the MASALA food frequency questionnaire. The vegetarian diet pattern designation was assigned to participants who indicated that they did not consume any meat, poultry or fish on the FFQ—in line with a lacto-ovo-vegetarian diet pattern [15].

Statistical Methods

Baseline characteristics of the MASALA participants were compared by tertile of dietary pattern using chi-square test and analysis of variance (ANOVA) where appropriate. We used ordinal logistic regression analysis for the prespecified outcomes, which were categorized as ordered tertiles of each dietary pattern. The Traditional Cultural Beliefs Scale, responses to the Traditional Cultural Practices questions and age were modeled as continuous covariates; study site, sex, education, income, were modeled as categorical variables. We used linear regression analyses for examining the association of cultural beliefs and practices and the AHEI score, and logistic regression for analysis of beliefs and practices and consumption of a vegetarian diet pattern.

We found no evidence of interaction between cultural beliefs or practices and sex, income or education in this cohort.

The analysis was completed using Stata (version 11.2, 2012, College Station, TX, USA).

Results

In this cohort of South Asian men and women living in the United States, we included 892 participants who had both dietary information and measures of acculturation. Approximately 47% of the participants were women, and the vast majority (84%) were of Indian origin. As previously reported, there were three distinct dietary patterns: Animal protein, Fried snacks, sweets and high-fat dairy, and Fruits, vegetables, nuts and legumes [9]. The Animal protein pattern was the only pattern with major non-vegetarian components.

Among those in the highest tertile of factor scores (Tertile 3) for the Animal protein diet, 48% identified as Hindu, while approximately 84% of those in the lowest tertile identified as Hindu. Those in the highest tertile of the Animal protein diet were less often born in India. (Table 1).

Weaker traditional cultural beliefs were associated with higher odds of consumption of the Animal Protein pattern [OR 1.07 (1.04, 1.10)] and with lower odds of consumption of the Fried snacks, sweets, high-fat dairy pattern [0.95 (0.93, 0.97)]. (Table 2) There was no association between traditional cultural beliefs and the Fruits, vegetables, nuts, legumes pattern. Weaker traditional cultural beliefs were also associated with a higher AHEI diet quality score [0.15; 95%CI (0.07, 0.22)] and with lower odds of consumption of only vegetarian food [0.93; 95% CI (0.90, 0.95)].

Weaker individual traditional cultural practices were associated with higher consumption of the Animal protein diet: less fasting [3.34 (1.27, 8.83)], eating less South Asian food in restaurants [8.45 (2.76, 25.89)] or at home [15.4 (7.09, 33.49)], shopping at South Asian grocery stores less frequently [3.44 (1.87, 6.33)], eating outside of the home more frequently [3.82 (2.39, 6.08)] or having fewer South Asian friends [10.45 (5.32, 20.53)]. Weaker individual South Asian traditional cultural practices were associated with lower consumption of the "Fried Snack, Sweets and High-fat dairy" dietary pattern. Those who fast less frequently [0.25 (0.10, 0.63)], eat South Asian food in restaurants [0.28 (0.09, 0.87)] or shop at South Asian grocery stores less frequently [0.21 (0.11, 0.38)] were less likely to consume the "Fried snacks, Sweets and High-fat dairy" dietary pattern. Participants who shop less frequently at South Asian grocery stores had lower odds of consuming the highest tertile of Fruits, vegetables, nuts, legumes diet pattern [0.50 (0.27, 0.92)]. Weaker individual traditional cultural practices were all associated with lower consumption of a Vegetarian diet (all $p < 0.05$).

Discussion

South Asians in the MASALA study who had stronger traditional culture beliefs were more likely to consume the Fried snacks, sweets and high-fat dairy pattern, less likely to consume the Animal protein dietary pattern, and were more likely to be vegetarian. Participants who routinely engaged in traditional cultural practices were also less likely to consume the Animal protein dietary pattern.

Dietary consumption is influenced by a multitude of factors, both cultural and practical, including religious affiliation, influence of the current culinary environment and accepted nutrition practices, and aging and health status [16]. Few studies have examined the association of cultural beliefs and practices on diet patterns in South Asians who have lived in America, on average, for decades. Our prior work in this cohort has shown that length of residence in the United States is associated with differences in intake of nutrients and biomarkers for cardiovascular disease [17]. Participants living in the United States for longer had greater consumption of specific food groups including alcoholic beverages, pizza and pasta, fats and oils and lower consumptions of foods such as beans and lentils, grain, dairy and candy/sugar. The current investigation broadens this inquiry to study overall cultural beliefs and practices and their effects on dietary patterns in the MASALA cohort.

Cultural gatherings and celebrations in South Asia often revolve around culinary customs. The majority of our participants identified as Asian Indian and Hindu, affiliations which would traditionally proscribe the consumption of a high animal-protein pattern diet. In our current investigation, the Fried snacks, sweets, high-fat dairy diet pattern includes many items that may be associated with celebratory occasions among those who take part in traditional cultural practices [1]. In our prior work, the Fried snacks, sweets and high-fat dairy pattern was associated with a lower HDL and higher HOMA-IR, [9] signifying high cardiometabolic risk. These changes occurred despite its status as a predominantly plant-based dietary pattern. This key point in culturally-specific nutrition counseling underscores the importance of educating at-risk individuals on the components of a more healthful diet pattern instead of relying on vegetarianism as a proxy for healthfulness.

The "westernization" of diet after living in the United States has previously been associated with increased BMI, obesity and consumption of caffeinated and sugar-sweetened beverages [3, 18] and with increased rates of type 2 diabetes [19]. In our current investigation, weaker traditional cultural beliefs and more infrequent participation

Table 1 Baseline characteristics of the MASALA study population by dietary pattern in tertiles, 2010–2013

	Animal protein				Fried snacks, Sweets, High-fat dairy				Fruits, Vegetables, Nuts, Legumes			
	Tertile 1	Tertile 2	Tertile 3	*P*-value for trend	Tertile 1	Tertile 2	Tertile 3	*P*-value for trend	Tertile 1	Tertile 2	Tertile 3	*P*-value for trend
	N = 297	N = 297	N = 298		N = 297	N = 297	N = 298		N = 297	N = 297	N = 298	
Women, (%)	176 (59)	138 (46)	106 (36)	< 0.001	164 (55)	140 (47)	116 (39)	< 0.001	129 (43)	152 (51)	139 (47)	0.59
Age, years	56.2 ± 9.29	55.9 ± 9.36	53.8 ± 9.35	0.001	56.1 ± 9.22	55.5 ± 9.30	54.4 ± 9.57	0.12	54.9 ± 9.56	54.9 ± 9.27	56.1 ± 9.29	0.09
BMI, (m/kg^2)	25.7 ± 3.76	26.0 ± 4.02	26.4 ± 5.04	0.003	26.0 ± 4.68	25.7 ± 4.13	26.4 ± 4.10	0.41	26.3 ± 4.49	26.0 ± 3.64	25.8 ± 4.73	0.40
Birth country, (%):				< 0.001				0.90				0.95
India	93	90	69		81	87	83		82	85	84	
Pakistan	0	3	10		3	4	6		5	4	4	
Sri Lanka	0	0	3		2	1	1		2	0	1	
United States	1	0	5		3	1	1		3	2	1	
Sub-Saharan Africa	3	3	3		5	2	2		3	2	4	
Other	3	5	10		6	1	7		5	5	6	
Religious affiliation, (%):				0.002				0.97				0.38
Hinduism	84	70	48		68	69	65		65	69	68	
Christianity	0	2	7		3	4	3		4	2	3	
Islam	0	6	15		5	5	10		9	7	5	
Jainism	11	7	1		7	7	5		4	8	6	
Sikhism	3	8	12		5	8	10		7	5	10	
Other	2	7	17		11	8	7		10	8	7	
Family income > $75 K, (%)	70	78	72	0.96	80	74	66	< 0.001	69	76	75	0.06
Exercise, log MET-min/week[a]	6.97 ± 0.89	7.01 ± 0.88	6.95 ± 1.02	0.32	7.10 ± 0.86	7.05 ± 0.88	6.75 ± 1.02	< 0.001	6.79 ± 0.98	6.93 ± 0.94	7.17 ± 0.83	< 0.001
Eating out, times/week (%)				< 0.001				0.18				0.89
2 or 3	4	9	20		14	10	9		10	13	10	
Once	28	37	34		32	31	37		33	33	33	
< Once	68	54	46		55	59	54		57	55	57	
Energy intake, kcal/d	1620 ± 467	1590 ± 435	1840 ± 566	< 0.001	1370 ± 371	1650 ± 398	2030 ± 502	< 0.001	1370 ± 383	1640 ± 384	2040 ± 489	< 0.001

Presented as Mean ± SD unless otherwise specified

[a](MET) metabolic equivalent

*p < 0.01

Table 2 Association of traditional cultural practices with major dietary pattern

	Odds of increasing tertile of diet pattern (OR, 95% confidence interval)			Vegetarian diet	Diet quality
	Animal protein	Fried snacks, Sweets, High-fat dairy	Fruits, Vegetables, Nuts, Legumes	Vegetarian diet (OR, 95% CI)	AHEI score β (95% CI)
Traditional cultural Beliefs score [OR (95% CI)]	1.07 (1.04, 1.10)*	0.95 (0.93, 0.97)*	0.99 (0.96, 1.01)	0.92 (0.90, 0.95)*	0.15 (0.07, 0.22)*
Questionnaire items (1 = strong South Asian; 6 = weak South Asian)					
How often do you fast?[a]	3.34 (1.27, 8.83)*	0.25 (0.10, 0.63)*	0.83 (0.33, 2.06)	0.66 (0.60, 0.74)*	0.57 (0.25, 0.89)*
What kind of food do you normally or usually eat at home?[b]	15.4 (7.09, 33.49)*	0.26 (0.13, 0.52)	0.85 (0.44, 1.66)	0.48 (0.39, 0.60)*	0.40 (−0.21, 1.00)
What kind of food do you normally or usually eat in restaurants?[b]	8.45 (2.76, 25.89)*	0.28 (0.09, 0.87)*	2.55 (0.85, 7.66)	0.57 (0.47, 0.68)*	1.10 (0.57, 1.62)*
How often do you eat out?[a]	3.82 (2.39, 6.08)*	0.73 (0.47, 1.14)	0.96 (0.63, 1.47)	1.75 (1.38, 2.22)*	−0.16 (−0.84,0.52)
How often does your family shop at South Asian grocery stores?[a]	3.44 (1.87, 6.33) *	0.21 (0.11, 0.38)*	0.50 (0.27, 0.92)*	0.68 (0.57,0.82)*	0.14 (−0.37, 0.65)
Which ethnic group or culture do most of your friends belong to?[c]	10.45 (5.32, 20.53)*	0.72 (0.18, 3.44)	0.90 (0.48,1.67)	0.52 (0.43, 0.64)*	−0.13 (−0.69, 0.43)

Adjusted for age, study site, sex, education and income

[a] 1 = two to three times per week; 2 = about once a week; 3 = about once or twice per month; 4 = less than once a month; 5 = once a year for a specific period; 6 = almost never or never

[b] 1 = Only South Asian food; 2 = Mostly South Asian food; 3 = Equally South Asian and other; 4 = Mostly other food; 5 = Only other food; 6 = Never eat at home/restaurants

[c] 1 = Only South Asian; 2 = Mostly South Asian; 3 = Equally South Asian group and Other groups; 4 = Mostly Other; 5 = Only Other groups

* $p < 0.05$

in cultural practices were both associated with higher intake of the Animal protein dietary pattern. Our prior work in MASALA has shown that consumption of the Animal protein pattern is associated with higher BMI and waist circumference [9], suggesting that this diet pattern is associated with increased adiposity, a major risk factor for incident cardiovascular disease and diabetes [20–23]. One of the major components of this diet pattern is red and processed meats, which makes our finding concordant with multiple investigations suggesting that higher red and processed meat intake has long-term associations with poor cardiometabolic outcomes [21, 23, 24]. As weaker traditional cultural beliefs and more infrequent practices are a mark for increased acculturation into a Western environment, adoption of the unhealthy components of a Westernized diet may be a consequence of this transition – a well-known phenomenon.

This investigation's findings, however, also show that those individuals with weaker traditional cultural beliefs consumed a diet of higher quality (represented by a higher AHEI score). In prior work focusing on South Asian immigrants in Canada, and as compared with recent immigrants, those individuals who had been in the host country for longer reported more healthful dietary preparation practices, and a lower BMI [16]. A higher degree of acculturation has been previously associated with higher diet quality in South Asian immigrants [25]. It has also been linked with increased consumption of fruits and vegetables [16], and currently the weight of the literature associates plant-based diets with better long-term health outcomes [26–28]. Thus, acculturation provides a complex set of influences that alter health behaviors both positively and negatively and the factors involved in these competing changes are not fully understood.

In our cohort of high-income, well-educated South Asian immigrants, greater acculturation may signify a shift towards a higher quality diet. There were, however, no statistically significant interactions between sex, education or income to explain why individuals with weaker traditional cultural beliefs and practices preferred the Animal protein pattern in lieu of the Fruits, Vegetables, Nuts and Legumes pattern. It is likely a combination of medical history and factors of social context beyond those explored in this investigation that affects the choice between the Animal Protein and Fried snacks, sweets, high-fat dairy.

Strengths of this study include a large, community-based cohort of South Asians in the United States, robust measures of dietary intake and cultural beliefs and practices. We also acknowledge that there are limitations to our study. This is a cross-sectional examination, and we were unable to determine changes in cultural beliefs and practices or dietary patterns over many years. Still, the current shed light on factors

that may lead to less healthful eating habits, and inform targets for culturally-specific dietary counseling.

Implications for Research and Practice

Identifying cultural beliefs and practices and understanding their effects on risk factors for cardiometabolic disease may help to broaden strategies of prevention for cardiovascular disease and diabetes in South Asians living in the United States.

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References

1. Gulati S, Misra A. Sugar intake, obesity, and diabetes in India. Nutrients. 2014;6(12):5955–74.
2. Bhattacharya M. A historical exploration of Indian diets and a possible link to insulin resistance syndrome. Appetite. 2015;95:421–54.
3. Novotny R, et al. US acculturation is associated with health behaviors and obesity, but not their change, with a hotel-based intervention among Asian-Pacific Islanders. J Acad Nutr Diet. 2012;112(5):649–56.
4. Anand SS, et al. Differences in risk factors, atherosclerosis, and cardiovascular disease between ethnic groups in Canada: the study of health assessment and risk in ethnic groups (SHARE). Lancet. 2000;356(9226):279–84.
5. Danaei G, et al. The global cardiovascular risk transition: associations of four metabolic risk factors with national income, urbanization, and Western diet in 1980 and 2008. Circulation. 2013;127(14):1493–8.
6. Mukherjea A, et al. Asian Indian views on diet and health in the United States: importance of understanding cultural and social factors to address disparities. Family Commun Health. 2013;36(4):311–23.
7. Rajpathak SN, et al. Elevated risk of type 2 diabetes and metabolic syndrome among Asians and south Asians: results from the 2004 New York City HANES. Ethn Dis. 2010;20(3):225–30.
8. Gadgil MD, et al. Dietary patterns in Asian Indians in the United States: an analysis of the metabolic syndrome and atherosclerosis in South Asians living in America study. J Acad Nutr Diet. 2014;114(2):238–43.
9. Gadgil MD, et al. Dietary patterns are associated with metabolic risk factors in South Asians living in the United States. J Nutr. 2015;145(6):1211–7.
10. Chiuve SE, et al. Alternative dietary indices both strongly predict risk of chronic disease. J Nutr. 2012;142(6):1009–188.
11. Kanaya AM, Kandula N, Herrington D, et al. Mediators of atherosclerosis in South Asians living in America (MASALA) study: objectives, methods, and cohort description. Clin Cardiol. 2013;36(12):713–20. https://doi.org/10.1002/clc.22219.
12. Kelemen LE, et al. Development and evaluation of cultural food frequency questionnaires for South Asians, Chinese, and Europeans in North America. J Am Diet Assoc. 2003;103(9):1178–84.
13. Kanaya AM, et al. Prevalence and correlates of diabetes in South asian indians in the United States: findings from the metabolic syndrome and atherosclerosis in South asians living in america study and the multi-ethnic study of atherosclerosis. Metab Syndr Relat Disord. 2010;8(2):157–64.
14. Hu FB. Dietary pattern analysis: a new direction in nutritional epidemiology. Curr Opin Lipidol. 2002;13(1):3–9.
15. Jin Y, Kandula NR, Kanaya AM, Talegawkar SA. Vegetarian diet is inversely associated with prevalence of depression in middle-older aged South Asians in the United States. Ethn Health. 2019;1–8. https://doi.org/10.1080/13557858.2019.1606166.
16. Lesser IA, Gasevic D, Lear SA. The association between acculturation and dietary patterns of South Asian immigrants. PLoS ONE. 2014;9(2):e88495.
17. Talegawkar SA, et al. Dietary intakes among South Asian adults differ by length of residence in the USA. Publ Health Nutr. 2016;19(2):348–55.
18. Garduno-Diaz SD, Khokhar S. South Asian dietary patterns and their association with risk factors for the metabolic syndrome. J Hum Nutr Diet. 2013;26(2):145–55.
19. Venkataraman R, et al. Prevalence of diabetes mellitus and related conditions in Asian Indians living in the United States. Am J Cardiol. 2004;94(7):977–80.
20. Liu E, et al. Cross-sectional association of dietary patterns with insulin-resistant phenotypes among adults without diabetes in the Framingham Offspring Study. Br J Nutr. 2009;102(4):576–83.
21. Judd SE, et al. Dietary patterns are associated with incident stroke and contribute to excess risk of stroke in black Americans. Stroke; A J Cereb Circul. 2013;44(12):3305–11.
22. Newby PK, et al. Dietary patterns and changes in body mass index and waist circumference in adults. Am J Clin Nutr. 2003;77(6):1417–25.
23. van Woudenbergh GJ, et al. Meat consumption and its association with C-reactive protein and incident type 2 diabetes: the Rotterdam study. Diab Care. 2012;35(7):1499–505.
24. Liu L, et al. Dietary pattern, the metabolic syndrome, and left ventricular mass and systolic function: the multi-ethnic study of atherosclerosis. Am J Clin Nutr. 2009;90(2):362–8.
25. Khan SA, Jackson RT, Momen B. The relationship between diet quality and acculturation of immigrated South Asian American adults and their association with metabolic syndrome. PLoS ONE. 2016;11(6):e0156851.
26. Newby PK. Plant foods and plant-based diets: protective against childhood obesity? Am J Clin Nutr. 1587S;89(5):1572S–87S.
27. Steffen LM, et al. Associations of plant food, dairy product, and meat intakes with 15-y incidence of elevated blood pressure in young black and white adults: the coronary artery risk development in young adults (CARDIA) study. Am J Clin Nutr. 2005;82(6):1169–74.
28. Satija A, et al. Plant-based dietary patterns and incidence of type 2 diabetes in US men and women: results from three prospective cohort studies. PLoS Med. 2016;13(6):e1002039.