

What are Asian-American Youth Consuming? A Systematic Literature Review

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Abstract Numerous studies have explored dietary practices among children, but there are limited studies on children of Asian background in the US. This review had three aims: (a) review literature regarding Asian-American youth's dietary behaviors, (b) critically evaluate the methodological quality of such research, and (c) provide recommendations for future nutrition-related research on Asian-American youth. The authors conducted a systematic literature review through MEDLINE (EBSCO), CINAHL Plus with Full Text (EBSCO), and Embase (Ovid); extracted descriptive data; and evaluated methodological quality. Thirteen articles were included. Major findings included: (a) frequent consumption of milk, fruit, meat, unenriched white rice, vegetables, and high-fat and high-sugar items among Asian-American children and (b) acculturation's influences on diet, resulting in Asian-

American youth consuming diets characterized by both Asian and American foods. Findings from this review may inform education and promotion programs and services for Asian Americans in the US.

Keywords Nutrition · Children · Asian American

Introduction

Chronic diseases develop over the lifespan, with increased risk for certain chronic diseases originating from developmental processes and behaviors formed in early childhood [1]. One factor related to chronic diseases is diet [2]. For example, excessive intakes of fats, cholesterol, and salt are related to high blood pressure [1], and consumption of sugar-sweetened beverages may play a role in obesity [3], which is a risk factor for multiple cancers [4, 5]. In contrast, fruit and vegetable consumption likely has protective effects against certain cancers and adiposity [6, 7].

Traditional Asian diets—rich in fruits and vegetables—have been associated with good health outcomes [8]. However, there are few studies on dietary practices among Asians living outside of Asia, especially in the US. Asians who immigrate to the US carry over their dietary preferences and practices but often begin to incorporate westernized foods into their diet. One study revealed increased consumption of cookies, cakes, and sweet buns as breakfast items for children [9], and another study found consumption of salty snacks, desserts, and sweetened beverages at snack time [10]. One possible reason for dietary changes is acculturation, or the process by which individuals from one cultural context adapt to another cultural context [11]. Such acculturation-related changes in dietary behaviors may partly account for increased prevalence of obesity, obesity-

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related diseases, and certain cancers observed among Asian immigrants [12–15].

Childhood is a critical period for developing dietary preferences; the foods children eat at a young age predict the foods they will eat in adolescence and adulthood [16]. Many studies have explored dietary practices among children, but there are limited studies on children of Asian background in the US. This study was conducted to determine what information is available regarding eating behaviors among Asian youth in the US and the impact of acculturation on these feeding behaviors. This review had three aims: (a) review literature regarding Asian-American youth's dietary behaviors, (b) critically evaluate the methodological quality of such research, and (c) provide recommendations for future nutrition-related research on Asian-American youth. For the purposes of this review, Asians are defined as people with origins in the Far East, Southeast Asia, or the Indian subcontinent [17], and Asian Americans are those persons living in the US from Asian backgrounds.

Methods

Retrieval Procedures

This review followed the matrix method systematic review procedures outlined by Garrard [18]. In October and November 2011, the authors searched electronic databases of MEDLINE (EBSCO), CINAHL Plus with Full Text (EBSCO), and Embase (Ovid) for English-language, peer-reviewed journal articles related to Asian-American youth's dietary behaviors. Search terms included variations of dietary behavior terms (e.g., feed, food, diet, or nutrition) and Asian population terms (e.g., Asian, Chinese, or Vietnamese) with limits on child age (i.e., child or preschool years) and English language. The authors also perused references of included studies for more publications.

Inclusion and Exclusion Criteria

In order to be selected for review, studies had to (a) appear in an English language, peer-reviewed journal; (b) present findings for Asians in the US; (c) primarily include preschool-aged or school-aged children (i.e., 2–11 years of age) and/or their caregivers; and (d) focus primarily on dietary behaviors or diets. The authors excluded studies that were not primary reports of research findings (e.g., reviews, commentaries, or program reviews); focused on food poisoning or food allergy; investigated physiological or nutritional aspects of nutrition (e.g., immunoglobulin, plasma, fatty acid levels, vitamins, or nutritional status);

studied feeding practices/styles or parents' perceptions of feeding; or investigated breastfeeding, bottle feeding, non-nutritive sucking, or introduction of solid foods. Thirteen articles met these criteria and were included in the final sample (see Fig. 1 for selection process).

Review Criteria

The authors created a coding scheme and methodological quality scale (MQS) for the current review. The coding scheme included sample characteristics, dependent variables, independent variables, study design, analytic methods, and findings related to children's dietary behaviors. To evaluate methodological quality, the authors adapted the MQS from Sosa [19] and Zhang and Goodson [20]. As seen in Table 1, the final MQS included ratings for study design, ethnicity, participant description, measures, validity, reliability, data analysis, and effect size; maximum possible points were 16. Two raters (i.e., the first author and a colleague, both with training in research methodology and statistics) independently reviewed and extracted data from 5 out of 15 reviewed studies (approximately 33.3 %). Interrater reliability was 1.0.

Results

Results are presented below in three sections: studies' characteristics, studies' methodological characteristics, and empirical findings. A matrix with more details is included in Table 2.

Studies' Characteristics

As seen in Fig. 1, the authors screened 574 articles; thirteen of which met inclusion and exclusion criteria. Over 40 % of screened articles were excluded because they did not focus primarily on dietary behaviors and instead focused on diet-related diseases or physiological markers of diet. An additional 30 % of studies described Asians outside the US, such as in Korea [21] and England [22]. The remaining articles that were excluded were not primary reports of research findings, or they exclusively sampled children outside of preschool or school ages (i.e., only included adolescents). The final articles represented 10 different peer-reviewed journals from various disciplines, including nutrition ($n = 7$ articles) [10, 23–28], nursing or health care ($n = 2$ articles) [29, 30], public health or disease prevention ($n = 2$ articles) [31, 32], and minority health ($n = 2$ articles) [33, 34]. All articles were published between 1986 and 2011, with a majority (i.e., 85 %) published after 2000 [10, 24–26, 28–34].

Studies' Methodological Characteristics

Sample Characteristics

Sample sizes ranged from 40 to 3,758 participants. Within these samples, the number of Asian participants ranged from 40 to 147. Nine studies gathered data from both parents and children [10, 23, 28–34], two studies from children only [25, 27], and two studies from parents only [24, 26]. About forty percent of studies ($n = 5$ articles) sampled children aged 8–10 years [29–31, 33, 34]; the remaining studies included children ranging in age from 2 months to 18 years [10, 23–28, 32]. Even though these latter studies had children outside the age range of child or preschool years, these studies included a majority of children between 2 and 11 years.

Ten studies purposively sampled Asian Americans, including Chinese Americans ($n = 7$) [10, 26, 29–31, 33, 34], Southeast Asians ($n = 1$) [23], and Hmong ($n = 2$) [32, 35]. The remaining studies did not purposively sample Asian Americans, but included them [24, 25, 27]. Six

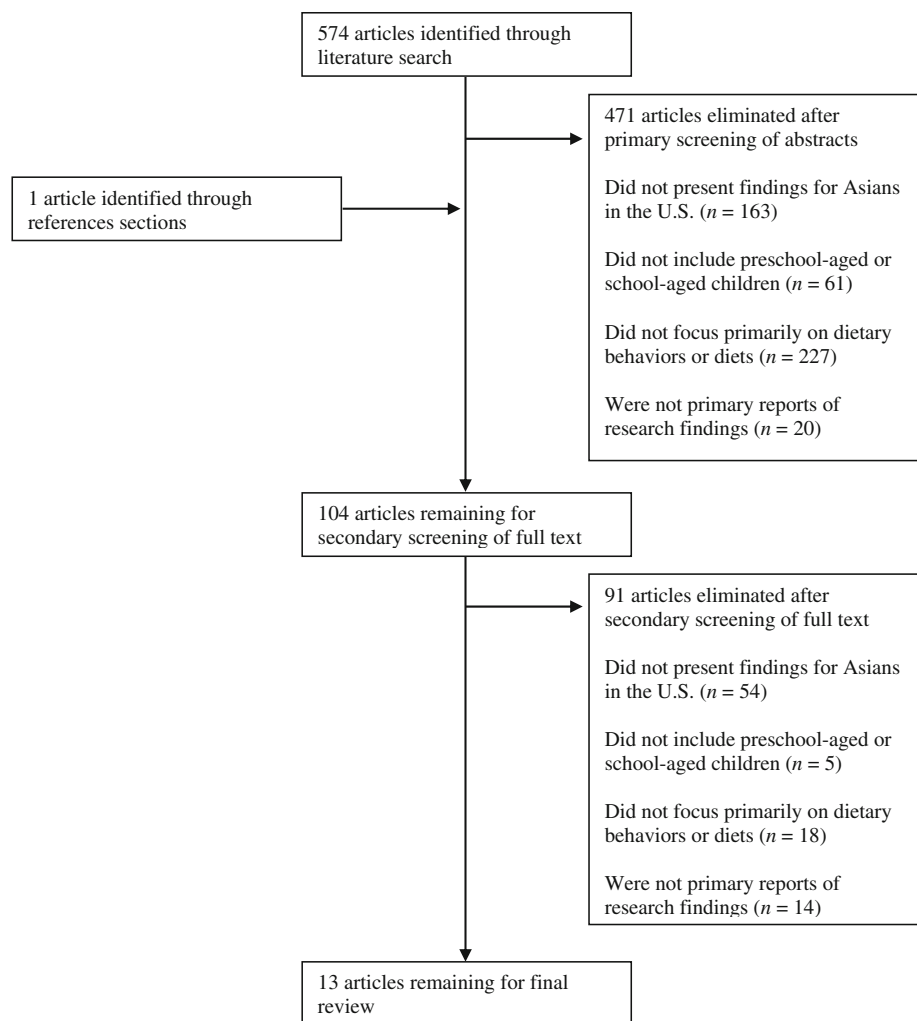
studies sampled Asians from California (mainly San Francisco) [29–34]; two studies from Houston, Texas [10, 25]; one from Lincoln, Nebraska [23]; one from Pennsylvania [26]; two from Minnesota [27, 28]; and one from numerous states [24].

Study Design, Measures, and Data Analysis

The sample comprised eight quantitative studies [10, 23, 25, 27, 29, 30, 33, 34], three qualitative studies [24, 26, 32], one mixed methods study [28], and one evaluation research [31] study. The quantitative, qualitative, and mixed methods studies were cross-sectional. The evaluation study was a randomized controlled study assessing the effectiveness of an intervention; diet-related data were obtained at baseline and three follow-up assessments.

About half of studies ($n = 6$) obtained measures of diets or dietary behaviors through food frequency questionnaires or interview questions [24, 26, 28, 29, 32, 33]. Three studies used 24-h dietary recalls or dietary records [25, 31, 34]. The remaining four studies used objective/observed

Fig. 1 Literature search selection process for retrieving articles on Asian-American youth's dietary behaviors



measures of diet, such as biomarkers or observations during meals, to complement self-reported measures [10, 23, 27, 30]. A majority of studies ($n = 9$) discussed both validity and reliability of their data (e.g., provided coefficients for questionnaires or inter-rater reliability for observations) [24, 25, 27–31, 33, 34]. Two studies discussed only validity or only reliability [10, 26], and two mentioned neither [23, 32].

For data analyses, five studies utilized multiple regression [27, 29, 34], ANOVA [25, 29], and/or mixed-effects models [31] as their highest level data analysis. Three studies used multivariate statistics (e.g., multivariate linear regression or principal components analysis) [28, 30, 33], one used bivariate statistics (e.g., correlations, Chi square, and t tests) [10], and one used univariate/descriptive statistics [23]. The remaining three studies were qualitative and included coding and thematic analysis [24, 26, 32]. About half of studies ($n = 6$) reported effect sizes (e.g., R^2 or percent of variance accounted for) [28–31, 33, 34], and about half ($n = 7$) did not [10, 23–27, 32].

Methodological Quality Scale

Table 3 provides the distribution of MQS points among studies. No study received the maximum 16 points; scores ranged from 6 to 13. Over half of studies ($n = 10$ studies) received 8 or more points for a score above 50 % [10, 23, 25, 27–31, 33, 34].

Empirical Findings

What are Asian-American Youth Consuming?

Betts and Weidenbenner [23] found milk to be the most frequently consumed food item among Southeast Asian children. Following milk, the next most consumed were fruit (more specifically, orange juice), meat, unenriched white rice, and vegetables. Mean servings of fruits and vegetables ranged from 2.1 to 3.9 (± 0.7 –3.1) [31, 33, 34]. Breakfast cereals, eggs, bread, cookies, cheese, and noodles were also frequently reported by participants [23]. In addition, Chinese-American children reported eating approximately seven high-fat and high-sugar items every day [29], and daily intake of soda and fruit-flavored drinks among Hmong girls was greater than intake of milk or soy milk [28]. The mean energy intake for Asian Americans was reportedly 1,109 kcal per day for 8- to 10-year-olds to 1,494 kcal per day for 4th through 6th graders, with 30–35 % of total energy from fat [25, 30, 33].

When compared to other racial groups regarding food consumption, Asian Americans consumed more fruit, more juice, and fewer vegetables than European Americans and African Americans [27]. In addition, Asian Americans

Table 1 Criteria for assessing studies' methodological quality

Methodological criterion	Description	Score
Study design	Longitudinal	2
	Cross-sectional	1
Ethnicity	Reported by subgroup (e.g., Chinese American)	2
	Reported as Asian or Asian American	1
Participant description	Parent and child	2
	Child	1
	Parent	0
Measures	Reported both self-report and objective/observed measures of diet	4
	Reported only objective/observed measures of diet	3
	Reported measures of diet from 24-h dietary recall or dietary record	2
	Reported measures of diet from food frequency questionnaire or interview/focus group	1
Validity	Discussed validity	1
	Did not discuss validity	0
Reliability	Discussed reliability	1
	Did not discuss reliability	0
Data analysis (highest level)	Multivariate statistics (canonical correlation analysis, discriminant function analysis, path analysis, structural equation modeling, MANOVA, MANCOVA)	3
	Multiple regression, ANOVA, ANCOVA	2
	Bivariate statistics (Pearson r , t tests)	1
Effect size	Qualitative (content analysis)	1
	Univariate statistics (descriptive)	0
	Reported effect sizes (R^2 , Cohen's d , η^2 , percent of variance accounted for)	1
	Did not report effect sizes	0

reported eating out less often than non-Hispanic whites [24], and Asian-American youth reported lower energy intakes and fewer low-fat practices than white children [25].

Acculturation and Diet

Acculturation and dietary behaviors was a common theme among studies. Children preferred Western foods [24, 26], but diets were characterized by both Asian and American types of foods. Of the four studies in this review that examined acculturation and dietary behaviors, two sampled Chinese Americans [10, 26], one sampled Hmong Americans [32], and one sampled unspecified Asians [24].

Table 2 Summary of research studies' sample characteristics, dependent variables, independent variables, study design, analytic methods, findings, and MQS score

Lead author	Pub. year	Sample characteristics	DVs	IVs	Study design	Analytic methods	Asian dietary-related findings	MQS
Betts	1986	72 Southeast Asian (Vietnamese and Cambodian) refugee children aged 2–60 months in Lincoln, Nebraska	Dietary intake (using WIC 24-h recall method); iron status (using blood samples); growth status (using measured height and weight)		Cross-sectional quantitative	Descriptive statistics, frequencies	Milk was the most frequently consumed food item. Fruit (e.g., orange juice) was also often consumed. Meat (i.e., pork, beef, and chicken), followed by unenriched white rice, followed by vegetables (e.g., carrots and cabbage) were next most consumed. Breakfast cereals, eggs, bread, cookies, cheese, and noodles also appeared often.	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 4 Validity: 0 Reliability: 0 Data analysis: 0 Effect size: 0 Total: 9/16 (56 %)
Chen	2005	68 Chinese-American children aged 8–10 years and their mothers in Northern California	Children's BMI (based on measured weight and height)	Family demographic information (using parent questionnaire); acculturation (using Suinn-Lew Asian Self-Identity Acculturation Scale); problem solving, communication, roles, affective responsiveness, affective involvement, and behavior control (using Family Assessment Device); child-rearing attitudes (using Attitudes toward Child-Rearing Scale); children's physical activity (using Children Self-Administered Physical Activity Checklist); dietary behaviors (using Food Frequency Questionnaire); stress-coping strategies (using Schollagers' Coping Strategies Inventory)	Cross-sectional quantitative study	Chi square tests, Pearson correlation, two-way ANOVA, stepwise multiple regression	Children reported eating about seven high-fat and high-sugar items every day. However, there were no links between dietary intake and BMIs.	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 1 Validity: 1 Reliability: 1 Data analysis: 2 Effect size: 1 Total: 11/16 (69 %)
Chen	2008	65 Chinese American children aged 8–10 years and their mothers in the San Francisco Bay area	Cardiovascular risk factors of children (measured using blood tests)	Family information (using Family Information questionnaire); acculturation (using Suinn-Lew Asian Self-Identity Acculturation Scale); anthropometric measures (using measured weight and height); physical fitness (using fitness tests and Children Self-Administered Physical Activity Checklist); dietary habits (using Kid's Food Frequency Questionnaire)	Cross-sectional quantitative study	<i>t</i> tests, linear regressions, stepwise multivariate linear regression	(1) Overweight and non-overweight children had similar rates of dietary intake (2) Mean servings of vegetables was 1.38 (3) Mean caloric intake was 1109.68 kcal, with 30.37 % from fat	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 4 Validity: 1 Reliability: 1 Data analysis: 3 Effect size: 1 Total: 15/16 (94 %)

Table 2 continued

Lead author	Pub. year	Sample characteristics	DVs	IVs	Study design	Analytic methods	Asian dietary-related findings	MQS
Chen	2009	65 Chinese-American children aged 8–10 years and their mothers in the San Francisco Bay area	Mother's physical activity (using seven day physical activity recall); mother's dietary intake (using SWAN Food Frequency Questionnaire); children's anthropometric measures (using measured weight and height); children's physical activity (using Caltrac accelerometer); children's dietary intake (using Kid's Food Frequency Questionnaire)	Family information (using parent questionnaire); acculturation (using Suinn-Lew Asian Self-Identity Acculturation Scale)	Cross-sectional quantitative study	Univariate linear regressions; multivariate linear regression	(1) Mean number of fruits and vegetables consumed daily was 2.82 (2) Mean caloric intake was 1109.68 kcal, with 30.37 % from fat (3) Percent of carbohydrates and sweet intake per day were 55.45 and 12.02 %, respectively	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 1 Validity: 1 Reliability: 1 Data analysis: 3 Effect size: 1 Total: 12/16 (75 %)
Chen	2010	67 Chinese-American children aged 8–10 years and their families in the San Francisco Bay area	Family information (using parent questionnaire); acculturation (using Suinn-Lew Asian self-identity acculturation scale); children's BMI and waist-to-hip ratio (using height, weight, waste, and hip measurements); blood pressure (using mercury sphygmomanometer); children's physical activity (using Caltrac); children's dietary intake (using self-reported three-day food diary); food choices (using Health Behavior Questionnaire); knowledge and self-efficacy (using Health Behavior Questionnaire)	Active Balance Childhood (ABC) program based on Social Cognitive Theory	Longitudinal randomized controlled study	<i>t</i> tests, mixed-effects model, power analysis	(1) Significantly more children in the intervention group (as compared to the control group) decreased fat intake and increased fruit and vegetable intake (2) Mean servings of vegetables and fruits for all children was 2.12 at baseline. This increased to 3.06 for the intervention group and decreased to 2.00 for the control group	Study design: 2 Ethnicity: 2 Participants: 2 Measures: 2 Validity: 1 Reliability: 1 Data analysis: 2 Effect size: 1 Total: 13/16 (81 %)
Chen	2011	67 Chinese-American children aged 8–10 years and their mothers in the San Francisco Bay area	Children's anthropometric measures (using measured height and weight); waist to hip ratio (using waist and hip measurements); blood pressure (using mercury sphygmomanometer)	Family information (using parent questionnaire); acculturation (using Suinn-Lew Asian Self-Identity Acculturation Scale); children's dietary intake (using three-day food diary); children's food choices (using Health Behavior Questionnaire); physical activity (using Caltrac personal activity computer); self-efficacy and knowledge (using Health Behavior Questionnaire)	Cross-sectional quantitative survey	Pearson correlations, Chi square tests, <i>t</i> tests, multiple linear regressions	Mean servings of vegetables and fruit was 3.9	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 2 Validity: 1 Reliability: 1 Data analysis: 2 Effect size: 1 Total: 12/16 (75 %)

Table 2 continued

Lead author	Pub. year	Sample characteristics	DVs	IVs	Study design	Analytic methods	Asian dietary-related findings	MQS
Cluskey	2008	201 parents of children aged 10–13 years (of which 54 were Asian) from 12 states	At-home and away-from-home family eating patterns based on interview questions		Cross-sectional qualitative interviews	Thematic content analysis	(1) Asian parents mentioned leftovers, soy milk, yogurt, cheese, cereal with milk, and cereal bars as breakfast food. Both Asian children and parents reported tea as a frequent beverage (2) Asian parents sometimes indicated their children preferred American rather than cultural food (3) Compared to non-Hispanic whites, Asians reported lower frequency of eating out and if so, primarily for socialization or celebration	Study design: 1 Ethnicity: 1 Participants: 0 Measures: 1 Validity: 1 Reliability: 1 Data analysis: 1 Effect size: 0 Total: 6/16 (38 %)
Cullen	2002	520 fourth- to sixth-grade students in Houston, Texas (of which 51 were Asian-American)	Dietary fat intake and fat practices (using food records)	Demographic variables	Cross-sectional quantitative	Spearman correlation coefficients; ANOVA	White children reported higher energy intakes and low-fat practices than other groups (including Asian-Americans). The mean energy intake was 1,494 kcal per day for Asians, with 35 % of total energy from fat	Study design: 1 Ethnicity: 1 Participants: 1 Measures: 2 Validity: 1 Reliability: 1 Data analysis: 2 Effect size: 0 Total: 9/16 (56 %)

Table 2 continued

Lead author	Pub. year	Sample characteristics	DVs	IVs	Study design	Analytic methods	Asian dietary-related findings	MQS
Demery-Luce	2005	53 Chinese-American children aged 3–5 years and their primary caregivers in Houston, Texas	Eating habits (using two 24-h intakes comprising observation of children during meals and caregiver reports of diet)	Acculturation (using Stumm-Lew Asian Self-Identity Scale); anthropometry (using measured height and weight)	Cross-sectional quantitative survey	Chi square analysis	(1) At child care centers, children consumed food and beverages classified as American or shared by both cultures. The food groups most commonly consumed were dairy, mixed dishes, fruits, fruit juice, and vegetables (2) At homes, foods consumed by children were 43 % Chinese, 26 % American, and 31 % both. Chinese foods included mixed dishes, bread, vegetables, meat, and soup. American foods included desserts, sweetened beverages, bread, candy, salty snacks, cereals, and meat. Foods of both cultures included dairy, fruits, and fruit juice (3) Foods consumed at breakfast were majority American or shared by both cultures; for dinner, foods were mainly Chinese; and for snacks, foods were American or shared by both cultures	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 4 Validity: 0 Reliability: 1 Data analysis: 1 Effect size: 0 Total: 11/16 (69 %)
Kim	2007	44 parents of children aged 5–14 years; 40 youths aged 11–14 years (all Hmong, low-income, and in California)	Knowledge, attitudes, opinions, and behavior (using focus group questions)	Health and healthy lifestyles, dietary practices (mainly fruit and vegetable consumption), and physical activity	Cross-sectional qualitative focus groups	Tape-recorded and transcribed focus groups; coded, organized, and analyzed content	(1) Fruits and vegetables were valued for health and illness prevention. Participants viewed them as healthiest types of foods. Meats were necessary for good health but should be limited. Beneficial starches included rice, bread, and noodles (2) Many adults expressed concern about eating too much meat, especially fatty meats, since moving to the US. Adults believed huge quantities of meat led to sicknesses (3) Almost all participants reported eating both Hmong and American foods 4) Youth viewed diet soda as healthier than regular soda	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 1 Validity: 0 Reliability: 0 Data analysis: 1 Effect size: 0 Total: 7/16 (44 %)

Table 2 continued

Lead author	Pub. year	Sample characteristics	DVs	IVs	Study design	Analytic methods	Asian dietary-related findings	MQS
Lv	2010	20 Chinese American couples with at least one child aged 5 years or older in Pennsylvania	Adoption of Western food	Personal characteristics, dietary behavior, family functioning, supportive behavior, and mechanics of food production in the home (using interview questions)	Cross-sectional qualitative interviews	Thematic analysis	(1) There was a contrast between parents' preferences for Chinese foods and children's preferences for Western foods (2) Parents reported that children were not willing to try new foods (3) Families consumed American food for breakfast and snacks, whereas they ate mainly Chinese food for lunch and dinner (4) Families required meat and vegetables to be served for dinners. Most families restricted fatty food, preserved meat, and junk/sweet food (5) Fathers' power to determine what was served for dinner was a major determinant of Western foods adoption	Study design: 1 Ethnicity: 2 Participants: 0 Measures: 1 Validity: 1 Reliability: 0 Data analysis: 1 Effect size: 0 Total: 6/16 (38 %)
Reynolds	1999	3758 youth aged 8–16 years (of which 147 were Asian-Americans aged 9–11 years in Minnesota)	Diet (using 24-h diet recalls in Alabama, 7-day food records in Georgia, 24-h diet recalls in Louisiana, and 24-h diet recalls in Minnesota)	Demographics measures (obtained via self-report from children or parents and/or administrative records)	Cross-sectional quantitative	Regression analyses	In Minnesota, Asian-American/Pacific Islanders consumed more fruit and juice than European-Americans. However, they consumed fewer vegetables than European-Americans and African-Americans.	Study design: 1 Ethnicity: 1 Participants: 1 Measures: 4 Validity: 1 Reliability: 1 Data analysis: 2 Effect size: 0 Total: 11/16 (69 %)

Table 2 continued

Lead author	Pub. year	Sample characteristics	DVs	IVs	Study design	Analytic methods	Asian dietary-related findings	MQS
Vue	2007	102 Hmong girls aged 10–13 years and 20 of their parents in Minnesota	Intake of calcium-rich foods and beverages (using child questionnaire and parent interviews)	Individual and environmental factors	Cross-sectional mixed methods	Spearman correlation analysis; principal components analysis; constant comparative method	Daily intake of soda and fruit-flavored drinks was greater than intake of milk or soy milk	Study design: 1 Ethnicity: 2 Participants: 2 Measures: 1 Validity: 1 Reliability: 1 Data analysis: 3 Effect size: 1 Total: 12/16 (75%)

MQS methodological quality scale

Table 3 Distribution of MQS characteristics across 13 reviewed studies

Methodological criterion	Description	<i>n</i> studies	Percentage (%)
Study design	Longitudinal	1	7.7
	Cross-sectional	12	92.3
Ethnicity	Reported by subgroup (e.g., Chinese American)	10	76.9
	Reported as Asian or Asian American	3	23.1
Participant description	Parent and child	9	69.2
	Child	2	15.4
	Parent	2	15.4
Measures	Reported both self-report and objective/observed measures of diet	4	30.8
	Reported only objective/observed measures of diet	0	0.0
	Reported measures of diet from 24-h dietary recall or dietary record	3	23.1
	Reported measures of diet from food frequency questionnaire or interview/focus group	6	46.2
Validity	Discussed validity	10	76.9
	Did not discuss validity	3	23.1
Reliability	Discussed reliability	10	76.9
	Did not discuss reliability	3	23.1
Data analysis (Highest level)	Multivariate statistics	3	23.1
	Multiple regression, ANOVA, ANCOVA	5	38.5
	Bivariate statistics	1	7.7
	Qualitative	3	23.1
Effect size	Univariate statistics	1	7.7
	Reported effect sizes	6	46.2
	Did not report effect sizes	7	53.8
Total points (out of 16)	≤7 points	3	23.1
	8–11 points	5	38.5
	≥12 points	5	38.5

MQS methodological quality scale

Specifically among Chinese Americans, foods consumed at home for breakfast and snack were mainly American or shared by both cultures, and foods for dinner were mainly Chinese [10, 26]. At child care centers, children consumed food and drinks classified as American or

shared by both cultures [10]. As specified in the study, Chinese foods included mixed dishes, bread (e.g., rice or noodles), vegetables, meat (e.g., seafood or poultry), and soup. American foods included desserts, sweetened beverages, bread (e.g., muffins or toast), candy, salty snacks, cereals, and meat (e.g., beef patties or meat sauce). Foods of both cultures included dairy, fruits, and fruit juice.

In agreement with these results, a sample of Hmong in California reported eating both Hmong and American foods [32], and a sample of Asians in 12 states reported eating both Asian and American foods [24]. Breakfast and lunch were commonly eaten at school and included traditional school foods, such as cereal, sausages, pizza, hot dogs, and hamburgers [32]. For dinner, participants reported consuming foods associated with their cultures, such as meat, egg-drop soup, or other typical meals [24]. Rice remained a staple in all home-cooked meals [32].

Discussion

This literature review aimed to identify studies on Asian-American youth's dietary behaviors and critically evaluate the methodological quality of such research. A systematic review identified 13 articles, and evaluation of these studies indicated that methodological quality points ranged from 6 to 13 (out of 16), with a majority of studies ($n = 10$ studies) receiving 8 or more points.

Based on these findings, it is clear that more research is needed on dietary behaviors of Asian youth in the US. Asians—either alone or in combination with other races—constitute approximately 6 % (or 17 million) of the total US population and increased by 43 % between 2000 and 2010 [36]. Not only are Asian Americans the fastest growing racial group in the US, they are a population with unique challenges [37]. Within families, there are differences in food preferences between older generations (e.g., parents and grandparents) and younger generations (e.g., children) [24, 26, 37], resulting in challenges for parents when preparing American food, knowing what is best for their children, and finding American and Asian groceries at their local markets [37], also resulting in rifts between what parents eat and what children eat [26].

In addition, research has shown of the role of acculturation, including acculturation gaps between parent and child on Asian Americans' diets and health [12, 13]. However, existing research on acculturation and dietary behaviors is sparse; this review found only four studies [10, 24, 26, 32], mainly of Chinese-American children. More research is needed to better understand acculturation and what it means in today's globalized society. As a diverse nation with different immigrants and multiple immigrant generations, acculturation plays a major role in the

behaviors and health of the US population. Important variables theorized to influence the relationship of acculturation to diet include socioeconomic and demographic factors, cultural factors, changes in taste preferences, and changes in environmental factors [12]. In addition, it is possible that acculturation partially overlaps with access and availability, globalization, and transnational processes in modernizing diets [38], but limited research has looked into why, how, and what about acculturation influences diet and health. The process of acculturation may not be simple and linear, but understanding the mechanisms by which acculturation contributes to dietary habits is important for research and intervention purposes. Immigrants bring their own perspectives, traditions, and beliefs, such as eating habits, from their native countries but are then exposed to different perspectives, traditions, and beliefs. It is important to understand their assets, challenges, and perspectives in order to improve prevention and intervention efforts [35].

More research is also needed to strengthen current research on Asian-American youth's dietary behaviors. About half the studies included in this review were written by Chen and her colleagues on Chinese-American children aged 8–10 years in northern California. First, Chinese Americans do not represent all Asian Americans. Asians are heterogeneous, with diverse religions, cultural practices, and beliefs [39]. The diets and associated factors of a particular group may not reflect those of other Asian-American groups. Thus far, this review captures research on Chinese Americans, Hmong Americans, Vietnamese Americans, and Cambodian Americans, but more research is needed on and beyond these Asian ethnic groups. Second, Asians live across the US, but current research is mainly limited to California, Texas, Nebraska, Pennsylvania, and Minnesota. Food practices may be influenced by geographical location, so more research is needed to explore Asian-American diets around the US. Last, more research is needed on different youth age groups. The influences on children's eating patterns (e.g., parents) may be different than the influences on adolescents' eating patterns (e.g., peers and friends), which in turn may be different than the influences on adults' eating patterns [40]. In order to target childhood obesity, health professionals must understand the diets of other age groups beyond late childhood years (as is currently represented in research on Asian-American youth's dietary behaviors). Particularly, it is during earlier ages that dietary habits and preferences of children are formed [41–43].

The studies in this review had relatively strong methodological quality, but some areas need diversification. Most of the reviewed studies utilized quantitative methods and analyzed cross-sectional data. These methodological aspects need to be addressed in order to strengthen current

research and expand findings. Strong methodological practices include purposively sampling specific ethnic groups, reporting validity and reliability coefficients, and reporting effect sizes. In addition, more diversity in analytic methods is needed to strengthen and move the field forward. Although in this review, analyses were ranked based on complexity (e.g., univariate vs. multivariate), it is crucial to have research with diverse and appropriately applied analytic methods, so that different questions may be answered. For example, more qualitative studies in immigrant Asian populations may illuminate social and cultural mechanisms of dietary change. Next, to obtain dietary information, a majority of studies relied primarily on self-reported measures of diet, of which most used food frequency questionnaires or focus groups/interviews with parents. These dietary assessment methods are prone to high measurement error relative to other methods [44] and are considered suboptimal [45]. In order to better estimate and understand Asian-American youth's dietary behaviors, researchers should complement food frequency questionnaires and qualitative methods with observations, biomarkers, or dietary records/recalls. Last, sample sizes ranged from 40 to 147 Asian participants. Low sample sizes, especially for quantitative methods, may have resulted in sampling error or low statistical power, so more effort is needed to sample more Asian Americans in the future.

Limitations and Recommendations

The authors must note some limitations of the current review. First, even though authors searched numerous databases and references sections and used several key terms in searches, it is possible that some articles relevant to this review were overlooked. Second, this review focused on studies of Asian Americans, exclusively. More reviews are needed to look at Asian diets in other countries, especially in other western countries, to explore how diets change upon immigration to other locations and acculturation into other cultures. Next, this review examined studies that included preschool-aged or elementary school-aged children (i.e., 2–11 years of age) and/or their caregivers. The authors chose this age group because of specific nutritional requirements and concerns for 2- to 11-year-olds [46], but nutrition research of different age groups may reveal additional insights for nutrition research. Lastly, this review did not examine socioeconomic status (SES), although SES may be an important risk factor for or have an effect on overweight, obesity, and dietary behaviors [47–50]. For example, low SES has been associated with lower quality diets [50], such as lower consumption of fruits and vegetables [48] and less access to supermarkets, convenience stores, and food variety [49]. Few studies in

the current review controlled for or considered measures of SES, and many of the samples were from well-educated, middle- to high-income families. In order to illuminate the effects of acculturation versus SES versus food availability on dietary behaviors and weight status, research is needed with more heterogeneous samples, especially in longitudinal research.

Implications for Research and Practice

Findings from the current review may inform health education and promotion programs and services for Asian Americans in the US. With a better understanding of Asian-American diets, increasing awareness among Asian Americans about issues related to diet (e.g., increased chronic disease, decreased academic performance) is crucial [37]. To do so, researchers and practitioners must not only target children but target parents, grandparents, and families because of the importance of families in Asian cultures. Health professionals must be culturally competent and trained to work with families of different Asian backgrounds.

Findings also provide direction for future research on Asian-American youth's dietary behaviors. First, stronger methodology in areas of study design and measures are needed. Second, findings from this review revealed influences of acculturation on diet and health status, so research that considers the acculturative processes involved in dietary habits may help Asian Americans maintain healthy aspects of their heritage cultural diets, while incorporating healthy aspects of western diets.

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