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Examination of Obesity Risk-Reduction Behaviors in Chinese Americans

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The purpose of this survey research was to examine the psychosocial characteristics of obesity risk-reduction behaviors in Chinese Americans. Obesity risk-reduction behaviors and psychosocial variables derived from the Theory of Planned Behavior and the Health Belief Model were measured. A questionnaire was administered to a convenience sample of 300 young adult Chinese Americans residing in the New York metropolitan area. Results suggest that when communicating messages to low adopters of health behaviors, promoting positive attitudes and social influences for healthful eating should be emphasized. High behavior adopters may benefit from strategies to maintain self-efficacy to enact health-related behaviors conducive to obesity prevention.

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The World Health Organization (WHO) (2012) identified overweight and obesity as the fifth leading cause of global deaths and a major risk factor for noncommunicable diseases (including coronary artery disease, hypertension, and type 2 diabetes). The United States is leading the weight crisis among industrialized nations, with over 69% of its population identified as overweight or obese (Centers for Disease Control and Prevention, 2012a). Asian Americans are a rapidly growing segment of the U.S. population (projected to increase from 5.6% to 9.3% by the year 2050), with Chinese Americans comprising the largest subgroup of the total U.S. Asian population (U.S. Census Bureau, 2011).

Chinese Americans, along with other Asian sub-groups, generally weigh less, but have a higher percentage of body fat compared with White Americans for the same body mass index.

Although the rate of obesity among Chinese Americans is much lower than that of other racial groups (Centers for Disease Control and Prevention, 2012b), it is the focus of this paper because visceral adipose tissue (i.e., body fat) tends to accumulate in this Asian population group and correlates with coronary artery

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disease, hypertension, and type 2 diabetes (Anderson et al., 1997). Chinese Americans, along with other Asian sub-groups, generally weigh less, but have a higher percentage of body fat compared with White Americans for the same body mass index (BMI) (Wang et al., 1994). With increasing Westernization of diet (such as intake of dietary fats and refined carbohydrates) and acculturation of succeeding generations of immigrants, the prevalence of Chinese Americans experiencing obesity issues is expected to increase (Bates, Acevedo-Garcia, Alegria, & Krieger, 2008).

The anticipated demographic changes and increased risk for obesity-related diseases at lower BMI magnify the importance of investigating this health concern among Chinese Americans. However, obesity research among Chinese Americans has been limited, possibly due to a mistaken belief that weight complications are not significant for this group. In fact, obesity-related health risks, including type 2 diabetes, have been identified at lower BMI for this population group than for White Americans (Tseng, Halperin, Ritholz, & Hsu, 2013; World Health Organization, 2013).

Obesity research among Chinese Americans has been limited, possibly due to a mistaken belief that weight complications are not significant for this group.

HEALTHY WEIGHT BEHAVIORS

A number of studies have identified healthy weight behaviors that reduce the risk of weight gain, regardless of the ethnicity of the population (Hu & Malik, 2010; Institute of Medicine, 2012; U.S. Department of Health and Human Services, 2012). Unfortunately, there have been limited studies focusing on Chinese Americans to ascertain culturally-relevant determinants of these behaviors as well as beliefs and attitudes pertaining to obesity risk-reduction behaviors. Examples of healthy weight behaviors include limiting intake of energy dense foods and beverages, selecting appropriate portion sizes, and choosing healthy snacks. Behaviors that promote healthy weight include eating fruits, nuts, legumes, vegetables, and whole-grain foods, and meeting exercise guidelines. Unhealthy weight behaviors include eating meals away from home, particularly fast-food meals, a lifestyle choice that has been shown to increase the risk of becoming overweight or obese (Bes-Rastrollo et al., 2010, Smith et al., 2009).

THEORETICAL FRAMEWORKS

Social psychological theories provide a basis for discovering beliefs and motivations involved in acquiring healthy weight behaviors. This quantitative study applied tenets of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) to investigate these factors among young adult Chinese Americans. First, the HBM proposes that cognitive factors influence the decision to adopt and maintain health behavior changes (Rosenstock & Kirscht, 1974). Cognitive factors influencing an individual's decision to change include: (a) personal belief in the susceptibility to a disease, (b) belief that the disease would severely affect quality of life, (c) belief in specific benefits from taking actions that would effectively prevent or cure the health concern, (d) perception that no major barriers would impede the health action, (e) exposure to a cue to take action, and (f) confidence in personal ability to perform a specific behavior (Bandura, 1986).

Ajzen's (1991) Theory of Planned Behavior (TPB) proposes that an individual's health behavior is influenced directly by intention to engage in that behavior. Three factors affecting behavioral intention include attitudes, subjective norms, and perceived behavioral control. Attitudes are favorable or unfavorable expectations of the outcomes of a health behavior. The subjective norm is the perceived social pressure to perform a given behavior based on the opinion of significant others (normative beliefs) and weighted by the strength of desire to comply with the wishes of significant others (motivation to comply). Perceived behavioral control is the degree to which individuals believe they have control over performing a specific behavior.

These two psychosocial models have been widely applied in Caucasian populations, with limited studies involving Chinese Americans. It is encouraging

that psychosocial predictors have been shown to be relevant and significant predictors of dietary behavior among Asian population groups (Satia-Abouta, Patterson, Kristal, Teh, & Tu, 2002). Therefore, the purpose of this research was to use the HBM and TPB to examine psychosocial differences between two groups of Chinese American participants with varying frequencies of adoption of obesity risk-reduction behaviors and healthy weight behaviors.

METHOD

Study Population and Design

A cross-sectional survey design was used in this investigation, which included a convenience sample of healthy, U.S.-born and foreign-born Chinese Americans, aged 18 to 40 years. The researchers distributed survey instruments, informed consent forms, and self-addressed, stamped envelopes to volunteer participants from a wide range of educational and socioeconomic backgrounds; they were from universities, churches, and cultural institutions in the New York metropolitan area. A raffle drawing for $50 gift cards provided incentive for participation. A total of 300 people completed the survey (63.2% response rate). Institutional Review Board approval was granted from a New Jersey state university, and data were collected between June 2008 and July 2009.

Instrument and Variables Measured

The researchers adopted a validated instrument (Liou, Bauer, & Bai, 2011) that included 146 questions on obesity risk-reduction behaviors, psychosocial variables, and demographic factors. Table 1 presents sample statements for all of the psychosocial and behavioral constructs.

A 4-point scale (*rarely/never* to *always/usually*) was used to indicate level of engagement in 19 obesity risk-reduction behaviors over the previous month. This category included five domains: food context (9 items), eating behavior (4 items), physical activity context (2 items), psychological context (2 items), and knowledge/awareness context (2 items). All behavioral domains were derived from the literature and items were modified for their applicability based on qualitative research for young adult Chinese Americans (Bes-Rastrollo et al., 2010; Smith et al., 2009).

In measuring constructs derived from the TPB, 12 items, using a 5-point scale ranging from 1 (*very unlikely*) to 5 (*very likely*), assessed intention to engage in obesity risk-reduction behaviors in the upcoming week. Twelve items measured attitude (the favorable or unfavorable evaluations of behaviors) based on a 5-point scale (*extremely good* to *extremely bad*). Subjective norm categories and perceived behavioral control statements were calculated using a 5-point scale (*strongly agree* to *strongly disagree*) plus a *not applicable* category.

In assessing constructs derived from the HBM, a 5-point scale (*strongly agree* to *strongly disagree*) measured perceived susceptibility (4 items), perceived severity (4 items), perceived benefits (8 items), and perceived barriers (9 items). Response options to 10 self-efficacy items included a 5-point scale ranging from *extremely confident* to *not at all confident*.

Demographic data were collected for age, sex (gender), education level, work status, income, marital status, and self-reported height and weight. Other variables measured included perceived stress, physical activity levels, and the likelihood of eating nutritious foods due to accessibility.

Questionnaire Validity and Reliability

Face validity was assessed via a pilot study of 30 Chinese Americans who provided feedback about the clarity of the questionnaire items. An expert panel of nutrition faculty members reviewed the instrument for content validity. Construct validity was established via a principal components exploratory factor analysis of variables. The entire scale produced a total of nine distinct factors accounting for 62.3% of the variance in responses. After additional factor analysis for each subscale, the researchers reduced the scale by only keeping items with a factor loading of at least 0.40 based on acceptable research protocol (Kline, 1994; Laher, 2010). As a result, 6 items were deleted from the entire scale.

The subscale of obesity risk-reduction behavior produced five distinct factors that accounted for 60.3% of the variance in responses. These distinct factors corresponded conceptually to the five domains of obesity risk-reduction behaviors: food context, eating behavior, physical activity context,

Table 1. Examples of Questionnaire Items

CONSTRUCTS	QUESTIONNAIRE STATEMENTS
Psychosocial Statements – Health Belief Model	
Perceived benefits	Limiting my intake of high-calorie soft drinks and juice will lower my likelihood of becoming obese.
Perceived barriers	I find it hard to prepare home-cooked meals due to lack of time.
Perceived susceptibility	I may develop obesity because of my sedentary lifestyle.
Perceived severity	If I gain excessive weight, my health would be in serious danger.
Cues to action	Health segments on television or radio are a reminder that I should watch my weight.
Self-efficacy	How confident are you in consuming small portion sizes of food?
Psychosocial Statements – Theory of Planned Behavior	
Behavioral intention	During the upcoming week, I plan to choose smaller portion sizes.
Attitude	Choosing home-cooked meals instead of restaurant-prepared foods is . . .
Normative beliefs	My parents encourage me to eat a lot of food.
Motivation to comply	I usually follow my parents' opinions on dietary matters.
Perceived behavioral control	As long as I want to, I can prevent myself from gaining excessive weight.
Obesity Risk Reduction Behaviors	
Psychological context	In the past month, how often did you engage in the following behaviors: • Took time to relax and improve my emotional well-being? (e.g., social involvement, positive thinking) • Took time to relax to decrease the amount of stress I feel?
Physical activity context	• Exercised at least 30 minutes, on 3 to 5 days per week (e.g., walking, biking)? • Engaged in at least 1 physically active leisure activity?
Eating behavior	• Ate home-cooked meals over restaurant-prepared foods? • Ate smaller portion sizes of foods than usual? • Followed traditional healthful Chinese food patterns (e.g., eating more fruits and vegetables, less red meat)? • Used portion size control methods to help decide how much to eat?
Food context	• Ate steamed foods instead of fried foods? • Used small amounts of oils or fat when preparing or cooking foods? • Ate at least 3 servings of vegetables per day? (1 serving = ½ cup cooked, 1 cup fresh leafy vegetables) • Ate at least 2 servings of fruits each day? (1 serving = 1 medium fruit) • Ate at least 3, 1-ounce servings of whole grains per day? • Made healthier choices at fast food restaurants? • Ate healthful snacks (e.g., fruit, nuts, etc.)? • Ate healthful pre-packaged foods • Limited intake of high calorie beverages (e.g., soft drinks, juice, alcoholic drinks)?
Knowledge awareness context	• Monitored my body weight? • Learned about obesity risk and prevention (e.g., attending seminars, reading health articles, watching health programs on TV)?

psychological context, and knowledge/awareness context. Reliability was measured using Cronbach's alpha internal consistency assessment. The Cronbach's alpha coefficients of the behavioral and psychosocial variables were at or above 0.70, reflecting good psychometric properties (Liou, Bauer, & Bai, 2013).

Data Analysis

Survey responses for all 19 obesity reduction behaviors were averaged as a whole and tabulated for each behavior. A behavioral index score was tabulated for each respondent, reflecting a mean value for all 19 behaviors. Participants were divided into two groups depending on their behavioral

index score. Participants with behavioral index scores of 1.00 to 2.55 were considered "low behavior adopters," indicating that they performed the behaviors *sometimes* or *rarely/never* over the previous month. Those with behavioral index scores of 2.56 to 4.00 were considered "high behavior adopters," indicating that they performed the behaviors *often* or *always/usually*. The cut-off distinction of performance was made between the choices of *sometimes* (score 2) and *often* (score 3). A total of 136 respondents (46%) were categorized as high performers and 161 participants (54%) were low performers.

Demographic characteristics between the two groups were compared to establish equivalency of the groups using independent *t* test and Chi-square test. Responses for all 19 obesity risk-reduction behaviors, as well as individual items, were averaged and compared between high and low performers using *t* tests. Stepwise regression analyses were performed using obesity risk-reduction behavior as the dependent variable for the two groups of performers. Psychosocial variables were the independent contributing factors. The regression analyses determined the most prominent psychosocial variables in explaining obesity reduction behaviors for each group.

RESULTS

Demographic Data

A total of 300 people completed the survey (63.2% response rate). The majority of the respondents were female (65%), with a mean age of 26 ± 6.8 years. Approximately 67% of the respondents' BMI fell within a normal range, 14% were overweight, 5% were obese, and approximately 9% were underweight (does not total 100). The average BMI of the participants was 22.6 ± 3.84 (see Table 2).

Considering obesity reduction behavior, 161 respondents (54%) were low performers and 136 respondents (46%) were high performers. *T* tests did not indicate a significant difference of the two groups based on age, hours engaged in work and exercise, or BMI (see Table 2). High- and low-performance groups were similar in percentage of males and females, education and income levels, marital status, and working status. For both groups, approximately 55% were employed and 33% were attending college. Said another way, nearly half were unemployed (45%) and not attending college (67%).

T tests were statistically significant for all 10 items measuring self-efficacy, with the high performers conveying stronger confidence levels than low performers in engaging in health behaviors. Such behaviors included incorporating traditional Chinese food patterns, eating more fruits and vegetables, selecting foods that are not fried, and engaging in regular physical activity ($p < 0.001$). In addition, high performers indicated strong confidence in limiting their intake of high calorie beverages and in engaging in relaxation efforts to reduce stress levels ($p < 0.01$).

In terms of perceived stress, 62.5% of the low performers indicated they were *moderately* to *very stressed* as opposed to only 45.9% of the high performers. Considering activity levels, high performers engaged in statistically significant more *moderate* to *heavy* activity levels than low performers. Two thirds (64%) of high performers described spending leisure time by walking or engaging in occasional sports; only 36% of the low performers indicated the same level of physical exertion. The high performance group also had more individuals indicating likelihood of eating nutritious food due to its access than did low performers (58% versus 43%).

Obesity Risk-Reduction Behaviors

Table 3 provides mean values for obesity risk-reduction behaviors performed during the past month. The mean value for the index of 19 obesity risk reduction behaviors was 2.19 for low behavior adopters versus 2.92 for high behavior adopters ($p < 0.001$). *T* tests assessed differences in mean values for each of the 19 obesity risk-reduction behaviors. All of the behaviors were statistically significant between the two groups, except for using small amounts of oils or fat when preparing or cooking foods ($p = 0.15$). Mean values for the food context, eating behavior, physical activity context, psychological context, and knowledge/awareness context were significantly higher in the high behavior adopters versus their counterparts ($p < 0.001$).

Table 2. Demographic Characteristics of Low and High Performers of Obesity Risk Reduction Behaviors

DEMOGRAPHIC CHARACTERISTICS	LOW PERFORMER (*N* = 161)	%	HIGH PERFORMER (*N* = 136)	%	*P*-VALUE
Gender	Frequency		Frequency		0.14
Male	62	38.8	41	30.4	
Female	98	61.3	94	69.6	
Education					0.34
Elementary or less	1	0.6	0	0	
Some high school	4	2.5	2	1.5	
High school graduate	14	8.8	17	12.6	
Some college	42	26.4	26	19.3	
College graduate	63	39.6	50	37.0	
Post graduate degree	35	22.0	40	29.6	
Marital status					0.38
Married	34	21.4	37	27.4	
Divorced	2	1.3	1	0.7	
Separated	0	0	1	0.7	
Never married	119	74.8	94	69.6	
Domestic partner	4	2.5	1	0.7	
Work status					0.25
Employed	89	56.0	73	55.3	
Retired/disabled	0	0	3	2.3	
Home maker	6	3.8	1	0.8	
High school student	4	2.5	4	3.0	
College student	53	33.3	43	32.6	
Temporarily unemployed	7	4.4	7	5.3	
Income					0.36
Under $20,000	71	46.4	61	45.5	
$20,000 to 39,999	23	15.0	13	9.7	
$40,000 to 59,999	28	18.3	22	16.4	
$60,000 to 79,999	14	9.2	17	12.7	
$80,000 and above	16	10.5	19	14.2	
Eating nutritious foods is not possible because of my limited access to healthful foods					0.15
Often true	13	8.1	3	2.2	
Sometimes true	74	46.3	48	35.6	
Never true	68	42.5	78	57.8	
Don't know	5	3.1	6	4.4	
Age (years)	25.89		27.06		0.15
Work hours/week (hours)	27.78		24.2		0.20
BMI (kg/m^2)	22.62		22.50		0.69
Exercise/week (hours)	4.09		4.97		0.38

Regression analyses. As shown in Table 4, regression analyses determined the most salient psychosocial predictors for each performance group. Among high behavior adopters, a total of 28.5% of the variance of behavior was accounted for by self-efficacy, followed by intention, perceived behavioral control, subjective norm, and attitude. Among low behavior adopters, the pattern was quite different, with 13.7% of the variance of behavior accounted for by subjective norm, self-efficacy, attitude, perceived behavioral control, and intention. Those inclined to have healthier behavior expressed self-efficacy (internal factor) and those with lower healthy behaviors deferred to subjective norms (external factor).

DISCUSSION

This study identified psychosocial variables uniquely explaining obesity risk-reduction behaviors among a sample of Chinese American adults

Table 2. Comparison of Mean Values of Obesity Reduction Behavior Between Low and High Performers

OBESITY RISK REDUCTION BEHAVIORS	LOW PERFORMERS (RANGE 1–4)	HIGH PERFORMERS	*P*-VALUE
Ate home-cooked meals instead of restaurant-prepared foods	2.70	3.29	<0.001
Ate smaller portion sizes of foods than usual	1.96	2.40	<0.001
Ate steamed foods instead of fried foods	2.16	2.94	<0.001
Used small amounts of oils or fat when preparing or cooking foods	2.96	3.11	0.15
Ate at least 3 servings of vegetables per day (1 serving = ½ cup cooked, 1 cup fresh leafy vegetable)	2.03	3.10	<0.001
Ate at least 2 servings of fruits each day (1 serving = 1 medium fruit)	1.93	2.92	<0.001
Ate at least 3, 1 ounce servings of whole grains per day	2.00	2.86	<0.001
Made healthier choices at fast-food restaurants	2.07	2.85	<0.001
Ate healthful snacks (e.g., fruit, nuts)	2.17	3.06	<0.001
Ate healthful pre-packaged foods	1.90	2.63	<0.001
Took time to relax and improve my emotional well-being (e.g., social involvement, positive thinking)	2.49	3.06	<0.001
Took time to relax to decrease the amount of stress I feel	2.32	2.79	<0.001
Followed traditional healthful Chinese food patterns (e.g., eating more fruits and vegetables, less red meat)	2.15	3.10	<0.001
Used portion size control methods to help decide how much to eat	1.57	2.27	<0.001
Limited intake of high calorie beverages (e.g., soft drinks, juice, alcoholic drinks)	2.46	3.31	<0.001
Monitored my body weight	2.03	2.78	<0.001
Exercised at least 30 minutes, on 3 to 5 days per week (e.g., walking, biking)	1.89	2.70	<0.001
Learned about obesity risk and prevention (e.g., attending seminars, reading health articles, watching health programs on TV)	1.63	2.24	<0.001
Engaged in at least 1 physically active leisure activity	2.21	3.01	<0.001
Average of all Behaviors	**2.19**	**2.92**	**<0.001**

Table 2. Regression Analysis of Obesity Risk Reduction Behaviors by Frequency of Performers

PERFORMERS	SIGNIFICANT PREDICTORS	β	*b*	*SE* OF *b*	*p*
Low frequency	Attitude	0.10	.035	.028	0.22
$R = 0.369$	Subjective norm	-0.29	.000	.000	0.001
$R^2 = 13.7\%$	Perceived behavioral control	0.08	.006	.007	0.39
$p < 0.001$	Self-efficacy	0.25	.139	.042	0.001
	Intention	0.08	-.004	.006	0.48
High frequency	Attitude	0.01	.010	.059	0.87
$R = 0.534$	Subjective norm	-0.02	<0.001	.000	0.77
$R^2 = 28.5\%$	Perceived behavioral control	-0.04	-.016	.041	0.69
$p < 0.001$	Self-efficacy	0.54	.297	.049	<0.001
	Intention	0.04	.003	.005	0.59

with varying degrees of adoption of these health behaviors. This investigation of the beliefs, motivations, and behaviors of these individuals can contribute to the development of effective nutrition interventions to mitigate obesity risk in this growing population group.

Self-efficacy (strength of one's belief in one's own ability to complete tasks and reach goals) emerged as the most prominent predictor of behavior among participants who consistently performed obesity risk-reduction behaviors. Prior successes in adopting healthy behaviors among

Self-efficacy (strength of one's belief in one's own ability to complete tasks and reach goals) emerged as the most prominent predictor of behavior among participants who consistently performed obesity risk-reduction behaviors.

these individuals may have largely contributed to their confidence in adopting these behavioral practices. According to Bandura (1986), one's judgments of self-efficacy affect one's choices of behavior undertaken. Generally speaking, individuals tend to pursue tasks they know they can accomplish and avoid those they perceive as exceeding their capabilities. Sun and Wu's (1997) study also pointed to the importance of dietary self-efficacy for the consumption of complex carbohydrates and fiber intake in Chinese populations. Furthermore, research has shown that high dietary self-efficacy predicts increased ability to lose weight and to prevent relapse into previous unhealthy diets (Bagozzi & Edwards, 1998; Weinberg, Hughes, Critelli, England, & Jackson, 1984). Latner, McLeod, O'Brien, and Johnston (2013) found that self-efficacy emerged as a significant predictor of weight maintenance.

Qualitative interviews conducted with Chinese Americans have documented the influence of family members as promoters of overeating.

In regression analyses performed in this study, subjective norm (the perceived social pressure to engage or not to engage in a behavior) and self-efficacy were found to be the salient contributing factors among low adopters of obesity risk-reduction behaviors. This study's identification of the salience of subjective norms in predicting behavior is notable because a previous large study of Chinese Americans did not find it statistically significant for fat-related dietary behavior (Liou & Contento, 2001). The authors of this paper postulate that these individuals lack positive social pressures to perform the behaviors and may be surrounded by family and friends who do not engage in these health behaviors. Indeed, qualitative interviews conducted with Chinese Americans have documented the influence of family members as promoters of overeating (Liou & Bauer, 2007).

The total amount of variance accounting for behavior among high and low behavior adopters (28.5% versus 13.7%, respectively) is comparable to that of research based on American and Caucasian population groups. Stafleu, De Graaf, Van Staveren, and Schroots (1991) reviewed studies assessing social-psychological determinants of fat/cholesterol intake and found that variance explained for behavior ranged from 10% to 30%. In a comprehensive review of empirical research, psychosocial factors were found to predict about 20% to 30% of the variability in behavior encompassing fat intake and intake of fruits and vegetables (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003). In a meta-analysis of studies, the TPB explained 27% and 39% of the variance in behavior and intention, respectively (Armitage & Conner, 2001). In the prediction of reduced-fat diets among Chinese Americans using the TPB and HBM, 19% of the variance was accounted for by attitude, perceived barriers, and self-efficacy (Liou & Contento, 2001).

The demographic characteristics were similar for both groups of participants (see Table 2). However, low behavior adopters perceived greater stress levels than their counterparts. The (in)ability to handle stress may contribute to performance of healthy behaviors. It is well documented that regular physical activity and exercise can alleviate stress levels in individuals (Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991). High behavior adopters in the current study engaged in more moderate-to-heavy activity levels than low performers. Regular engagement in physical activity can be pivotal in promoting overall well-being and reducing stress. It is noteworthy that more than half of respondents were employed (leaving less time for physical activity). Yet, high behavior adopters took more time to relax to mitigate stress levels and to improve emotional well-being. In addition, they exhibited more frequent exercise

and engagement in physically active leisure activities than did low adopters.

High behavior adopters also indicated having greater access to healthful foods than their counterparts had. Research has demonstrated that accessibility of healthful food may decrease risk of obesity by facilitating healthier diets (see Cerin et al., 2011) and that limited access to supermarkets in low-income communities may present a significant barrier to intake of healthy foods (Larson, Story, & Nelson, 2009). In our study, high behavior adopters, as compared with low behavior adopters, consumed more fruits, vegetables, and home-cooked meals.

Limitations

Study limitations include the lack of a random sample of individuals. The results cannot be generalized to the entire Chinese American population. Also, within the convenience sample, the majority of respondents were young, college-educated, and female adults. Future studies need to include a more robust sample reflecting older individuals and male adults. Also, volunteers who completed the survey may be inherently more health-conscious than non-participants. In addition, longitudinal data were not available to assess the stability of respondents' beliefs, attitudes, and behavior over time and contexts. Finally, the researchers did not measure participants' actual height and weight (self-reported data may reflect underreporting of actual weight). All of these limitations can be accommodated in future studies.

CONCLUSIONS

This study revealed important relationships between psychosocial factors and obesity risk-reduction behaviors in a sample of Chinese American adults. Family and consumer sciences (FCS) and nutrition educators should focus on delivering messages that are culturally sensitive and that address individuals' motivation or disinclination to engage in healthful eating practices, physical activity, and stress reducing activities. To state the obvious, FCS nutrition education programs for Chinese Americans must include components on exercise and stress reduction, because these affect weight management. Convincing them to perform obesity risk-reduction behaviors should be a cornerstone in the development of effective nutrition education interventions. Messages focusing on the positive social influences for healthful eating and accessibility to healthful foods may benefit the low behavior adopter group. High behavior adopters may benefit from strategies to build on prior healthful habits to maintain self-efficacy; programs targeting low adopters must include the concept of self-efficacy and should sensitize them to the power of subjective norms. Both strategies better ensure weight management, healthy eating, and fewer relapses into previous behaviors.

FCS nutrition education programs for Chinese Americans must include components on exercise and stress reduction, because these affect weight management.

On a final note, the results of this study illustrated the predictive power of using the Theory of Planned Behavior and the Health Belief Model in concert when examining obesity risk-reduction behaviors in Chinese Americans. Given the recent alarming obesity trends, future studies need to explore in greater detail the mediating effects of psychosocial factors on obesity risk-reduction behaviors in under-represented Chinese Americans. There is a need for more in-depth qualitative and survey research to explore context, motivators, and the perceptions of individuals who adopt health behaviors at varying levels. Longitudinal research studies should be encouraged to examine dietary patterns and behaviors over time and with succeeding generations of Chinese Americans.

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