DIETARY BEHAVIORS AND NUTRITION KNOWLEDGE AMONG SOUTH

ASIANS

A Thesis

by

ZUBAIDA QAMAR

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2011

Major Subject: Nutrition

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Approved by:

Chair of Committee,	Ranjita Misra
Committee Members,	Karen Kubena
	Steven Riechman
Intercollegiate Faculty Chair,	Stephen Smith

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ABSTRACT

Dietary Behaviors and Nutrition Knowledge among South Asians. (December 2011)

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Chair of Advisory Committee: Dr.Ranjita Misra

South Asians have 2-4 times higher risk of heart disease than Caucasians, African Americans, and Hispanics and India has the highest number of individuals with type 2 diabetes. National studies on South Asians chronic disease prevalence, nutrition knowledge, and dietary patterns are limited in the U.S. since all Asian subgroups are aggregated into the "Asian" category. These are particularly important for South Asians because their genetic predisposition and acculturation into the westernized lifestyle after immigration increases their risk for chronic diseases. The objectives of the study were to focus on various factors that influence dietary patterns and changes that increase the risk of diet-related diseases and general nutrition knowledge of South Asians living in the U.S. The data were collected using a survey questionnaire on dietary habits, nutrition knowledge and health of 105 South Asians (men=58, women=47). The mean age and Body Mass Index (BMI) of the participants was about 24 years and 22.8±3.5 kg/m^2 respectively. On average, respondents scored moderately on dietary habits scale. Participants reported an increase in weight after coming to the U.S. The top 3 barriers to eating healthy were " not a priority" ,"busy lifestyle" and "healthy foods not tasting as

good" .The top 3 motivators for healthy eating were "losing weight", "prevention of diseases", and "ability to find quick healthy recipes". The nutrition knowledge was assessed by qualitative and quantitative measures .Approximately half of the participants reported avoiding junk, incorporating low fat, low sugar, more vegetables, fruits and increased intake of water. Furthermore, obese individuals scored better on dietary behavior scale as compared to their peers. The multivariate regression model was significant (df=13, F=2.980, R2 =0.356, P<0.002) for Nutrition Behaviors of South Asians and 35.6% of the variance in nutrition behavior was explained by the variables in the model. Nutrition Behavior was significantly and positively related to use of food labels and BMI. With the current emphasis on cultural competency and providing culturally appropriate health services, results from this study can help to develop strategies to prevent diseases using nutritional strategies and to promote a general healthy life style among this educated South Asian group.

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I would like to express my immense gratitude to my parents, siblings and friends for their life-long love and support. Secondly, I sincerely thank my advisor, Dr.Ranjita Misra, for her valuable guidance and suggestions. Also, I am grateful to my committee members, Dr.Karen Kubena and Dr.Steven Riechman, for their cooperation and understanding. Last but not the least, I am honored to be a part of the great Aggie Network and proud to be an alumnus of my undergraduate institution, State University of New York, College at Oneonta.

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

South Asians comprise of the second largest Asian subgroup and one of the fastest growing immigrant population in the United State .[1] South Asia or the Indian subcontinent, as the region is often referred to, consists of the countries of India, Pakistan, Sri Lanka, Bangladesh, Nepal, and Bhutan .[2] "Differentiation" of having a diverse ethnic identity has been shown for the South Asian countries from the Far East (Japan, China etc.) and South East Asian (Malaysia, Thailand, Singapore etc.) countries in the literature. [3,4,5] Even though South Asians may include individuals from mostly India, Pakistan, and Bangladesh who have similar cultural traits and history, these countries differ in language, religion, culture and traditions. There is substantial heterogeneity among South Asians but there are numerous similarities in the culture that the people from this region share allowing for this group to be considered homogenous for purposes of health programming .[1] However, there are few studies on South Asian in the U.S. that have estimated the prevalence of overweight and obesity, and examined culturally-relevant determinants of health, and culturally-appropriate health education and promotion interventions .[2]

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This thesis follows the style of *Journal of American Medical Association.*

Studies have shown that immigrants of Asian Indian origin have a significantly higher risk of Cardiovascular diseases (CVD) with heart disease rates estimated to be 1.5 to 4 times greater than whites .[3,4] South Asians are more predisposed to have non-communicable diseases such as cardiovascular diseases and diabetes.[5] The risk level for these diseases increases particularly for those who have immigrated to other countries .[6] Along with genetic predisposition of developing CVD and Type 2 diabetes, risk factors such as abnormal lipid levels, increased abdominal fat, diets high in fat, saturated and trans fat, simple carbohydrates and sedentary lifestyles play a part in the development of chronic diseases .[7] Higher diabetes prevalence includes cultural, socioeconomic, behavioral, and genetic factors.[8]

Research has shown that a normal Body Mass Index (BMI) is considered important in the prevention and early onset of these diseases.[6] A Study by the US Department of Health and Human Services have shown that BMI is influenced by diet and physical activity and can be used as an indicator of a person's health risk. The literature on dietary intake and BMI among immigrants points to changes that occur in these variables as a result of adaptation to new environments.[9,10,11,12,13] Hence the World Health Organization (WHO) has recommended lower BMI for Asians are compared to Western populations. Overweight and obese categories for South Asian individuals is BMI $\geq$ 23-25kg/m^2 and BMI $\geq$ 25kg/m^2 respectively.[14] This is in accordance with the international standards that the BMI should be lower than 25kg/m^2 for this population.[15] Studies have also shown gender differences exist and that South Asians females are more prone to these diseases in comparison to males .Hence, the suggested cut offs are 23 kg/m^2 for South Asian women.

[6,16] In concordance with this, Kumar et al also indicated that people of Pakistani origin (35-65 years of age) to have a BMI of 25 kg/m^2 or above categorizing them as obese.[17]

Overweight and obesity are caused by various factors. Body weight is shaped by a combination of genetic, metabolic, behavioral, environmental, cultural, and socioeconomic influences.[2] In health education and health promotion, primary interests are modifiable behavioral, cultural, and environmental factors.[2] For a large majority of individuals, overweight and obesity result from excess calorie consumption and/or inadequate physical activity .[18] Stress is often associated with obesity and improper eating behaviors .[19] Hence dietary behaviors are very important for maintaining healthy body weight. Healthy eating that includes increased fruit and vegetable consumption, controlled portion size, and limited soft drink consumption is considered effective for combating obesity .[20] Unfortunately, not many studies have been examined dietary behaviors in Asian Americans in general and South Asian Americans/immigrants in particular.

Acculturation has been found to be a risk factor for several unhealthy behaviors among Asian Americans including obesity-related behaviors such as physical inactivity and fast-food consumption and rising concerns have been shown with acculturation .[21] Dietary acculturation is described as the process by which immigrants and their descendants take on the dietary practices of the host country. Diseases associated with dietary acculturation influence young people .Studies among Japanese immigrants show that as individuals acculturate to the U.S. Society, the prevalence of chronic disease

equals that of the general U.S. population .Acculturation to the U.S. lifestyle was found to be significantly associated with a sedentary lifestyle and a higher frequency of fast-food consumption .[2] Hence ,health promotion programs should be developed for new immigrants that encourage physical activity and healthy diets ,especially, among youth.[2]

Immigrant status is also linked with overweight and obesity. A Canadian study found that people who were recent immigrants (< 10 years) had significantly lower prevalence of overweight and obesity when compared to non-immigrants .[22] The problem of overweight and obesity may affect natives of these countries more when they immigrate to the United States .[23] However, this difference did not remain over a longer period of time.

There is a large variation in religions among the South Asians and dietary habits may change depending on religion.[24] Religious Hindus are more likely to be vegetarians than Non-religious Hindus or individuals of other religions. Similarly, Muslims are more likely to be non-vegetarians. Hence, there is a lot of diversity in food habits in terms of religion. Vegetarians are in general perceived to be healthier than non-vegetarians. It will be interesting to see if such an effect exists in South Asians. It would also be note-worthy to see what general nutrition behaviors are for South Asians, barriers for eating healthy and motivating factors for individuals encouraging healthy eating.

1.1 Purpose and Significance of Study: With the current emphasis on cultural competency and providing culturally appropriate health services, studies are necessary to examine the nutrition knowledge and dietary behaviors and how these change during

their process of acculturation. Knowledge is frequently a prerequisite for making healthy changes, even if it does not automatically lead to actual improvements.[25] The objective of the study was: (1) Focus on the various factors that influence dietary patterns and changes that increase the risk of diet-related diseases and (2) General nutrition knowledge of South Asians living in the U.S. Results will help to develop nutritional strategies to prevent diet-related diseases and to promote a general healthy life style among the South Asians.

2. METHODS

2.1 Sample: A convenience sample of 105 South Asians including men (n=47) and women (n=58) living in College Station/Bryan, TX and Oneonta, NY were recruited for the study. Age of the participants ranged from 18-45 years .The data was collected by using a questionnaire. The inclusion criteria for the study were: (1) South Asian origin/Descent and (2) age≥18 years. The survey was personally handed to the participants after inquiring about their South Asian origin. The participants were either U.S. citizens or nationals from South Asian countries (Indian, Pakistan, Bangladesh, etc.) who came to the U.S. for the purpose of study or work. Figure 1 shows the distribution of nationality. The study was conducted in compliance with the ethical principles of Institutional Board or Review (IRB).The protocol was approved by the Texas A&M University committee on use of humans in research.

2.2 Demographic/Anthropometric Information: The questionnaire incorporated self-reports on weight, height, age, gender, educational level, marital status, current employment/student status, years in the U.S. Body mass index (BMI) was calculated from the self-reported height and weight using the formula, weight in kilograms/height in metres.[2] Participants were categorized into underweight (<18.5), normal (<23), overweight (23-25) and obese (>25) based on the WHO criteria for Asians.[15] Information on participants' weight change after coming to the U.S. and the weight perception in

comparison to peers of their own age was evaluated. Participants' level of self-reported

physical activity was also obtained.

Figure 1. Percentage of Nationality
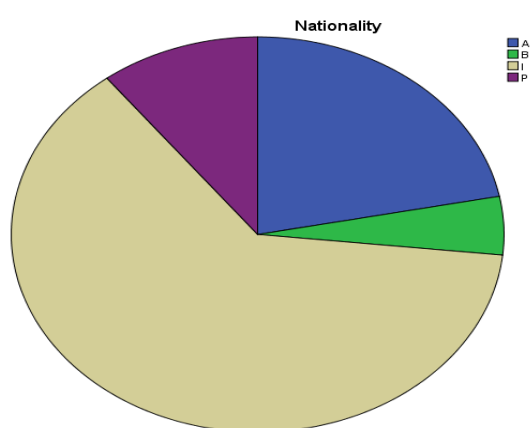
A=American=Pakistani=Bangladeshi, I=Indian

2.3 Diet and Health : Diet related questions involved their dietary preference

(vegetarian, non-vegetarian, vegan),change in diet after coming to the U.S., and

frequency of fast food consumption .For the assessment of their dietary behaviors, a set

of 9 scored questions (total score 36)was asked with the options of "Always(4), Often(3)

,Sometimes(2), and Never(1)."The participants were also asked questions related to the

use of nutritional supplements, incorporation of traditional foods, and dietary restrictions.

2.4 Health Risk Behaviors: The estimation of their health risk behavior was based on collecting information on alcohol consumption, smoking, and stress levels. Genetic predisposition to chronic diseases was also assessed by family history of diseases which are diet related (e.g. diabetes, CVD, Kidney problems, cancer). Information was gathered about the 10 barriers to healthy eating and the top three barriers were determined. Also, in order to allow people to follow a healthy diet, information was collected about the 10 motivating factors that persuaded people to follow a healthy diet. Once again, the top three motivators were assessed from the data.

2.5 Nutrition Behavior: Dietary behaviors were calculated from the nutrition subscale of the revised Health Promotion Lifestyle, Profile II .[26] The subscale included 9 items that measured the frequency of self-reported nutritional behaviors based on the Food Guide Pyramid recommendation (Cronbach's α = 0.87). The items were scored from never (1) to always (4) with a higher score indicative of healthier dietary behavior.

Perceived barriers to healthy eating were also identified by asking respondents the main reasons that prevent them from eating a healthy diet. Nine barriers were as follows: it is not a priority for me, healthy foods are expensive ,healthy foods do not taste good, my family would not eat it, I do not want to give up cultural traditions, I have a very busy life, healthy foods take time, healthy foods do not look good, non-supportive

friends/family. These were identified and a point was scored for each barrier marked by the respondent. Higher score represented more barriers to adherence for a healthy diet.

Motivation for having a healthy diet was measured by nine different motivators for healthy eating among the respondents e.g. I want to lose weight, becoming a better role model for my kids, prevent getting certain diseases, I can find quick healthy recipes, family members are willing to change, I am diagnosed with a disease or illness, someone close is diagnosed with a disease, if restaurants offered more healthy foods, if somebody else cooked it. Response format was yes (1) or no (0). All the items were summed for a motivation score (range 0-9); higher score indicated more factors necessary to motivate the individual for healthy diet.

2.6 Nutrition Knowledge: In order to evaluate the participants' nutrition knowledge, an open ended, qualitative question "How do you keep yourself healthy? Please specify in terms of Dietary Habits, Physical Activity, and Mental/Spiritual wellbeing" was asked. This open-ended question probed the participants' dietary habits, physical activity, and mental/spiritual wellbeing. A thematic analysis was conducted and over-arching themes were determined. Besides the open ended-qualitative assessment, several survey questions also determined the nutritional knowledge. For example, a basic question was asked about the highest calories in protein, fat or carbohydrate and frequency and percentages were calculated. Another question was asked to determine their opinion on the usefulness of food package labels and to observe if they follow what they believe.

2.7   Statistical Analysis: Gender specific analyses were conducted to show the different

dietary behaviors of South Asian men and women. All analyses were done using the

Statistical Program for Social Sciences (SPSS) system (version 19.0). Basic descriptive

statistics were obtained for demographic variables, nutrition knowledge and behavior.

Level of significance was set at $p< 0.05$.the Student t-test and Chi-square analysis (for

categorical variables) evaluated the association of dietary factors by gender. Multivariate

Linear Regression Analysis was conducted to predict the nutrition behaviors. The

independent variables were gender, use of food labels, born in U.S., BMI, age, educational

level, years in U.S., barriers to healthy eating, religion, motivators for healthy eating,

vegetarianism, and nutrition knowledge whereas the dependent variable was nutrition

behavior.

3. RESULTS

3.1 Demographics*:* The total number of participants was 105, with the respondents evenly split by males (n=58) and females (n=47). The mean age of the participants was about 24 years and the sample mean was very similar to the mean years of males and females. The mean weight was 146.0±27.6 lbs. for the studied population and the mean weight for males and females was 159.9±21.9 lbs. and 128.9±24.2 lbs. respectively. The mean height for the participants was 66.9±3.7 inches and 69.5±2.5 and 63.7±1.0 inches for males and females respectively. The mean BMI was 22.8±3.5 kg/m^2 and mean BMI value for males was 23.1±2.7 kg/m^2 and 22.3±4.4 kg/m^2 for females (Table 1). The percentage distribution of participants in terms of BMI ranges is depicted in Figure 2.

Figure 2. BMI Percentage
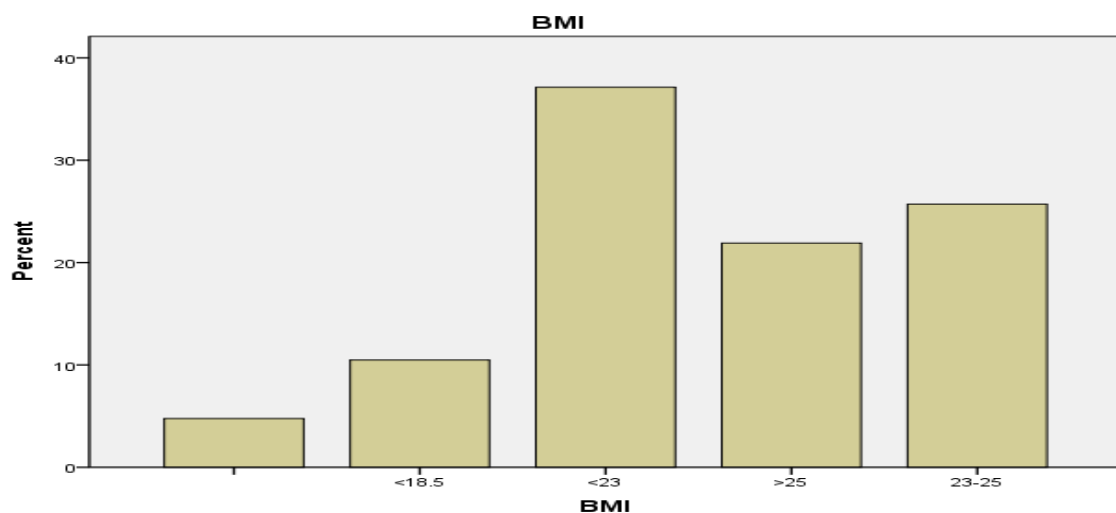
The majority of the participants were Hindus (53.3%), followed by Muslims (32.4%) and Christians (7.6%) respectively. There was no significant difference in females in terms of religion but in males significant difference existed for Hindus and Muslims. Most of the participants were single (78.1%) with only 12.4% married and 8.6% specifying having partners. No significant difference existed between males and females in terms of marital status. The educational level of 64.8% participants was seeking a degree at graduate levels/professional degree followed by 33.3% pursing a College Degree and only 1.9% completing high school. There was no significant difference between females in terms of different educational levels but in males, there existed significant difference at college and graduate/professional education levels in terms of level of education. Most of the participants were students (74.3%) followed by 20% employed for wages whereas the percentage for people out of work was 3.8% and for homemakers, it was 1.9%. There was no significant difference between males and females in terms of current positions as in if they were working or were students. Out of all the participants, only 11.4 % were born in the U.S. with 3.4% of males and 21.3% females. The rest were born in their respective countries but have come to the U.S. for varied reasons. Significant differences existed only in males between those born in the U.S. and those not born in the U.S. About 55.2% of people have been living in the U.S. for less than 5 years, out of which 39% were males and 16.2% were females.

Table 1. Demographic Characteristics of the Respondents							
Variable	Total		Males		Females		p-value
	105		58		47		
	Frequency	%	Frequency	%	Frequency	%	
Religion							.001
Christian	8	7.6%	2_a	3.4%	6_a	3.4%	
Hindu	56	53.3%	40_b	69.0%	16_a	34%	
Muslim	34	32.4%	11_b	19.0%	23_a	48.9%	
Other	7	6.7%	5_a	4.8	2_a	1.9%	
Marital Status							.282
Single	82	78.1%	49_a	84.5%	33_a	70.2%	
Married	13	12.4%	5_a	8.6%	8_a	17.0%	
Have a partner	9	8.6%	4_a	6.9%	5_a	10.6%	
Educational Level							.028
High School or less	2	1.9%	1_a	1.7%	1_a	2.1%	
Some college/Bachelors	35	33.3%	13_b	22.4%	22_a	46.8%	
Graduate education/Professional Degree	68	64.8%	44_b	75.9%	24_a	51.1%	
Current Position:							0.168
Employed for Wages	21	20.0%	14_a	24.1%	7_a	14.9%	
Out of work	4	3.8%	1_a	1.7%	3_a	6.4%	
Homemaker	2	1.9%	0_a	0%	2_a	4.3%	
Student	78	74.3%	43_a	74.1%	35_a	74.5%	
Born in the U.S.	12	11.4%	2_b	3.4	10_a	21.3%	0.016
Not born in the U.S.	89	84.8%	54_b	93.1	35_a	74.5%	
≤5 years in U.S.	58	55.2%	41_b	39	17_a	16.2%	.001
>5 years in U.S.	32	30.5%	13_b	12.4	19_a	18.1%	
Variables	Mean ±S.D.		Males (Mean ±S.D.)		Females (Mean ±S.D.)		
Age(years)	24.3±4.2		24.5±3.3		23.0±5.2		
Weight(lbs)	146.0±27.6		159.9±21.9		128.9±24.2		
Height(inches)	66.9±3.7		69.5±2.5		63.7±1.0		
Body mass Index(BMI)	22.8±3.5		23.1±2.7		22.3±4.4		
Marital Status (Missing) =1; Born in U.S. (Missing) =4; Years in U.S. (Missing) =15 Each subscript letter denotes a subset of Gender categories whose column proportions do not differ significantly from each other at the .05 level							

Out of the total study population, 55.2% indicated that they had been living in the U.S. for less than 5 years. Up to 30 % people indicated that they had lived in the U.S. for more than 5 years. There were 14.3% who did not respond to the question. Analysis of the data showed that there is a significant difference between people who have been living in the U.S. for less than 5 years compared to those living in the U.S. for more than 5 years in terms of changes in weight. Figure 3 shows this trend. All the participants were of South Asian descent but some were born in the U.S. whereas majority of them were born in India, Pakistan and Bangladesh. Their nationalities were as follows: American (21.9 %), Indian (62.9%), Pakistani (10.5%) and with 4.8% Bangladeshis as was shown in Figure 1.

Figure 3. Comparison of Weight Change in Relation to Years lived in the U.S
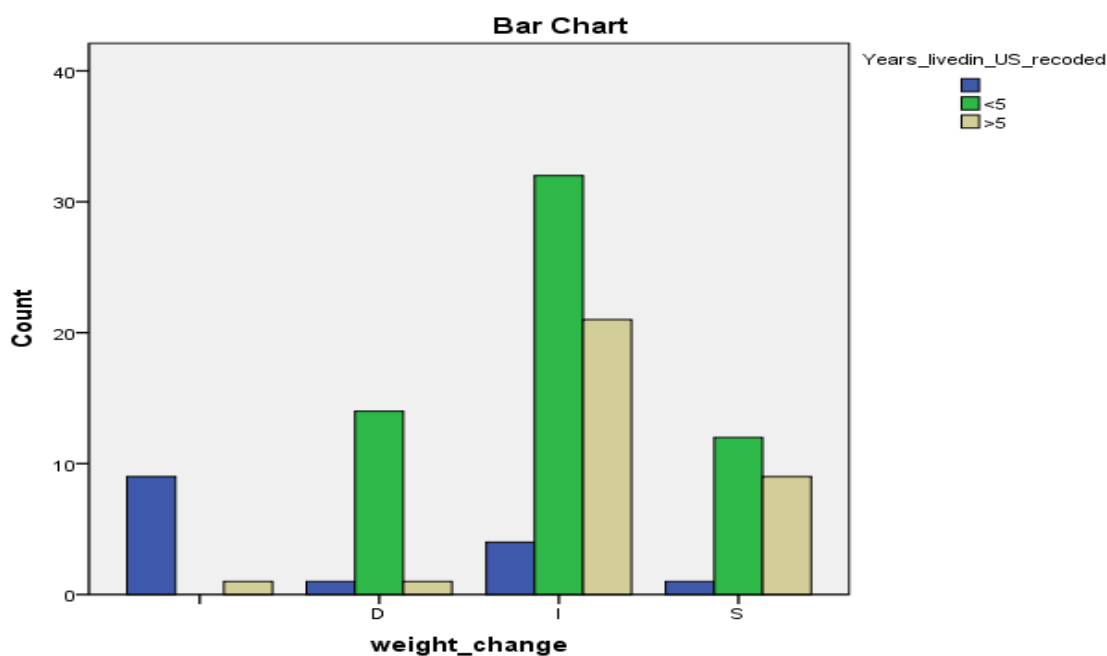
3.2   Healthy Behaviors of Respondents by Gender*:* Table 2 shows the healthy habits of respondents by gender. For dietary preferences, there was no significant difference among females but in males, there were significant differences in terms of vegetarian and non-vegetarian values. There were 39.7% males who were vegetarian and 58.6% were non-vegetarian. There was no significant difference in females in terms of weight perception but in males there was significant difference in males that 40% of males reported perceiving their weight to be normal which was a higher percentage among males in comparison to other options of being overweight and underweight. There was no significant difference in males at the overweight, underweight and obese levels. About 54.3% participants indicated increase in weight whereas 15.2% indicated decrease in weight and 21% indicated that weight remained the same. There was a lot of variation in terms of 30 minutes of physical activity per week as is evident from Table 2.The percentage of those who agreed to consumption of fast food was 66.7%.Among this, the percentage of males was 37.1% and for females, it was 29.5%.There was no significant difference between males and females in this variable (Table 2).About 76.2% indicated no use of any nutritional supplements. A lot of varied responses were seen with the frequency of use of diet products. For consumption of traditional foods, 56.4% indicated having traditional cultural food at least once a day.

Table 2. Health Behaviors of Respondents by Gender							
Variables	Options	Total		Male		Female	
		Frequency	%	Frequency	%	Frequency	%
Dietary Preference	Non-Vegetarian	72	68.6	34	33.3	38	37.3
	Vegetarian	29	28.4	23	22.5	6	5.9
	Vegan	1	1	1	1	0	0
Weight perception in comparison to others	Underweight	17	16.2	8	7.6	9	8.6
	Normal	67	63.8	42	40	25	23.8
	Overweight	18	17.1	8	7.6	10	9.5
	Obese	0	0	0	0	0	0
Weight change after coming to the U.S.	Increased	57	54.3	30	28.6	27	25.7
	Decreased	16	15.2	12	11.4	4	3.8
	Remained the same	22	21	15	14.3	7	6.7
30 minutes of physical activity per week	None	7	6.7	4	3.8	3	2.9
	<2 times/week	33	31.4	14	13.3	19	18.1
	3-4times/week	35	33.3	21	20	14	13.3
	5≥times/week	27	25.7	19	18.1	8	7.6
Fast food consumption	Yes	70	66.7	39	37.1	31	29.5
	No	31	29.5	19	18.1	12	11.4
Frequency of fast food/outside food consumption	None	9	8.6	6	5.7	3	2.9
	<2 times	52	49.5	23	21.9	29	27.6
	3-5times	29	27.6	21	20	8	7.6
	>5 times	6	5.7	3	2.9	3	2.9
	Everyday	5	4.8	4	3.8	1	1
Use of Nutritional Supplements	Yes	21	20	15	14.3	6	5.7
	No	80	76.2	43	41	37	35.2
Frequency of use of diet products	Never	21	21	9	9	12	12
	Rarely	42	42	32	32	10	10
	Sometimes/week	23	23	7	7	16	16
	Everyday	14	14	8	8	6	6
Frequency of traditional food intake per day	None	6	5.9	4	4	2	2
	Once a day	57	56.4	30	29.7	27	26.7
	Twice a day	27	26.7	16	15.8	11	10.9
	3≥times a day	11	10.9	7	6.9	4	4
Physical Activity Missing=3; Fast Food frequency Missing=4; Frequency of fast food/outside food consumption Missing =4; Nutritional Supplements Use Missing=4							

3.3   Dietary Habits of Respondents by Gender: Table 3 shows a detailed questionnaire

asking about the dietary habits of the participants. The score was calculated for all the

responses. The score was as follows Always=4, Often=3, Sometimes=2, Never=1. The total

mean score was 20.9 ±3.9 and mean score for males and females was 20.5± 3.9 and

21.4±3.8 respectively. It was noteworthy to see that the highest percentage of

participants (35.2%) choosing "Always" was in response to question "How often do you have breakfast?". The highest percentage of people (35.2%) choosing "Never" was in response to question "How often do you limit use of sugars, sweets, & desserts? "(Table 3).

Table 3: Dietary Habits of Respondents by Gender							
Variables		Total		Males		Females	
		Frequency	%	Frequency	%	Frequency	%
1-How often do you choose a diet low in fat, saturated fat, and cholesterol?	Never	20	19	16	27.6	4	8.5
	Sometimes	51	48.6	25	43.1	26	55.3
	Often	25	23.8	14	24.1	11	23.4
	Always	6	5.7	3	5.2	3	6.4
How often do you limit use of sugars, sweets, & desserts?	Never	37	35.2	26	44.8	11	23.4
	Sometimes	37	35.2	21	36.2	16	34
	Often	23	21.9	11	19	12	25.5
	Always	5	4.8	0	0	5	10.6
How often do you eat 6-11 servings of bread, roti, nan, rice, etc.?	Never	36	34.3	17	29.3	19	40.4
	Sometimes	41	39	25	43.1	16	34
	Often	16	15.2	11	19	5	10.6
	Always	7	6.7	4	6.9	3	6.4
How often do you eat 2-4 servings of fruit each day?	Never	14	13.3	8	13.8	6	12.8
	Sometimes	62	59	35	60.3	27	57.4
	Often	21	20	13	22.4	8	17
	Always	4	3.8	2	3.4	2	4.3
How often do you eat 3-5 servings of vegetables each day?	Never	12	11.4	7	12.1	5	10.6
	Sometimes	48	45.7	24	41.4	24	51.1
	Often	27	25.7	16	27.6	11	23.4
	Always	14	13.3	11	19	3	6.4
How often do you consume 2-3 servings of milk, buttermilk, or curd each day?	Never	10	9.5	6	10.3	4	8.5
	Sometimes	35	33.3	17	29.3	18	38.3
	Often	35	33.3	19	32.8	16	34
	Always	19	18.1	13	22.4	6	12.8
How often do you eat only 2-3 servings from the meat, poultry, fish, eggs, and nuts group each day?	Never	18	17.1	15	25.9	3	6.4
	Sometimes	37	35.2	22	37.9	15	31.9
	Often	38	36.2	17	29.3	21	44.7
	Always	9	8.6	4	6.9	5	10.6
How often do you read labels to identify nutrients, fats, and sodium content in packaged food?	Never	22	21	13	22.4	9	19.1
	Sometimes	34	32.4	22	37.9	12	25.5
	Often	27	25.7	15	25.9	12	25.5
	Always	19	18.1	8	13.8	11	23.4
How often you eat breakfast?	Never	6	5.7	3	5.2	3	5.4
	Sometimes	31	29.5	18	31	13	27.7
	Often	28	26.7	18	31	10	21.3
	Always	37	35.2	19	32.8	18	38.3
Mean Score (Total score =36	20.9 ±3.9			20.5± 3.9		21.4±3.8	

3.4 Risky Health Behaviors of Respondents by Gender*:* Table 4 shows about 46% of

people indicated consumption of alcohol and about 54% with no consumption of

alcohol.85% of participants had never used any tobacco products. On a scale of 1-5, with

1 being the lowest and 5 being the highest, 3 was the number with the greatest

percentage (49%) for stress levels. There was no significant difference in stress levels

among females but there were significant differences among males at the stress levels of

2 and 4.The general stress level of the total studied population was 3 which was in the

middle. 28.7% males had a stress level of 3 and 19.8% females also had stress levels of

3.In terms of family history of diseases, 76.2% of the people indicated having some sort of

diet-related diseases such as diabetes, cardiovascular disease, cancer, kidney stones, and

thyroid problems. There was no significant difference between males and females in

terms of those who had a family history of disease and those who did not (Table 4).

Table 4-Risky Health Behaviors of Respondents by Gender							
Variables	Options	Total		Males		Females	
		Frequency	%	Frequency	%	Frequency	%
Alcohol consumption	Never	54	53.5	30	29.7	24	23.8
	Rarely/Occasionally	26	25.7	15	14.9	11	10.9
	Only on Weekends	20	19.8	11	10.9	9	8.9
	Daily	1	1.0	1	1	0	0
Tobacco Use							
	Never	85	85.0	48	48	37	37
	Only Occasionally	6	6.0	2	2	4	4
	1-2 times/day	9	9.0	6	6	3	3
	>3 times/day	0	0	0	0	0	0
Stress levels	1(lowest)	9	8.9	6	5.9	3	3
	2	18	17.8	14	13.9	4	4
	3	49	48.5	29	28.7	20	19.8
	4	20	19.8	6	5.9	14	13.9
	5(highest)	5	5.0	2	2	3	3
Family History(person, parents, siblings, Grandparents,uncles/aunts)	Any of the following: Diabetes, CVD, Cancer, Kidney and Thyroid problems.	80	76.2	45	42.9	35	33.3
Family History Missing=25							

3.5   Barriers to Eating a Healthy Diet: The top 3 barriers in general for the group are a

tie of not a priority and busy lifestyle followed by healthy foods not tasting as good. The

top 3 barriers for males are healthy eating is not a priority for them; healthy foods do not

taste good and a busy life. The top 3 barriers for females are busy lifestyle, not a priority

and expensiveness of healthy foods. There was no significant difference between the

choices made by males and females (Table 5).

Table 5: Barriers to Eating Healthy						
Barriers			Males		Female	
	Frequency	%	Frequency	%	Frequency	%
It is not a priority for me	27	25.7	17	63	10	37
Healthy foods are expensive	16	15.2	7	43.8	9	56.3
Healthy foods do not taste good	18	17.1	10	55.6	8	44.4
My family would not eat it	10	9.5	5	50	5	50
I do not want to give up cultural traditions	8	7.6	5	62.5	3	37.5
I have a very busy life	27	25.7	10	37	17	63
Healthy foods take time	15	14.3	7	46.7	8	53.3
Healthy foods do not look good	0	0	0	0	0	0
Non Supportive friends/family	5	4.8	1	20	4	80
I already eat a very healthy diet	29	27.6	20	69	9	31

3.6   Motivators for a Healthy Diet: The top 3 motivators which would encourage

people in general to eat a healthier diet are losing weight, prevention of diseases, and if

they can find quick healthy recipes. The top three motivators for males were a tie

between losing weight and if somebody else cooked for them. The top thee motivators

for females were losing weight ,prevention of diseases and finding quick healthy recipes

.There was no significant difference between the choices made by males and females

(Table 6).

Table 6: Motivators for a Healthy Diet						
Motivators	Frequency	%	Males		Females	
			Frequency	%	Frequency	%
I want to lose weight	41	39.0	16	39	25	61
To become a better role model for my kids	7	6.7	6	85.7	1	14.3
To prevent getting certain diseases	28	26.7	12	42.9	16	57.1
I can find quick healthy recipes	26	24.8	12	46.2	14	53.8
Family members are willing to change	22	21.0	9	40.9	13	59.1
I am diagnosed with a disease or illness	12	11.4	5	41.7	7	58.3
Someone close is diagnosed with a disease	6	5.7	1	16.7	5	83.3
If restaurants offered more healthy	25	23.8	12	48	13	52
If somebody else cooked it	19	18.1	16	84.2	3	15.8
I already eat a very healthy diet	18	17.1	13	72.2	5	27.8

3.7   Nutrition Knowledge/Attitudes*:* In response to the question about Body Fat

percentage, only 16% of study population knew about their body fat. There were a few

qualitative questions in the survey which asked about how the participants kept

themselves healthy and gave them three sub categories of Dietary habits, Physical

Activity and Mental/Spiritual. For the Dietary habits, about 50% of the participants gave a

response and the trends was towards eating more vegetables and fruits ,incorporating

low fat food in the diet, avoiding junk food, increasing intake of water and limit sugar use

respectively. For physical activity, about 80% of people responded to this question. The most common trend was going to the gym followed by sports, walking, running and yoga. Out of all the participants, about 25% people responded to having some sort of mental/spiritual activity. The most common was prayers followed by meditation.

In response to the question, "Has your diet changed after coming to the U.S.? If yes, please specify." About 36% replied to some sort of change in their diet after coming to the U.S. Majority of the participants replied to increase in junk food consumption followed by becoming non-vegetarian, increase in fatty foods, incorporation of westernized diet with only one response of intake of less spicy food and becoming vegan each. The most common place for fast food consumption was McDonalds, followed by Taco bell and Subway. Table 7 shows the 3 nutrition knowledge/opinion questions. In response to the nutrition knowledge question, "Which of the following has the most calories per gram?", 61% responded "Fat" whereas rest chose "Carbohydrate" or "Protein". In response to the question, "The Nutrition Facts label that appears on most food packages is a useful tool for consumers. Do you?" about 91% agreed but when asked "When you eat a food, do you use the information on the "Nutrition Facts" label to help you fit that food into your daily diet?" about 63% agreed (Table 7).

Table 7: Nutrition Knowledge/Attitudes							
Nutrition Knowledge/Opinion questions	Frequency	Total		Males		Females	
			%	Frequency	%	Frequency	%
Which of the following has the most calories per gram?	Protein	8	7.6	3	5.2	5	10.6
	Fat	64	61	38	65.5	26	55.3
	Carbohydrate	28	26.7	15	25.9	13	27.7
The Nutrition Facts label that appears on most food packages is a useful tool for consumers. Do you?	Strongly Agree	37	35.2	18	31	19	40.4
	Agree	59	56.2	36	62.1	23	48.9
	Disagree	3	2.9	1	1.7	2	4.3
	Strongly disagree	2	1.9	2	3.4	0	0
When you eat a food, do you use the information on the "Nutrition Facts" label to help you fit that food into your daily diet?	Strongly Agree	15	14.3	6	10.3	9	19.1
	Agree	51	48.6	26	44.8	25	53.2
	Disagree	27	25.7	19	32.8	8	17
	Strongly disagree	8	7.6	6	10.3	2	4.3

3.8   Predictors of Nutrition Behavior: The multivariate regression model examined the influence of study variables on Nutrition Behaviors of South Asians. The regression model was significant (df=13, F=2.980, R^2=0.356, P<0.002) and 35.6% of the variance in nutrition behavior was explained by the variables in the model. Nutrition Behavior was significantly and positively related to use of food labels and BMI. In other words, participants who reported the use of food labels (β=0.245) and had higher BMI (β=0.251) had more healthy dietary behavior (Table 8). Although gender was not significant at the 0.05 level of significance, it approached significance (p=.087). Barriers and motivation to health eating, nutrition knowledge, and other demographic factors were not significantly associated with nutrition behavior in the model.

Table 8: Predictors of Nutrition Behavior			
Independent Variables	Beta	t-value	p-value
Gender	.192	1.736	.087
Food label Use	.245	2.169	.033
Born in U.S.	-.97	-.92	.361
BMI	.251	2.336	.022
Age(in years)	.052	.428	.670
Educational Level	.105	.899	.372
Years in U.S.	.085	.742	.461
Barriers to Healthy Eating	-.107	-.993	.324
Motivators to healthy eating	-.008	-.069	.945
Religion	-.138	-1.159	.250
Vegetarianism	.091	.835	.407
Nutrition Knowledge	.067	.641	.524
Family History of Chronic diseases	-.076	-.717	.476
R^2= 0.356; F-value = 2.980; Significance = 0.002			

R^2 calculated from multiple (linear) regression analysis

Barriers to healthy eating were identified from responses to nine barrier options; it is not a priority for me, healthy foods are expensive, healthy foods do not taste good, my family would not eat it, I do not want to give up cultural traditions, I have a very busy life, healthy foods take time, healthy foods do not look good, non-supportive friends/family. A point was scored for each barrier marked by the respondent. Higher score represented more barriers to adherence for a healthy diet.

Motivation for healthy diet measured by nine different motivators for healthy eating: I want to lose weight, becoming a better role model for my kids, prevent getting certain diseases, I can find quick healthy recipes, family members are willing to change, I am diagnosed with a disease or illness, someone close is diagnosed with a disease, if restaurants offered more healthy, if somebody else cooked it. , items summed for a motivation score (range 0-9); higher score indicated more factors necessary to motivate the individual for healthy diet.

Nutrition Knowledge assed by a question "Which of the following has highest calories? Response options were fat, carbohydrate or protein.
Nutrition behavior was computed from the nutrition subscale of the revised Health Promotion Lifestyle, Profile II and included 9 items that measured the frequency of self-reported nutritional behaviors based on the Food Guide Pyramid recommendation. The items were scored from never (1) to always (4) with a higher score indicative of healthier dietary behaviors.

4. DISCUSSIONS

The primary findings of this study were that only BMI and food label use significantly predicted healthy dietary behaviors among the participants. It was also seen that obese people had a healthier dietary behavior as compared to their peers. This may be because obese individuals are either advised by their physicians to eat a healthy diet due to their own medical history and secondary prevention activities or they themselves are trying to prevent chronic disease given their higher body weight by following healthy dietary behaviors. Although not shown in the results section, it was interesting to note that 50% of obese South Asians, who were also highly educated, had poor nutrition knowledge of calorie content as indicated by them selecting carbohydrate as having the highest calorie from the 3 macronutrient. But in contrast, the obese individuals were more likely to agree/strongly agree to using food labels in their daily diet and considering that a useful tool. Misperceptions were also noted between their actual and personal weight status. About 10% of the participants who perceived themselves to be of normal weight were actually obese according to BMI calculated from self-reported height and weight.

Those who perceived themselves to be overweight also had a higher dietary behavior score as compared to other normal weight South Asians. Nutrition behavior was also found to be associated with barriers for eating healthy. Individuals who reported a lower barrier tended to have better dietary behavior and vice versa. Healthy dietary

behavior was also significantly associated with family history of chronic diseases .In other words, South Asians who were aware of their family history tended to follow healthier dietary habits. A significant association was also observed between those who used food label and having motivating factors to eat a healthy diet. A plausible explanation is that motivation to follow a healthy diet requires use of food labels in healthy diet planning and is consistent with the study of Kreuter et al. who showed this in his study. [27] Additionally, South Asians who lived in the U.S. for a longer time reported the use of food labels. This is relevant because in South Asian countries, the food labeling law and regulations are not as strictly followed as in the U.S. Besides greater information obtained on the nutrient composition using the food labels, studies confirm that label users have a low fat, low cholesterol and higher fruit and vegetable intake .[28]The results concur with prior studies as label users in this study have better dietary behavior.

These findings will help health care practitioners ,dietitians and physicians in creating culturally appropriate diet plans and nutrition education programs for a high risk ethnic group growing at a fast pace in the U.S. There is a distinct requirement for culturally specific educational interventions specifically for minority ethnic groups, including South Asian populations[29]. It also highlights the diversity of South Asians. Variations occur in terms of religion, westernization, dietary habits and nutrition knowledge. Although not mentioned in results, data presented that more Hindus were vegetarians compared to the vegetarians in Muslim population suggesting that religion might impact food habits.

A cross sectional study by Jonnalagadda et al. examined acculturation, behavioral risk factors, BMI, and chronic disease prevalence of middle aged and older Asian Indian immigrants in the U.S.[30] The study found that 52% reported normal weight, 41% reported being vegetarians, 55% reported performing aerobic activity in daily life, and 5% reported being smokers. The most common reported chronic diseases were hypertension (31%) and diabetes (18%). Being young, longer residency in the U.S., and American identity were found to be associated with greater levels of physical activity.

The participants in this study were highly educated with almost 95% participants having college education. This is consistent with reports by Census Bureau which indicates that Asian Indian immigrants in the U.S. are highly educated with the average educational attainment of a bachelor's degree or higher.[7] A widely recognized risk factor for poor health is BMI, which among immigrants is influenced by adaptation to new environments, dietary intake, physical activity, and demographic characteristics such as age, sex, and socioeconomic status. [9-11,18,31-34] The mean BMI of respondents in this study was 22.79±3.55 kg/m^2 which was in the healthy range for this population and those with a higher BMI significantly had healthier nutrition behaviors than their peers.

Immigrants in general and South Asians immigrants in particular are affected by acculturative stress and westernized lifestyle after they immigrate to the U.S. Food habits changed among 50% of the participants .Research shows that individuals tend to switch from plant based diet to a meat based, western diet which often means a shift from a low fat and high fiber diet to a high fat, low fiber diet. Immigrant status is also linked with

overweight and obesity. The problem of overweight and obesity affects natives of these South Asian countries more when they immigrate to the United States .[23] However, this difference in being more prone to being overweight and obese did not remain over a longer period of time. Similar effects were seen in this study for participants who were living in the U.S. for >5 years and these results concur with the results of Singh et al.[23] Hence, more nutrition education programs are needed for the group of South Asians who have lived for a longer time in the United States.

There were several limitations of this study. A convenience sample was used and sample size was also small. Other limitation was that the responses to the questions were self-reported by the participants. There is potential for underreporting, over-reporting or both for self-reported weight and height. Even though the response rate was very high but some of the questions were not answered.

5. CONCLUSIONS

More research is needed to study dietary behaviors and nutrition knowledge in South Asians. Studies are needed to find effective ways to educate South Asians about western diet, moderation in intake of certain foods, portion control, benefits of physical activities, barriers to healthy eating and motivating factors which encourage healthy eating. Future studies may involve anthropometric measures such as weight and height, body fat % and assessment of their food intake and frequency to evaluate macro and micro nutrients. Also variations in diet can be examined by religion and weight status to confirm the results. Intervention studies should be carried out with control groups of South Asian immigrants and second generation South Asian Americans to determine if culturally tailored programs can improve nutrition knowledge and dietary behaviors.

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APPENDIX A.SURVEY INSTRUMENT

Dietary Behaviors and Nutrition Knowledge Questionnaire

Demographics:

1-Nationality: _____   2- % Body fat:_____

3-What is your gender?   Male □   Female □

4-Age(in years): _____   5-Weight: _____   6- Height:_____

7-Religion: Christian □   Hindu□   Muslim □   Other □
(if you choose "Other ", please specify_____)

8-Marital Status: Single□   Married □   Have a partner□

9-Are you: Vegetarian □   Vegan□   Non-Vegetarian □

10-Education Level (Check one) :

    High school or less□   Some College or Bachelors □   Graduate
    education or Professional degree □

11-How many people live with you now?

    _____Adults (18 years or over)   _____Children   _____Parents

12-Are you currently:

    Employed for wages   □   Self-employed □   Out of work □

    Homemaker □   Student □   Retired □   Unable to work □

13-Were you born in the USA?

    Yes (If yes, please skip the next question)

    No (If No, How many years have you lived in the US?)   _____years

<u>Nutrition/Dietary Behavior</u>

1-Has your diet changed since you came to the US?

     No

     Yes   If Yes, please specify_____

2-How do you consider your weight compared to others of your age?

     Underweight□   Normal□   Overweight□   Obese □

3-Has your weight changed after coming to the U.S?

     Increased □   Decreased □   Remained the same □

4-How many times in a week do you get at least 30 minutes of any physical activity (walking, exercise, playing sports, gardening etc.)?

     None □   <2 times/week □   3-4 times/week □   5 or more times/week □

5-Do you eat fast food?   Yes□ No□   (If Yes, where do you frequently go: _____)

6-How often do you eat fast food or eat outside food per week?

     None □   < 2 times □   3-5 times □   >5 times □   Everyday □

7-Which of the following meals do you eat by yourself(alone)?

     Breakfast□   Lunch□   Dinner□   Snacks□

8-Do you use Nutritional Supplements?   Yes□ No□   If yes, please specify_____

9-How do you keep yourself healthy? Please specify below

Dietary Habits:

_____

Physical Activity:

_____

Mental/Spiritual:

_____

10-How often do you use diet products (e.g. skimmed or low fat dairy products, sugar free, etc.)?

Never □   Rarely□   Some times a week□   Everyday□

11-How often do you eat traditional foods per day?

None□ Once a day□   Twice a day□   3 or more times a day□

12-Do you have any dietary restrictions?

Low sodium (e.g. for heart disease) □   Low sugar (e.g. for diabetes) □

Low fat(e.g. for blood pressure) □   Allergies (Nuts, seafood, soy, etc.) □
None□

13-How often do you consume alcohol?

Never□   Only on weekends□   Daily□   Rarely/Occasionally□

14-What type of food do you consume? (Check all that apply)

_____Home cooked   _____Restaurant food   _____Fast-food   _____Snacks

15-The following questions in this section are about your personal habits. You will answer either Never, Sometimes, Often, or Always to indicate how often you engage in each behavior. Circle the answer that is the most appropriate

#	Questions	Never(N)	Sometimes(S)	Often(O)	Always(A)
1	How often do you choose a diet low in fat, saturated fat, and cholesterol?				
2	How often do you limit your use of sugars and food containing sugar (sweets)?				
3	How often do you eat 6-11 servings of roti, nan, parathas, rice, idli, etc.?				
4	How often do you eat 2-4 servings of fruit each day?				
5	How often do you eat 3-5 servings of vegetables each day?				
6	How often do you consume 2-3 servings of milk, buttermilk, or curd each day?				
7	How often do you eat only 2-3 servings from the meat, poultry, fish, eggs, and nuts group each day?				
8	How often do you read labels to identify nutrients, fats, and sodium content in packaged food?				
9	How often you eat breakfast?				
10	How often do you use artificial sweeteners (for example: Splenda, Equal, etc.)				

Health Behaviors

1-Do you use tobacco products? (e.g. cigarettes, bidi ,pan, gutka ,cigars, etc.)

Never☐   1-2 times a day☐   >3 times a day☐   Only occasionally☐
Few times a week☐

2-How many hours of sleep do you get per day?

<5 hrs.☐   5-6 hrs.☐   7-8 hrs.☐   >8 hrs.☐

3-Rate your general stress levels from 1-5, with 5 being the highest (Circle one)

1   2   3   4   5

Family/Personal History

Do you have any of these diseases or have a family history of illness of any of the following (please do not include spouse and his/her family members)?

Condition	You	Brother	Sister	Father	Mother	Grandparents/ uncles, aunts, etc.)
Diabetes						
Heart disease						
High blood pressure						
Stroke						
Kidney problems						
Cancer (please specify what kind)						
Jaundice(Hepatitis)						
Arthritis						
High Blood Cholesterol						
Thyroid problems						
Depression						

Barriers/Motivation:

1-What are the main reasons that prevent you from eating a healthier diet?

_____ It is not a priority for me   _____ I have a very busy life

_____ Healthy foods are expensive   _____ Healthy foods take too much time to make

_____ Healthy foods do not taste good   _____ Healthy foods do not look good

_____ My family would not eat it   _____ Non Supportive friends/family

_____ I do not want to give up cultural traditions   _____ I already eat a very healthy diet

2-What would motivate you to eat a healthier diet?

_____ I want to lose weight   _____ I am diagnosed with a disease or illness

_____ To become a better role model for my kids   _____ Someone close is diagnosed with a disease

_____ To prevent getting certain diseases   _____ If restaurants offered more healthy foods

_____ I can find quick healthy recipes   _____ If somebody else cooked it

_____ Family members are willing to change   _____ I already eat a very healthy diet

Nutrition Knowledge:

1-The Nutrition Facts label that appears on most food packages is a useful tool for consumers. Do you?

Strongly Agree☐   Agree☐   Disagree☐   Strongly Disagree☐

2-Which of the following has the most calories per gram?

Protein☐   Fat☐   Carbohydrate☐

3-When you eat a food, do you use the information on the "Nutrition Facts" label to help you fit that food into your daily diet?

Strongly Agree☐   Agree☐   Disagree☐   Strongly Disagree☐

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