Snacking behavior in adolescents and adults in the United States

by

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B.S., University of Costa Rica, 2011
M.Sc., Kansas State University, 2015

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Food, Nutrition, Dietetics, and Health
College of Health and Human Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2019

Abstract

Understanding snacking behavior in adults and adolescents is important for developing effective marketing campaigns and health interventions. This research provides information about the main motivations to consume different snacks in two age groups. An online survey was conducted with 1551 adults. The reported snacks were classified into 11 groups: sweets, salty snacks, baked products, refined grains, beverages, sandwich or wraps, meats, bars/nuts or seeds, fruits, dairy products, and vegetables. Based on the main motivations to be consumed, these snacks were organized in 3 clusters. Cluster 1: “fun for you" snacks included sweets, salty snacks, and baked products. The main motivations associated with this group were price, social image, social norms, sociability, and affect regulation. Cluster 2: “good for you" snacks included vegetables, dairy products, fruits, and bars/nuts & seeds. The main motivations associated with this group were natural concerns, weight control, and health. Cluster 3: included refined grains, beverages, meats, and sandwich or wraps. The main motivations associated with this group were choice and visual appeal. Motivations to consume different snack groups can vary depending on factors such as gender, race/ethnicity, sociodemographic background, and the place where people live. This research also provides information about the motivations to consume different snack groups based on gender, ethnicity, U.S. region, and annual household income. Results showed that liking and choice were the strongest motivations to consume snacks in all four groups. Convenience, natural concerns, need & hunger, health, weight control, habits, pleasure, and traditional eating were the main motivations to consume “good for you” snacks such as dairy products, fruits, bars, nuts & seeds and were mentioned differently depending on each group. Pleasure, affect regulation, sociability, social image, habits, traditional eating, need & hunger,

and visual appeal were related to “fun for you snacks¨ such as salty snacks, baked products, and sweets and were also mentioned differently depending on each group.

Snacking behavior in adolescents is a complex process that can be influenced by many different factors. To understand this behavior a study was conducted using an online survey with 1050 adolescents from 13 to 17 years old. This survey included questions related to the snacking behavior of this population using a slightly modified version of the Eating Motivation Survey (TEMS) and the Kids-Palatable Eating Motives Scale. These snack groups were grouped into clusters (three clusters in total) based on their similarity with the 16 motivations from TEMS and the Kids-Palatable Eating Motives. Cluster 1 was considered the group of “fun for you” snacks. These snacks were associated with the following motivations: liking, pleasure, affect regulation, sociability, and social image. Cluster 2 was considered the group of “good for you” snacks and was associated with motivations liking, weight control, natural concerns, health, and traditional eating. Cluster 3 was considered the group of “mixture snacks” and was associated with the motivations of liking, need & hunger, and visual appeal. Knowing the motivations to consume certain types of snacks is important because it can help in developing the right strategies for adults and adolescents based on the reasons that are important for each group.

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Acknowledgements

I would like to thank my major advisor Dr. Delores Chambers, for all your support and assistance and my committee members Dr. Edgar Chambers IV, Dr. Kadri Koppel, and Dr. Uyen Phan for supporting me during the completion of this research. I feel so fortunate I had the chance to work at the Center for Sensory Analysis and Consumer Behavior. I truly appreciate every opportunity I had during the last six years. Dr. D and Dr. E you have been my mentors since the beginning of my life here at K-State, I have no words to express my gratitude, this has been a wonderful journey thanks to you both. I also want to thank the University of Costa Rica for the financial support they gave me during the last six and a half years.

To my parents for all their support and encouragement. Thanks for always believe in me. It has been hard to be far away from home, but we always have made it work and figure it out how to stay in touch. Thank you to my dear husband, Kenny, who has always been here with me throughout this process; without him, I would not be able to finish this degree. To my beautiful son Gabriel who is my everything, my motivation, my reason to continue even in the most challenging days. To our little Santiago, who worked very very close to me during the last nine months, we do not know you yet, but we love you immensely, thank you for letting Mami finished this dissertation, we were definitely the best team!

Finally, I would like to thank all the graduate students that have worked with me during the last almost seven years. Brizio, Uyen, Curtis, Sirichat, Federica, David, Hannah, Brendan, Adriana, Thao, Ilze, Tyler, Melissa, Meetha, Porranee, Congcong, Gongshung, Weilun, Denis, Huizi, Rajesh, Jessie, Stephanie, Taylor. I have learned a lot from every single one of you. You guys made the lab a better place to be.

Chapter 1 - Literature Review

Snacking is a common practice in the United States. Usually, people describe a snack as a type of food that is usually eaten in between the main meals (breakfast, lunch, and dinner). Previous studies have defined eating events as main meals and snacks, describing main meals as structured meals and snacks as unstructured eating events between meals (Ovaskainen et al., 2006). The study of the types of snacks consumed in different populations is essential because high energy-low nutrient snacks can contribute a substantial amount of calories in the diet and increase the risk of obesity, diabetes, and other metabolic diseases.

Snack concept

Snack products may be challenging to define, as several articles have mentioned different definitions for snacks. For this reason, before beginning any study related to snack behavior, it is necessary to clearly define the term "snack" and the specific criteria to be used to measure the consumption of this food group. Snacks have been defined based on the caloric consumption, social interactions, and/or time of day the snack is consumed (Chaplin & Smith, 2011; Marmonier, Chapelot, Fantino, & Louis-Sylvestre, 2002).

Defining the concept of what a snack is can be complicated; it may have different interpretations depending on the culture or age group. For example, in England, "a snack" refers to different eating occasions and is different from the word "snacking." "Snacking" refers to the consumption of particular types of foods (Chamontin, Pretzer, & Booth, 2003). In a study conducted in Scotland in 2009 with school-aged children the authors defined snack as an eating event containing non-core foods or drinks. Non-core foods include food such as cake, soft drinks, ice cream, biscuits, chips, and confectionery (Macdiarmid et al., 2009).

There is not a clear definition of what constitutes a snack or an eating occasion. Different articles, depending on the country and age group, define and use the word "snack" differently. A recent study conducted with US adults referred to snacks as any drink or extended consumption that was not reported as breakfast, brunch, lunch, supper, or dinner. These researchers also classified snacks depending on the mealtime. A snack was classified as any eating occasion that did not happen between 6 am to 10 am, 12 pm to 3pm, and 6 pm and 9 pm (Murakami & Livingstone, 2016). The same classification was used in a study conducted in Brazil. This study also classified a snack as any eating occasion that did not occur between the same times mentioned in Murakami & Livingstone's study (Duffey, Pereira, & Popkin, 2013).

Another study conducted with adults in the US classified snacks as any eating occasion that happens before breakfast, between breakfast and lunch, between lunch and dinner, and after dinner (Kant & Graubard, 2015). A simplified concept for snack food is defined as products that are consumed between the three traditional meals of the day, which are breakfast, lunch, and dinner (Forbes, Kahiya, & Balderstone, 2016). Gatenby (1997) defined a "snack" as food that is consumed over fifteen minutes, meals that are smaller than the main meals, or the ones that are less structured and occur spontaneously.

A study conducted in 2002 proposed a different definition for snacks. These researchers recommended that snacks be classified based on metabolic findings. The authors defined snack as an eating episode not triggered by hunger. They based this definition on the statement that energy substrates provided by the main meals compared with a snack are different (Marmonier et al., 2002).

Even though there is not a clear definition of what a snack is, the literature suggests that snacks contribute to about 15-20% of the daily energy intake and about 15-20% of the daily mineral intake and 13-17% of the daily vitamin intake (Chaplin & Smith, 2011).

Snacking behavior in different age group populations

Adults

The consumption of snack products has increased recently; new trends show that instead of just eating the three main meals each day (breakfast, lunch, and dinner), it appears that people prefer to eat smaller amounts of food more frequently (Chaplin & Smith, 2011; Forbes et al., 2016). Snacking behavior in adults around the world seem to follow a similar pattern. In Northern Ireland, the most common snacks consumed were savory snacks such as potato chips, or breadsticks, bakery products, sweets, and chocolate. In Finland, the main consumed snacks were classified as sweet bakery, sweets, chocolate, bread, milk and milk products, coffee or tea, water, and interestingly alcoholic beverages (Ovaskainen et al., 2006). A study conducted in Norway showed that the top five energy-contributing food groups from snacks were cakes, fruits, sugar/sweets, bread, and also alcoholic beverages (Myhre, Løken, Wandel, & Andersen, 2015). In the United States, studies have found that fruit, cookies, ice cream, popcorn, soft drinks, crackers, milk, tea, yogurt, candies, nuts/seeds, desserts, and salty snacks were the preferred types of snacks (Hess, Julie, Rao, & Slavin, 2017; Piernas & Popkin, 2010). In China, fruits, grains, and beverages were the most popular snacks and higher contributors to snacking energy, according to a study conducted in this Asian country (Wang, Zhai, Zhang, & Popkin, 2012). As noted from these studies, even if adults lived in different parts of the world, their snacking choices were similar.

Knowing these similarities in snacking choices is interesting, but it is also essential to know what the motivations behind those choices are. According to McGill and Appleton (2009), pleasure was the main reason that people consumed snacks, followed by hunger, availability, and convenience. Other studies have found more motivations to explain snack eating behavior in adults. Literature suggests that adults are more aware of their food choices and tend to be more concerned about what they are eating than other groups such as adolescents. Motivations for eating a particular snack food were found to be related to their health, animal welfare, and the state of the physical environment (Forbes et al., 2016). Other differences between adults and younger people include the frequency of eating times, which, on average, is 6.5 for adults and 6 per day for young people (Chaplin & Smith, 2011).

Adolescents

Motivations to consume a specific type of snack in adolescents are different from the motivations in adults. Adolescents represent a particular group because their parents, school peers, and friends influence their eating behavior and motivations to consume certain types of food (Johnson, Wardle, & Griffith, 2002). Another unique situation with adolescence is that this is a time when they start to have money of their own, become more independent and want to make their own decisions regarding the types of food they want to eat.

Previous studies have shown that adolescents are economically active as to have enough money to purchase snacks and even consume snacks more often than adults. Research indicates that if an adolescent helps in food preparation in their home, they are motivated to consume healthier foods (Johnson et al., 2002). A study conducted in 2006 showed that adolescents or young adults that prepare their food frequently consume less fast food and were more likely to consume food with less amount of fat, more calcium, and had a higher consumption of

vegetables and whole-grain products (Larson, Nicole I., Perry, Story, & Neumark-Sztainer, 2006).

However, with this new sense of independence, other issues arise. In the United States, 35% of the 12-19-year-old adolescents are overweight or are diagnosed with obesity, having BMIs at the 85th percentile or higher (Ogden, Carroll, Kit, & Flegal, 2014). Adolescents are exposed to high-calorie foods and might feel more tempted to consume more unhealthy snacks due to motivational reasons more than just to meet energy needs. Previous studies have found that the most popular snacks chosen by young people, especially teenagers, include junk food that is low in nutrients and usually high in calories. Some of the options include candy, bakery, ice cream, and carbonated beverages (Gillis & Bar-Or, 2003).

Snacking behavior and health outcomes

Snacking behavior has been used to analyze dietary patterns, especially in the study of the prevalence of overweight and obesity. Snacks can contribute to an increase in daily calorie intake. Previous studies have shown that snack items are often highly processed food that tends to be higher in added fat, added sugar, and salt (Duffey et al., 2013). Studies also indicate that snack foods tend to represent a significant contributor to an increase of the energy intake, mainly due to a recent increase in the frequency of eating/drinking occasions that are classified as snacking (Duffey et al., 2013; Duffey & Popkin, 2011; Piernas & Popkin, 2010).

Previous research described snacking behavior as a harmful habit because it could increase the necessity to consume food, also known as hyperphagia. Usually, this necessity to regularly consume food is related to poor quality foods, higher in calorie content, fat, and sugar (Gatenby, 1997). However, this behavior is not necessarily bad if the food that is consumed is considered of high nutrient quality, such as dairy products, fruits, or vegetables (Gatenby, 1997).

The increase of accessibility to bigger supermarkets and advertisements promoting highly processed food items are just a few of the factors that have been linked with an increase in higher calorie products consumed during snack time (Duffey et al., 2013). Other factors that have been associated with snack behavior and the risk of overweight or obesity are late-night snacks, greater intake of energy-dense salty snacks and sweetened high energy beverages, and increased portion sizes of snacks. Also, many of these products tend to be low in protein content (Erlanson-Albertsson & Zetterström, 2005; Piernas & Popkin, 2010). The increase of snacking behavior has been associated with a higher risk of energy imbalance and increased overweight and obesity (Piernas & Popkin, 2010).

A study conducted with 195 Caucasian children and adolescents ages 4 to 16 years in Canada showed that children with a normal weight tend to consume healthier snacks such as cheese or crackers. However, the ones that were classified as overweight or obese tend to consume high-calorie foods such as potato chips, meat sandwiches, and sweetened fruit juices (Gillis & Bar-Or, 2003).

Based on the literature reviewed, snacking could be considered as a positive behavior or negative behavior depending on the type of food that is consumed. Some studies have associated snacking behavior with a reduction in blood cholesterol and improved glucose tolerance (Bellisle et al., 2003).

Food choice process

Food choice behavior is complicated because many factors influence this process. Several psychological theories include perception, learning and memory, motivation and emotion, decision-making, cognition, and social behavior as the main factors that should be understood to explain the food choice behavior (Köster & Mojet, 2010).

The Wills and Holmes-Rovner's Simplified Model of Decision Making gives a possible explanation for the decision-making process which includes information, values, preferences, decision, behavior, and outcomes (Dobal, Wesley, & Wilson, 2018). This process model explains how individuals receive information before making a decision; which in turn interacts with the values of each individual. This interaction leads to preferences that influence the final decision. However, this process was adapted to a more dynamic model, where the information, values, and preferences interact between each other and the environment as an additional factor (Dobal et al., 2018).

This interaction could explain why different age groups respond differently to food choices. The environment for adolescents is very different to the environment experienced by adults. In the same way, adults of different backgrounds that live in different environments will potentially have different food choices.

Factors influencing decision making about food

People could be motivated to consume certain types of foods based on different influences such as culture, social situations, physiological factors, and cognitive aspects (Scheibehenne, Miesler, & Todd, 2007). However, the final decision to choose one type of food over the other is an integrated process that also includes some elements such as the sensory appeal of food, weight control, convenience, nutritional value, emotional comfort, familiarity, and price (Kaya, 2016).

To make the process easier to understand, some authors differentiate this group of factors as food-internal aspects or intrinsic factors and food-external aspects or extrinsic factors (Forbes et al., 2016; Furst, Connors, Bisogni, Sobal, & Falk, 1996; Scheibehenne et al., 2007). Food-internal aspects represent properties related to the food itself, such as flavor, nutrient content,

appearance, texture, and other sensory characteristics. Food-external aspects are related to the physical environment, such as advertising, prices, product packaging and individual preferences, attitudes, motives, and background (Forbes et al., 2016; Scheibehenne et al., 2007).

From the group of internal aspects of food, previous research has shown that consumer's most important factor when buying snacks is flavor (Forbes et al., 2016; Zbib, Wooldridge, Ahmed, & Benlian, 2010). Trends in the snack food market also show that consumers choose their snacks based on food products that are of easy preparation and convenient. In stress occasions, snacks can also be used as comfort food and used in parties or sports events as a way to socialize with other people (Kindle, 2002).

Differences in age, gender, and socio-economic status also play an essential role in the decision-making of food. According to literature, different age groups tend to show different reasons to consume some types of food. For example, when deciding what type of food to consume, young consumers might be less influenced by health issues when compared to older consumers (Johansen, Næs, & Hersleth, 2011).

Gender has also been associated with differences in motivations for food consumption. Females might be more concern than males about food hazards, natural foods, and health issues such as weight control and calorie content of the food. These motivations are also expected for higher education and high-income populations (Shafie & Rennie, 2012).

Research Objectives

There are many articles that try to address the motivations to consume different types of food; however, there is not much information available that helps to describe the main motivations to consume snacks or the motivations to not consume specific snacks. For this reason, the main objective of this research was to provide information about snacking behavior

in adults and adolescents in the United States. Specifically, what was eaten on various occasions, the motivations for eating a particular group of snacks, and the motivations for not eating other available snacks.

Information about physical activity and cooking patterns was also collected to understand the characteristics of these two populations (adults and adolescents). Literature has suggested that people that tend to be more active and is involved in cooking at their home have a preference for healthier choices in their food options and have lower intakes of high sugar, high-fat foods. Information collected on physical activity and cooking patterns can help to understand the motivations when choosing certain types of snacks for the population in study.

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Chapter 2 - Physical activity and eating behavior in US adults and adolescents

Abstract

Understanding physical activity and eating behavior in adults and adolescents is essential for developing effective marketing campaigns and health interventions. Physical activity and eating behaviors learned and practiced during this period will determine their future health. This research provides information about physical activity patterns and eating behaviors such as cooking and shopping in adults and adolescents. An online survey was conducted that included the following information: demographic information, level of physical activity, cooking and shopping percentage done by the participants at home, vegetarianism, participation in the National School Lunch Program, and frequency of meals outside the home and family meals per week. One thousand five hundred fifty-one adults and 1050 adolescents from all over the US completed the survey. Results showed that on a typical week, the majority of adults were physically active for three, five, and seven days. During the week, the majority of participants spend between 6 to 10 hours sitting. Differences in cooking habits were found for gender and the US region in adults. 44% of females report to cook every day, while males represent 31%. The Northeast region reported 11%, while the West region reported 5% of participants that did not cook or bake at all. The South and Midwest regions showed the highest percentages of respondents that cook or bake every day (41% and 39%, respectively). Results for adolescents showed that 71.5% of the participants were active for vigorous physical activities; 51.2% were active for strength training activities, and 79.7% received at least one day of physical education classes per week. For the eating habits, results showed that women are still in charge of most of the cooking activity at home, with a total of 74.7% of the participants reporting that the primary

female adult was in charge of cooking most of the meals. Adolescents were not that involved in shopping or preparing food at their homes. Ninety-five point six percent (95.6%) reported to do less than 40% of the household food shopping, and 92.8% reported to cook less than 40% of the time. Vegetarianism was not common in adolescents, with 95.8% of the participants reporting not being vegetarians. A total of 54.1% of respondents participates in the National School Lunch Program, with a majority of them being African American or Hispanic boys. Finally, 59.4% of adolescents reported eating at least one meal outside their home less than two days per week, and 47% eat together as a family on an average of 3 to 5 times per week. This study shows the main physical activity patterns and eating behaviors of a group of adults and adolescents from the United States, information that can help to make important decisions about appropriate strategies to addressed sedentary and poor eating habits.

Keywords: Physical Activity; Cooking habits; Food shopping.

Introduction

The busy lifestyle in urban areas has changed the way people live today. It is known that adults are living an unhealthy lifestyle with poor eating habits and low physical activity.

Previous studies in the US have shown that a large proportion of adults in the United States are sedentary [1, 2]. Differences have also been found based on gender, showing that females tend to have lower physical activity than males [2]. Age is also another critical factor. Physical activity tends to decrease with age and tends to be lower in adults, with just about 10% of adults following the 30-minute recommendation of physical activity per day or 150 minutes per week [2, 3].

Besides sedentary patterns, adults and adolescents also faced a reality of poor eating habits. However, some actions can be taken to instill good eating habits in adults and adolescents, for example, the preparation of their own meals. Food preparation habits in younger people have been associated with healthier dietary intakes and less frequency of fast food consumption [4, 5].

Another practice that can help in the formation of healthy eating habits is having family meals together. Parents are usually the first source of socialization for young kids, which means that they can be of significant influence in their eating behavior [6]. Studies have shown that having regular family meals at least five or more times per week during middle school was associated with higher consumption of fruits, vegetables, calcium, and iron-rich foods, and dietary fiber in both boys and girls [7].

The present chapter examines common practices in physical activity and eating behaviors such as cooking responsibility at home, cooking and shopping behavior, eating practices such as vegetarianism, participation in the National School Lunch Program, days per week adolescents

eat a meal outside their home, and days per week adolescents seat together and eat as a family. All these variables are analyzed by gender, ethnicity, US region, and the highest level of education for the primary female and primary male adult living at home with the adolescents. Thus, the main objective of this chapter is to provide information about physical activity and cooking patterns in adults and adolescents in the United States.

Materials and Methods

Participants

The Human Subjects Institutional Review Board at Kansas State University approved this study (#7297.3). Participants were recruited using Qualtrics database. The online recruitment process included a screener to verify the participant's qualification for the study. Criteria for adults to participate in the study were based on the following requirements: participants had to be 18 years old or older, have lived in the United States for more than five years. A total of 1551 adults from all over the country were recruited. For adolescents, to participate in the study, they have to be in the age range of 13 to 17 years old and have lived in the United States for more than five years. A consent form was distributed to obtain the parent or guardian`s permission to allow their child to participate in the study. This consent form included a small introduction, the purpose of the research survey, the procedures and questions that will be asked to the child, and also a statement of confidentiality. A total of 1050 participants were recruited from all over the country. Participants were recruited from all the States of the USA and were classified into four regions based on the United States Census Bureau.

Online survey questionnaire

Qualified adult participants were asked to complete an online survey operated by Qualtrics software (Qualtrics, Provo, UT, USA) licensed for Kansas State University. In the case of adolescents besides their qualification they also needed to obtain their parent or guardian´s permission to participate in the study. The survey included multiple questions covering various topics such as demographics (gender, age, race/ethnicity, highest education level from the primary female adult, highest education level from the primary male adult), physical activity on a typical school week, cooking percentage, shopping percentage, vegetarianism, participation in the school breakfast/lunch program, eating outside, and frequency of family meals per week.

For adolescents, the physical activity variables were categorized as physically active or insufficiently active based on the number of sessions per week of physical activity or their enrollment in physical education classes [8]. To be considered under the "active" category the following criteria must be met: 3 or more sessions of at least 60 minutes per week of vigorous physical activity, three or more sessions per week of strength training, and enrollment in physical education. The following questions were asked to study this section: "How many days do you exercise or participate in physical activity for at least 1 hour that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities", "How many days do you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting", "How many days do you go to physical education (PE) class".

Questions about the percentage of cooking and percentage of household food shopping that adolescents do at their home were categorized as less than 40%, 40-70%, and more than 70%. For the number of days per week that adolescents eat a meal outside their home and the

number of days per week that adolescents sit together and eat as a family data was reported in three categories: less than two days, between three to five days, and more than six days.

Data analysis

Descriptive statistics were used to summarize participants' demographics, physical activity, and snacking eating behaviors data. Proportion tests using Pearson's chi-squared test statistic was also performed on the data. Check-all-that-apply (CATA) count data collected for the consumption of different food groups (dairy products, eggs, fish, and meat) was analyzed using Correspondence Analysis (CA) to link these groups with the frequency of consumption per month and week. All data analysis was analyzed using XLSTAT-Sensory (Version 2019.1.1, Addinsoft, New York, USA).

Results and Discussion

Population demographics for adults

Table 2.1 shows the results for the population demographics. There are a total of 1551 participants from all over the country. There is a slightly higher number of females, with a total of 806 (52%) and 745 males (48%). The majority of participants are between 18 and 64 years old. The age group 18-34 corresponds to 46% of the participants, 35-64 is the largest age group with 49% of the participants, and the smallest age group corresponding to 65 or more, which represents only 5% of the respondents. Sixty-two percent of the participants are White/Caucasian, seventeen percent are Hispanic/Latino, and twelve percent are Black/African American. Asian participants represent 5% of the respondents, American Indian/Alaska represent 2% and Hawaiian/Pacific Islander, and Indian represent 0.4% each. 31% of participants lived in the South region of the US, 27% lived in the Midwest, 25% lived in the Northeast, and 17%

lived in the West. About the income, 33% of participants had an annual income between $50,000 and $99,999, 27% was between $25,001 and $49,999, 18% had an annual income higher than $100,000, 16% had an income lower than $25,000, and 6% prefer not to answer.

Table 2.1 Demographic information representing the participants in the study (N=1151)

Category	Number of Participants	Percentage (%)
Gender		
Males	745	48
Females	806	52
Age		
18-34	707	46
35-64	762	49
65 or more	82	5
Race/Ethnicity		
Hispanic/Latino	257	17
White/Caucasian	964	62
Black/African American	190	12
Hawaiian/Pacific Islander	6	0.4
Asian	76	5
American Indian/Alaska	34	2
Indian	6	0.4
Prefer not to answer	18	1
US Region		
Northeast	380	25
Midwest	417	27
South	488	31
West	266	17
Annual Income		
Less than 25000	251	16
25001-49999	420	27
50000-99999	515	33

More than 100000	272	18
Prefer not to answer	93	6

Population demographics for adolescents

Table 2.2 shows the results for the population demographics. There were a total of 1050 participants from all over the country. There was a higher number of females, with a total of 552 (53%) and 498 males (47%). Sixty-seven percent of the participants were White/Caucasian, twelve percent were Hispanic/Latino, and thirteen percent were Black/African American. Asian participants represent 3.8% of the respondents, American Indian/Alaska represents 1.3%, and Hawaiian/Pacific Islander and Indian represent 0.8% and 0.6, respectively. Participants were recruited from all the States of the USA and were classified into four regions based on the United States Census Bureau. Eighteen percent of participants lived in the Northeast region of the US, twenty percent lived in the West, twenty-two percent lived in the Midwest, and forty percent lived in the South. The education level of both the primary female and primary male adult in the household was also explored. For both, a majority of participants reported that college was the highest level of education completed by the primary parent/guardian (42% for female adults and 35% for male adults). High school was the next with 32% for female adults and 34% for male adults. For female adult graduate school represent 12%, less than high school 11%, and I do not know was the lowest with only 3%. For male adults, the distribution was slightly different. Graduate school represented 12%, “I do not know” was 11%, and “less than high school” was the lowest with 8%.

Table 2.2 Demographic information

Category	Number of Participants	Percentage (%)
Gender		

Males	498	47
Females	552	53
Race/Ethnicity		
Hispanic/Latino	131	12
White/Caucasian	706	67
Black/African American	140	13
Hawaiian/Pacific Islander	6	0.8
Asian	38	3.8
American Indian/Alaska	12	1.3
Indian	4	0.6
Prefer not to answer	13	1.5
US Region		
Northeast	187	18
Midwest	232	22
South	419	40
West	212	20
Education Level (Female Adult)		
Less than high school	111	11
High school	340	32
College	444	42
Graduate school	130	12
I do not know	25	3
Education Level (Male Adult)		
Less than high school	84	8
High school	356	34
College	367	35
Graduate school	131	12
I do not know	112	11

Physical activity and eating patterns in adults

Physical activity

Participants were asked a few questions about the number of days they were active for at least 60 minutes. On a typical week, the majority of respondents were physically active for three, five, and seven days (15.9%, 20.4%, and 20.9%, respectively). Based on gender, the majority of females were physically active 5 days a week (19%), and the majority of males were physically active 7 days a week (24.6%). The number of hours spent sitting during the week and the weekend was investigated. During the week, the majority of participants spend between 6 to 10 hours sitting (44.7%). These numbers were similar for females and males. During the weekend, the majority of participants also spend 6 to 10 hours a day sitting (42.9%); however, males were more active than females during the weekend. Males reported spending 0 to 5 hours sitting (43.1%), while females reported 6 to 10 hours sitting (41.2%).

The current study found that men tend to be more active than women. This is in accordance with previous literature that has found that men tend to achieve physical activity recommendations easily when compared to women [3]. However, it is important to mention that physical activity can be measured with several different methods and this can cause differences in the results.

The most common methods to collect data about physical activity in adults are self-report questionnaires and accelerometer data [3]. Accelerometer data have revealed low levels of physical activity participation, while self-reported data from questionnaires tend to be more positive and usually show higher levels of physical activity [3]. This could explain why our results show that most of the adults reported being active for five and seven days.

Eating behaviors

Cooking or baking at home

Figure 2.1 provides information about the percentage of participants that cook or bake at their home based on gender. There was a significant association between the gender of respondents and the cooking or baking frequency ($p<0.0001$). The main differences in gender were more evident for respondents that cook or bake every day, where 44% of females report to cook every day, while males represent 31%. Significant differences were also observed for once or twice a week and not at all cooking or baking at home. For both, the majority of respondents were males showing 17% for cook once or twice a week and 10% for not at all cooking, while females reported 11% for cook once or twice and 5% for not at all cooking.

It is common nowadays that people cook less frequently at home. A busy lifestyle, longer working hours, after-work social activities, convenient delivery food services, or simply because they do not know how to cook are some factors that are causing people to stay away from the kitchen. According to previous research, people in the United States cook less frequently and spend less time in the kitchen [4]. The US population prefers to eat out more frequently and cook less at home [9]. Snacking behaviors have been associated with less time cooking or baking [5]. An increase in snacking times and calories consumed per snack occasion have been associated with decreased time spent cooking because people prefer portable pre-packaged snacks more than regular larger meals [5, 6].

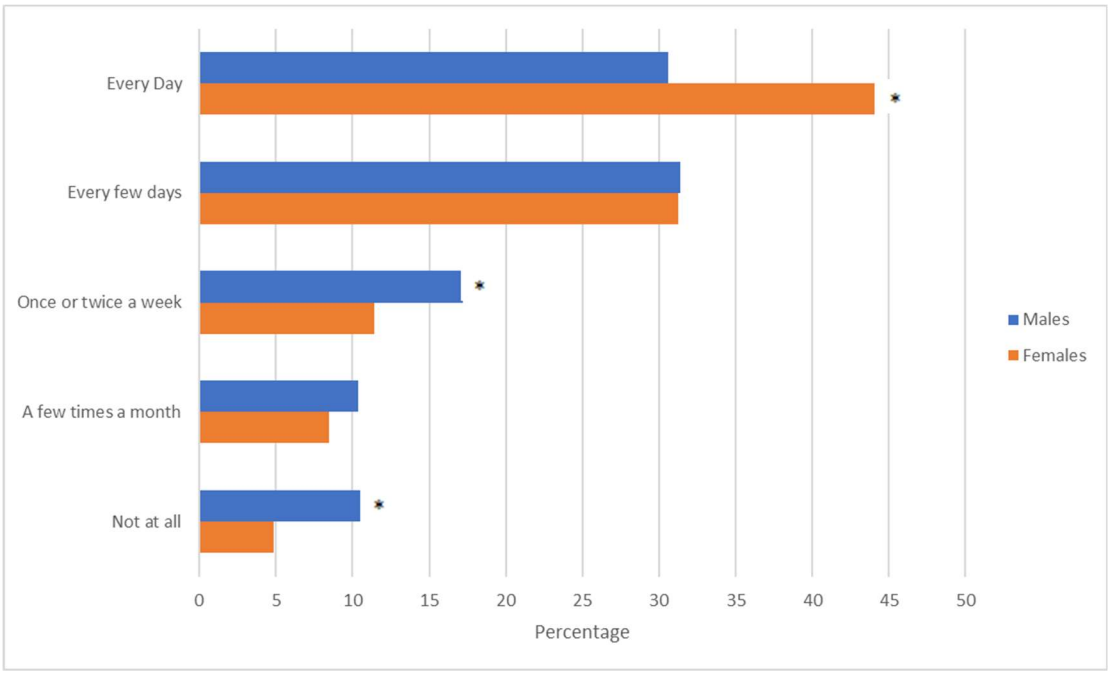


Figure 2.1 Percentage of respondents that cook or bake at their home based on gender.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Figure 2.2 presents the information about "cook or bake at home" based on age group. There was also a significant association between the age group of respondents and the cooking or baking frequency (p=0.000). Respondents in the range of 18-34 and 35-64 had a similar frequency of cooking or baking responses (except for cooking every day that was slightly higher in the 35-64 group). However, the group of 65 or more had a significantly higher percentage of respondents that did not cook or bake at all or that just cook every few days.

According to literature, historically in the United States, family meals were once considered an important daily ritual that included cooking and involved the entire family no matter what their age group was [7]. However, this pattern is changing due to a different social context of family meals that have changed over the last decades, mainly because women have entered the workforce [7]. This could explain why our results showed that younger generations such as those individuals between 18 to 34 years old are cooking less, same for people older than 65 that are not cooking at all.

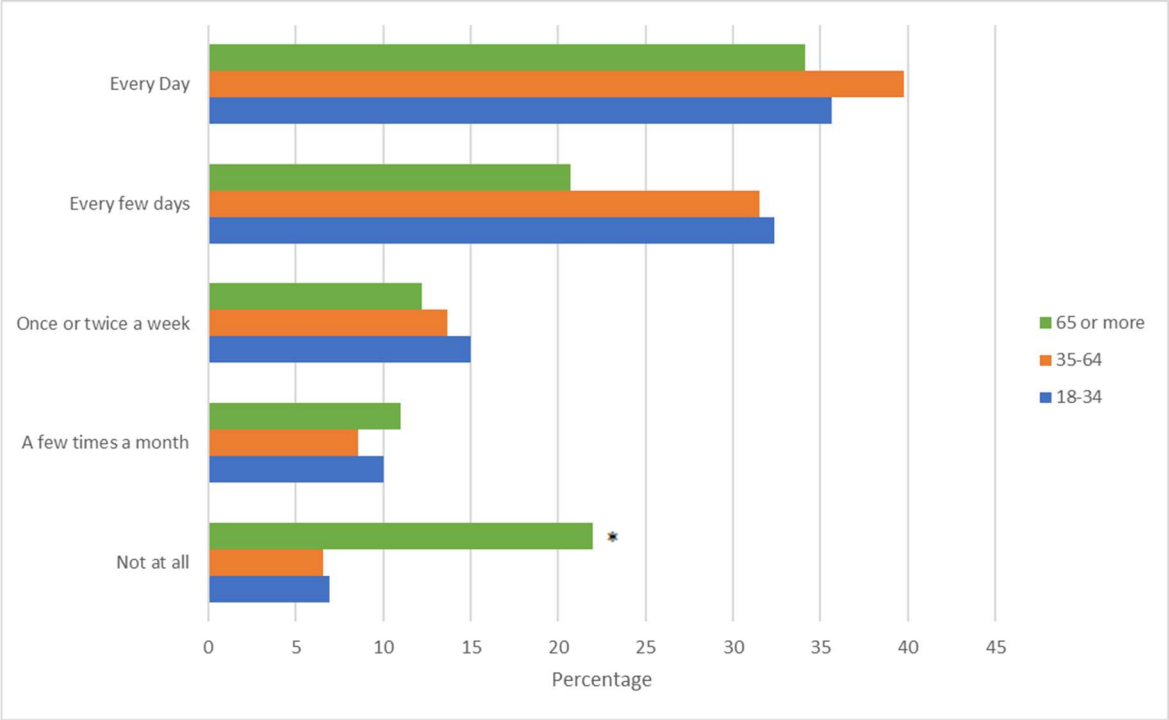


Figure 2.2 Percentage of respondents that cook or bake at their home based on age group

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

The percentage of respondents that cook or bake at their home was also evaluated based on the race/ethnicity, annual income, and US region. The first two groups did not show a relationship with the cooking frequency; however, there was a significant association between the US region and the cooking or baking frequency (p=0.029). This relationship was more evident for respondents that did not cook or bake at all, showing a significant difference between the northeast and the west region of the country (Figure 2.3). The Northeast reported 11%, while the West region reported 5% of participants that did not cook or bake at all. The South and Midwest regions showed the highest percentages of respondents that cook or bake every day (41% and 39%, respectively).

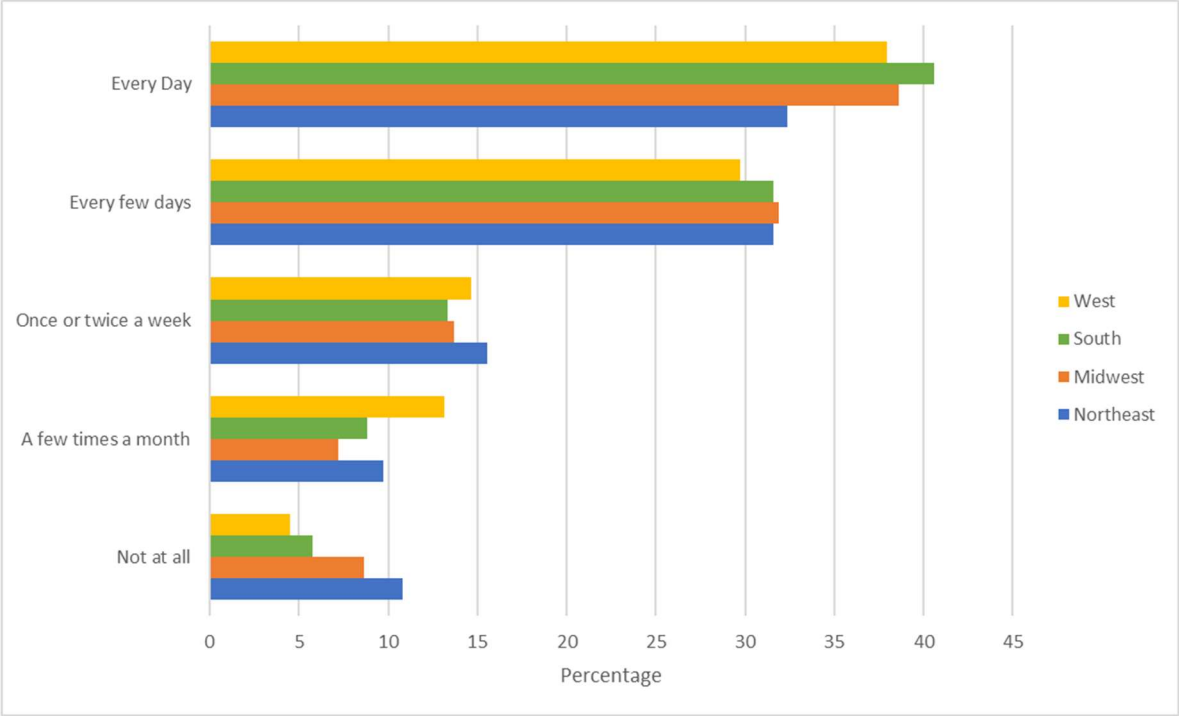


Figure 2.3 Percentage of respondents that cook or bake at their home based on US region

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Physical activity and eating patterns in adolescents

Physical Activity

From the totality of adolescents who completed the survey, 71.5% were classified as active for vigorous physical activity (for example, basketball, soccer, running, or similar aerobic activities). 51.2% were classified as active for strength training activities (for example, push-ups, sit-ups, or weightlifting). A more significant percentage was classified as active for physical education (PE) classes, with 79.7% of the participants receiving at least one day of PE classes per week.

Based on these results, a high number of adolescents are meeting the recommendation of physical activity from the 2018 Physical Activity Guidelines [9]. This recommendation states that children and adolescents should participate in muscle-strengthening and vigorous physical activities for 60 min at least three days per week [8, 9]. Physical activity during early stages in

life is critical because it has been associated with less cardiovascular disease risk and also a lower risk of chronic disease development [10, 11].

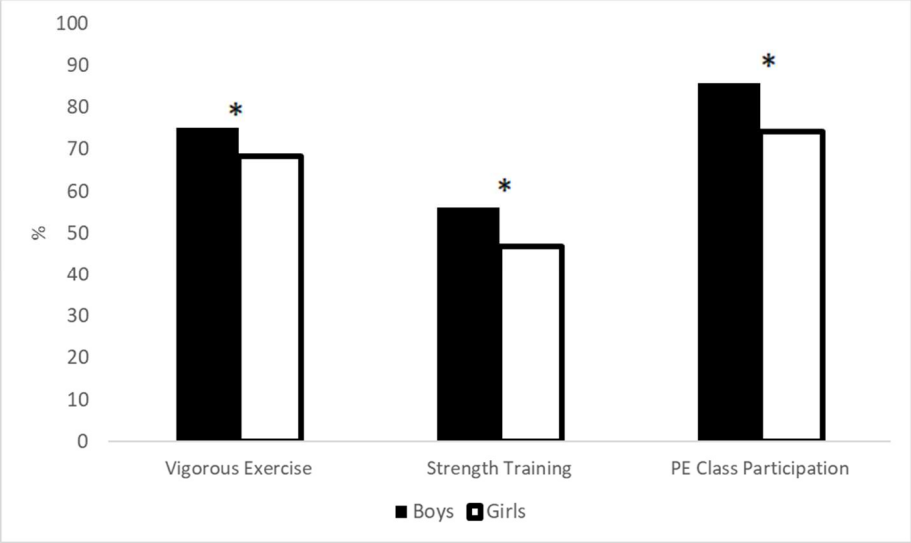


Figure 2.4 Percentage of estimated active adolescents by gender.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Adolescent boys were significantly more active in all three categories than girls (Figure 2.4). There is extense evidence that differences in physical activity exist between genders. Similar to our results, previous research has found that boys are more physically active than girls [12-14]. A study conducted in 2003 found that boys were significantly more likely to be active than girls in vigorous physical activity, moderate physical activity, strength training, physical education enrollment, and also in sports participation [14].

An explanation for this difference in physical activity could be due to the type of exercises that are included in this study. Vigorous and strength exercises such as basketball, soccer, or weightlifting tend to be performed by boys. According to literature, girls prefer aesthetically physical activities that maybe require a learning process [15]. This could explain that girls in the present study were reporting lower percentages for those activities because they were engaged in another type of physical activity that was not mentioned in our questionnaire.

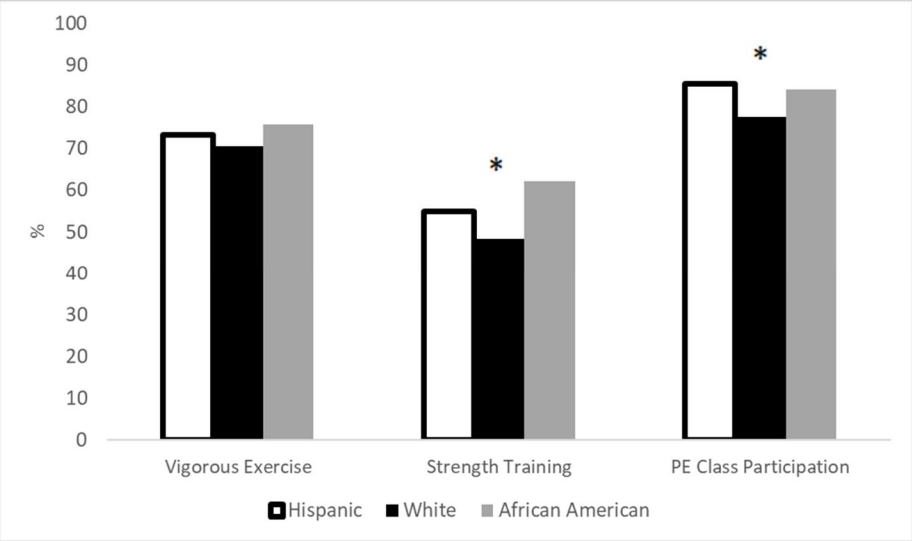


Figure 2.5 Percentage of estimated active adolescents by ethnicity.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Differences in ethnicity were also found. African Americans and Hispanics were significantly more active than White adolescents in strength training activities and PE class participation, respectively (Figure 2.5). Other studies have also found differences in physical activity related to ethnicity. However, the trend seems to be different from our results. According to a report from the Center for Disease Control and Prevention, African American, and Hispanic children between 9 to 13 years old were significantly less involved in organized physical activities [15].

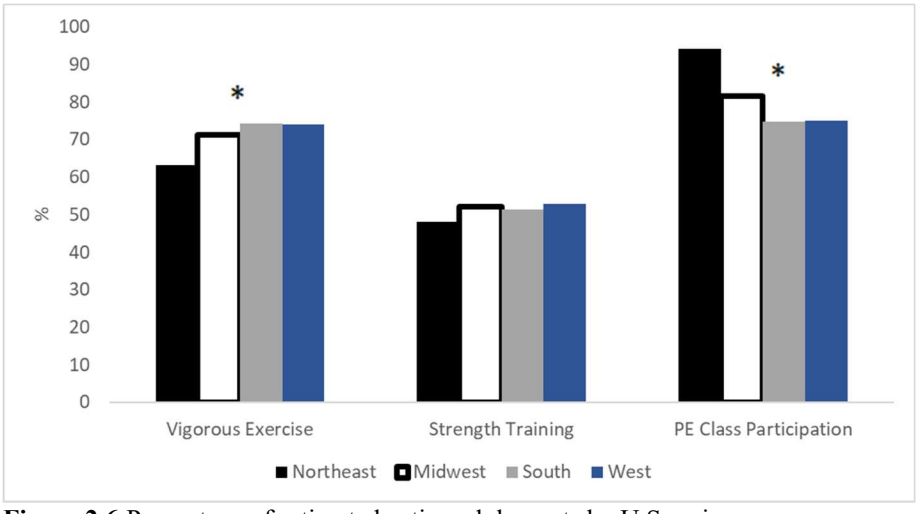


Figure 2.6 Percentage of estimated active adolescents by U.S region.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

By U.S region (Figure 2.6), adolescents in the Northeast area were significantly less active than the other three regions for vigorous exercise (*p-value 0.034).* On the other hand, the percentage of active Northeast participants was significantly higher for actively participating in PE classes (*p-value < 0.0001).*

These differences in physical activity patterns due to the U.S region could be due to the influence of the adolescent's environment. It could be possible that young kids in the Northeast area of the country live in urban areas with lower accessibility to recreation facilities. A study published in 2011 addressed this issue and propose to enhance parks around neighborhoods, opening school facilities to the community, and the creation of private recreation facilities to motivated adolescents in urban areas to be more active [16].

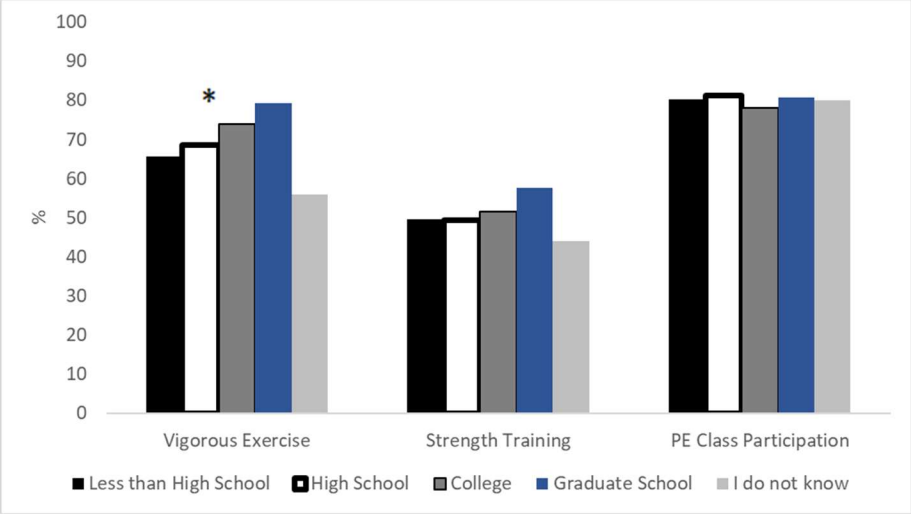


Figure 2.7 Percentage of estimated active adolescents by the highest level of education of the primary female adult in the household.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Figure 2.7 shows the percentage of active adolescents by the highest level of education of the primary female adult in the household. Results showed that higher levels of education (college and graduate school) resulted in significantly higher active adolescents for vigorous exercise (*p-value 0.024).* These results are similar to those reported by the Center for Disease

Control and Prevention in a report issued in 2003. Their results showed that children that were less involved in physical activities were those whose parents had lower incomes and lower education levels [15]. This report also mentioned some of the barriers that lower-income families mentioned to increase physical activity in their children. These barriers included lack of transportation, cost of the equipment and accessories needed to perform in physical activities, and fewer opportunities in their neighborhoods [15].

Cooking and shopping frequency

An important question to address in our study is related to who is responsible for cooking at home. Table 2.3 shows the results for who is doing the cooking at home based on gender, ethnicity, and level of education in participant's homes. These results showed that women are still in charge of most of the cooking, with a total of 74.7% female adults. Two or more people was the second response with a total of 15.3%, and male adult was the third response with 7.8%.

These results are not surprising; historically, women have been the main responsible for food shopping and cooking [17]. According to literature, women still spend more time, specifically more than twice the amount of time cooking than men, which means that even if others are responsible for cooking at home, women are still following the traditional pattern of having the primary responsibility for household food preparation [17].

When looking at differences in gender, girls tend to cook themselves significantly more than boys (*p-value 0.034).* However, for both genders, the adult female tends to be in charge of the cooking responsibility. For ethnicity, Hispanic participants reported that a sibling is sometimes in charge of the cooking responsibility, which was not the case for Whites, neither African Americans.

The highest level of education also showed significant differences. When the highest level of education of the primary female adult was "unknown," there was a significantly higher percentage reported for having the housekeeper responsible for cooking at home. When the highest level of education of the primary male adult was "college," participants reported a significantly higher percentage of male adults being in charge of cooking at home. If "graduate school" was the highest level of education, then two or more people were in charge of cooking.

Literature suggests that low-income households have experienced a reduction of hours dedicated to food preparation [18]. Knowing who is responsible for cooking at home is important; it will probably be easier to engage teenagers in the cooking process if their parents/guardians are involved in food preparation, different situation than if a housekeeper is in charge of cooking most of the time.

Table 2.3 Person responsible for cooking at home based on ethnicity, gender, and level of education.

	Responsible for cooking at home					
	Female Adult	Male Adult	Two or more people	Themselves	Sibling	Housekeeper
Total	74.7%	7.8%	15.3%	1.5%	0.2%	0.3%
Ethnicity						
Hispanic	75.6%	8.4%	13.0%	1.5%	**1.5**%	0%
White	75.3%	7.7%	15.5%	1.3%	0%	0.3%
African American	71.4%	7.9%	16.4%	3.6%	0%	0.7%
p-value	0.611	0.958	0.706	0.148	***0.002****	0.556
Gender						
Males	73.2%	8.5%	17.1%	0.6%	0.0%	0.6%
Females	76.2%	7.3%	13.8%	**2.4**%	0.4%	0.0%
p-value	0.266	0.473	0.138	***0.021****	0.179	0.068
Highest Level of education primary female adult						

Less than high school	73.9%	11.7%	11.7%	2.7%	0.0%	0.0%
High school	71.8%	8.5%	17.4%	1.8%	0.0%	0.6%
College	**79.6**%	5.7%	13.6%	0.9%	0.2%	0.0%
Graduate school	71.5%	8.5%	13.6%	2.3%	0.8%	0.0%
I do not know	52.0%	16.0%	28.0%	0.0%	0.0%	**4.0**%
p-value	***0.005****	0.098	0.160	0.525	0.521	***0.004****
Highest Level of education primary male adult						
Less than high school	79.8%	6.0%	14.3%	0.0%	0.0%	0.0%
High school	74.9%	6.8%	16.1%	2.0%	0.0%	0.3%
College	71.3%	**10.7**%	16.4%	1.1%	0.0%	0.5%
Graduate school	68.7%	9.9%	**19.8**%	1.5%	0.0%	0.0%
I do not know	**89.3**%	0.9%	5.4%	2.7%	**1.8**%	0.0%
p-value	***0.001****	***0.010****	***0.025****	0.522	***0.002****	0.771

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Table 2.4 shows the results for the percentage of adolescents cooking at their home. The majority of adolescents cook less than 40% of the time (92.8%), 4.1% cooperates more than 70%, and 3.1% cooks between 40 to 70%. When looking at differences in gender, girls tend to cook more than boys. For ethnicity, a significantly higher percentage of Hispanics and Whites reported cooking less than 40% at their home. Differences in the highest level of education of primary female adults were only significant when participants did not know the level of education. A study conducted in 2006 showed similar results. Researchers reported that food

preparation behaviors were not performed by the majority of adolescents, and among genders, boys were significantly preparing less food than girls [4].

An article published in 2013 attributes a decline in cooking based on income level to the lack of cooking knowledge, confidence, and cooking skills. The authors mentioned the importance of having home economic classes. This type of education in food and cooking has been part of the US public school curricula for a long time. However, most US schools have declined over the last decades, a phenomenon that could be affecting young kids and their willingness to cook or help cooking at their homes.

Table 2.4 Percentage of cooking that adolescents do at their home based on ethnicity, gender, and level of education.

	Percentage of cooking adolescents do at their home		
	Less than 40%	40-70%	More than 70%
Total	92.8%	3.1%	4.1%
Ethnicity			
Hispanic	**94.7**%	0.8%	4.6%
White	**94.2**%	2.4%	3.4%
African American	87.9%	**6.4**%	5.7%
p-value	***0.019****	***0.010****	0.393
Gender			
Males	94.4%	2.0%	3.6%
Females	91.3%	**4.2**%	4.5%
p-value	0.055	***0.045****	0.455
Highest Level of education primary female adult			
Less than high school	96.4%	0.0%	3.6%
High school	91.2%	4.7%	4.1%
College	93.5%	1.8%	4.7%
Graduate school	91.5%	5.4%	3.1%
I do not know	92.0%	**8.0**%	0.0%

p-value	0.393	***0.011****	0.748

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Table 2.5 shows the percentage of household food shopping that adolescents do at their home. In general, adolescents do less than 40% of the household shopping (95.6%), only 2.5% reported to help with more than 70%, and 1.9% reported to do between 40 to 70% of the food shopping at their home.

There were significantly different results based on gender and ethnicity. A higher percentage of boys reported doing less than 40% of the food shopping at home when compared to girls. The White participants also reported a significantly higher percentage for doing less than 40% of the shopping when compared to Hispanics and African Americans.

Table 2.5 Percentage of household food shopping that adolescents do at their home based on ethnicity and gender.

	Percentage of food shopping adolescents do at their home		
	Less than 40%	40-70%	More than 70%
Total	95.6%	1.9%	2.5%
Ethnicity			
Hispanic	94.7%	2.3%	3.1%
White	**97.3**%	1.6%	1.1%
African American	92.9%	1.4%	**5.7**%
p-value	***0.021****	0.814	***0.002****
Gender			
Males	**97.4**%	0.8%	1.8%
Females	94.0%	**2.9**%	3.1%
p-value	***0.008****	***0.013****	0.185

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Our study found that cooking in the United States is predominantly performed by women; this trend was the same no matter the ethnicity or level of education of both parents or

guardians. Adolescents tend to do less than 40% of the cooking at their home and less than 40% of the household food shopping. This lower involvement of teenagers in food shopping and preparation has to be taken seriously. Previous research has shown the importance of developing appropriate cooking skills at a young age to have good dietary behaviors in the future. Involvement in food preparation has been associated with a better diet and eating behaviors in adolescents that tends to continue in their adult life [18].

Vegetarianism and meat consumption

Participants were asked if they were vegetarians or not. From all the participants, 95.8% reported not being vegetarian, and 4.2% reported to be vegetarians, most of them were girls (65.9%). These results are similar to the ones reported in a previous study in São Paulo, Brazil. For this study, only 4% of the sample was vegetarian, and 70.8% were females aged between 14 to 19 years old [19].

Our results showed a low percentage of vegetarianism among adolescents. However, literature suggests that there is an increase in vegetarianism among youths because they are more aware of their well-being and are looking for healthy tendencies in their diets. A study conducted in 2001 explains that teenagers may want to be vegetarians because they are looking for a healthy diet or want to lose or maintain weight [20]. Other studies conducted in the adolescent population have shown that the main reason to choose vegetarian diets is because of health/nutrition, weight control, taste preferences, religious belief, parental influence, and animal ethics [21, 22].

The term "vegetarian" can be described as someone following a diet that avoids animal flesh such as meat, fish, and poultry, which can include varying degrees of restriction [21]. In this context, participants, both vegetarian and non-vegetarian were asked how often they

consumed the following food: dairy products, eggs, fish, and meat. Our purpose was to understand if adolescents were clear about the concept of vegetarianism.

Results showed that non vegetarian adolescents tend to consume dairy products every day (cheese, yogurt, or milk), meat every few days, eggs once or twice a week, and fish just a few times a month, less often or not at all (Figure 2.8).

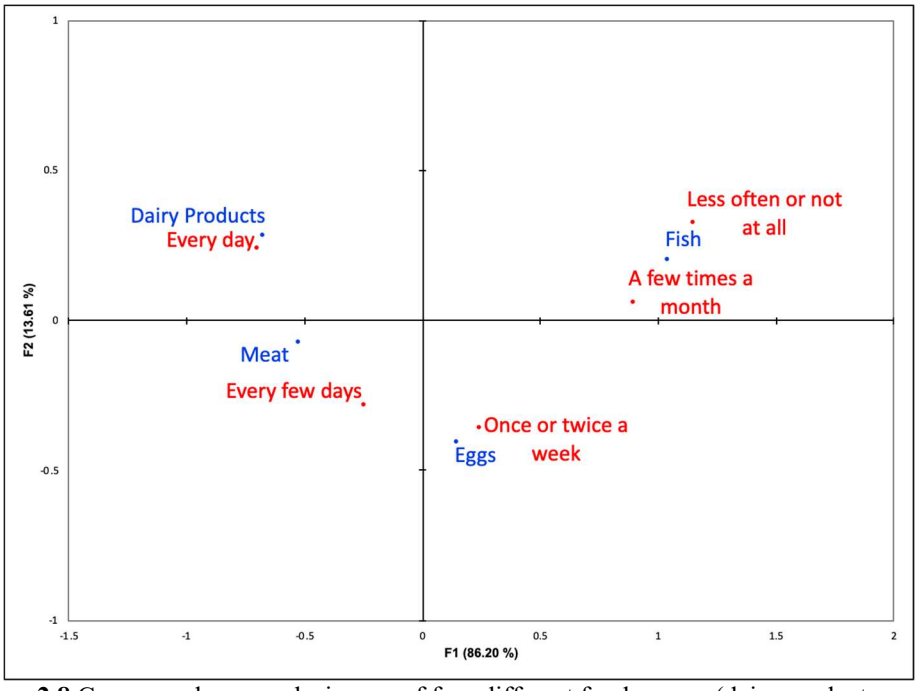


Figure 2.8 Correspondence analysis map of four different food groups (dairy products, meat, eggs, and fish) and their frequency of consumption by **non vegetarian** adolescents. This map represents 99.81% of the total variance of the data.

On the other hand, vegetarian participants also tend to consume dairy products every day, eggs once or twice a week, every few days or a few times a month (Figure 2.9). The main difference between vegetarians and non-vegetarians was as expected, the frequency in meat and fish consumption. Vegetarians reported to consume fish or meatless often or not at all, while meat was consumed every few days for non-vegetarians.

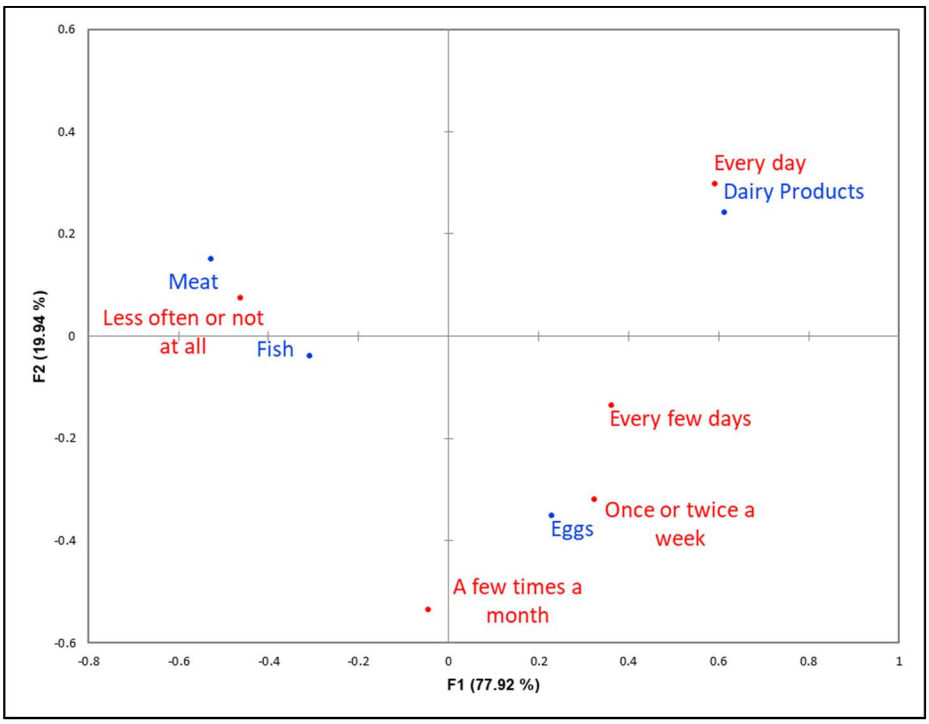


Figure 2.9 Correspondence analysis map of four different food groups (dairy products, meat, eggs, and fish) and their frequency of consumption by **vegetarian** adolescents. This map represents 97.86% of the total variance of the data.

Adolescents that have eliminated meat from their diets need to add alternative sources of protein to compensate for the amount of protein they could get from meat. According to literature, meat is important because it provides easily absorbed protein; however, other foods such as dairy products, eggs, grains, legumes, and various soy foods such as tofu can provide good quality protein [23].

Energy and protein requirements might be hard to meet in vegetarian adolescents because they are more independent about their eating decisions and sometimes do not make healthier choices. This issue is especially crucial in girls because they are more concern about their body weight and tend to restrict their energy intake, making it challenging to meet the nutrient and energy requirements [24].

Other eating behaviors

As part of the eating behavior section, participants were asked if they participate in the National School Lunch Program. The National School Lunch Program (NSLP) is a federally assisted meal program that serves in public and nonprofit private schools and residential childcare institutions [25]. From all the respondents, a total of 54.1% participate in the program, and 45.9% did not participate. These results are similar to the ones reported by the School Nutrition Dietary Assessment Study III, where 62% of the students assessed participated in the NSLP [26].

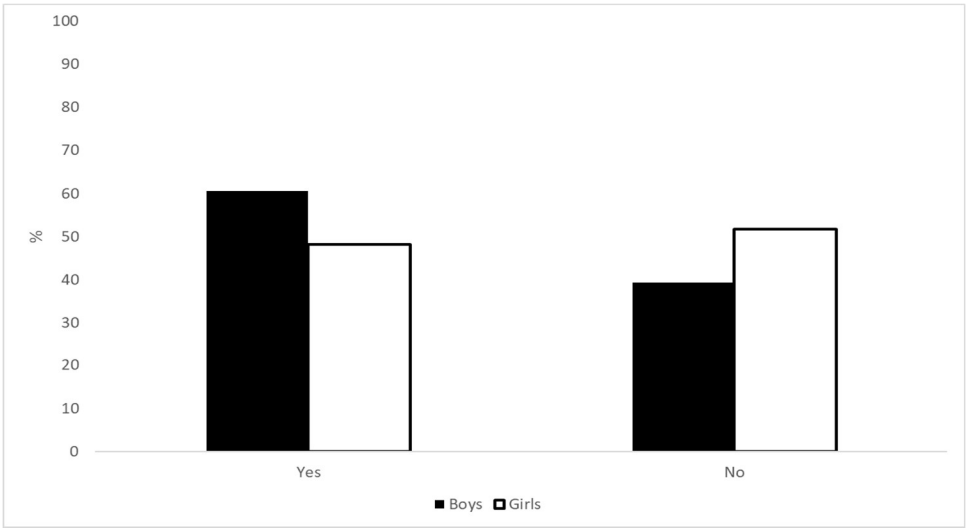
Figure 2.10 shows the distribution of participants by gender, ethnicity, and level of education of the primary female and male at home. Results showed that a significantly higher percentage of boys (60.6%) participate in the program when compared to the girls (51.8%) (*p-value < 0.0001)* (Figure 2.10a). These results were also valid for the School Nutrition Dietary Assessment Study III, where participation rates were higher among boys than girls [26].

Among ethnic groups (Figure 2.10b), a significantly higher percentage of African Americans (66.4%) reported participating in the program when compared to Hispanic (58.8%) and White (51.6%) participants (*p-value 0.003)*. A study conducted in 2010 also showed the same tendency. This study found a statistically significant difference by ethnicity, with a higher probability of participation in the NSLP among African Americans and other ethnic groups when compared to Whites [27].

Figures 2.10 c & d shows that adolescents whose parents had a lower education level were more likely to participate in the NSLP. This result was expected considering that the NSLP was created to provide adequate meals for children in low-income families, and previous reports have shown that students from low-income households had a higher participation rate when

compared with students from a higher-income household [26, 28]. The school nutrition dietary assessment study-III showed that a student's likelihood of NSLP participation decreased as the student's family income increased [26].

(a)



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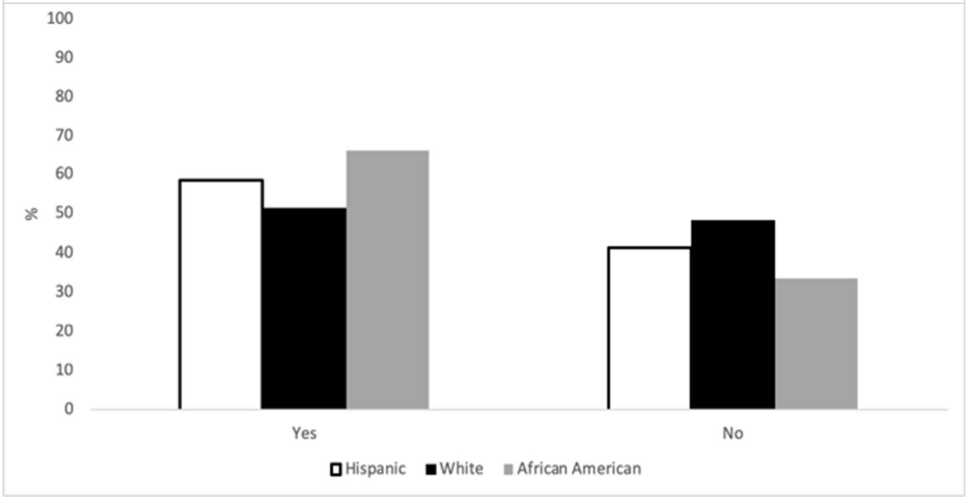

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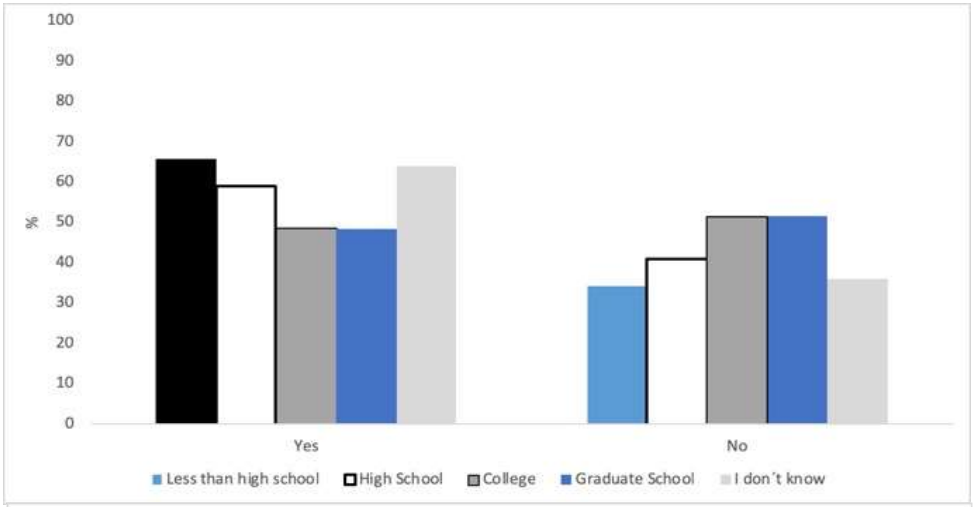

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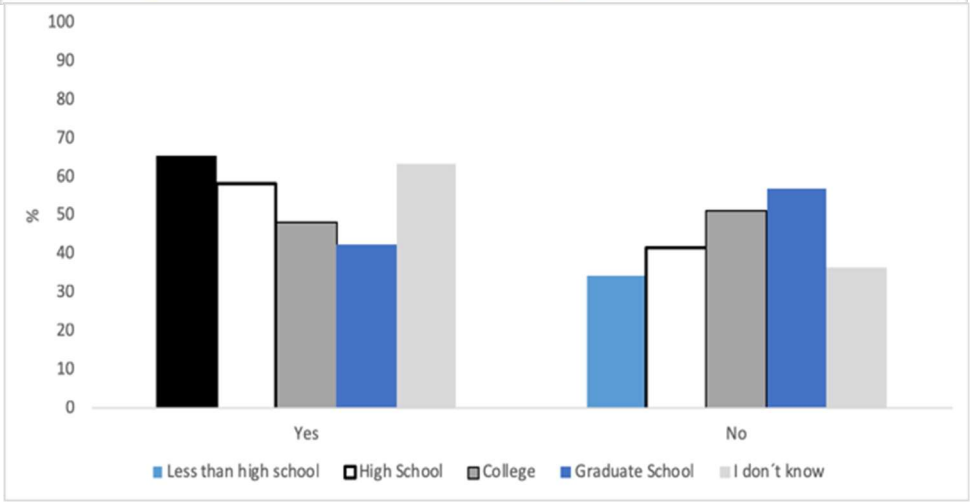

Figure 2.10 Percentage of adolescents that participate in the National School Lunch Program by (a) gender, (b) ethnicity, and level of education for (c) female and (d) male adult.

Another topic that was explored in our research was the frequency with which adolescents eat outside their home. Results in Table 2.7 showed that from the total of participants in this study 59.4% eat at least one meal outside their home less than two days per week, 35.1% does it on a range of 3 to 5 days, and 5.4% does it more than six days a week.

Most of the participants in our research seem to eat more at home than outside. However, 35.1% still eats outside their home more than three days a week. Some nutritionists have tried to explain why adolescents are attracted to fast food and eating outside their homes. Teenagers tend to seek independence and are trying to find their own identities, this could be reflected in the

number of meals they do, and the freedom they get when they choose to eat away from home [29].

When looking at differences in ethnicities, White participants reported significantly higher percentages for eating a meal outside less than two days when compared to African Americans and Hispanics. On the other hand, African Americans reported a significantly higher percentage for eating out on more than six days per week.

Table 2.6 Percentage of days per week that adolescents eat a meal outside their home based on ethnicity.

	Less than two days	**3 to 5 days**	**More than six days**
Total	59.4	35.1	5.4
Ethnicity			
Hispanic	56.5	35.9	7.6
White	**63.0**	33.3	3.7
African American	45.7	43.6	**10.7**
p-value	***0.001***	0.065	***0.001***

Table 2.8 shows the results for the number of days per week that adolescents sit together and eat as a family. Results from our study showed that 47% of participants sit to eat together as a family on an average of 3 to 5 times per week. 32.5% reported doing it more than six days per week, and 20.5% reported to do it less than two days per week. Even if our results show a favorable scenario with a higher percentage of families eating together at least 3 to 5 days a week, there is still a 20.5% that is not sitting down for regular meals together.

Some studies have listed the potential barriers that explain why families are not sharing this time together, for example, conflicting work schedules, before- and after-school activities, stress, financial resources, or lack of suitable space to sit at home [30].

Some ethnic groups are also more likely than others to have family meals. Our results showed that there were no significant differences in the percentage of participants per ethnic group that sat together to eat as a family on more than six days a week. However, White and African Americans reported a significantly higher percentage than Hispanics when the frequency was 3 to 5 days. For less than two days per week, Hispanics showed a significantly higher percentage than the other two groups.

Table 2.7 Percentage of the number of days per week that adolescents sit together and eat as a family based on ethnicity.

	More than six days	**3 to 5 days**	**Less than two days**
Total	32.5	47.0	20.5
Ethnicity			
Hispanic	35.9	35.1	**29.0**
White	33.4	**48.9**	17.7
African American	24.3	**50.0**	25.7
p-value	0.072	***0.012***	***0.003***

Having family meals during adolescence can bring an opportunity for young kids to prepare and share healthy food. Previous research has shown that adolescents that sit together and eat as a family tend to have healthier diets that include more fruits, vegetables, less fried food and soda, less saturated and trans fat, and more fiber. Some of these studies also showed that this practice reduces the chances of overweight and obesity [30-33].

In addition to these known health benefits, the literature has also suggested that eating together as a family helps establish a bond between parents and adolescents that could prevent their participation in risky activities. Some of these activities include substance use, suicide ideation/attempts, and delinquency [34].

Conclusions

Our findings contribute to the evidence that already exists about physical activity and eating behaviors in adults and adolescents. Adolescents, especially boys, are meeting the recommendation of physical activity for vigorous activity, and the majority have access to at least one day a week of physical education class. It is critical to encourage young kids and adults to be actively involved in the acquisition and preparation of food. Our results show that the majority of adolescents are not involved in the household food shopping process, neither helping in the cooking process. The primary female adult is still the principal person in charge of preparing the meals for the family. Eating family meals is also explored and shows that most families, especially from White participants, sit together to eat as a family from 3 to 5 days per week. One of the main limitations of this study is that physical and eating behaviors were based on self-report. This can bias participants to answer what they think is correct or socially acceptable not reporting what they really do or consume. Despite this limitation, the present study contributes to the understanding of some important adolescent and adult´s physical and eating patterns.

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Chapter 3 - Snacking behavior in US adults

Abstract

Motivations to consume different snack groups can vary depending on factors such as gender, race/ethnicity, sociodemographic background, and the place where people live. This research provides information about the motivations to consume from different snack groups. Another analysis also provides information based on gender, ethnicity, U.S. region, and annual household income. An online survey was conducted with a modified Eating Motivation Survey. This survey used a Check-All-That-Apply (CATA) procedure to allow participants to choose the main reasons they consumed a particular snack. Sixteen motivations were included to investigate the main drivers that lead consumers to choose snacks from different snack groups. These motivations were liking, habits, need & hunger, health, convenience, pleasure, traditional eating, natural concerns, sociability, price, visual appeal, weight control, affect regulation, social norms, social image, and choice. The reported snacks were classified into 11 groups: sweets, salty snacks, baked products, refined grains, beverages, sandwich or wraps, meats, bars/nuts or seeds, fruits, dairy products, and vegetables. These groups were organized in 3 main clusters based on their primary consumption motivation. Cluster 1 could be classified as “fun for you” snacks, which included sweets, salty snacks, and baked products. The main motivations associated with this group were price, social image, social norms, sociability, and affect regulation. Cluster 2 could be classified as “good for you” snacks group, which included choosing vegetables, dairy products, fruits, and bars/nuts & seeds to eat. The main motivations associated with this group were natural concerns, weight control, and health. Cluster 3 was a more diverse group, consuming foods such as refined grains, beverages, meats, and sandwich or wraps. The main motivations associated with this group were choice and visual appeal. Results for different

groups showed significant differences between gender, ethnicity, annual household income, and U.S region. Liking and choice were the strongest motivations to consume snacks in all four snack groups. Convenience, natural concerns, need & hunger, health, weight control, habits, pleasure, and traditional eating were the main motivations to consume "good for you snacks" such as dairy products, fruits, bars, nuts & seeds and were mentioned differently depending on each group. Pleasure, affect regulation, sociability, social image, habits, traditional eating, need & hunger, and visual appeal were related to "fun for you" snacks such as salty snacks, baked products, and sweets and were also mentioned differently depending on each group. Understanding the different motivations for the consumption of snacks in different genders, socioeconomic groups, or ethnic groups is fundamental to construct cultural and socioeconomic successful health interventions.

Introduction

Snack time represents a special eating occasion different from other meals in the number of food and beverage items, variety of food groups, and motivations to consume them (Phan & Chambers, 2016). Motivations to consume different kinds of snacks is known to be influenced by several factors that include convenience, price, taste, health, visual appeal, religious beliefs, and cultural and social influences (Birkenhead & Slater, 2015; Burger, Cornier, Ingebrigtsen, & Johnson, 2011; Milošević, Žeželj, Gorton, & Barjolle, 2012; Sommer, MacKenzie, Venter, & Dean, 2012). Also, even the snack eating motivations were different depending on the time of the day they were consumed. Snacks in the daytime involved healthier choices, while late-night snacks were motivated mainly by pleasure (Phan & Chambers, 2016).

Other studies have differentiated the main motivations to consume main meals, healthy snacks, and unhealthy snacks. Researchers found that reasons to consume main meals appear to be related to hunger, healthy snacks associated with hunger, while unhealthy snacks were most frequently consumed as a result of their visual appeal or because they smelled very tempting (Verhoeven, Adriaanse, de Vet, Fennis, & de Ridder, 2015).

Making decisions about what snack to consume can be difficult because of the many options available in the market. Food, in general, has become almost universally available and accessible, especially in the US, meaning it can be obtained almost anywhere, at any time, and by anyone (Sobal & Bisogni, 2009). The increase in food availability also increases the number of eating occasions, meaning that now people have more snacking occasions during a regular day, which in turn means the more decision they will need to make about their food. Research has estimated that most people make over 220 food decisions per day (Wansink & Sobal, 2007).

With the many different types of food decisions a person must make about their food, it can be challenging to find a good approach to study the snacking behavior in the US population. The present study used a modified version of the Eating Motivation Survey (Phan & Chambers, 2016; Renner, Sproesser, Strohbach, & Schupp, 2012) to determine the motivations for choosing a specific snack from a specific food group for specific participants. From this information, motivations for larger categories of snacks and consumers can be generalized (Phan & Chambers, 2016).

Knowing the motivations to consume food can help to understand why different food choices are made. Motivations are affected by different factors, such as gender, ethnicity, neighborhood, and income. Examples of these motivations can be liking, pleasure, habits, affect regulations, need & hunger, natural concerns, social norms, health, choice, or convenience. These motivations can act as barriers or promoters to consume from different snack groups. For example, liking promotes the consumption of the majority of foods, while price can be a barrier. However, convenience promotes the consumption of "fun for you" snacks but can be a barrier to fruits and vegetables (Lucan, Barg, & Long, 2010).

These barriers or promoters can be different depending on the group of consumers being study. Males can find social norms as promoters to consume vegetables (Lucan et al., 2010); however, this motivation may not be the main driver to consume vegetables in females. Understanding how these barriers or promoters function for different genders, socioeconomic groups, or ethnic groups is fundamental to construct successful interventions and promote sustainable changes that can improve the quality of snacks consumed by the population. Understanding what the main motivations are that determine the reason a consumer decides to choose a snack from a particular food category can offer valuable information to the food

industry and health professionals. The food industry is interested in developing snacks that consumers will buy. By using the right motivations and emotions, they can create successful promotional campaigns. However, on the other hand, this information can provide valuable information to health professionals that will enable them to guide their patients towards more healthful snacks. Besides, by understanding what the main motivations are to consume healthy or unhealthy snacks also can help health professionals create effective nutritional education materials. The main objective of this research was to investigate the motivations behind the consumption of different snack food groups in a population of US adults using a bottom-up approach with the Eating Motivation Survey (TEMS).

Materials & Methods

Participants

Participants were recruited using Qualtrics database. The online recruitment process included a screener to exclude those participants who did not qualify for the present study. Criteria for participation in the study included: participants at least 18 years or older and who have lived in the United States for more than five years. A total of 1551 people from all over the United States were recruited.

Online survey questionnaire

Participants who qualified completed an online survey operated by Qualtrics software (Qualtrics, Provo, UT, USA) licensed for Kansas State University. The questionnaire included three sections: (1) demographic information: gender, race/ethnicity, state of residence, and household income in the past 12 months. (2) Snacking occasion: this section recorded information about the most recent snack occasion, such as, time of the day that the snack was

consumed, if the snack was consumed on a weekday or a weekend or holiday, what the main activity that people were doing when they ate the snack, what type of food was included in their snack occasion, if the snack item had label information and if so, did they read it. Information in this section also included how many food or beverage items were included in the snack time and who purchased the snack. (3) The Eating Motivation Survey (TEMS), used to understand the motivations to consume different snack food groups. This section used the procedure of Check–All–That–Apply (CATA) to allow participants to check on the reasons to consume a particular snack. TEMS items in this study included the following 16 motivations:

Liking	Habits	Need & Hunger	Health
Convenience	Pleasure	Traditional Eating	Natural Concerns
Sociability	Price	Visual Appeal	Weight Control
Affect Regulation	Social Norms	Social Image	Choice

Figure 3.1 16 motivations included in the Eating Motivation Survey (TEMS)

These motivations were taken from Renner, Sproesser, Strohbach, 2012, and Phan & Chambers, 2016. To measure each of these motivations included three items (except for social norms that included four items and choice that included two items). For example, to measure health, the following three statements were used: “because it is healthy”, “to maintain a balanced diet”, and “because it keeps me in shape (e.g., energetic, motivated). Appendix G shows the Eating Motivation Survey (TEMS) used in this research.

Data Analysis

For the motivations to consume the snack groups section, each snack reported was classified into eleven different groups: sweets, salty snacks, baked products, refined grains, beverages, sandwich or wraps, meats, bars/nuts or seeds, fruits, dairy products, and vegetables.

This classification was based on the United States Department of Agriculture (USDA); specifically, the Five Food Groups Program and the USDA Branded Food Products Database. The 16 motivation factors from the Eating Motivation Survey were linked to the snack food groups using correspondence analysis (CA) to obtain the main motives for each snack group. Hierarchical clustering was performed on the CA factors to classify each snack into clusters based on the similarities in motivations among snack groups. Proportion tests, using Pearson's chi-square test statistic, were performed on the proportion data of all 16 motivations to validate the primary motivations for each snack group consumption. Demographic information from participants was also used to explore different motivations to consume snacks in four categories: gender, ethnicity, US region, and annual household income. Gender was identified as females and males. Three ethnicities were chosen based on the majority of respondents: White, Hispanic, and African American. US region was classified as Northeast, Midwest, South, and West based on the United States Census Bureau (United States Census Bureau, 2019). Household annual income was classified into four categories: less than $25,000 per year, $25,000 to $49.999 per year, $50.000 to $99.999 per year, and more than $100.000 per year. The 16 motivation factors from the Eating Motivation Survey were linked to the snack food groups using correspondence analysis (CA) to obtain the main motives for each snack group based on gender, US region, annual household income, and ethnicity. Proportion tests using Pearson's chi-square test statistic were performed on the proportion data of all 16 motivations to validate the primary motivations for each snack group based on the four categories previously mentioned. Data analysis was done using XLSTAT-Sensory (Version 2019.1.1, Addinsoft, New York, USA).

Results

Snacking behaviors

A total of 2853 food and beverage items were reported from the participants. Figure 3.2 shows the percentage of each type of activity respondents were doing when they consumed their snack. Watching television or movies was the main activity reported (36.4%), followed by working, studying or reading (23.7%), chatting or browsing the internet (14.6%), socializing, being with family or friends (8.3%), driving or walking (6.4%). The lower percentages were reported for playing videogames (4.1%) and getting ready to go to sleep (1.5%). Other activities accounted for 4.9% of respondents, the most frequent other activities mentioned were: eating the snack during a break from work, while cleaning the house, while listening to music, while taking care of kids, after exercising, and while sitting in class.

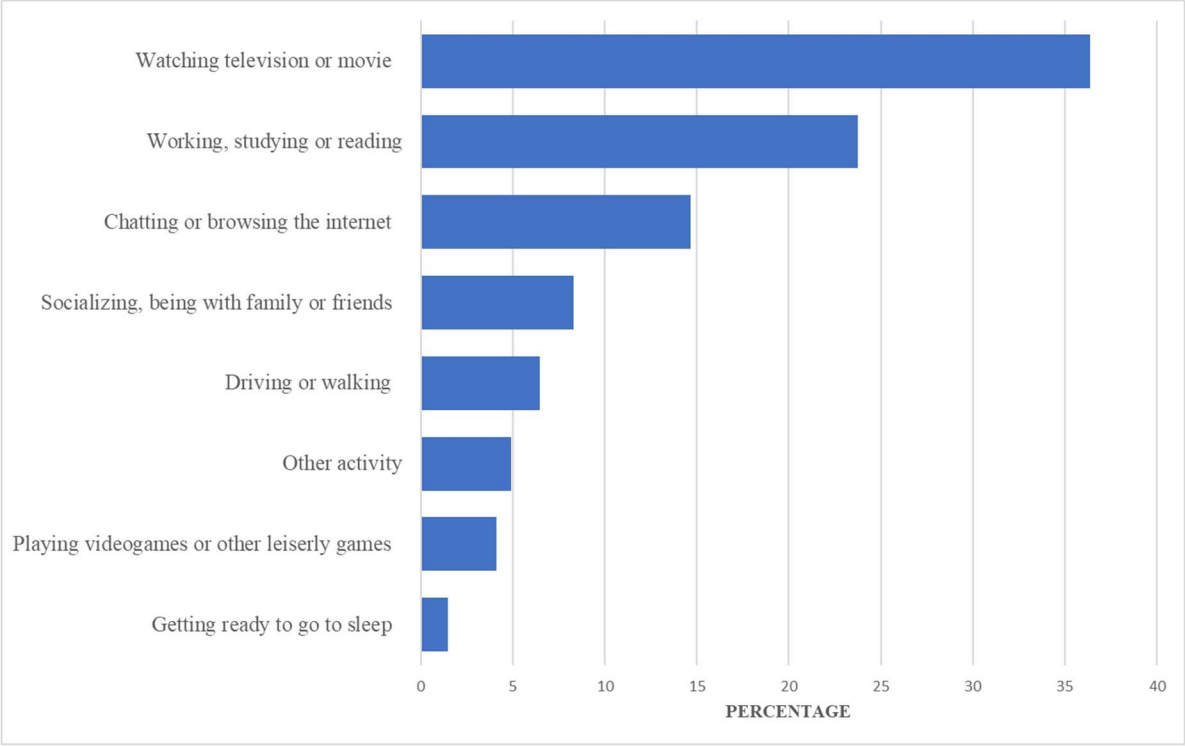


Figure 3.2 Main activities respondents were doing when they consumed their snack

Figure 3.3 presents the percentage of respondents that read or did not read the label information in their snack based on gender and annual household income. There was a significant association between the gender of respondents and their willingness to read the label information from their snacks (p=0.005). A higher percentage of females reported reading the label information, and if they did not read the label, it was because they knew the information already. On the other hand, a significant percentage of males reported not reading the label because they were not interested in the information presented in the snack package. Significant differences were also found in the percentage of respondents that read or not read the label based on annual income (p=0.024). As shown in Figure 3.3, participants in the lower range for a yearly salary reported not to read the label and were not interested in the information displayed on the label. There were no significant differences between the percentage of participants that read the nutritional label and the age group, ethnicity, and US region.

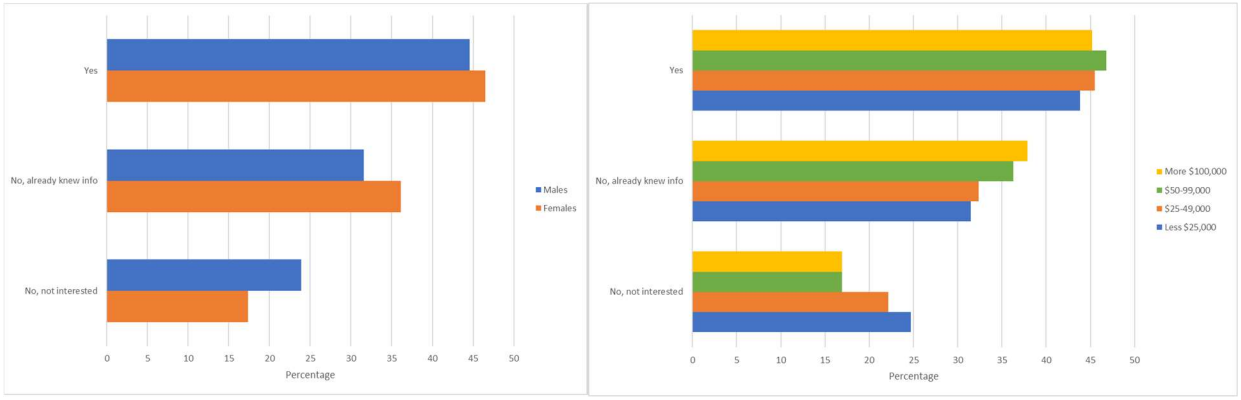


Figure 3.3 Percentage of respondents that read the label information of their snack based on gender and annual income.

The number of items consumed during the snack occasion was also explored. The majority of participants reported consuming only one item during their snack time; this group corresponded to 56.8%. 34.2% of the participants reported consuming two items, and only 9% reported three snacks. Participants already purchased these snack items before the snack

occasion in the majority of cases. For either the snack time itself or any other occasion. 77.3% reported having bought the snack item themselves. 18% mentioned that someone in their family purchased their snack. 3% explained the snack they had did not need to be bought either because they cook it or because it was something they obtained from someone else. Finally, 1.6% of participants reported somebody outside their family purchased their snack item.

Motivations to consume different snack food groups

Figure 3.4 shows the motivations to consume different snack groups. The items reported by the participants were classified as sweets, salty snacks, baked products, refined grains, beverages, sandwich or wraps, meats, bars/nuts or seeds, fruits, dairy products, and vegetables. These snacks were categorized into three different clusters based on their relationship with the 16 motivations. Liking was the principal driver of motivation to consume any of the snacks groups in the three clusters found in this research. Choice was the second principal driver of motivation.

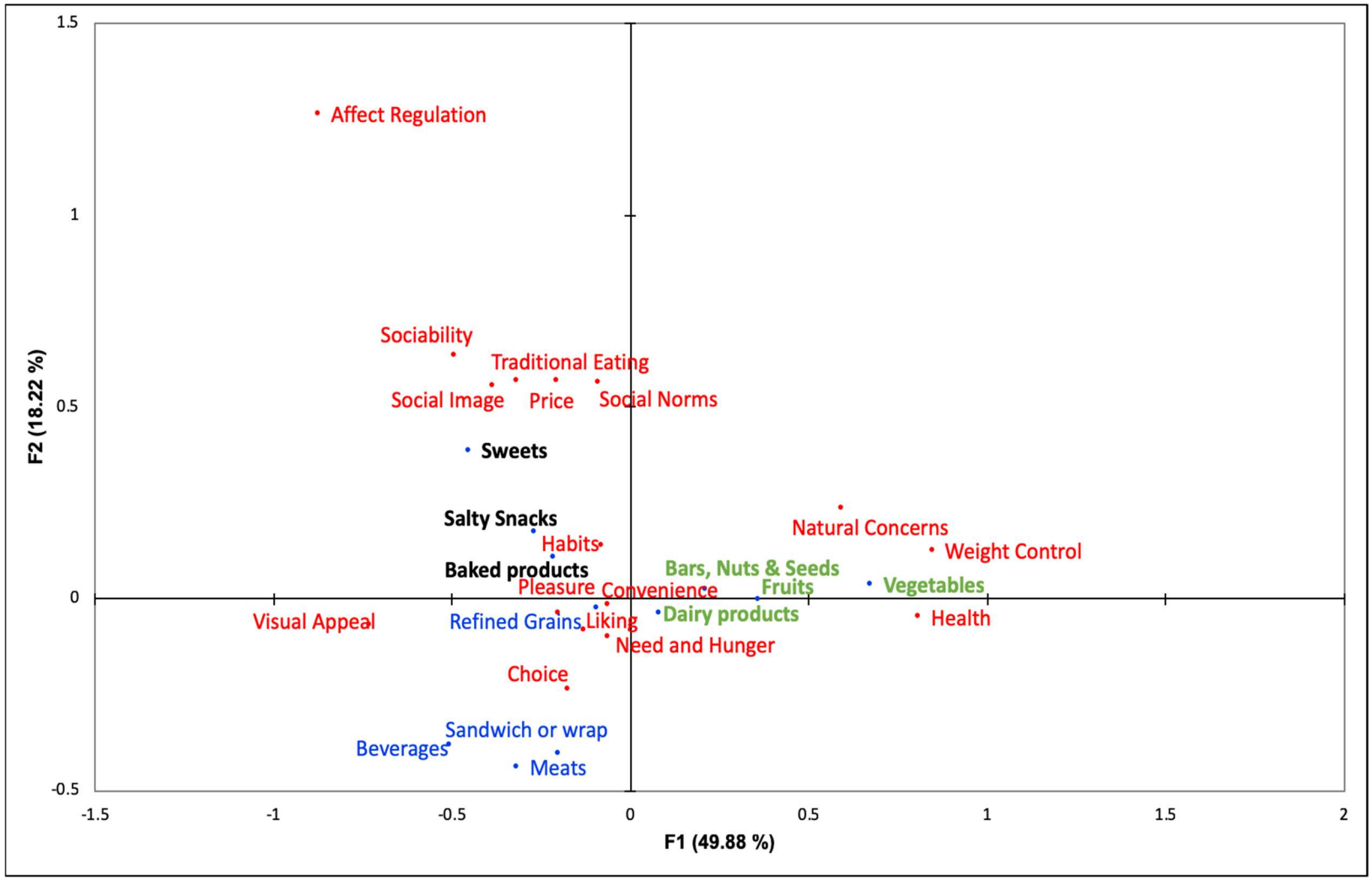


Figure 3.4 Correspondence analysis map of eleven food groups and sixteen motivations. This map represents 68.1% of the total variance of the data. The eleven food groups were classified into three clusters shown in the map with different colors (black, blue and green); these clusters were grouped based on their similarity with motivation patterns.

Cluster 1 is represented with the black color in Figure 3.4 and includes sweets, salty snacks, and baked products. This group was associated with price, social image, social norms, sociability, and affect regulation. Cluster 2 in figure 3.4 is represented with the green color and includes vegetables, dairy products, fruits and bars, nuts, & seeds. This group was associated with natural concerns, weight control, and health. These three motivations are closely related to each other. Health is linked to healthy food and maintaining a balanced diet. Weight control is related to food that is low in calories and fat. This could be considered healthy food, and finally, natural concerns is related to natural food, usually organic, that contains no harmful substances.

The blue color in figure 3.4 represents Cluster 3 and includes refined grains, beverages, meats, and sandwiches or wraps. Choice and visual appeal were the two main motivations associated with this group. This cluster is more diverse than the others are. It includes mostly high protein snacks and beverages. From this study, choice refers to snacks that participants reported consuming every day or simply because it was the only choice available at snack time. On the other hand, visual appeal refers to snacks that were spontaneously eaten or were chosen because of the attractive presentation or its package.

Some motivations such as liking, need & hunger, habits, pleasure, and convenience were located in the center of the correspondence analysis map (Figure 3.4). This is an indication that those were strong motivations for more than one cluster. Table 3.1 shows the percentages of the motivations associated with the snack food groups and can help better explain these four motivations that did not belong to just one cluster. Convenience and need & hunger were also located in the center on the map as they were the main reasons to consume foods in more than one group.

Table 3.1 Percentages of the motivations associated with the snack food groups

Item	Baked Products	Refined Grains	Beverages	Sweet	Dairy Products	Fruits	Bars, nuts & seeds	Meats	Salty Snacks	Sandwich & Wraps	Vegetables	p-value[b]
Number of items[a]	328	29	18	176	147	150	239	28	369	34	33	
Liking	**9.35**	3.45	3.70	6.44	7.03	**10.89**	3.91	5.95	**8.13**	5.88	8.08	*< 0.0001*
Habits	4.47	2.30	1.85	3.60	4.31	4.89	2.51	1.19	5.15	0.98	3.03	0.079
Need & Hunger	4.17	4.60	3.70	3.41	**7.03**	**6.67**	3.21	5.95	**6.23**	2.94	3.03	*0.008*
Health	1.22	1.15	0.00	0.38	4.31	**9.78**	2.79	1.19	0.90	0.98	**9.09**	*< 0.0001*
Convenience	4.37	1.15	1.85	3.22	**5.90**	**5.56**	2.51	2.38	**4.79**	1.96	3.03	*0.033*
Pleasure	**6.10**	1.15	1.85	4.73	4.31	**5.33**	2.23	4.76	**4.97**	1.96	3.03	*0.010*
Traditional Eating	1.02	0.00	0.00	1.33	0.91	1.56	0.70	0.00	1.90	0.00	0.00	0.221
Natural Concerns	1.42	1.15	0.00	0.76	0.68	**4.00**	0.98	0.00	0.90	0.00	**3.03**	*< 0.0001*
Sociability	1.02	0.00	0.00	0.76	0.91	0.22	0.00	0.00	1.17	0.00	0.00	0.122
Price	1.83	2.30	0.00	**2.65**	0.23	1.11	0.84	0.00	2.17	0.00	2.02	*0.026*
Visual Appeal	0.71	0.00	1.85	**2.27**	0.68	0.89	0.28	1.19	0.99	0.00	0.00	*0.041*
Weight Control	1.02	0.00	0.00	0.38	3.85	**5.56**	2.23	0.00	1.17	0.00	**6.06**	*< 0.0001*
Affect Regulation	0.41	0.00	0.00	**1.52**	0.00	0.22	0.00	0.00	0.36	0.00	0.00	*0.005*
Social Norms	0.38	0.00	0.00	0.43	0.51	0.17	0.10	0.00	0.20	0.00	0.00	0.835
Social Image	0.30	0.00	0.00	0.38	0.68	0.00	0.28	0.00	0.81	0.00	0.00	0.486
Choice	9.30	5.17	2.78	7.39	7.48	10.00	4.18	5.36	7.99	7.35	6.06	0.072

[a] The sample size for choice was nx2, and for social norms was nx4 based on the number of items used to measure those motivations. For example, choice has two sub-scales, while social norms have four sub-scales.

[b] p-value of two-sided proportion test using Pearson's Chi-square test statistic, df=10, value in bold-significant at alpha = 0.05.

Snacking motivations based on gender

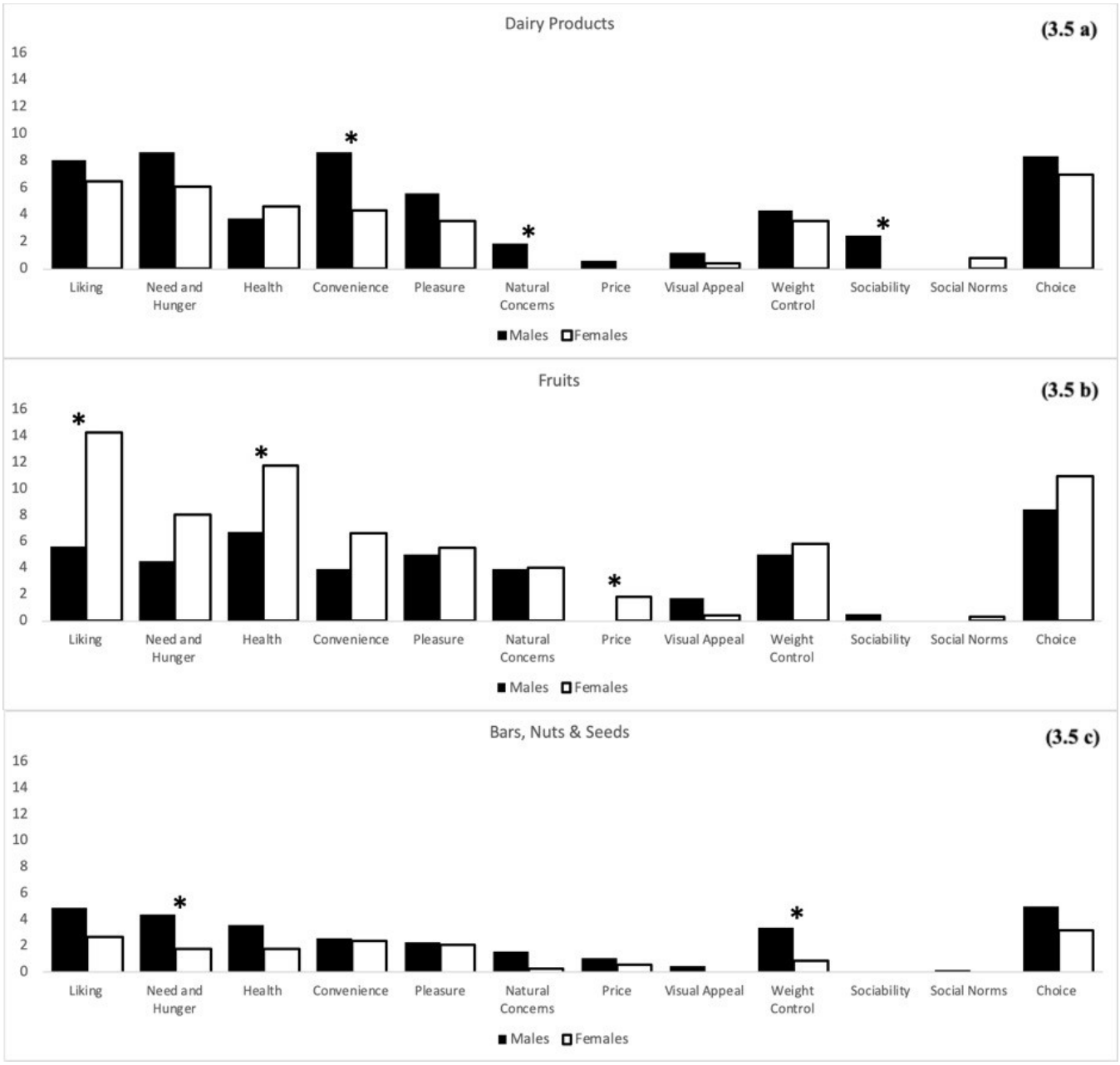


Figure 3.5 Motivation patterns (%) for four snack groups based on gender. 3.5a) This motivation pattern was associated with dairy products. 3.5b) This motivation pattern was associated with fruits. 3.5c) This motivation pattern was associated with bars, nuts & seeds. 3.5d) This motivation pattern was associated with meats.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Figure 3.5 shows the motivation patterns in percentage for four snack groups based on gender. Liking (because it tastes good, because I like it, because I have an appetite for it) was the primary motivation to consume different groups of snacks in both genders. It is followed by choice (I want to eat it every day, or I eat it because it was the only choice). Snack groups shown in Figure 3.5 were chosen based on significant differences in motivation patterns between males and females. Other snack group motivation patterns can be found in Appendix C.

Figure 3.5a shows the main motivations to consume dairy products based on gender. There were significant differences between three motivations to consume dairy products between males and females. A significantly higher percentage of males found convenience (*p-value 0.046*), natural concerns (*p-value 0.022)*, and sociability (*p-value 0.008)* as important motivations when compared to females.

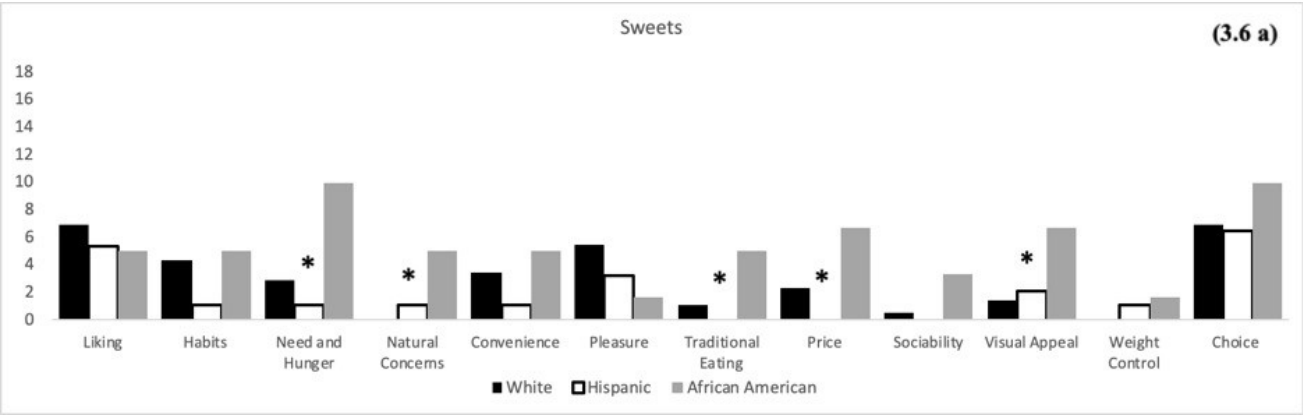
The motivations to consume fruits were also different and showed significant differences for three motivations based on gender (Figure 3.5b). A significantly higher frequency of females reported consuming fruits motivated by liking (*p-value 0.001)*, health (*p-value 0.041)*, and price (*p-value 0.047)*. Visual appeal and sociability were the only two motivations that were higher in

males than females; however, they were not significantly different between genders. For vegetables, natural concerns was the only motivation that was different based on gender (Appendix C). In general, a higher frequency (%) of males reported being motivated to consume vegetables due to liking, natural concerns (*p-value 0.010)*, habits, and price. On the other hand, frequencies were only higher for females for the motivation of choice.

Figure 3.5c shows the main motivations to consume bars, nuts & seeds based on gender. There were significant differences between two motivations to consume this snack group between males and females. A significantly higher percentage of males found need & hunger (*p-value 0.044)* and weight control (*p-value 0.023)* as important motivations when compared to females.

Motivations to consume meats as snacks were also different in males and females. Males reported significantly higher frequencies for liking (*p-value 0.023)* and choice (*p-value 0.034),* while females reported significantly higher frequencies for need & hunger (*p-value 0.033)*.

Snacking motivations based on ethnicity



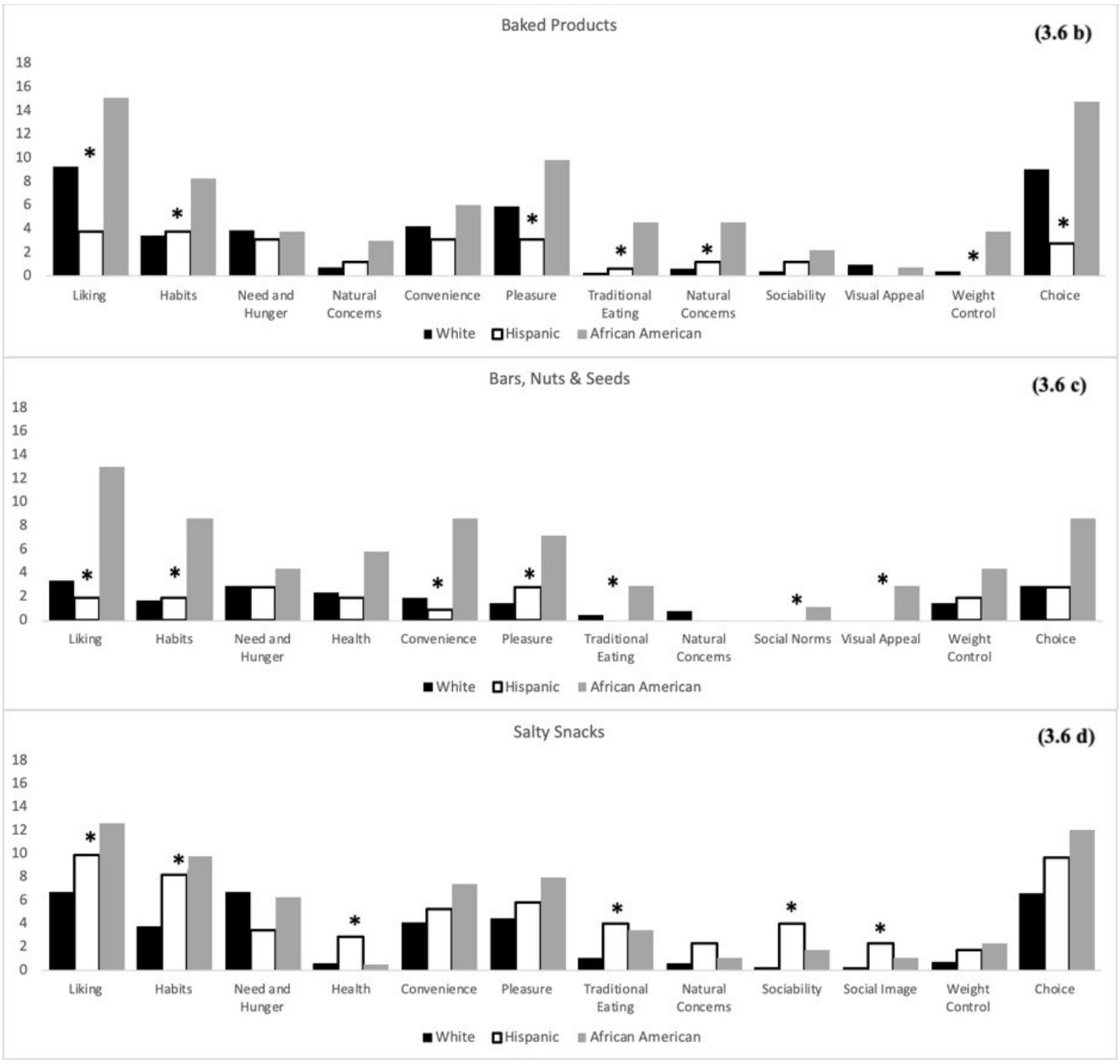


Figure 3.6 Motivation patterns (%) for four snack groups based on ethnicity. 3.6 a) This motivation pattern was associated with sweets. 3.6 b) This motivation pattern was associated with baked products. 3.6 c) This motivation pattern was associated with bars, nuts & seeds. 3.6 d) This motivation pattern was associated with salty snacks.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Figure 3.6 shows the motivation patterns in percentage for four snack groups based on ethnicity. Three ethnicities were the majority among participants in this study: White, Hispanic, and African American. Liking was the main motivation to consume different groups of snacks in all the three different ethnicities, followed by choice. Snack groups shown in Figure 3.6 were

chosen based on significant differences in motivation patterns among ethnicities. Other snack groups' motivation patterns can be found in Appendix D.

Figure 3.6a shows the main motivations to consume sweets based on ethnicity. There were significant differences among ethnicities for five motivations. African American participants reported significantly higher frequencies for the motivations of need & hunger (*p-value 0.005),* natural concerns (*p-value 0.000)*, traditional eating (*p-value 0.026),* price (*p-value 0.026),* and visual appeal (*p-value 0.034).*

Figure 3.6b shows the main motivations to consume baked products based on ethnicity. There were significant differences among ethnicities for seven motivations. African Americans and White participants reported significantly higher frequencies for the motivations of liking (*p-value 0.001),* pleasure (*p-value 0.036)*, and choice (*p-value 0.008)* as compared to Hispanics. African Americans also showed the highest frequencies for the motivations of habits (*p-value 0.027)*, traditional eating (*p-value < 0.0001),* natural concerns (*p-value 0.002)*, and weight control (*p-value 0.000)* when compared to both White and Hispanic participants.

The main motivations to consume bars, nuts & seeds are shown in Figure 3.6c. There were significant differences among ethnicities for seven motivations. African Americans reported significantly higher frequencies for the motivations of liking (*p-value 0.000),* habits (*p-value 0.002),* convenience (*p-value 0.001),* pleasure (*p-value 0.010),* traditional eating (*p-value 0.033),* visual appeal (*p-value 0.000),* and social norms (*p-value 0.015).* White and Hispanic participants had similar motivations and were, in all cases, were lower than those for African Americans.

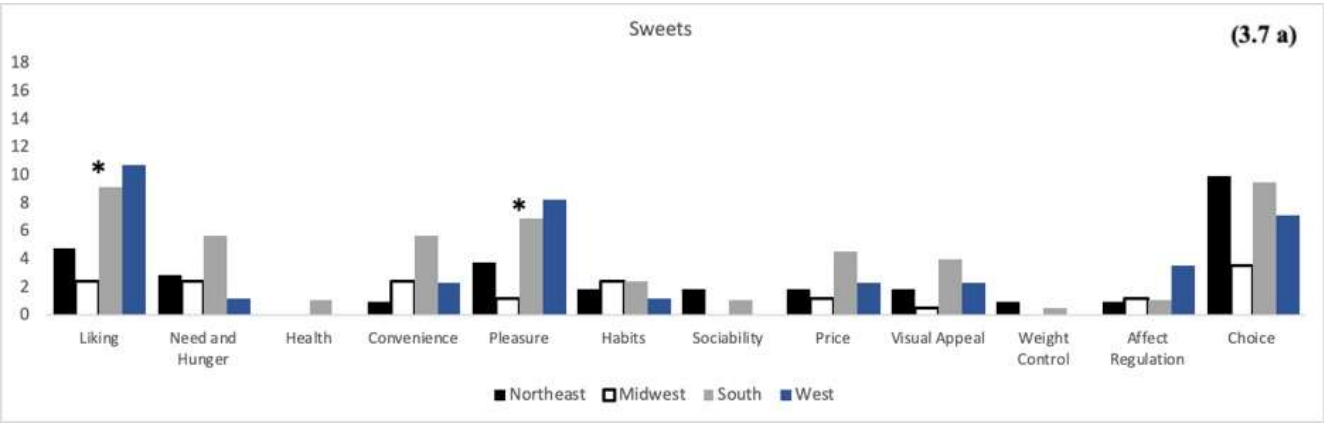
Figure 3.6d shows the main motivations to consume salty snacks. There were significant differences among ethnicities for six motivations. African Americans and Hispanics reported

significantly higher frequencies for the motivations of liking (*p-value 0.015),* habits (*p-value 0.001),* and traditional eating (*p-value 0.012)* when compared to Whites. Hispanics also showed the highest frequencies for the motivations of health (*p-value 0.020),* sociability (*p-value 0.000),* and social image (*p-value 0.024).* White participants reported need & hunger, choice, and liking as their main motivations to consume salty snacks; however, their frequencies were not significantly different from African Americans and Hispanics for need & hunger or choice.

The main motivations to consume fruits were slightly different among ethnic groups (Appendix D). For White participants, liking and choice were the main motivations to consume fruits. Hispanics reported liking and choice as their main motivation but also reported health and pleasure as two important reasons to consume this food group. African American population put health as the primary motivation.

The main motivations to consume dairy products is shown in Appendix D. This group of snacks seemed to be less important for African American participants because they reported fewer motivations to consume them than Whites and Hispanics. African Americans reported consuming this snack group because of liking, convenience, and weight control.

Snacking motivations based on US Region



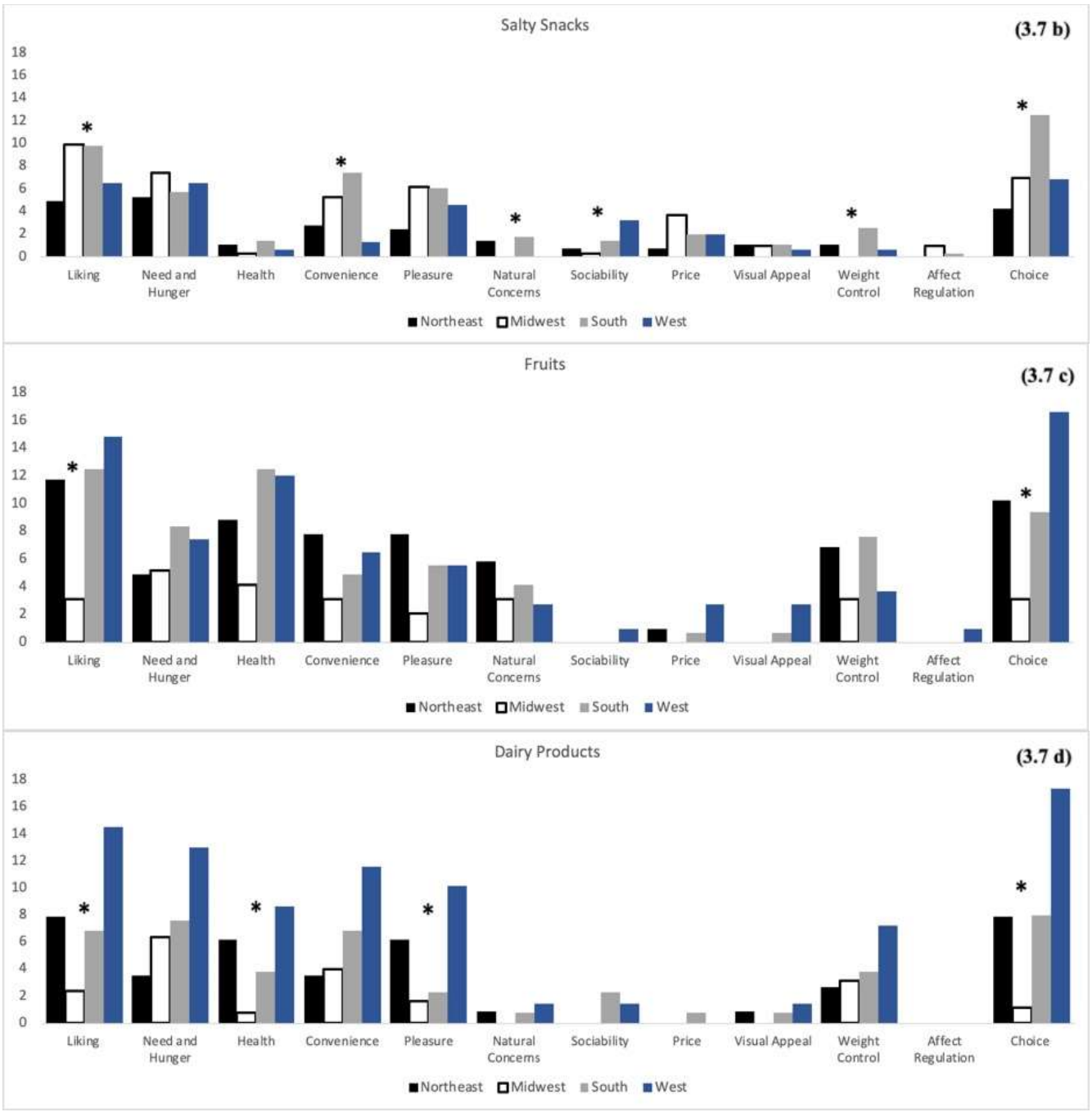


Figure 3.7 Motivation patterns (%) for four snack groups based on US region. 3.7 a) This motivation pattern was associated with sweets. 3.7 b) This motivation pattern was associated with salty snacks. 3.7 c) This motivation pattern was associated with fruits. 3.7 d) This motivation pattern was associated with dairy products.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Figure 3.7 shows the motivation patterns in percentage for four snack groups based on U.S. regions. The regions were divided into Northeast, Midwest, South, and West based on the

United States Census Bureau. Snack groups shown in Figure 3.7 were chosen based on significant differences in motivation patterns among U.S. regions. Other snack groups' motivation patterns can be found in Appendix E.

Figure 3.7a shows the main motivations to consume sweet snacks based on U.S. regions. There were significant differences among regions for two motivations. South and West regions of the country reported significantly higher frequencies for the motivations of liking (*p-value 0.013)* and pleasure (*p-value 0.019).* The South region also reported higher frequencies for need & hunger and convenience, but they were not significantly different from the other areas.

Another snack that showed significant differences among regions were salty snacks (Figure 3.7b). There were significant differences among regions for six motivations. Participants in the Midwest and South regions of the country showed significantly higher frequencies for liking (*p-value 0.033)* and convenience (*p-value 0.004),* meaning that they probably consume this type of snack because it is easy to obtain and it does not require any preparation. Respondents in the South region also showed significantly higher frequencies for weight control (*p-value 0.015)* and choice (*p-value 0.009).* Natural concerns were significantly important for participants in the Northeast and South regions (*p-value 0.042).* The West region of the country showed significantly higher frequencies for sociability (*p-value 0.032),* which may mean when compared to other regions in the country, participants in the West tend to consume salty snacks because it is social and makes social gatherings more comfortable.

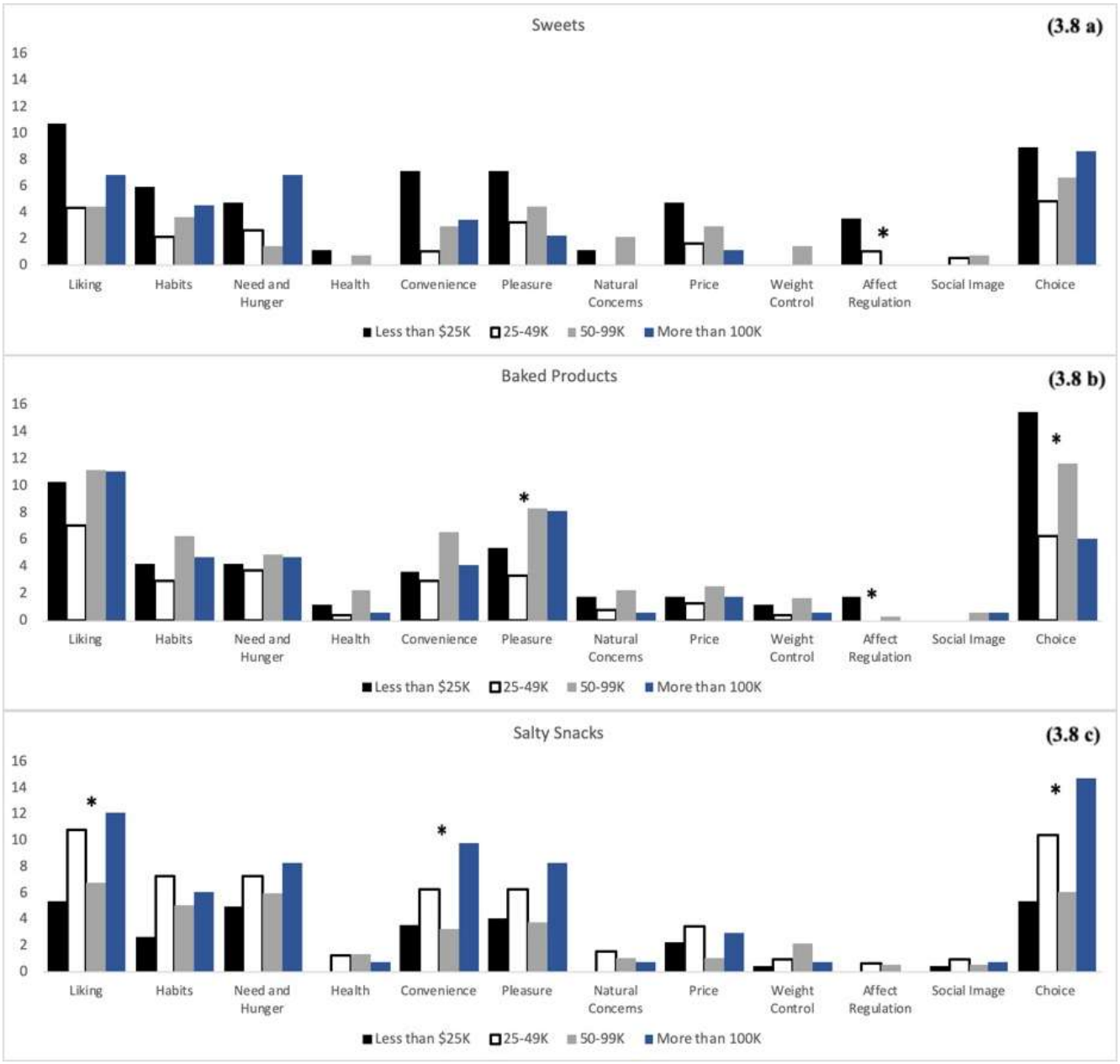
Figure 3.7c shows the main motivations to consume fruits as snacks. Liking (*p-value 0.013)* and choice (*p-value 0.045)* were again the main motivations to consume fruits as snacks and showed significantly higher frequencies in all the regions except for the Midwest. Not surprisingly, the third primary motivation to consume this snack group was health (because it is

healthy, to maintain a balanced diet, because it keeps me in shape). This pattern was similar for all the four regions, except for the Midwest, where need & hunger (because I am hungry, because it is pleasantly filling, because I need energy) was the primary motivation to consume from this snack group. Sociability and affect regulation seem to have a low effect on the consumption of fruits as snacks in all four regions. Price and visual appeal seem to be important motivations to consume fruits in the West region of the country.

Dairy products could also be considered as a "good for you" snack similar to fruits. Their main motivations to be consumed in all four regions were similar to the motivations to consume fruits (liking, choice, health, need & hunger, and convenience). However, the motivation patterns to consume dairy products as snacks were significantly higher in the West area when compared to the other regions, showing that probably participants tend to consume more dairy products such as yogurt or cheese in the Western side of the country (liking *p-value 0.007, health p-value 0.032, pleasure p-value 0.011, choice p-value 0.006)*. Pleasure, liking, and choice were the main motivations to consume from this group, which shows that participants tend to enjoy and consume dairy snacks for fun and because they like them and not just for health or need and hunger.

Consumption of meats as snacks was not significant between regions; however, showed interesting patterns. Consumption of meat as a snack was mainly driven by choice and liking in all four regions (Appendix E).

Snacking motivations based on annual income



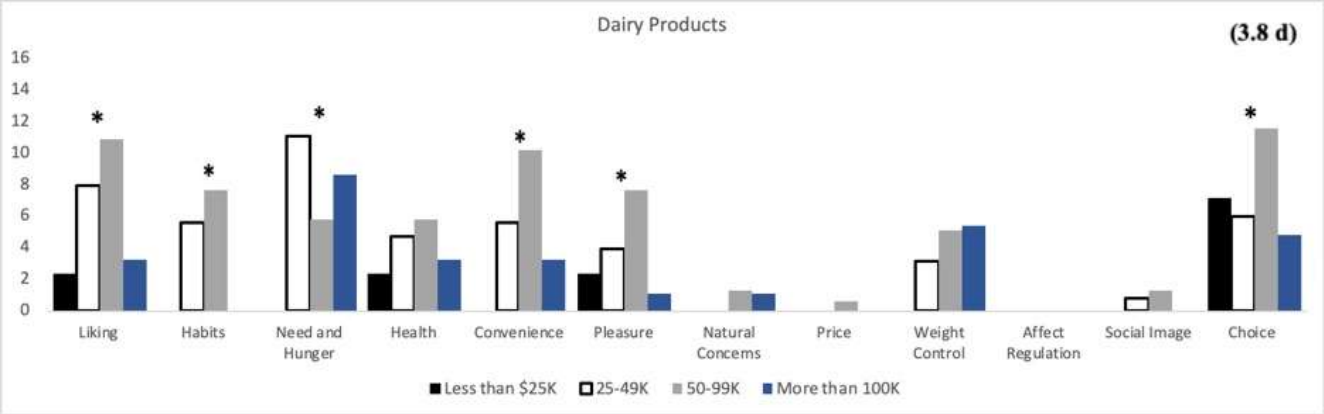


Figure 3.8 Motivation patterns (%) for four snack groups based on annual income. 3.8 a) This motivation pattern was associated with sweets. 3.8 b) This motivation pattern was associated with baked products. 3.8 c) This motivation pattern was associated with salty snacks. 3.8 d) This motivation pattern was associated with dairy products.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Figure 3.8 shows the motivation patterns in percentage for four snack groups based on the total household annual income. Income was classified into four categories: less than $25.000 per year, between $25.000 to $49.999 per year, between $50.000 to $99.999 per year, and more than $100.000 per year. Liking was the primary motivation to consume different groups of snacks in all four annual income categories, followed by choice. The snack groups shown in Figure 3.4 were chosen based on significant differences in motivation patterns among annual household income. Other snack food groups' motivation patterns can be found in Appendix F.

The household income ranges determined by the United States Census Bureau will be used to facilitate the discussion of different snack groups by income level. According to this census less than $20,000 is considered below or near poverty level, between $20,000 to $44,999 is considered low income, between $45,000 to 139,999 is consider middle class, and more than $140,000 is considered upper middle class or high income (U.S. Census Bureau: Income and poverty in the United States: 2017.2019).

Figure 3.8a shows the motivation patterns to consume sweet snacks. There was a significant difference among annual income categories for only one motivation. Participants in

the near-poverty income category (less than $25K) were significantly more motivated to consume sweets due to affect regulation (*p-value 0.049)*. Liking, convenience, pleasure, price, and choice were also important for this category; however, they were not significantly different when compared to the other categories. The main motivations to consume sweet snacks in low, middle, and upper-income categories were liking and choice. These motivations were not significantly different between categories.

Motivations to consume baked products are shown in Figure 3.8b. There were significant differences among annual income for three motivations. Middle and upper-income categories showed significantly higher frequencies for the motivation of pleasure (*p-value 0.044),* while participants in the near-poverty category reported significantly higher frequencies for affect regulation (*p-value 0.025)* and choice (*p-value 0.020)*.

Another snack that showed significant differences between categories was salty snacks (Figure 3.8c). There were significant differences among annual income for three motivations. Liking was significantly higher for low and upper-income categories (*p-value 0.015)*. The upper-income category also showed a significantly higher frequency for the motivations of convenience (*p-value 0.007)* and choice (*p-value 0.017).* Other motivations such as habits, need & hunger, pleasure, and price were important for low-income participants. However, they were not significantly different when compared to other categories.

Motivations to consume dairy products were also significantly different between categories. There were significant differences among annual income for six motivations. Low and middle-income participants reported significantly higher frequencies for liking (*p-value 0.046)* and habits (*p-value 0.010)*. Low-income participants also reported higher frequencies for need & hunger (*p-value 0.047),* while middle income respondents showed significantly higher

frequencies for convenience (*p-value 0.019)*, pleasure (*p-value 0.041)* and choice (*p-value 0.028).*

Motivations to consume meat as a snack were different in all four annual income categories; however, they were not significantly different (Appendix F). Participants with an annual income of less than $25,000 reported to consume meat as a snack, mainly because of need and hunger. Lower-income (25,000-49,000) reported being motivated to consume this snack group mainly because of liking, pleasure, and choice. High-income class does not see meat as a snack but tends to consume it mostly as part of other main meal times, such as lunch or dinner. The middle class was motivated by liking, choice, convenience, and pleasure. The upper-middle and high-income population reported to be motivated to consumed meat because of need and hunger but in a lower frequency (%) than low-income class.

Finally, the motivation patterns for fruits and vegetables were not significantly different but showed interesting patterns that are shown in Appendix F. The motivations to consume fruits were similar in all four categories; however, differences were reported in the motivation pattern for vegetables. Middle, Upper and High-income categories (50-99K and More than 100K) consume vegetables motivated by several reasons such as liking, habits, need & hunger, health, convenience, pleasure, natural concerns, price, weight control, and choice; whereas lower-income categories tend to consume vegetables motivated by fewer reasons such as liking, need & hunger, health, pleasure, weight control and choice. Even if both income categories share some of the same motivations, lower-income categories showed lower frequencies of responses (%) for most of the motivations to consume vegetables.

Discussion

Motivations to consume different snack food groups.

Liking was the main motivation to consume snacks in all the three clusters identified in this research. This is consistent with previous research that found that liking was the most influential motivation people report when selecting their food (Phan & Chambers, 2016). Usually, this motivation is related to the way food tastes and the sensory acceptance of food. People usually report consuming certain types of foods because it tastes good. Usually, liking is also linked to pleasure. Health professionals and marketers recognize that people tend to seek food they like and food that gives them pleasure (Glanz, Basil, Maibach, Goldberg, & Snyder, 1998). Not surprisingly, liking and pleasure were the primary motivations to consume baked products, salty snacks, and fruits. The first two tend to be considered not as healthy as other types of snacks but usually have a really good taste and are not selected due to healthiness criteria.

Convenience and need & hunger were the main reasons to consume foods in more than one cluster. Both motivations were the main reasons to consume dairy products, salty snacks, and fruits. Nowadays, convenience is an essential factor in food selection. People work longer hours, have busier schedules, and tend to have less time to cook their meals. The same trend happens for snacks, where food choices are driven by snacks that are quick and easy to prepare, but at the same time, are pleasantly filling.

From the Correspondence Analysis presented in Figure 3.4, three clusters were identified from the snacks reported in this study. Cluster 1 could be considered the less healthy of the groups and will be assigned as “fun for you” snacks. Not surprisingly, this cluster was associated with affect regulation. Affect regulation has been associated with higher consumption of

carbohydrates and sugars in previous research. Consumption of what could be considered as less healthy food such as sweets, cookies, chips, or desserts has been positively associated with stress and depressive symptoms (El Ansari, Adetunji, & Oskrochi, 2014). Affect regulation refers to certain emotions associated with sadness, loneliness or frustration; these emotions could lead or indicate stress and depressive symptoms. Results from previous research have also shown that under stress or depression, food choices tend to go into an unhealthy direction (Verhoeven et al., 2015), which could explain why sweets, salty snacks, and baked products were associated with affect regulation in our study. Under stress conditions, people tend to increase appetite significantly to more types of sweet foods such as desserts, chocolate, candy, ice cream, bakery products such as muffins or sweet bread and even salty food such as tacos or fast food (Kandiah, Yake, Jones, & Meyer, 2006).

These groups of snacks are considered less healthy because an increase in their consumption has been associated with a higher incidence of chronic diseases such as obesity, hypertension, and diabetes mellitus (Renner, Sproesser, Strohbach, & Schupp, 2012). Another issue is that they tend to be accessible to the population because they are inexpensive, and depending on the season of the year, they could be on sale at the stores. In Great Britain, there was an analysis presented in 2018 where authors suggested that an increase in price for the sweet snacks could lead to a reduction in purchasing and consumption of these foods (Smith, R. D., Cornelsen, Quirmbach, Jebb, & Marteau, 2018). A reduction in the purchasing and consumption of sweet snacks can contribute to a reduction in the total energy intake, weight gain, and risk of type 2 diabetes, lowering the incidence of the chronic diseases mentioned before.

Higher consumption of sweet and salty snacks was also related to sociability, social image, and social norms in the present study. Social gatherings tend to include this type of snack,

and often people consume them because others like it or because it is trendy, and they think they have to eat it. Previous research investigating the reasons for unhealthy snacking found that participants consume unhealthy snacks on special occasions such as a party or a birthday, also to celebrate a special occasion with their friends, family, or significant other (Verhoeven et al., 2015).

Cluster 2 is represented with the green color in Figure 3.4 and includes vegetables, dairy products, fruits and bars, nuts & seeds. This group was associated with natural concerns, weight control, and health, and it will be called "good for you" snacks.

Fruits and vegetables have been associated with healthy eating behaviors. Both food items are often given as definitions of healthful eating, regardless of income, race, or sex (Eikenberry & Smith, 2004). Results from the present study reinforced that these two groups are associated with health concerns and how people are interested in following a balanced diet. The attitudes affecting decisions to consume fruits and vegetables are associated with the perception that we need to do something good for our body and have good weight management (Qamar, 2016).

Dairy products were also grouped in this cluster. Not all dairy products are necessarily healthy; however, the main dairy products reported in this survey were yogurt and cheese, which are products that have a reputation of been classified as good snacks for your health. Bars, nuts & seeds have also been associated as good snacks and usually are advertised as great snack options that are low in calories and fat.

Cluster 3 is represented with blue color in Figure 3.4 and includes refined grains, beverages, meats, and sandwiches or wraps. This group was mainly associated with choice and visual appeal. This cluster is more diverse than the others and will be called "mixture snacks"

because it includes snacks with different characteristics such as high protein snacks and beverages.

The visual presentation of food is one of the first reasons why people choose what they eat. Appearance provides valuable information about palatability and availability; images of food are constantly shown in advertisements, print media, and television influencing the eating environment (Burger et al., 2011). Some of the foods reported in cluster 3 were probably not considered usual snacks and tended to be part of a main eating occasion such as lunch or dinner. However, meats, sandwiches or wraps, and some refined grains are constantly on advertisements (e.g. chicken fingers, fried chicken, subs, wraps, popcorn), increasing the chances of its consumption more frequently as snack occasions.

Another reason why these foods were grouped together in cluster 3 could be related to leftovers that were left at home from lunch or dinner. Choice was one of the reasons associated with this group, and choice included the option "I eat it because it was the only choice". Some of the snacks reported as meats, or refined grains were probably chosen because it was the only option available at the snack time.

The majority of beverages reported in this study were energy drinks, carbonated beverages, water, tea, and coffee. These types of beverages are usually consumed every day, which explains why choice was one of the main motivations for their consumption. Choice included in its items the option "I want to eat/drink it every day". The appearance of some energy drinks and carbonated beverages is very appealing, which also explains why the visual appeal was one of the primary motivations to consume these beverages.

Snacking motivations based on gender

Results from this research showed that there were significant differences between males and females for the snack groups of dairy, fruits, bars, nuts & seeds, and meats. Previous research has shown that consumption of dairy products between men and women is similar (Hightower, 2010). However, based on our results, the motivations to consume these products could be slightly different depending on gender.

Our results showed that males consumed dairy snacks because it is easy and quick to prepare; it is natural and it can be used as a snack in social gatherings to spend time with other people. Health and weight control were not significantly different in both genders, but previous research regarding the barriers and limitations to consume dairy products in males and females found differences in health motivations to consume these products. This study showed that males tend to consume dairy products because it is a type of food that makes them feel stronger, while females were more concerned about how many calories and how much fat is contained in these products (Racey et al., 2017).

Our results also showed that males consume bars, nuts, or seeds driven by their liking, appetite, or because they need energy. This group also recognizes it as a healthy snack that can help them to maintain a balanced diet. Previous research found that males had lower consumption of grain-based bars compared to females (Hightower, 2010), so it was surprising to find higher frequencies for almost all the motivations reported in our study.

Motivations to consume meats as snacks were also different between males and females. Previous research has shown that males tend to consume more meat than females. The consumption of processed meat is almost double the amount in males than females (Davis & Lin,

2005). This could help to explain why males tend to report more motivations to consume meat as snacks than females, especially motivations related to liking, good taste, and pleasure.

Another group that did not show significant differences but showed trends between genders was sweets. Our results showed that females tend to consume sweet snacks driven by liking, choice, and pleasure, while males tend to consume sweet snacks motivated by choice, need & hunger, and liking (Appendix C). These results are supported by previous research that has shown that females and males eat unhealthy snacks for different motivations. Similar to our results it has been reported that bodily sensations and hunger motivate males, and females are more motivated by thoughts, cognitions, social reasons, and higher levels of emotional eating (Adriaanse, de Ridder, & Evers, 2011; Cleobury & Tapper, 2014; Larsen, van Strien, Eisinga, & Engels, 2006).

Compared to men, women were the only ones reporting eating sweet snacks for social norms (to avoid disappointing someone who is trying to make me happy, or because it would be impolite not to eat it) and health, suggesting that, females may have more diverse reasons to consume sweets or simply because they are more likely to report more motivations for eating this snack group.

Snacking motivations based on ethnicity

Results from this research showed that there were significant differences between ethnicities for the snack groups of sweets, baked products, bars, nuts & seeds, and salty snacks. Results indicate that African American consumers tend to consume sweet snacks such as candies, chocolates, or desserts, mainly because of energy. Also, because they grew up consuming these types of snacks because it is inexpensive, and because of the presentation or packaging that could be appealing to them. White consumers reported consuming sweet snacks,

mainly because of liking, choice, and pleasure. However, there were no significant differences in these motivations when compared to Hispanics and African Americans. Hispanics also reported consuming sweets, mainly for the same reasons: liking, choice, and pleasure.

Visual appeal is related to food that people recognize from advertisements or television. There could be a relationship between the motivation to consume sweet snacks and the advertisements that African Americans get from watching TV. This population tends to watch on-screen media such as TV, videos, or movies more than Hispanics and Whites do. Television is especially important for African American households (Shiriki Kumanyika & Sonya Grier, 2006). According to a research conducted in 2006, African American TV shows have more food commercials than general prime-time shows, and usually, these commercials feature high calorie and high sugar foods (Shiriki Kumanyika & Sonya Grier, 2006).

Differences between the motivations for the consumption of bars, nuts & seeds were obtained in the present study, as previous research has also shown differences between African Americans, Whites, and Hispanics in their consumption of nuts and seeds. Consumption of nuts and seeds was higher for Whites than African Americans and Hispanics, especially for almonds, cashews, and walnuts (Hightower, 2010). However, based on our results, African Americans were able to identify a higher number of motivations related to consuming snacks in this group even though previous research reports their consumption as lower than other ethnic groups.

Two groups of snacks that were not significantly different but showed important trends were fruits and dairy products. Previous research has shown that African Americans tend to consume less “healthy” snacks when compared to White and Hispanic populations, especially fruits and vegetables (Hightower, 2010; Lucan et al., 2010). None of the African American participants reported consuming vegetables as snacks for this research. This could explain why

this ethnic group did not include liking or pleasure as their primary motivation to consume fruits. They reported health as the primary motivation, showing that probably they consume fruits because of the health benefits they can get from this group but not necessarily because of liking or enjoyment when eating them. Inaccessibility to grocery stores has been described as one of the main barriers to consume fresh and healthy snacks in these population groups. Also, their consumption is discouraged because these snacks have a reduced shelf life when compared to other less healthy options in the market (Yeh et al., 2008).

Snacking motivations based on US region

Results from this research showed that there were significant differences between U.S regions for the snack groups of sweets, salty snacks, fruits, and dairy products. The main motivations to consume sweets were liking and pleasure. Some other motivations to consume sweet snacks were representative of specific regions, even if they were not significantly different. For example, sociability was important for participants in the Northeast region. These participants probably consume sweets in social gatherings or to spend time with other people more than in other regions of the country. Price and visual appeal were important aspects for participants in the South region. Sweets tend to be inexpensive and easy to obtain at the stores, and at the same time, tend to have attractive packages that call for consumer's attention. For the West region, affect regulation was important for participants, meaning they reported to consume this type of snacks when they are sad, lonely, or frustrated more frequently than the other regions of the country.

Consumption of meat as snacks was not significantly different between regions; however, showed interesting patterns. Need & hunger was the primary motivation to consume meat as a snack for participants from the Midwest, showing that for this group of participants getting meat

as a snack is important because of the amount of energy they can get from it, or because they believe it is a snack that is pleasantly filling. Visual appeal was an important characteristic for the South region, showing that besides liking or hunger reasons, the presentation of the meat snacks was a critical motivation to consume them.

The Northeast region showed more motivations to consume meat as a snack than the other regions. Liking and choice were the main motivations, followed by need and hunger, convenience, health, and pleasure. A report from the USDA about meat consumption showed that consumers in the Northeast region of the country tend to eat more processed meat than other regions (Davis & Lin, 2005). Processed meat such as ham, sausages, salami, and beef jerky are more commonly included as snack meats, which may help explain why the Northeast region showed more motivations for eating this type of snack.

Snacking motivations based on annual income.

Results from this research showed that there were significant differences between annual income for the snack groups of sweets, baked products, salty snacks, and dairy products. The motivations to consume "fun for you" snacks such as sweets, baked products, and salty snacks could be related to how quick, easy, cheap, and inexpensive is to obtain this type of snacks and their availability at corner stores in the low-income neighborhoods. Previous research has shown that low-income populations have higher access to less nutritious snacks due to a more significant number of small convenience stores in their neighborhoods that tend to sell high-energy foods (Haynes-Maslow, Parsons, Wheeler, & Leone, 2013; Kiszko et al., 2015). The majority of products available at these stores are potato chips, sweet snacks like desserts, pastries, cookies, cakes, chocolates, or candy, and sugar-sweetened beverages (Lent et al., 2015).

Another different group corresponds to dairy products. Based on our results, participants in the lower-income category tend to consume dairy products as snacks because they are pleasantly filling and because they need the energy. On the other hand, participants in the middle-income category are more motivated to consume dairy products for their convenience (quick and easy to prepare) and also because they enjoy eating them and possibly tend to consume this snack to indulge or reward themselves.

Our results showed lower motivations to consume meat in the upper and high-income class, possibly due to these categories not seeing meat as a snack but mainly as a type of food that is consumed during lunch or dinner. A report from the USDA showed that low-income consumers tend to eat more meat at home than middle or high-income consumers, which tend to eat more meat from restaurants (Davis & Lin, 2005). Also from this report, it was shown that high-income households were big consumers of steaks more than any other type of meat (Davis & Lin, 2005).

Finally, results in our study found that low-income participants had less motivation to consume vegetables. Previous studies have shown some barriers to consume fruits and vegetables in this population (Dong & Lin, 2009). Price is one of those barriers and was reported only in poverty and low-income categories as a motivation to consume fruits (Appendix F). This shows that lower-income populations will consider this factor before getting their fruits, or will tend to look for fruits that are on sale or are less expensive. Previous research has shown that income affects the consumption of fruits and vegetables. Poor households located in poverty communities tend to find higher prices for their fruits and vegetables due to lower accessibility when compared to households located in other communities (Stewart & Blisard, 2008).

Conclusions

This study aims to provide an overview of the main motivations to consume different groups of snacks in US adults. The main findings of this study showed three clusters: “fun for you” snacks, “good for you” snacks, and “mixture” snacks. Liking was the primary motivation to consume snacks in all three groups. “Good for you snacks” options tend to be motivated by natural concerns, weight control, and health. These snacks were mainly fruits, vegetables, dairy products, and bars/nuts and seeds.

On the other hand, “fun for you snack” options tend to be motivated by social image, price, social norms, sociability, traditional eating, and affect regulation. These snacks correspond to sweets, salty snacks, and baked products. Knowing the motivations behind different snack food groups can help food product developers, marketing teams, or health care providers to work as interdisciplinary teams to create and promote different category snacks.

Limitations of the study should be acknowledged. This study was conducted with an Internet survey; this means that some people were automatically excluded from the study. A significant number of potential participants do not have access to the Internet which is a limitation to include them in the study. This situation also limits the analysis of data per income level. Probably people in lower-income levels do not have access to the Internet or even a computer, which automatically excludes from our study people in a lower-income status.

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Chapter 4 - Snacking behavior in US adolescents

Abstract

Snacking behavior in adolescents is a complex process that can be influenced by many different factors. The motivations to consume certain types of snacks in boys can be different than in girls, and can also differ depending on the ethnicity of the adolescent. This study aimed to explore the motivations behind the snacking choices in adolescents. The study was conducted using an online survey with 1,050 adolescents from 13 to 17 years old, that have lived in the United States for more than five years. This survey included questions related to the snacking behavior of this population using a slightly modified version of the Eating Motivation Survey (TEMS) and the Kids-Palatable Eating Motives Scale. The following 16 motivations were included: liking, habits, need and hunger, health, convenience, pleasure, traditional eating, natural concerns, sociability, price, visual appeal, weight control, affect regulation, social norms, social image, and choice. The snacks reported by the participants were classified in the following snack groups: baked products, refined grains, beverages, sweets, dairy products, fruits, bars/nuts or seeds, meats, salty snacks, sandwich or wrap, and vegetables. These snack groups were grouped into clusters (three clusters in total) based on their similarity with the 16 motivations form TEMS and the Kids-Palatable Eating Motives. Cluster 1 was considered the group of "fun for you" snacks. These snacks were associated with the motivations: liking, pleasure, affect regulation, sociability, and social image. Cluster 2 was considered the group of "good for you" snacks and was associated with the motivations: liking, weight control, natural concerns, health, and traditional eating. Cluster 3 was considered the group of "mixed" snacks and was associated with the motivations of liking, need & hunger, and visual appeal. Knowing what the motivations are for consuming certain types of snacks is important because it can help researchers and

educators develop the appropriate strategies for adolescents based on the reasons that are important to each group.

Introduction

Studying the snacking behaviors of adolescents in the United States is an important topic because of the increase in snacking patterns in this age group. Studies suggest that the percentage of adolescents that consume snacks has increased in the last decades. The proportion of adolescents and young adults that snack has increased but also the total energy consumed from snacks has increased by 20% in the years between 1977 to 1978 to around 23% in the years between 1994 to 1996 (Zizza, Siega-Riz, & Popkin, 2001). Most of this extra energy comes from the kinds of snacks consumed by these adolescents. The top sources of energy reported by adolescents in this study included desserts, sweetened beverages, dairy products such as whole milk and whole milk made cheese, and salty snacks (Zizza et al., 2001).

Adolescence is a critical time as these kids are economically active and have enough resources to buy their own snacks. This may represent a challenge because it means many adolescents are free to decide what they want to eat, possibly for the first time in their lives. It is in this context that food developers and healthcare providers need to create and promote snacks that can be attractive for teenagers. These snacks need to be “nutritionally dense” meaning that ideally should be low in fat and sugar but rich in other essential nutrients (Anderson, Macintyre, & West, 1993).

Depending on the nutritional quality of the snacks, they can be either beneficial or detrimental to the adolescents' diet. A study conducted in Iran indicated that frequent consumption of highly caloric snacks in adolescents was associated with a prevalence of overweight, general obesity, and abdominal obesity (Azadbakht, Hajishafiee, Golshahi, &

Esmaillzadeh, 2016). However, healthy snacks such as fruit and vegetables were significantly associated with a decreased prevalence of overweight, general obesity, and abdominal obesity in female adolescents (Azadbakht et al., 2016).

As shown in these studies snacking can be a positive or a negative behavior depending on the type of snacks consumed by the adolescents. For this reason, it is crucial to understand the motivations to consume either "good for you" or "fun for you" snacks in order to develop strategies that can help them make healthier choices in their daily snacking routine. The main objective of this research was to investigate the motivations behind the consumption of different snack food groups in a population of US adolescents using a bottom-up approach with the Eating Motivation Survey (TEMS).

Materials & Methods

Participants

Respondents were recruited by Qualtrics database. To qualify for the study, participants had to be between 13 and 17 years old, and have lived in the United States for more than five years. A consent form was distributed to each of the possible participants in order to obtain permission from their parents or guardians to participated in the study. This consent form included a small introduction, purpose of the research survey, procedures, and questions that will be asked to the child, and also a statement of confidentiality. A total of 1050 participants were recruited from all over the country.

Online survey questionnaire

Qualified adolescents were asked to complete an online survey in Qualtrics software (Qualtrics, Provo, UT, USA) licensed to Kansas State University. The questionnaire included a demographic section described in Chapter 3. The snack section which included the following

topics: primary activity adolescents were doing when they consumed their snack, percentage of adolescents that read the nutritional label, number of snack items consumed during the snack occasion, and acquisition of that snack. The last section of the survey included the modified Eating Motivation Survey (TEMS) to investigate the main motivations to consume different snack groups. This section used the procedure of Check–All–That–Apply (CATA) to allow participants to check on the reasons to consume a particular snack. TEMS items in this study included 16 motivations: liking, habits, need and hunger, health, convenience, pleasure, traditional eating, natural concerns, sociability, price, visual appeal, weight control, affect regulation, social norms, social image, and choice. These motivations were similar to the ones used in the adults' survey adapted from Renner, Sproesser, Strohbach, 2012, and Phan & Chambers, 2016. However, some of the motivation's vocabulary was adjusted for adolescents using the Kids-Palatable Eating Motives Scale (K-PEMS) (Boggiano, Wenger, Mrug, Burgess, & Morgan, 2015). Table 4.1 shows the adjusted terms for adolescents. Three items were included to measure each of these motivations. For example, to measure the motivation ***liking***, the following three statements were used: "because it tastes good", "because I like it", and "because it is fun".

Table 4.1 Modified motivations from The Kids-Palatable Eating Motives Scale used in this research.

Liking because it tastes good because I like it ** because it's fun*	**Pleasure** because I enjoy it in order to reward myself ** because it gives me a pleasant feeling*	**Weight Control** because it is low in calories because it is low in fat ** to lose weight*
Convenience because it is easy to prepare ** because it is available at school* ** because it is available at home*	**Traditional Eating** because I grew up with it out of traditions (e.g., family traditions, special occasions)	**Affect Regulation** because I feel lonely ** because it helps me when I feel down or nervous*

	** because my family always prepares it at home*	** to forget things that I am worrying about*
Sociability ** to enjoy time with friends* ** because it makes social gatherings more fun* ** so that others won't joke about me not eating or drinking these snack*	**Price** because it is inexpensive because it is on sale ** because it is the cheapest option at school*	**Social Norms** because I am supposed to eat it to avoid disappointing someone who is trying to make me happy ** because my friends want me to eat/drink it*
Choice I want to eat it every day ** because that is the only choice at home* ** because that is the only choice at school*	**Social Image** because others like it ** so I won't feel left out* ** to fit in with a group I like*	**Habits** because I usually eat it because I am familiar with it because I am accustomed to eating it
Need and Hunger because I am hungry because it is pleasantly filling because I need energy	**Natural Concerns** because it is natural (e.g., not genetically modified) because it contains no harmful substances because it is organic	**Health** because it is healthy to maintain a balanced diet because it keeps me in shape (e.g., energetic, motivated)
Visual Appeal because it spontaneously appeals to me because the presentation is appealing (e.g., packaging) because I recognize it from advertisements or have seen it on TV		

** Modified item vocabulary for adolescents.*

Data Analysis

Descriptive statistics were used to summarize the main activity while snacking and the percentage of adolescents reading the labels on their snacks. Proportion tests using Pearson's chi-squared test statistic was also performed on the data. For the motivations to consume snack groups section each snack reported was classified into eleven different groups: sweets, salty snacks, baked products, refined grains, beverages, sandwich or wraps, meats, bars/nuts or seeds, fruits, dairy products, and vegetables based on the United States Department of Agriculture

(USDA) The Five Food Groups Program and the USDA Branded Food Products Database. The 16 motivation factors from the Eating Motivation Survey and the Kids-Palatable Eating Motives Scale were linked to the snack food groups using correspondence analysis (CA) to obtain the main motives for each snack group. Hierarchical clustering was also performed on the CA factors to classify each snack into clusters based on the similarities in motivations among snack groups. Proportion tests using Pearson's chi-square test statistic were also performed on the proportion data of all 16 motivations to validate the main motivations for each snack group. Data analysis was done using XLSTAT-Sensory (Version 2019.1.1, Addinsoft, New York, USA).

Results

Figure 4.1 shows the primary activity adolescents reported they were doing when they consumed their snack. Watching television or movies was the main activity reported, followed by playing video games or other leisurely games. The lower percentages were reported for driving and getting ready to go to sleep. Other activities accounted for 2.6% of participants and included activities such as: rehearsing, while practicing a sport, at school, and while listening to music.

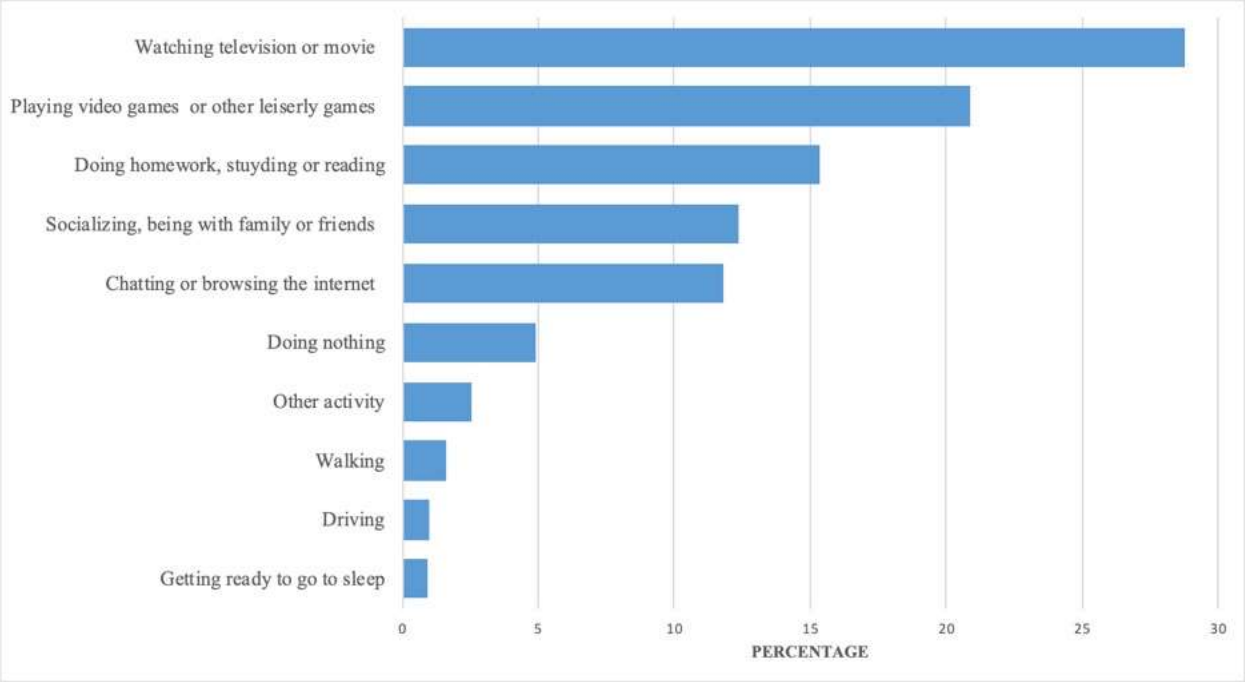


Figure 4.1 Main activities adolescents were doing when they consumed their snack

Figure 4.2 presents the percentage of adolescents who either read or did not read the label information on their snack. There was a significant association between gender and their willingness to read the snack label panel (p=0.005). A significant percentage of males reported not reading the label because they were not interested in the information. Among the respondents that did not read the label, a higher percentage of girls claimed to know the information already.

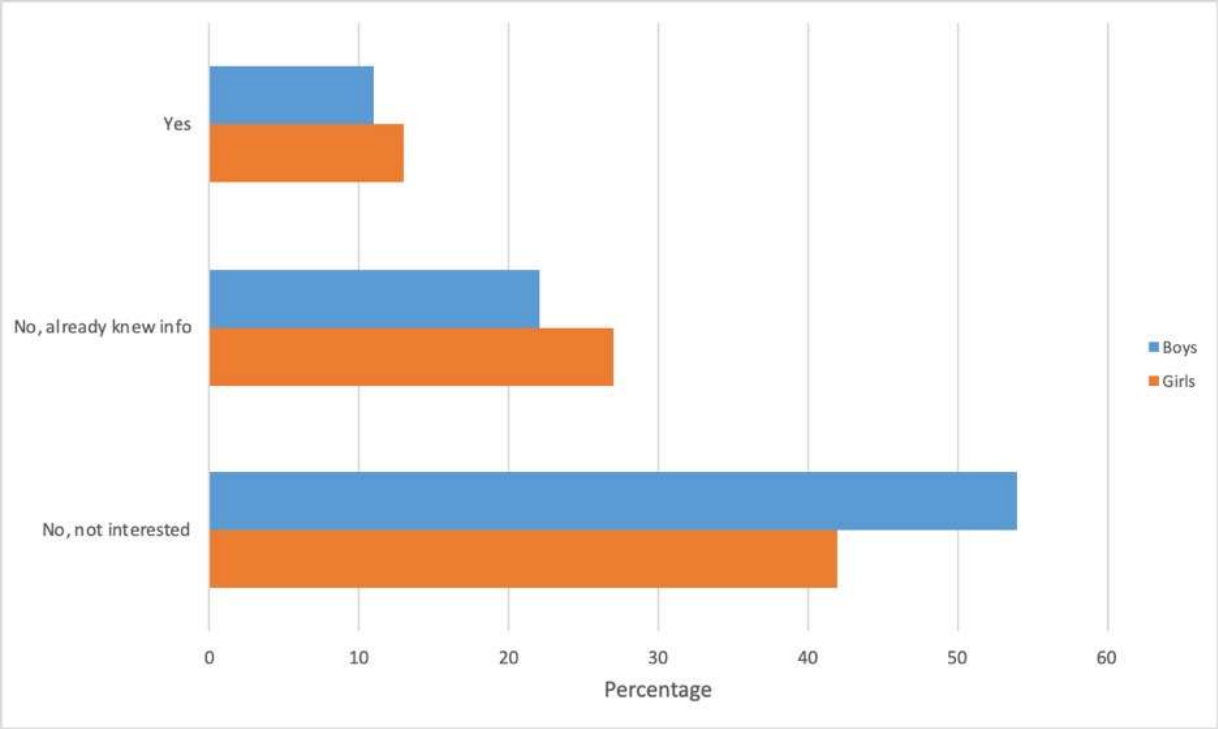


Figure 4.2 Percentage of adolescents that read the label information of their snack based on gender.

Significant differences were also found in the percentage of adolescents that read or did not read the label based on the highest education of the primary male or female in their home. As shown in Figure 4.3 (a), participants, where the primary female highest level of education was "unknown", they reported not to read the label and were not interested in the information shown on the label. If the highest level of education was "graduate school", a higher percentage of participants reported to read the label or at least to already know what this information was. In the case of households were the primary male highest level of education was "less than high school," there was less interest in reading the nutritional label information. Similar to the primary female, if "graduate school" was the highest level of education, a higher percentage of participants reported to read the nutritional label (Figure 4.3 (b)). There were no significant differences between the percentage of participants that read the nutritional label and the ethnicity and US region.

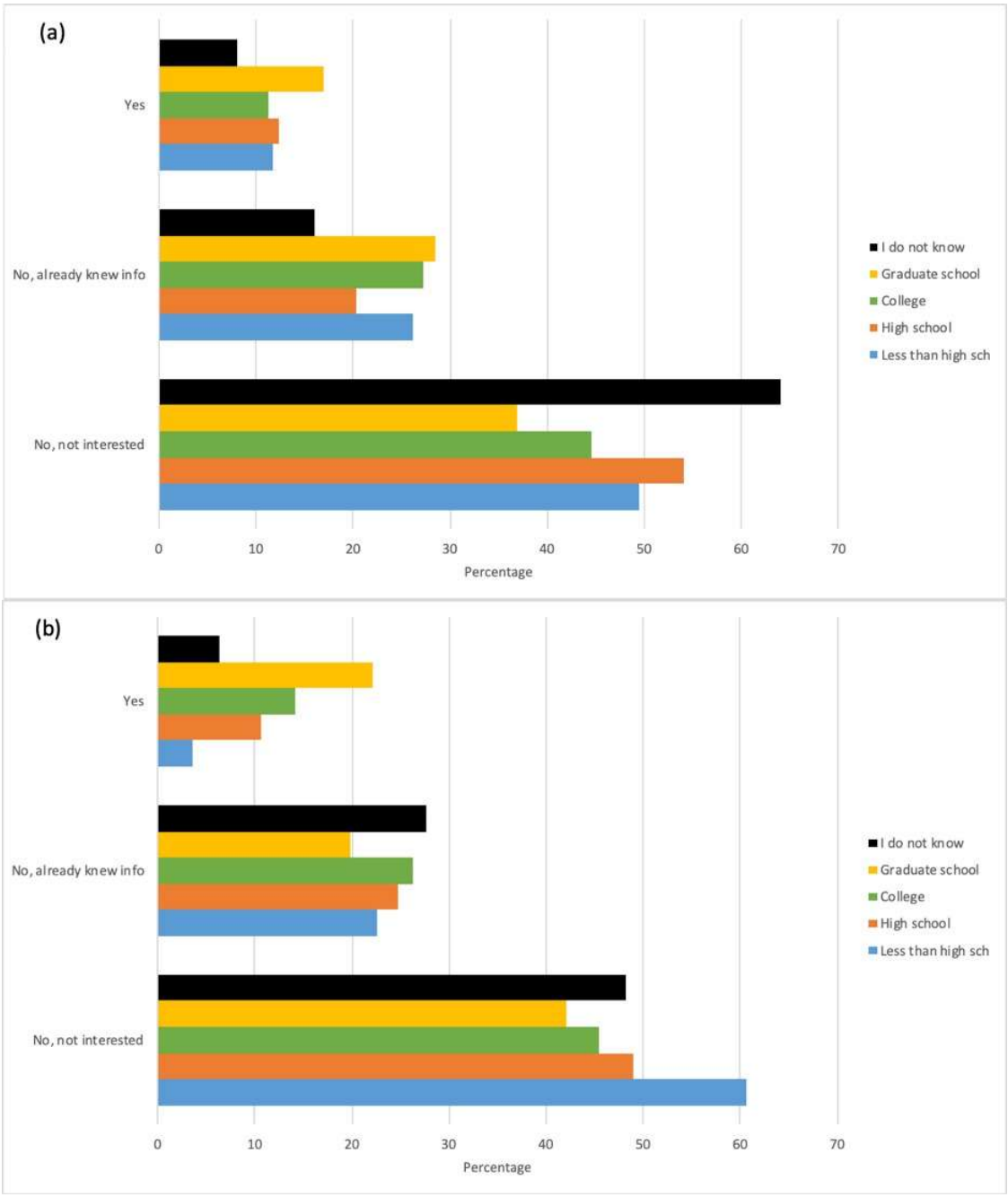


Figure 4.3 Percentage of adolescents that read the label information of their snack based on the highest level of education of the primary female (a) and the primary male (b) at their home. The **"I do not know"** statement refers to adolescents that did not know the highest level of education of their primary female or male caregiver.

The number of items consumed during the snack occasion was also explored in Table 4.2.

Table 4.2 Number of items consumed in each snack occasion.

Number of items per snack time	Percentage (%)
1	49.4
2	37.6
3 or more	13

The majority of adolescents reported consuming only one item during their snack time; these snacks were already purchased by participants before the snack occasion in the majority of cases (81.4%). 82.3% of adolescents reported somebody in their family purchased their snack item, 12% reported to have bought the snack item themselves outside the school, 4.2% bought the snack themselves in their school, and 1.5% of participants reported somebody outside their family purchased their snack item.

Motivations to consume different snack food groups

Figure 4.4 shows what the motivations were when consuming from different snack groups. Participants classified the snacks they had eaten into categories such as baked products, refined grains, beverages, sweets, dairy products, fruits, bars/nuts or seeds, meats, salty snacks, sandwich or wraps, and vegetables. These categories were grouped into clusters (three clusters in total) based on their similarity with the 16 motivations form the Eating Motivation Survey and the Kids-Palatable Eating Motives.

Cluster 1 is represented in black in figure 4.4 and includes the snack groups baked products, beverages, sweets, and salty snacks. This cluster could be considered as a group of "fun for you" snacks. These snacks were associated with liking, pleasure, affect regulation, sociability, and social image. Table 4.3 shows the responses in percentage for each motivation for each of the snack groups. According to these results, adolescents do not care much about health, natural concerns, or weight control when choosing food items in this cluster (Figure 4.4).

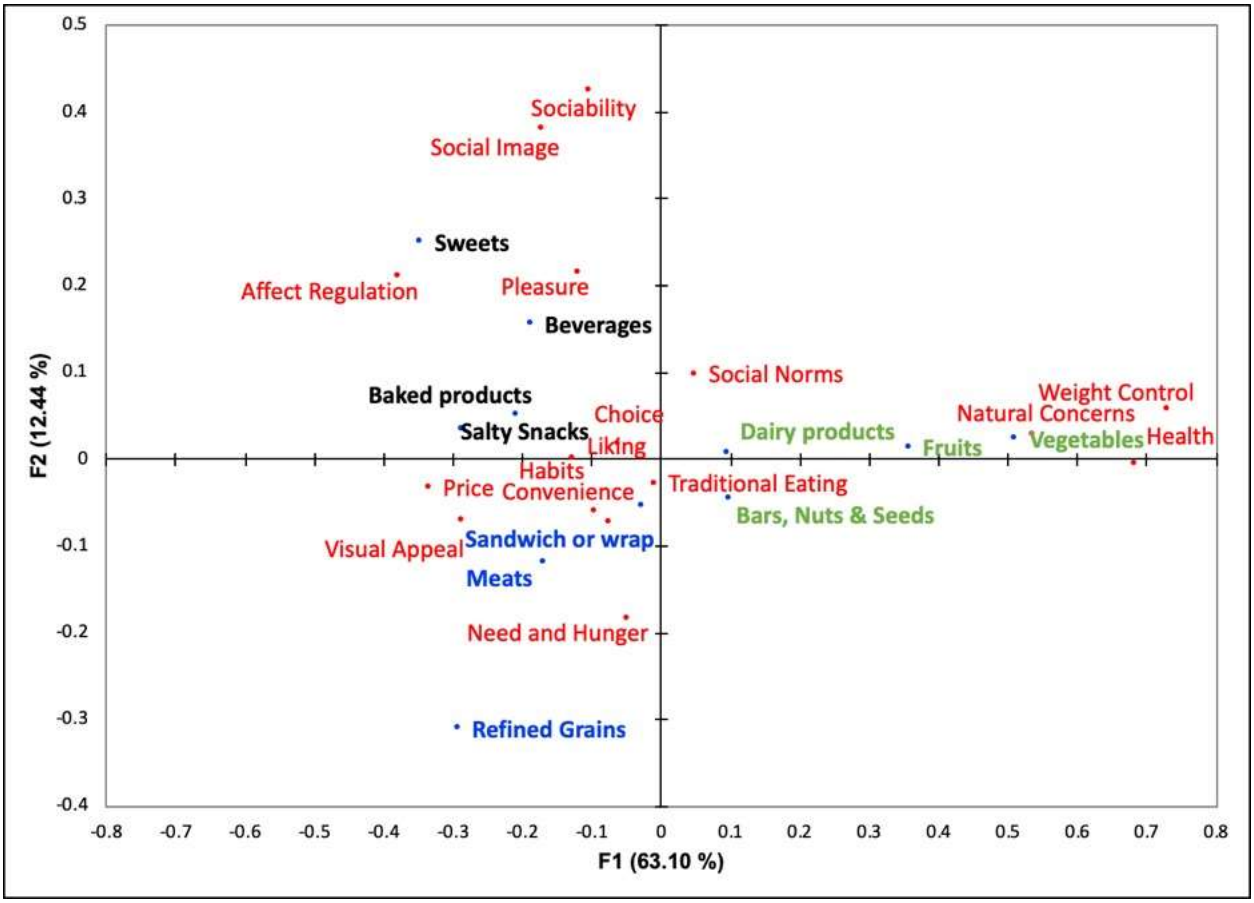


Figure 4.4 Correspondence analysis map of eleven food groups and sixteen motivations. This map represents 68.1% of the total variance of the data. The eleven food groups were classified into three clusters shown in the map with different colors (black, blue and green), these clusters were grouped based on their similarity with motivation patterns.

Cluster 2 is represented in green in figure 4.4 and includes the snack groups dairy products, fruits, vegetables, and bars, nuts & seeds. These snacks were associated with the motivations of liking, weight control, natural concerns, health, and traditional eating. According to these results, adolescents do not care much about affect regulation, social image, or sociability when choosing food items in this cluster (Figure 4.4).

Cluster 3 is represented in blue in figure 4.4 and includes the snack groups sandwich or wrap, meats, and refined grains. These snacks were associated with the motivations of liking, need & hunger, and visual appeal. According to these results, adolescents do not care much

about sociability, need and hunger, visual appearance, price, affect regulation, or social image when choosing food items in this cluster (Figure 4.4).

This group could be considered moderately healthy because it includes snacks that are typically high in protein, fiber, and are low in sugar and fat. For example, meat is a snack option that contains a higher amount of protein. Sandwich and wraps could be considered as moderately healthy depending on their composition and added ingredients. Refined grains are a diverse group that can be considered as healthy and unhealthy. Some of the refined grains reported in this study included rice, pasta, popcorn, tortillas, noodles, and cereal breakfast. This group is very diverse, and even if it is not entirely unhealthy, some products such as cereal breakfast can be loaded with sugar making it a less healthy option.

Table 4.3 Percentages of the motivations associated with the snack food groups in adolescents

Item	Baked Products	Beverages	Sweet	Salty Snacks	Dairy Products	Fruits	Bars, nuts & seeds	Vegetables	Meats	Sandwich & Wraps	Refined Grains	p-value[a]
Number of items	235	226	166	490	159	154	167	32	14	34	21	
Liking	38.6	40.6	33.7	***41.2***	***41.3***	40.3	***41.5***	39.6	40.5	32.4	36.5	*0.0010*
Habits	17.9	23.0	14.3	23.5	***24.5***	***24.9***	***24.4***	19.8	19.0	23.5	22.2	*0.005*
Need & Hunger	21.0	12.2	12.2	21.4	21.8	22.5	***28.1***	25.0	21.4	***26.5***	25.4	*< 0.0001*
Health	5.0	5.9	1.2	2.5	20.8	28.1	17.6	***34.4***	9.5	9.8	1.6	*< 0.0001*
Convenience	19.9	18.0	9.4	18.9	19.7	***22.9***	16.6	17.7	14.3	19.6	19.0	*< 0.0001*
Pleasure	22.7	***27.6***	***27.7***	23.9	27.0	22.7	22.8	24.0	19.0	17.6	11.1	*< 0.0001*
Traditional Eating	6.8	8.0	3.8	5.5	6.9	***9.7***	4.6	8.3	7.1	5.9	6.3	*0.003*
Natural Concerns	3.1	3.4	1.0	2.4	7.5	***18.4***	9.4	9.4	4.8	5.9	0.0	*< 0.0001*
Sociability	2.8	2.7	1.8	2.8	0.8	1.9	2.0	2.1	0.0	2.0	0.0	0.311
Price	5.1	4.9	4.2	4.1	2.7	2.2	3.2	3.1	9.5	4.9	3.2	0.105
Visual Appeal	5.7	5.9	4.2	5.6	4.8	5.2	5.2	2.1	9.5	4.9	4.8	0.763
Weight Control	3.5	4.0	1.4	1.8	5.2	13.6	6.8	***22.9***	2.4	6.9	1.6	*< 0.0001*
Affect Regulation	2.7	1.6	1.6	2.0	1.3	1.3	1.6	0.0	2.4	2.0	0.0	0.545
Social Norms	2.0	2.4	1.0	1.5	1.7	2.6	2.2	2.1	0.0	1.0	1.6	0.677
Social Image	2.4	2.4	2.0	2.4	1.5	2.2	1.0	1.0	0.0	3.9	0.0	0.439
Choice	6.7	6.2	3.8	4.9	6.9	7.6	5.6	5.2	4.8	4.9	4.8	0.235

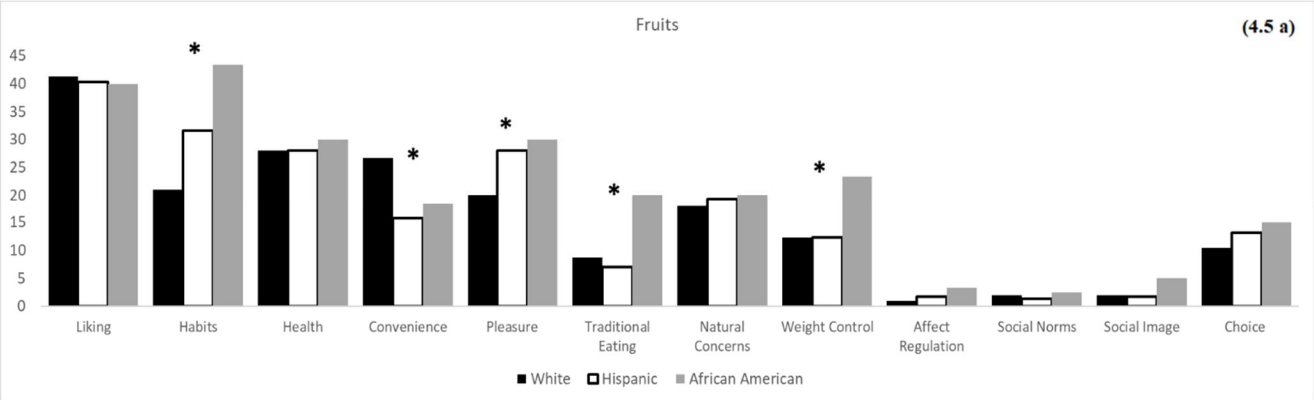
[a] p-value of two-sided proportion test using Pearson's Chi-square test statistic, df=10, value in bold-significant at alpha = 0.05.

Snacking motivations based on ethnicity

Figure 4.5 shows the motivation patterns in percentage for three snack groups based on ethnicity. Three ethnicities were the majority represented among participants: White, Hispanic, and African American. Snack groups shown in Figure 4.5 were chosen based on significant differences in motivation patterns among ethnicities.

Figure 4.5a shows the main motivations to consume fruits based on ethnicity. There were significant differences among ethnicities for five motivations. African American participants reported significantly higher frequencies for the motivations of habits (*p-value 0.002),* traditional eating (*p-value 0.007),* and weight control (*p-value 0.021).* Pleasure was significantly higher for Hispanics and African Americans (*p-value 0.008),* while Americans reported significantly higher percentages for the motivation convenience (*p-value 0.003).*

Figure 4.5b shows the main motivations to consume salty snacks based on ethnicity. There were significant differences among ethnicities for four motivations. White and Hispanic adolescents reported significantly higher frequencies for motivation liking (*p-value 0.022)* when compared to African Americans. White's also showed the highest frequencies for motivation convenience (*p-value 0.031)*. African Americans reported higher frequencies for the motivations of natural concerns (*p-value 0.016)* and price (*p-value 0.019).*



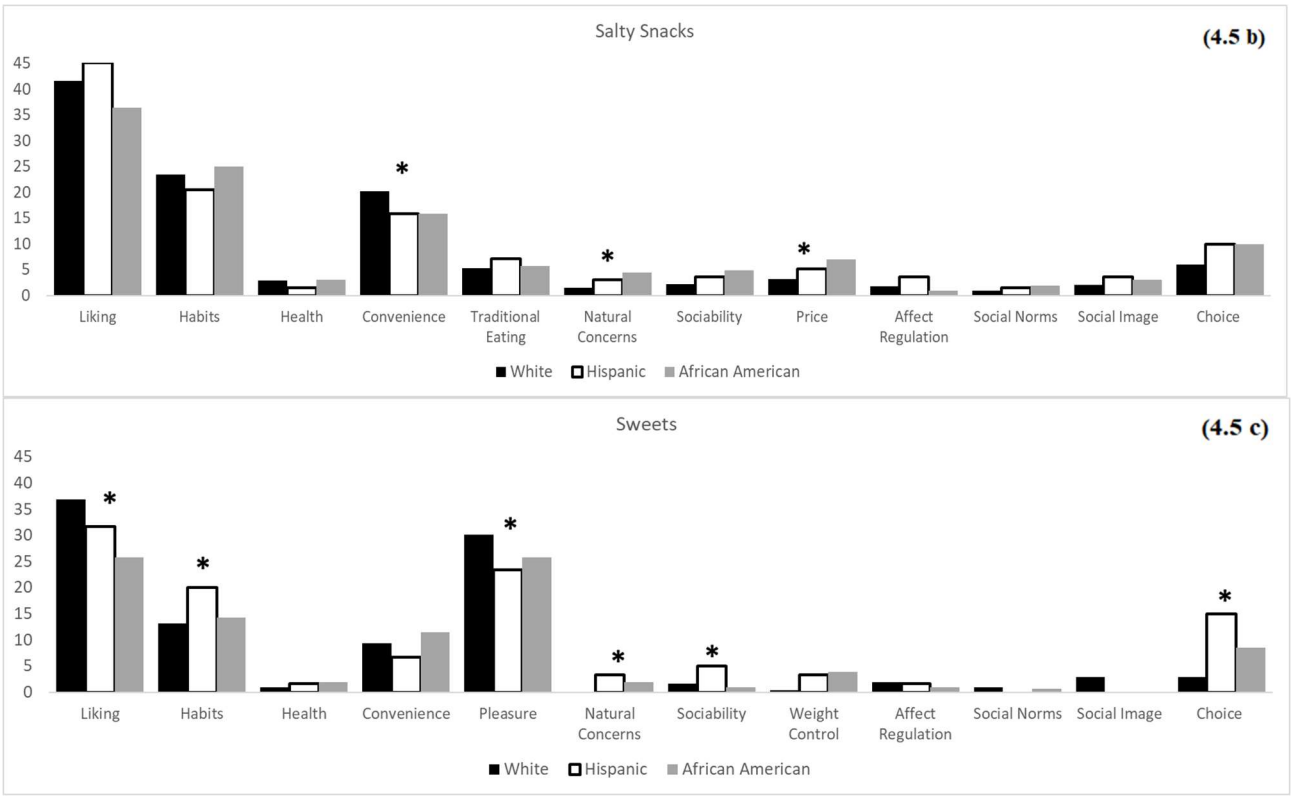


Figure 4.5 Motivation patterns (%) for three snack groups based on ethnicity. 4.5 a) This motivation pattern was associated with fruits. 4.5 b) This motivation pattern was associated with salty snacks. 4.5 c) This motivation pattern was associated with sweets.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

The main motivations to consume sweets are shown in Figure 4.5c. There were significant differences among ethnicities for six motivations. White adolescents reported significantly higher frequencies for the motivations liking (*p-value 0.004)* and pleasure (*p-value 0.023).* Hispanics reported higher frequencies for the motivations: habits (*p-value 0.034),* natural concerns (*p-value 0.013),* sociability (*p-value 0.014),* and choice (*p-value 0.003).*

Snacking motivations based on gender

Figure 4.6 shows the motivation patterns in percentage for three snack groups based on gender. Snack groups shown in Figure 4.6 were chosen based on significant differences in motivation patterns between males and females.

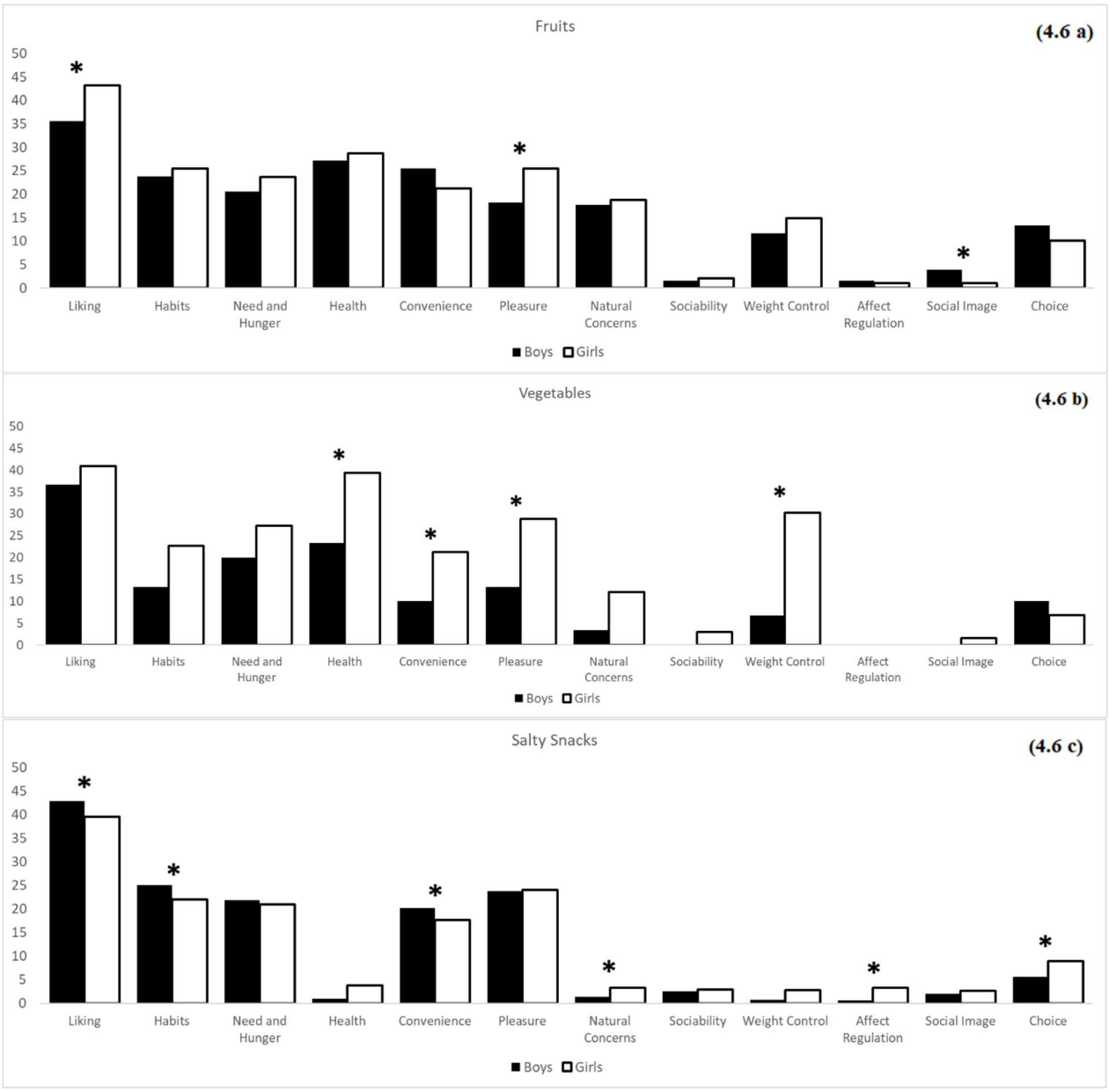


Figure 4.6 Motivation patterns (%) for three snack groups based on gender. 4.6 a) This motivation pattern was associated with fruits. 4.6 b) This motivation pattern was associated with vegetables. 4.6 c) This motivation pattern was associated with salty snacks.

* significantly different proportions based on Pearson's Chi-square test statistic at alpha = 0.05.

Figure 4.6a shows the main motivations to consume fruits based on gender. There were significant differences between three motivations to consume fruits between boys and girls. A significantly higher percentage of girls found liking (*p-value < 0.0001)* and pleasure (*p-value*

0.005) as important motivations when compared to boys. Boys reported a significantly higher frequency than girls to consume fruits motivated by social image (*p-value 0.037)*.

The reasons to consume vegetables also differed in some motivations and showed significant differences for four motivations based on gender (Figure 4.6 b). A significantly higher frequency of girls reported consuming vegetables motivated by: health (*p-value 0.007)*, convenience (*p-value 0.014)*, pleasure (*p-value 0.007)*, and weight control (*p-value < 0.0001)*.

Figure 4.6c shows the main motivations to consume salty snacks based on gender. There were significant differences between six motivations to consume this snack group between boys and girls. A significantly higher percentage of girls found natural concerns (*p-value 0.015)*, affect regulation (*p-value 0.000)*, and choice (*p-value 0.039)* as important motivations when compared to boys. On the other hand, boys reported higher percentages for the motivations: liking (*p-value 0.046)*, habit (*p-value 0.021)*, and convenience (*p-value 0.047)*.

Discussion

The results from this study focus on the motivations to consume from different snack food groups in adolescents. Three clusters were identified. The first cluster was considered the "fun for you" snack cluster and was associated with liking, pleasure, affect regulation, sociability, and social image. Liking tends to be the primary motivation to consume food in all three clusters; however, pleasure is a different motivation that tends to be associated with "fun for you" foods. For this reason, it is not surprising that marketing companies often use pleasure to sell food products, emphasizing the pleasure it can bring to consumers (Pettigrew, 2016).

Similar to our findings, previous research has found a relationship between "fun for you" snack foods (such as sweets, chocolate, and baked products) and pleasure (Brown & Ogden, 2004). An explanation for this relationship could be associated with the learning and memory

process related to pleasant eating experiences. Previous research has shown that memory activation occurs when choosing a specific type of food that is considered pleasant. The memory of a previous pleasant experience eating some food makes people want to eat more of that food to feel the same enjoyable experience again (Jacquier, Bonthoux, Baciu, & Ruffieux, 2012).

According to our results, habits was also a motivation to consume "fun for you" snacks, especially for salty snacks, baked products, and beverages (Table 4.3). This result is in agreement with a study conducted in nine European countries in 2015. This study found a correlation between unhealthy snack intake and the habit strength that starts at youth and increases with age (De Vet, Stok, De Wit, & De Ridder, 2015). Habit as a driver to consume unhealthy snacks is a dangerous motivation because it could be strong enough to overpower any other motivation to consume healthy snacks. According to the authors, habit strength beats healthy eating intentions. This leads to an unwanted eating behavior despite any good intentions of having better and healthier eating options (De Vet et al., 2015).

Other reasons to eat "fun for you" snacks found in our study were related to socialization, meaning spending time with friends or making social gatherings more fun. They may feel this kind of food is socially accepted (because others like it or so they do not feel left out of a group). Affect regulation also seem to be a reason to consume from this group and is related to helping when adolescents feel down or nervous or to forget about things they are worried about. A previous study conducted in Iran identifies other reasons to consume "fun for you" snacks. These authors mentioned taste, peer pressure, parental influence, and easy access as the main motivations to consume "fun for you" type of snacks (Karimi-Shahanjarini et al., 2010).

The "fun for you" group includes snacks that contain higher amounts of sugar, fat, and calories when compared to the other snack types. "Fun for you" snacks have been associated

with overweight and obesity among children and adolescents due to the extra calories consumed in the form of added sugar and fats (Sebastian, Cleveland, & Goldman, 2008).

Cluster 2 represents the “good for you” snacks and included groups such as dairy products, fruits, vegetables and bars, nuts & seeds. These snacks were associated with liking, weight control, natural concerns, health, and traditional eating. Liking was the main motivation to consume healthy snacks in adolescents; this motivation was the strongest for all three clusters. Health, natural concerns, and weight control were also the primary motivations for this group. These results suggest that adolescents choose to eat healthy snacks such as fruits and vegetables mostly because they are concern about their health, because they want to lose or maintain their weight, and because they are worried about the natural properties of their snacks.

Similar results were found in a study conducted in Switzerland. The authors identified clusters based on snacking patterns: healthy dietary pattern, moderate dietary pattern, and unhealthy dietary pattern. The healthy cluster was characterized by higher consumption of fruits and vegetables and showed that participants were more aware of their health and were more concern about the quality of the food they were eating (Hartmann, Siegrist, & van der Horst, 2013).

However, the decision to consume “good for you” snacks is represented by an interactive process among several factors. According to literature, the acceptance and consumption of healthier snacks are related to a combination of social and individual factors. Health consciousness is a powerful motivator but cannot act alone; social factors have to come in to play in the food choice decision because snacks are usually consumed in the presence of family or friends. Some of these social factors can include friends' influence and social activities with peers that occur around snack meals (Nørgaard, Sørensen, & Grunert, 2014).

Weight control is also a powerful motivator to consume healthy snacks. Literature suggests that adolescents that tend to consume low-calorie and low-fat foods are more interested in reducing energy for weight control and have higher intentions to keep consuming these types of food in the future (Fulkerson, French, & Story, 2004). This is especially important in adolescents because they are exposed to different kinds of snacks in the school environment. The motivation to keep their weight under control could be enough to help them decide to choose healthier options such as dairy products, or fruits and vegetables, over other high fat, high sugar snacks.

Knowing the motivations that drive adolescents to choose healthy snacks is essential because eating snacks between the main meals can help to speed up the metabolism and provide satiety. In addition, healthy snacks can be an excellent opportunity to increase the number of nutrients obtained in adolescents' diets (Bucher, Collins, Diem, & Siegrist, 2016; Hartmann et al., 2013).

Cluster 3 was considered "moderately healthy or mixed" snacks because it included snacks high in protein, fiber and were low in sugar and fat. This group was associated with liking, visual appeal and need & hunger. This is a very interesting group to examine due to the diversity of its characteristics. The inclusion of meat and sandwich or wraps represents an opportunity to increase the amount of protein consumed by adolescents. Previous research has studied the importance of having a daily high protein snack in young people. Rich in protein snacks can help to improve the ingestive behavior, mood, and cognition in adolescents (Leidy et al., 2015).

According to figure 5.4 visual appeal and need & hunger were also the main motivations to consume some of the snack foods in cluster 3. Meats were the snack group that showed a higher

percentage of responses for the visual appeal motivation. Sandwich or wraps was one of the groups that had a higher percentage of responses for the motivation need & hunger (Table 4.3).

Visual appeal and need & hunger have been recognized as important factors that influence food choices in adolescents (Neumark-Sztainer, Story, Perry, & Casey, 1999). A group of adolescents in 7th and 10th grade that participated in a series of focus groups mention hunger as one of the first responses when asked why they eat what they eat. This motivation was particularly associated with the need to obtain something that could be quick to eat and substantial enough to fill them up (Neumark-Sztainer, Story, Perry, & Casey, 1999). This could explain why sandwich or wraps were associated with need & hunger. This type of snack is quick and easy to eat and can be very satisfying.

In the same study, participants discussed the visual appeal of food and how this could influence their food choices. Visual appeal was related to taste and seemed to be a crucial factor when making food decisions in this age group (Neumark-Sztainer et al., 1999). Some of the participants mentioned that they consumed certain types of foods because of how they look. If they look good and from previous experience, they knew it would tastes good. Others gave examples of how they are not be willing to eat foods that did not look as expected (Neumark-Sztainer et al., 1999). In our study meat had a higher percentage of responses for visual appeal, showing that adolescents tend to consume meat snacks due to the way they look or their appealing package.

Snacking motivations in adolescents were also studied based on ethnicity and gender. Based on ethnicity there were main differences in three snack food groups: fruits, salty snacks, and sweets. Results showed that African American adolescents reported consuming fruits as snacks because they enjoyed them, are familiar with it, they usually eat it, they considered them

as low in calories and fat, or because they want to watch their weight. Both African Americans and Hispanics reported significantly higher frequencies for pleasure, meaning that they consume fruits for this motivation more than Americans do. On the other hand, Whites showed significantly higher frequencies for convenience, meaning that when compared to Hispanics and African Americans, they think fruits are easy and quick to prepare and are a very convenient snack.

Interestingly, habits was a significantly important motivation to consume fruits in African Americans, followed by Hispanics. Previous research has pointed out the role of family members in successful interventions to increase fruit consumption. Family traditions and habits were considered a channel to increase fruit and vegetable intake in adolescents (Molaison, Connell, Stuff, Yadrick, & Bogle, 2005). Family traditions and consumption pattern of fruits could be related to the higher percentage of African American adolescents who reported habits as one of the main motivations to consume this type of snack.

Based on gender there were main differences in three snack food groups: fruits, vegetables, and salty snacks. Our results show that girls tend to consume fruits and vegetables because they like them, they are healthy, convenient, and pleasurable, while the motivation for boys are related to social image.

Our results are in agreement with a previous study conducted in 2007. This study showed that girls have a higher consumption of fruits and vegetables than boys and that the main motivation to consume them was because they liked them. The authors stated that boys eat fewer fruits and vegetables because they like them less girls (Bere, Brug, & Klepp, 2008).

Finally, the motivations to consume salty snacks were different in girls and boys. Girls tend to prefer salty snacks due to affect regulation motivations and also due to choice and natural

concern factors, while boys prefer salty snacks because they like them, because they taste good, because it´s fun or because they are easy to eat. Girls may choose this type of snack to regulate some emotions such as loneliness, to help them when they feel down or nervous or to forget things that they are worried about, while boys just eat them for simpler reasons.

Conclusions

The results of this study confirmed that adolescents have different motivations to consumed different snack groups. Three main clusters were identified based on the preferences of adolescents that contain healthy, moderately healthy, and "fun for you" snacks. Adolescents reported consuming healthy snacks based on motivations related to their well-being including weight control, natural concerns, and health. Moderately healthy snacks were consumed based on need & hunger and their appearance, while "fun for you" snacks were consume based on emotions such as pleasure, affect regulation, sociability, and social image. Similar to results in previous chapters of this dissertation, liking was always present as one of the strongest motivations to consume snacks in all three clusters. A description of the snacking patterns and motivations in adolescents can provide a foundation for successful behaviorally focused interventions.

Every research has limitations. This study's limitation was related to the self-reported methodology. Therefore, some of the respondent's answers could be inaccurate or imprecise, not necessarily on purpose, but it may be possible that they do not recall an exact motivation to consume their last snack. Another limitation of this study was related to the small sample size of some of the snack food groups, such as meats, or sandwich or wraps. Consequently, the findings for those groups should be considered as preliminary results and further investigation may be needed to draw stronger conclusions.

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Chapter 5 - Reasons US consumers do not choose certain snack options during snacking occasions.

Abstract

Understanding the reasons why consumers choose not to eat certain types of snacks is important for the food industry and healthcare providers. The objective of this study was to investigate consumers motivations for not choosing a particular snack. Choices for the snacks came from the food groups: salty snacks, sweets, dairy products, fruits, vegetables, nuts, cereal, and fast food. The study was conducted using an online survey that included questions related to demographics and a modified Eating Motivation Survey adapted to the following question: "Why did you not choose _____ as your snack?". A Check-All-That-Apply procedure was used to measure five motivations: liking, health, emotion & social suitability, and variety. The survey was conducted with two different age populations: adults and adolescents. A total of 1551 adults and 1050 adolescents completed the study. CATA data was analyzed by Correspondence Analysis and Hierarchical Cluster Analysis. The results showed that adults and adolescents have similar motivations not to eat snacks that were considered "good for you" and "fun for you." Interesting, the differences that existed in both populations were related to expectations of what was classified as a particular food to be labeled as a snack or not. The main motivations to not choose a "good for you" snack were related to liking and variety, specifically, because they did not like them or because they did not consider them filling enough. "Fun for you" snacks were not chosen for the motivations of emotion & social and health, specifically because these snacks were too high in calories or because they did not want to indulge themselves. These findings can help nutritional educators to construct the best recommendations to improve the nutritional quality of the snacks consume by adults and adolescents.

Practical Applications

Findings in this research can help educators, researchers, and industry understand the main barriers to consuming healthy snacks in adults and adolescents. Previous research has shown that people are aware of healthy food options available in the market. However, when looking at the consumption of snacks in America, it is evident that people are not making healthy food choices. Knowing what the motivations are causing people to reject these healthy snacks may help eliminate the barriers that are preventing people from making healthier snack choices. Snacking constitutes an integral part of the dietary intake in adults and adolescents. Snacking can contribute to the amount of energy consumed from fat and sugar, or it can be an opportunity to increase fruits, vegetables, and whole-grain products in one's diet. Understanding the reasons certain foods are not chosen as snack options can help the public health services.

Introduction

Snack consumption has increased in the last decades. Globally, sales for snack foods are expected to exceed US$630 billion by the year 2020 (Cleobury & Tapper, 2014; Mattes, 2018). Snacking contributes 15 to 30% to the overall average daily energy intake in the United States (Mattes, 2018).

This increase in the snacking frequency could be due to the busy lifestyle people are facing nowadays. With less time to cook, consumers demand foods that are convenient, easy to prepare, palatable, affordable, and easy to eat while doing other activities (Mattes, 2018). Snacking allows adults and adolescents to obtain all these benefits from this type of eating occasion.

The typical pattern of having only three big meals a day is changing which allows for more snacking opportunities and occasions throughout the day. Due to this increase in snacking

occasions, a vast amount of research has been published to try to explain this behavior. However, current data about snacking behavior is mainly focused on “fun for you” snacking behavior in both adolescents and adults. This research primarily focuses on the adverse effects of snacks and how they increase the total daily calorie intake because many are high in saturated fat, salt and refined sugars (Lloyd-Williams, Mwatsama, Ireland, & Capewell, 2009; Sanchez-Villegas, Basterra-Gortari, Nunez-Cordoba, Toledo, & Serrano-Martinez, 2009).

It is not surprising that much of the literature focuses on the negative aspects of snacks. When looking at previous literature, it seems as the “fun for you” snacks are preferred by the general population. Previous research shows that most of these snacks are highly processed foods, with preferences for desserts, salty snacks, sugar-sweetened beverages, and other types of “fun for you” highly dense and caloric foods (Duffey et al., 2013; Myhre et al., 2015; Ovaskainen et al., 2006).

However, not all snacks consumed are unhealthy. In the United States, studies have found that consumers also include fruits, crackers, milk, yogurt, and nuts or seeds as snacks. These types of snacks are considered healthy options with lower calories, a higher amount of fiber, and more vitamins and minerals (Hess, Julie, et al., 2017; Piernas & Popkin, 2010). Small changes in the items consumed during snack time can make significant differences in the total calorie intake per day. A study conducted in 2008 showed that replacing unhealthy snacks such as chocolate, or chips with dried or fresh fruit or nuts and seeds could potentially reduce the total energy from saturated fats 10% or less (Lloyd-Williams et al., 2009).

This demonstrates that consumers have many options to choose from when deciding what type of snacks they want to include in their diets. As seen from previous paragraphs, there are many unhealthy options, but also there are food items that could be beneficial. For this reason, it

is important to explore the motivations behind the decision of choosing certain types snacks. Previous studies have included the following motivations to consume snacks: hunger, liking, convenience, health, weight control, pleasure, visual appeal, location, social/food culture, impression management, food insecurity, distracted eating or boredom and hedonic eating (Hess, J. & Slavin, 2018; Phan & Chambers, 2016).

However, the motivations of why certain types of foods are not chosen to eat as snacks have not been investigated. The present study tries to explore the main motivations certain types of foods are not selected using a series of 20 snacks that could represent healthy and "fun for you" snacks. Knowing the specific reasons a group of snacks is not selected to eat can be helpful to establish realistic health interventions that solve the barriers that are preventing people from eating healthy snack options.

Materials & Methods

Participants Profile

Two surveys were conducted to target adults and adolescents. Adults Survey: respondents were recruited by Qualtrics, an online survey company, from their existing databases. One thousand fifty-one (1551) participants were recruited from all over the United States. The following criteria were necessary to participate in the study: participants had to be 18 years old or older and have lived in the United States for more than five years. Adolescents Survey: The participants for the study were recruited through Qualtrics software. To participate in the study respondents had to meet the following criteria: age range of 13 to 17 years old and have lived in the United States for more than five years. Because the survey was for adolescents, a consent form was distributed to obtain the parent or guardian´s permission to allow their child to

participate in the study. A total of 1050 adolescents from all over the United States completed the study.

Online survey

An online survey for both adults and adolescents was used to investigate the motivations that influence adults and adolescents not to choose specific types of snack foods. Qualified participants were asked to complete the questionnaire that included demographic questions such as gender, race/ethnicity, state of residence, and household income in the past 12 months for the adult´s version, and highest education level from the primary female or male adult in the adolescent´s version. Both questionnaires included a snacking occasion section to explore the motivations for not eating snack foods that were available during the snack occasion. A modified version of the Eating Motivation Survey (TEMS) was used to understand the different motivations to not choose snacks from a particular food group of available snacks. This survey used Check-All-That-Apply (CATA) to allow participants to check the reasons they did not choose a particular available snack. The following 20 snack foods were presented in randomized order, without grouping:

Salty Snacks	**Sweets**	**Dairy Products**
Crackers	Chocolate Bar	Cheese
Popcorn	Gummy Candy	Smoothie
Potato Chips	Muffin or Pastry	Yogurt
Fruits & Vegetables	**Nuts & Cereal**	**Fast Food**
Apple	Granola Bar	Egg roll / Spring Roll
Banana	Oatmeal Cookies	Nachos
Carrot Sticks	Energy Bar	Sandwich
	Nuts	Slice of Pizza

TEMS items in this study included five main motivations: liking, health, suitability, variety, and emotion & social. These motivations were adapted from Renner, Sproesser, Strohbach, 2012 and Phan & Chambers, 2016. To measure each of these motivations included

four items, for example, to measure the motivation health the following four statements were used: “it is too high in calories”, “it is not healthy”, “I am not supposed to eat it”, “it is not organic”. Figure 6.1 shows the modified TEMS used in this research.

Liking	**Health**	**Suitability**
it was not something I had desire to eat at that time I don´t like it I didn´t like the way it looked it is not filling enough	it is too high in calories it is not healthy I am not supposed to eat it it is not organic	it is not convenient the portion size was not suitable the price was too high it was not appropriate for the situation
Variety	**Emotion & Social**	
I don´t think it is a snack I had it recently and I don´t want to eat the same food too often I don´t usually eat it I would never choose this. I like to eat the same snack every day	I did not want to indulge myself it is not a food I eat around other people eating it makes me seem “behind the times” this food makes me feel sad, lonely, or frustrated	

Figure 5.1 Modified five motivations from the Eating Motivation Survey used in this research.

Data Analysis

Descriptive statistics were used to summarize the participant’s demographic information. For the reasons not to choose a specific food item, the is evident motivation factors from the modified Eating Motivation Survey were linked to the snack food items using correspondence analysis (CA) to obtain the main motivations to reject each snack item. Hierarchical clustering was also performed on the CA principal factors to classify each snack item into groups based on the similarities in motivations not to choose each item. Proportion tests using Pearson´s chi-square test also were performed on the proportion data of the five motivations to validate the main reasons to not choose each snack food item. Data analysis was done using XLSTAT-Sensory (Version 2019.1.1, Addinsoft, New York, USA).

Results

Population demographics

Table 5.1 Demographic information

Category	ADULTS	ADOLESCENTS
Gender		
Males	48	47
Females	52	53
Age		
18-34	46	N/A
35-64	49	N/A
65 or more	5	N/A
Race/Ethnicity		
Hispanic/Latino	17	12
White/Caucasian	62	67
African American	12	13
Hawaiian/Pacific Islander	0.4	0.8
Asian	5	3.8
American Indian/Alaska	2	1.3
Indian	0.4	0.6
Prefer not to answer	1	1.5
US Region		
Northeast	25	18
Midwest	27	22
South	31	40
West	17	20

Table 5.1 shows the results for the population demographics in percentage for the adults and adolescents that participated in the study. In both surveys, there was a slightly higher number of females or girls than males or boys. Also, for both surveys, the majority of participants were

White/Caucasian, followed by Hispanic/Latino and African Americans. The majority of participants lived in the South for both surveys, followed by the Midwest region of the country.

Motivations to not consume certain snacks in adults

Figure 5.2 shows the motivations not to consume 20 different snack food items in US adults. These 20 items were grouped into three clusters based on their similarity with the five motivations described in figure 5.1.

Cluster 1 is represented with the green color in Figure 5.2 and includes food items from the groups of fruits and vegetables, dairy products, nuts & cereal, and salty snacks. The specific items were bananas, apples, carrot sticks, yogurt, nuts, granola bars, crackers, cheese, energy bars, and popcorn..

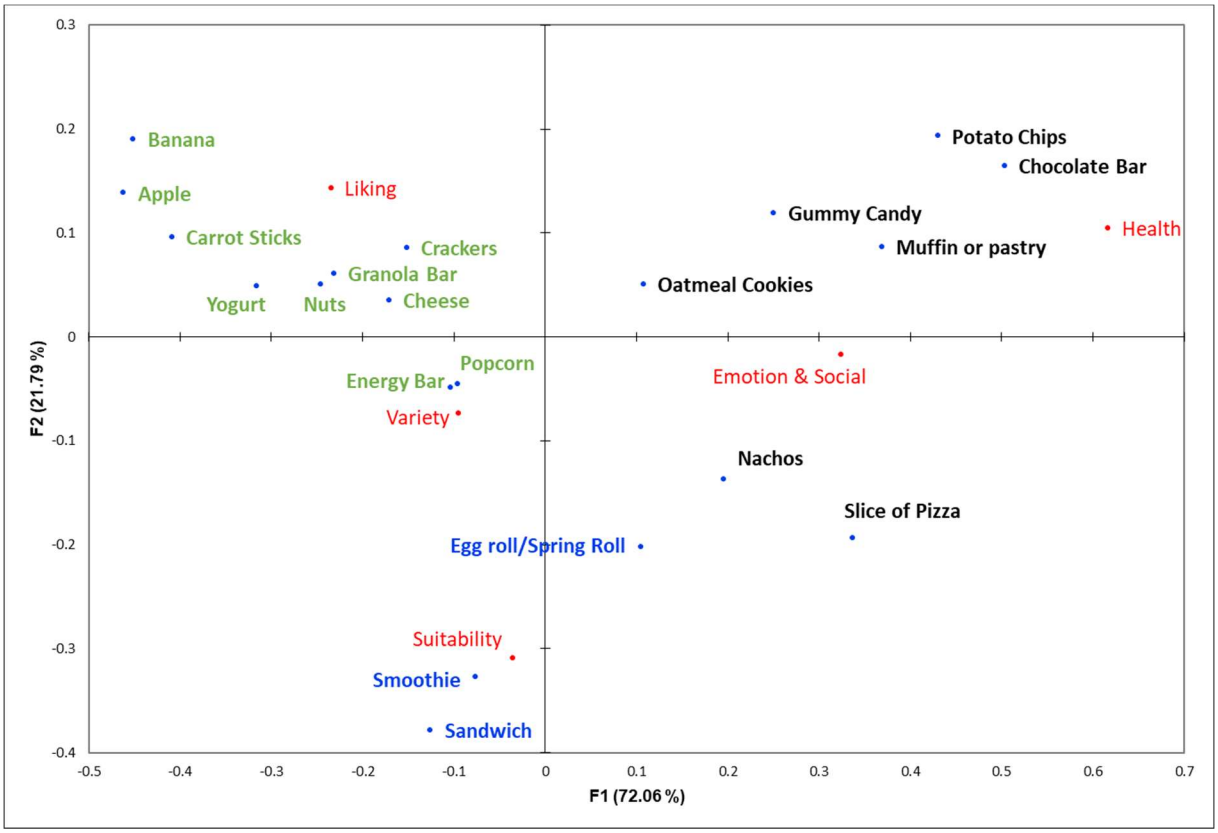

Figure 5.2 Correspondence analysis map of twenty food snack items and five motivations to **not** consume those snacks in **adults**. This map represents 93.85% of the total variance of the data. The food items were classified into three clusters shown in the map with different colors (black, blue, and green); these clusters were grouped based on their similarity with motivation patterns.

From the three clusters, this group could be considered the one that has the "good for you" snacks and was mainly not consumed because participants did not like these types of snacks and for variety reasons. In looking at Table 5.2, it is easy to identify that the snack items in this group were not consumed mainly because of liking. Participants reported not consuming these "good for you" snacks even if they were available because they did not have desire to eat that kind of food at the snack time, because they did not like them, because they do not usually eat them, or because they consider these types of foods as not filling enough. Additionally, popcorn was rejected because it was not considered convenient as a snack, and cheese was rejected because participants did not think about cheese as a snack.

Table 5.2 Percentages of the motivations associated with the no consumption of twenty food snack items in adults.

Snack Food Item	**Motivations**					Number of items
	Liking	**Variety**	**Suitability**	**Emotion & Social**	**Health**	
Apple	**20.29**	0.86	4.76	9.43	1.00	*525*
Banana	**20.15**	0.83	3.89	8.96	1.49	*572*
Carrot Sticks	**19.55**	0.96	4.89	10.51	1.85	*445*
Cheese	16.65	4.05	5.66	10.96	2.02	*778*
Smoothie	11.63	3.38	**10.81**	7.84	2.89	*303*
Yogurt	16.64	1.78	5.21	8.91	1.87	*547*
Chocolate Bar	14.21	15.38	5.16	8.21	**6.85**	*533*
Gummy Candy	15.60	11.04	5.91	8.62	3.70	*351*
Muffin or pastry	12.96	12.04	5.79	8.66	4.36	*384*
Crackers	17.13	4.59	5.56	9.05	1.65	*801*

Popcorn	16.37	4.76	8.30	7.18	2.38	*672*
Potato Chips	14.13	**14.01**	4.44	8.47	4.36	*614*
Granola Bar	16.85	2.97	5.33	9.26	2.11	*497*
Oatmeal Cookies	13.81	6.67	5.16	9.29	4.44	*315*
Energy Bar	15.01	4.36	6.97	9.79	2.55	*373*
Nuts	16.69	2.74	5.73	7.97	1.94	*593*
Egg roll or Spring Roll	11.81	6.53	9.44	10.83	4.44	*180*
Nachos	11.45	8.19	8.78	8.53	3.34	*299*
Sandwich	11.00	2.93	**10.92**	12.58	2.62	*648*
Slice of Pizza	8.47	11.08	8.94	**13.45**	4.11	*316*

Cluster 2 is represented in black in Figure 5.2 and includes food items from salty snacks, sweets, nuts & cereal, and fast food. The specific items were potato chips, chocolate bar, gummy candy, muffin or pastry, oatmeal cookies, nachos, and pizza. From the three clusters, this group could be considered the one that has the “fun for you” snacks and was mainly rejected because of health, emotion, and social reasons. From Table 5.2, it is also easy to identify that the snack items in this group were rejected mainly because of health concerns.

Participants reported not consuming these “fun for you” snacks even if they were available because they were not healthy, because they did not want to indulge themselves, because they were too high in calories, or because it was something that they simply do not desire to eat at the snacking time. Additionally, nachos were not consumed because it was considered not convenient as a snack food, and pizza was not consumed because participants did not think of a slice of pizza as a snack item.

Cluster 3 is represented in blue in Figure 5.2 and includes food items from fast food and dairy products. The specific items were egg roll/spring roll, sandwich, and a smoothie. These items were mainly rejected because of suitability reasons such as it is not convenient, but other reasons such as “it was not something I had desire to eat at the snack time” and “I did not choose it because I don’t think it as a snack” were important for this group. Additionally, for egg roll/spring rolls “I don’t usually eat it” was also a strong motivation to not consider this as a snack item.

Motivations to not consume certain snacks in adolescents

Figure 5.3 shows the motivations to reject the consumption of 20 different snack food items in US adolescents. These 20 items were group into three clusters based on their similarity with the five motivations described in the materials and methods.

Cluster 1 is shown in green in Figure 5.3 and includes fruits and vegetables, dairy products, nuts & cereal, and salty snacks. The specific items were bananas, apples, carrot sticks, yogurt, nuts, granola bars, crackers, cheese, energy bars, and popcorn.

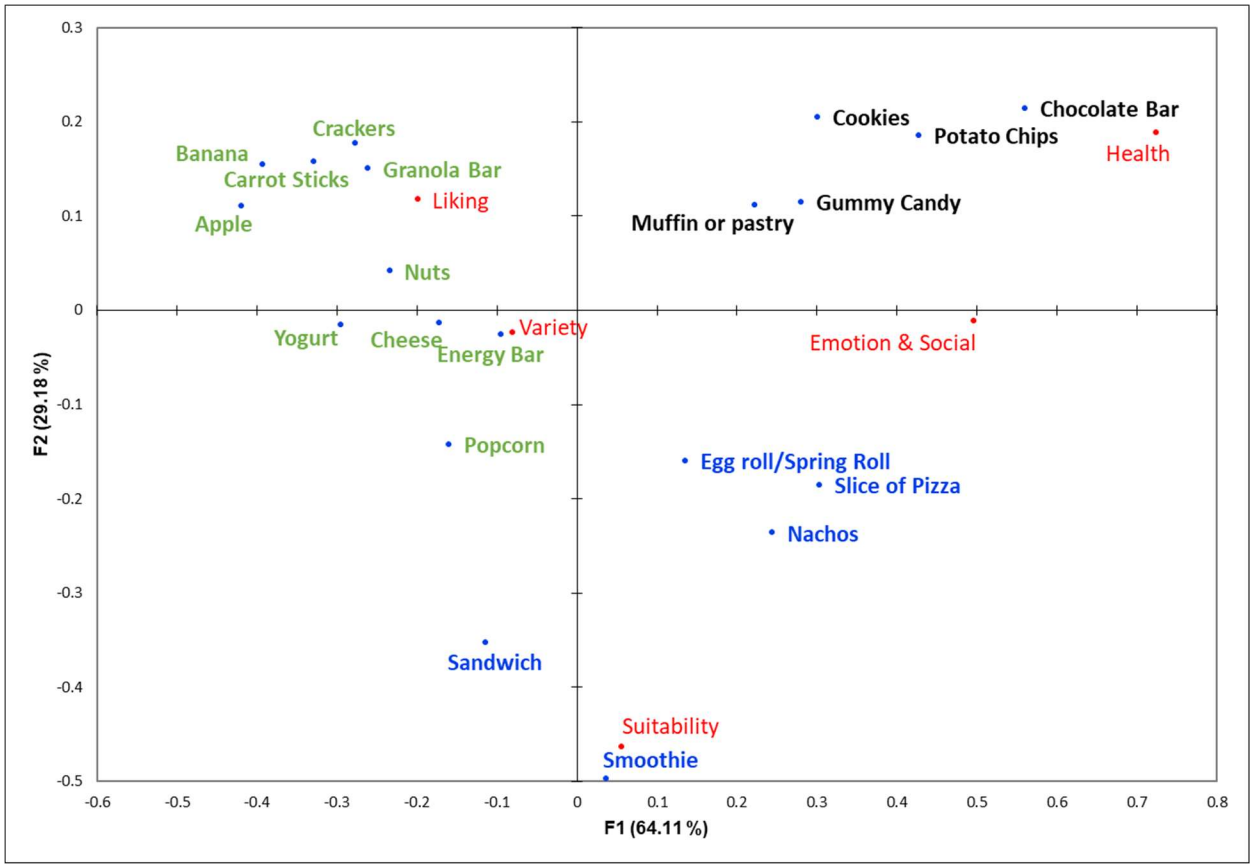

Figure 5.3 Correspondence analysis map of twenty food snack items and five motivations to **not** consume those snacks in **adolescents**. This map represents 93.29% of the total variance of the data. The food items were classified into three clusters shown in the map with different colors (black, blue, and green); these clusters were grouped based on their similarity with motivation patterns.

Similar to the results obtain for the adults, this cluster is considered the "good for you" snack group. The snacks included in this group were generally not consumed because of liking and variety reasons. Similar reasons to the ones reported by the adults were reported by the adolescents. The strongest reason for all the items in this cluster was liking, specifically "it was not something I had desire to eat at the snack time." Table 5.3 also shows the trend that liking was the main reason not to consume "good for you" snack food items.

Table 5.3 Percentages of the motivations associated with the no consumption of twenty food snack items in adults.

Snack Food Item	Motivations					Number of items
	Liking	**Variety**	**Suitability**	**Emotion & Social**	**Health**	
Apple	**20.34**	0.25	3.11	10.01	0.56	*402*
Banana	**19.57**	0.55	2.50	9.63	0.67	*410*
Carrot Sticks	**20.86**	0.98	2.74	9.90	1.26	*356*
Cheese	15.86	2.09	4.50	10.76	1.07	*539*
Smoothie	11.92	1.79	**10.77**	7.69	2.95	*195*
Yogurt	17.61	0.99	4.62	8.81	0.80	*406*
Chocolate Bar	13.14	9.76	3.19	8.03	**4.93**	*274*
Gummy Candy	14.34	6.75	4.03	9.00	3.08	*211*
Muffin or pastry	13.72	5.69	3.56	9.35	2.95	*246*
Cookies	14.75	6.39	2.88	6.91	3.51	*434*
Popcorn	15.29	1.71	6.09	6.69	1.11	*497*
Potato Chips	13.22	8.84	3.53	8.51	2.68	*382*
Crackers	18.56	1.60	2.35	9.46	0.98	*563*
Granola Bar	17.89	1.68	2.71	8.66	0.90	*387*
Energy Bar	15.64	2.53	4.85	9.47	1.65	*227*
Nuts	17.65	1.45	3.92	9.94	1.39	*415*
Egg roll or Spring Roll	11.48	4.08	6.38	10.97	2.55	*98*
Nachos	12.43	5.27	8.51	7.16	2.70	*185*
Sandwich	11.88	1.41	8.23	12.29	1.41	*480*
Slice of Pizza	9.45	5.86	7.06	11.72	2.99	*209*

Cluster 2 is represented in black in Figure 5.3 and includes salty and sweets snacks. The specific items were muffin or pastry, gummy candy, cookies, potato chips, and chocolate bar. This cluster could be considered as the one containing "fun for you" snacks and similar to the adults, these snacks were not consumed because of health, emotion, and social reasons

Cluster 3 is represented in blue in Figure 5.3 and includes fast food options and dairy products. This group includes egg roll/spring roll, sandwich, smoothie, nachos, and pizza. Nachos and pizza were classified differently by adolescents, mainly because adults did not consider nachos or pizza as snacks. Adolescents did not report this as an important reason to stop consuming these types of fast foods as snacks.

Discussion

Our results showed that adults and adolescents have similar reasons to reject the consumption of "healthy" and "fun for you" snacks. The main differences in both populations were related to the expectations they have for certain types of foods. For example, pizza was an item that adults did not think of as a snack, while adolescents did not consume pizza mainly because they did not have the desire to eat it but not necessarily because it was something they did not consider as a snack item.

Both groups, adolescents and adults, tend to group the presented snack items into "healthy" and "fun for you" clusters. One of the main barriers to consuming "healthy" snacks were related to liking and variety. Participants reported not consuming healthy snacks because they did not like them or because they did not consider them filling enough. Liking could be related to the way the food looks or tastes. Sensory appealing, for example, the way food smells or tastes, is a significant motivation for food choice (Eikenberry & Smith, 2004; Steptoe, Pollard,

& Wardle, 1995). People may reject healthy snacks simply because they consider the taste of other food items more appealing.

It has been previously reported that unhealthy snacks are most frequently consumed because they looked, tasted, or smelled very tempting (Cleobury & Tapper, 2014; Verhoeven, Adriaanse, de Vet, Fennis, & de Ridder, 2015). A study conducted with Chinese adolescents showed that taste was the main reason for choosing "fun for you" foods, and at the same time was the main reason for not choosing healthy foods. Participants in this study tend to describe "fun for you" foods as delicious, strongly flavored, or satisfying, while the healthy options were described as plain, mild, tasteless, and not exciting (Chan, Tse, Tam, & Huang, 2016).

This motivation to reject healthy snacks represents an opportunity for dietitians and food product developers. If appealing sensory factors such as taste are critical when choosing snacks, it is then important to offer attractive snack options to consumers. The main question is, how to make healthy snacks that look more appealing and taste better than or at least be similar to "fun for you" snacks. Simple changes in the appearance of food or combinations of ingredients can make a big difference in the presentation and flavor of snacks, making healthier snacks more attractive as snack food options for consumers.

Satiety also seems to play a role in this decision-making process. According to our results, participants did not select healthy snacks because they considered them as not filling enough. This is in accordance with previous research that reports that people tend to consume "fun for you" snacks in order to gain energy and to satisfy hunger (Cleobury & Tapper, 2014; Verhoeven et al., 2015). This could explain that healthy snacks are not consumed due to a perception of being less satisfying when compared to more tempting and energy-dense "fun for you" snacks.

Unhealthy snacks often offer more energy-dense, nutrient-poor food options such as sweets, desserts, salty snacks, bread, and sugar-sweetened beverages (Hess, J. & Slavin, 2018; Myhre et al., 2015). All these highly dense products send a satiety signal to our bodies that may be lacking in the "good for you" type of snacks. According to the literature, snack consumption is positively related to energy intake, showing higher consumption of high-density foods, which provide a greater feeling of fullness (Fotiadou & Babajimopoulos, 2006).

These results show that motivations to not consume healthy snacks are associated with psychological reasons, but also have a component of physiological motivations that interact with the process of deciding on not having this type of snack, even if it is available for its consumption during the snack time.

When analyzing the motivations to not consume "fun for you" snacks, participants in the study recognize that they should not eat "fun for you" snacks because they may be harmful to their health. Both adults and adolescents recognize sweets and salty snacks as high in calories, sugar, and salt. Previous studies have shown that people who are concerned about their health and want to maintain a healthy lifestyle are more likely not to consume "fun for you" foods (Eikenberry & Smith, 2004).

In the literature, this type of behavior is referred to as health consciousness and is defined as the motivational component that stimulates consumers to undertake healthy actions. This means that health-conscious consumers are concerned about their well-being and are motivated to engage in healthy eating behaviors (Michaelidou & Hassan, 2008). This does not mean that all the participants in our study could be considered as health-conscious, but it seems many are aware of the consequences of making bad food choices for their health.

In a study conducted in 2012, it was determined that health consciousness could help determine the characteristics consumers consider as relevant when making food choices. Health-conscious people tend to evaluate the quality or healthiness of food products, even if they do not choose to eat those food items, but at least they recognize their value (Mai & Hoffmann, 2012). Adults can understand and apply the concept of health consciousness easily; however, for adolescents, this factor may not be that powerful. A study conducted in 2014 aimed to measure the acceptability of novel healthy snacks in adolescents. The authors found that acceptance of new healthy products was determined by a combination of social and individual factors in adolescents. Health consciousness as an individual factor interacts with social factors because adolescents tend to be influenced by their peers or family (Nørgaard et al., 2014). Many adolescents are conscious of the healthiness of a particular snack, and they may recognize the importance of choosing this type of food over other less healthy options. However, when deciding to consume a healthy food option, they may be influenced by their friend's decisions and what their parents have taught them concerning the importance of consuming healthy food (Nørgaard et al., 2014). Health consciousness acts as a motivator to influence the decision making of whether or not to consume certain types of foods, or in the case of this study, certain types of snacks.

Conclusions

Results in this study revealed that participants reported not consuming "good for you" snacks in both adults and adolescent populations because they did not like them or because they felt they were not filling enough. The sensory characteristics of the snacks may also play a critical role in the decision-making process. Healthy snacks need to be more appealing in the way they look, smell, and taste when compared to healthier options.

In contrast, respondents reported not consuming "fun for you" snacks because they were too high in calories or because they did not want to indulge themselves. They recognized the adverse effects that these types of snacks may have on their health. Health consciousness plays a vital role in the recognition of the adverse effects of less healthy snacks and the ability of consumers to no consume certain types of foods based on their nutritional quality.

Nutritional educators should be aware of the reasons adults and adolescents do not consume "good for you" snacks. This knowledge can help them to construct the best recommendations to improve the nutritional quality of the snacks in these populations. At the same time, knowing the reasons to reject less healthy snacks is a powerful tool to understand what are the areas and motivations that help people make smarter options about their snacks.

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Chapter 6 - General Conclusions

The main goal of this research was to investigate the reasons why adults and adolescents consume different types of snacks in the United States. Sixteen motivations were used to describe these reasons or preferences: liking, pleasure, weight control, habits, traditional eating, affect regulation, need and hunger, natural concerns, social norms, health, choice, social image, convenience, price, sociability, and visual appeal.

Liking was the primary motivation to consume different snack food groups in both adolescents and adults. Liking has been associated with the sensory characteristics of food and has also been associated as the primary motivation in food choice not just for snacks, but also for other different types of foods. This finding has been confirmed in other studies related to food choices and represents an important challenge for food developers that need to take into account that food needs to meet certain sensory characteristics to be chosen by consumers.

For both populations, adults and adolescents, three main clusters were identified: “fun for you”, “good for you”, and “mixed” snacks. “Fun for you” snacks were identified as those that contain more calories, usually with higher amounts of fat, sugar, and salt. For adults, sweets, salty snacks, and baked products were categorized in this group. Adolescents had the same snacks, but beverages were added to this cluster. Both populations share the following motivations to consume these snacks: sociability, social image and affect regulation. However, for adolescents pleasure was an essential factor that was not present in adults, while price, social norms and traditional eating were motivations that only adults reported for this cluster.

“Good for you” snacks were identified as those that were often considered as healthy, such as fruits, vegetables, dairy products, and bars, nuts, & seeds. Adults and adolescents share the following motivations to consume them: weight control, natural concerns, and health.

However, adolescents reported consuming these group also because of social norms, which shows that this group may feel some pressure to consume this type of snack, they may feel that they supposed to be eating "good for you" snacks, or maybe avoiding disappointing someone, or simply feel pressure from their friends or parents to include these snacks in their daily routine.

The third cluster identified for adults and adolescents included refined grains, meats, and sandwiches or wraps. Adults include beverages in this group, possibly because of different beverage options. Adults reported mostly water, coffee, or tea as their beverage options for snacks, while adolescents reported carbonated beverages as their leading beverage choice for the snack occasion. Visual appeal was one of the main motivations in both populations to choose these types of snacks. However, adults reported choice as another motivation, while adolescents reported need and hunger as the other main motivation to consume this "mixed" snack group. This finding shows that adolescents may be more attracted to high protein snacks such as meat snacks due to a need for energy, because they are hungry, or because it is pleasantly filling. For adults, it may be more important to get this type of snack because it is the only choice available.

These findings showed that even if the same snacks were grouped in both populations, the motivations to consume them in adults and adolescents were different. Adolescents may be more influenced by social aspects than adults. Consequently, food product developers and marketers should take into consideration these social aspects when attempting to create or promote snacks for adolescents. For example, if trying to encourage adolescents to buy "good for you" snacks, the marketing strategy should be driven from a social setting perspective, that includes all the potential influences that peers or family can make in this group.

The present study had some limitations that need to be mentioned. Participants completed the survey online, which means that a specific part of the United States population is

automatically excluded from the study, specifically those that do not have access to the Internet or do not have access to a computer. This could represent a biased when trying to make comparisons among different income level groups. Another limitation was related to the lack of factors related to religion, culture, or politics. If the same study is replicated in other cultures different than the United States, it is necessary to take into consideration how culture, religion or politics can affect the decision making of different snacks. Other motivations can be added to the sixteen used in the present study. Lastly, self-reported motivations can represent a limitation because they may not accurately reflect the actual reasons behind the snack food choices.

Appendix A - US Adults Snacking Behavior Survey (Short Version)

1.1 Thank you so much for your interest in our study. In this section, please provide some information about yourself. This information will only be used for the purpose of this study.

1.2 **What is your gender?**

- Male
- Female

1.3 **In what year were you born? _____**

1.4 **How long have you been living in the United States?**

- less than 5 years
- 5 to 10 years
- most of my adult life
- all my life

1.5 **What is your race/ethnicity?**

- Hispanic / Latino
- White / Caucasian
- Black / African American
- Native Hawaiian / Pacific Islander
- Asian
- American Indian / Alaska Native
- Indian
- Prefer not to answer

1.6 Please indicate where you currently live (city, state): _____

1.7 Which of the following best describes your total household income during the past 12 months?

- ≤ $25,000
- $25,001 - 49,999
- $50,000 - 99,999
- ≥ $100,000
- Prefer not to answer

1.8 On how many days were you physically active for a total of at least 60 min per day?

	over the past 7 days	over a typical or usual week
0 days	○	○
1	○	○
2	○	○
3	○	○
4	○	○
5	○	○
6	○	○
7	○	○

1.9 On how many days were you physically active for a total of at least 60 min per day?

	0 days	1	2	3	4	5	6	7
over the past 7 days	○	○	○	○	○	○	○	○
over a typical or usual week	○	○	○	○	○	○	○	○

1.10 On an average DAY during the week, how many <u>hours</u> do you spend sitting? Include e.g. driving or sitting in a car, sitting at a desk and spending time watching TV.

_____

1.11 On an average DAY during the weekend, how many <u>hours</u> do you spend sitting? Include e.g. driving or sitting in a car, sitting at a desk and spending time watching TV.

_____

1.12 Do you cook or bake?

- Every day
- Every few days
- Once or twice a week
- A few times a month
- Less often or not at all

1.13 Now think about your <u>most recent snack</u> and answer the following questions based on that snack and its occasion. At what time did you start eating your snack? _____

1.14 Was it ...

- Weekday
- Weekend or holiday

1.15 What was the main activity you were doing when you had your snack? I was ...

- working, studying or reading
- socializing, being with family or friends
- driving or walking
- watching television or movie
- playing on play-station or other leisurely games
- chatting or browsing the internet
- getting ready to go to sleep
- other (please specify below) _____

1.16 Please briefly describe your snacking <u>occasion</u> in your own words: _____

1.17 What did your snack include?

- Baked products (e.g. donuts, sandwich, toast)
- Chocolate, candy
- Dairy (e.g. yogurt, cheese)
- Fruits, vegetables
- Nuts, seeds, granola or energy bar
- Salty snacks (e.g. chips, salty crackers)
- Beverages
- Other, what? _____

1.18 Did at least one of your snack items have label information?

- yes
- no

1.19 Did you read the label information of the snack?

- No, I am not interested
- No, because I already knew what there was in the label
- Yes

1.20 How many food or beverage items did you have for your snack?

- 1
- 2
- 3 or more

1.21 My snack item was _____

1.22 Was this snack something you

- already had obtained (without planning it to be used for this snack)
- obtained previously specifically for this occasion
- obtained immediately before consuming
- other (please specify below) _____

1.23 This snack item was purchased by

- me
- somebody in my family
- somebody outside family
- did not need to be purchased

1.24 In the next section, for the snack you had, please provide reasons how and why you chose your main snack item (check all that apply). If the snack item was something you previously purchased, please indicate reasons why you initially bought it as well as the reasons you chose to consume it at this time. Snack item: _____

1.25 I had this item for my snack ... (check all that apply):

- ... because I am accustomed to eating it
- ... because it is healthy
- ... because it is quick to prepare
- ... because it tastes good
- ... in order to indulge myself
- ... because it is natural (e.g. not genetically modified)
- ... because I don't want to spend any more money
- ... because it is low in calories
- ... because I am frustrated
- ... because it makes me look good in front of others
- ... because it would be impolite not to eat it
- ... because the presentation is appealing (e.g. packaging)
- ... so that I can spend time with other people
- ... because it is organic
- ... because I grew up with it
- ... because I enjoy it
- ... because I was hungry
- ... because I usually eat it
- ... because I have an appetite for it
- ... because it is easy to prepare
- ... because I am sad
- ... because it is low in fat
- ... because I recognize it from advertisements or have seen it on TV
- ... because it makes social gatherings more comfortable
- ... because I am supposed to eat it
- ... because others like it
- ... because I feel lonely
- ... because I watch my weight
- ... because it contains no harmful substances (e.g. pesticides, pollutants, antibiotics)
- ... because it is the most convenient

- ... because I need energy
- ... because I am familiar with it
- ... because I like it
- ... because it is pleasantly filling
- ... in order to reward myself
- ... out of traditions (e.g. family traditions, special occasions)
- ... because it belongs to certain situations
- ... to maintain a balanced diet
- ... because it is social
- ... because it is inexpensive
- ... because it spontaneously appealed to me (e.g. situated at eye level, appealing colors)
- ... to avoid disappointing someone who is trying to make me happy
- ... because it is trendy
- ... because it is on sale
- ... because it keeps me in shape (e.g. energetic, motivated)
- ... because that was the only choice
- ... because I want to eat it every day

1.26 In this final section of the survey, we ask about 20 snacking items. Were the following items readily available when you chose your snack?

	Yes, and I chose it	Yes, but I didn't choose it	No	No. I would have chosen this but it was not available
Apple	○	○	○	○
Banana	○	○	○	○
Carrot sticks	○	○	○	○
Cheese	○	○	○	○
Chocolate bar	○	○	○	○
Crackers	○	○	○	○
Egg roll or spring roll	○	○	○	○
Energy bar	○	○	○	○
Granola bar	○	○	○	○
Gummy candy	○	○	○	○
Muffin or pastry	○	○	○	○
Nachos	○	○	○	○
Nuts	○	○	○	○
Oatmeal cookies	○	○	○	○
Popcorn	○	○	○	○
Potato chips	○	○	○	○

Sandwich	○	○	○	○
Slice of pizza	○	○	○	○
Smoothie	○	○	○	○
Yogurt	○	○	○	○

1.27 Why did you not choose _____ as your snack? Because ...

- I don't think it is a snack
- I don't like it
- I don't usually eat it
- the portion size was not suitable
- it is not filling enough
- it is not healthy
- it is not convenient
- I did not want to indulge myself
- it was not appropriate for the situation
- it is not a food I eat around other people
- the price was too high
- I didn't like the way it looked
- it is too high in calories
- I am not supposed to eat it
- eating it makes me seem "behind the times"
- it was not something I had a desire to eat at that time
- I had it recently and I don't want to eat the same food too often
- I would never choose this. I like to eat the same snack every day.
- this food makes me feel sad, lonely, or frustrated
- it is not organic

Appendix B - US Adolescent Snacking Behavior Survey (Short Version)

Consent Form

Parent/Guardian Permission for Child to Participate in an Online Research Study Survey "Snack Eating Motivation in US Adolescents"

Purpose of the online research survey

The purpose of this survey is to understand snack eating motivations in adolescents. The questionnaire includes questions about demographics (such as gender, age, ethnicity, etc.), physical activity patterns, food shopping, preparation and cooking at home. There is a series of questions about what snacks were eaten or not eaten in the past 24 hours and the reasons for those choices. We need your child's honest opinion. Note that there are NO NAMES COLLECTED by the researchers.

Procedures

If you give permission and your child decides to participate, he/she will proceed to complete the online survey provided by Qualtrics. This survey has a duration of approximately 20 min. We are happy to let you read a set of survey questions if you wish to know the specific questions being asked (click the next link to see the survey (Us snack survey teens). However, to ensure we get honest answers about their snacking, we want to be sure that you do not help your adolescent answer the questions or check their answers. Please let them complete the survey independently.

Confidentiality

Your child´s data will be confidential. Results of this study will be published in scientific journals and presented at conferences, but the data will not be linked to you or your child. Remember, no names or other personally identifying information is being collected.

Statement of participation for parents/guardians:

I have read the information and I allow my child to participate in this study.

- Yes, I Consent
- No, I do not Consent

1. **Thank you so much for your interest in our study. In this section, please provide some information about yourself. This information will only be used for the purpose of this study.**
2. **What is your gender?**
   - Male
   - Female
3. **What is your age group?**

- Less than 12
- 13-17
- 18-24
- More than 25

4. **What is your birthdate? (Month/Year) _____/_____**
5. **How long have you been living in the United States?**
   - less than 5 years
   - 5 to 10 years
   - most of my adult life
   - all my life
6. **What is your race/ethnicity?**
   - Hispanic / Latino
   - White / Caucasian
   - Black / African American
   - Native Hawaiian / Pacific Islander
   - Asian
   - American Indian / Alaska Native
   - Indian
   - Prefer not to answer
7. **In which state do you currently reside? _____**
8. **What is the highest level of education of the primary female adult in your household?**
   - Less than high school
   - High school
   - College
   - Graduate school
   - I don't know
9. **What is the highest level of education of the primary male adult in your household?**

- Less than high school
- High school
- College
- Graduate school
- I don't know

10. On a typical school week. How many days do you exercise or participate in physical activity for at least 1 hour that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

11. On a typical school week. How many days do you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

12. In an average week when you are in school, on how many days do you go to physical education (PE) class?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

13. Who does most of the cooking at your home?

- Female adult
- Male adult
- Two or more people share equally
- You
- Sibling
- Housekeeper
- Other, specify: _____

14. What percentage of the cooking do you do at your home? _____

15. What percentage of the household food shopping do you personally do? _____

16. Do you consider yourself vegetarian?

- Yes
- No

17. How often do you eat the following food?

	Every day	Every few days	Once or twice a week	A few times a month	Less often or not at all
Dairy products	☐	☐	☐	☐	☐
Eggs	☐	☐	☐	☐	☐
Fish	☐	☐	☐	☐	☐
Meat	☐	☐	☐	☐	☐

18. Do you participate in the school breakfast or lunch program?

- Yes
- No

19. How many days per week do you eat a meal outside your home? (not including breakfast or lunch at school)

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

20. How many days per week do you seat together and eat as a family?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

21. Now think about your <u>most recent snack</u> and answer the following questions based on that snack and its occasion. You ate your most recent snack on a...

- Weekday
- Weekend or holiday

22. What was the <u>main</u> activity you were doing when you had your snack? I was ...

- Doing homework, studying or reading
- Socializing, being with family or friends
- Walking
- Driving
- Watching television or movie
- Playing video games or other leisurely games
- Chatting on or browsing the internet
- Getting ready to go to sleep
- Doing nothing
- Other (please specify) _____

23. What did your snack include?

- Baked products (e.g. donuts, sandwich, toast)
- Chocolate, candy
- Dairy (e.g. milk, yogurt, cheese)
- Fruits, vegetables
- Nuts, seeds, granola or energy bar
- Salty snacks (e.g. chips, salty crackers)
- Beverages
- Other, what? _____

24. Did at least one of your snack items have label information?

- yes
- no

25. Did you read the label information of the snack?

- No, I am not interested
- No, because I already knew what there was in the label
- Yes

26. How many food or beverage items did you have for your snack?

- 1
- 2
- 3 or more

27. My snack item was _____Was this snack something you

- already had it
- just got it
- other (please specify _____

28. This snack item was purchased by

29. In the next section, for the snack you had, please provide reasons how and why you chose your main snack item (check all that apply). Snack item: _____

30. I had this item for my snack ... (check all that apply)

- ... to forget things that I am worrying about
- ... in order to reward myself
- ... because my friends want me to eat/drink it
- ... because I'm hungry
- ... because the presentation is appealing (e.g. packaging)
- ... because my family always prepares it at home
- ... because other like it
- ... to lose weight
- ... because I usually eat it
- ... because that is the only choice at school
- ... because I like it
- ... because it makes social gatherings more fun
- ... because it is easy to prepare
- ... because it is organic
- ... to maintain a balanced diet
- ... because it is on sale
- ... because I'm accustomed to eating it
- ... I want to eat it every day
- ... because it is available at home
- ... because it is healthy

- ... because it is low in fat
- ... because I recognize it from advertisements or have seen it on TV
- ... to enjoy time with friends
- ... because I am supposed to eat it
- ... to fit in with a group I like
- ... because I feel lonely
- ... because I enjoy it
- ... because it contains no harmful substances (e.g. pesticides, pollutants, antibiotics)
- ... because it is fun
- ... because I need energy
- ... because I grew up with it
- ... because it is the cheapest option at school
- ... because it gives me a pleasant feeling
- ... so that others won't joke about me not eating or drinking these snack
- ... because I am familiar with it
- ... so I won't feel left out
- ... because it is low in calories
- ... because it is available at school
- ... because it is inexpensive
- ... because it is natural
- ... to avoid disappointing someone who is trying to make me happy
- ... because it spontaneously appeals to me
- ... because it is pleasantly filling
- ... because it keeps me in shape (e.g. energetic, motivated)
- ... because that is the only choice at home
- ... because it helps me when I feel down or nervous
- ... out of traditions (e.g., family traditions, special occasions)
- ... because it tastes good

31. In this final section of the survey, we ask about 20 snacking items. Were the following items readily available when you chose your snack?

	Yes, and I chose it	Yes, but I didn't choose it	No	No. I would have chosen this but it was not available
Apple	○	○	○	○
Banana	○	○	○	○
Carrot sticks	○	○	○	○
Cheese	○	○	○	○
Chocolate bar	○	○	○	○
Crackers	○	○	○	○
Egg roll or spring roll	○	○	○	○
Energy bar	○	○	○	○
Granola bar	○	○	○	○
Gummy candy	○	○	○	○
Muffin or pastry	○	○	○	○
Nachos	○	○	○	○
Nuts	○	○	○	○
Cookies	○	○	○	○
Popcorn	○	○	○	○

Potato chips	○	○	○	○
Sandwich	○	○	○	○
Slice of pizza	○	○	○	○
Smoothie	○	○	○	○
Yogurt	○	○	○	○

32. Why did you not choose _____ as your snack? Because ...

- I don't think it is a snack
- I don't like it
- I don't usually eat it
- the portion size was not suitable
- it is not filling enough
- it is not healthy
- it is not convenient
- I did not want to indulge myself
- it was not appropriate for the situation
- it is not a food I eat around other people
- the price was too high
- I didn't like the way it looked
- it is too high in calories
- I am not supposed to eat it
- eating it makes me seem "behind the times"
- it was not something I had a desire to eat at that time
- I had it recently and I don't want to eat the same food too often
- I would never choose this. I like to eat the same snack every day
- this food makes me feel sad, lonely, or frustrated
- it is not organic

Appendix C - Motivation patterns in adults for other snacks based on gender

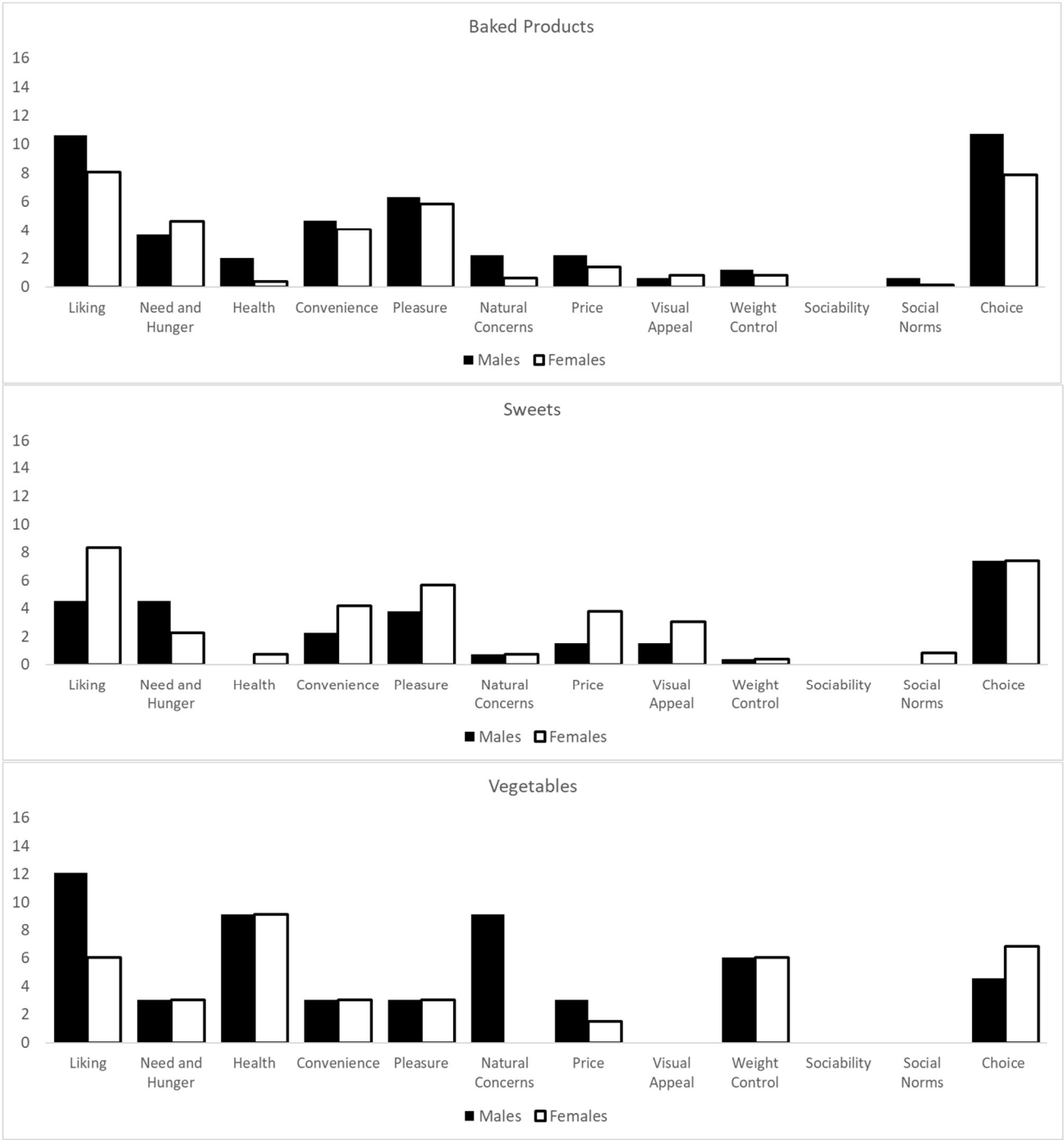

Figure C.1 Motivation patterns (%) for four snack groups based on gender.

Appendix D - Motivation patterns in adults for other snacks based on ethnicity

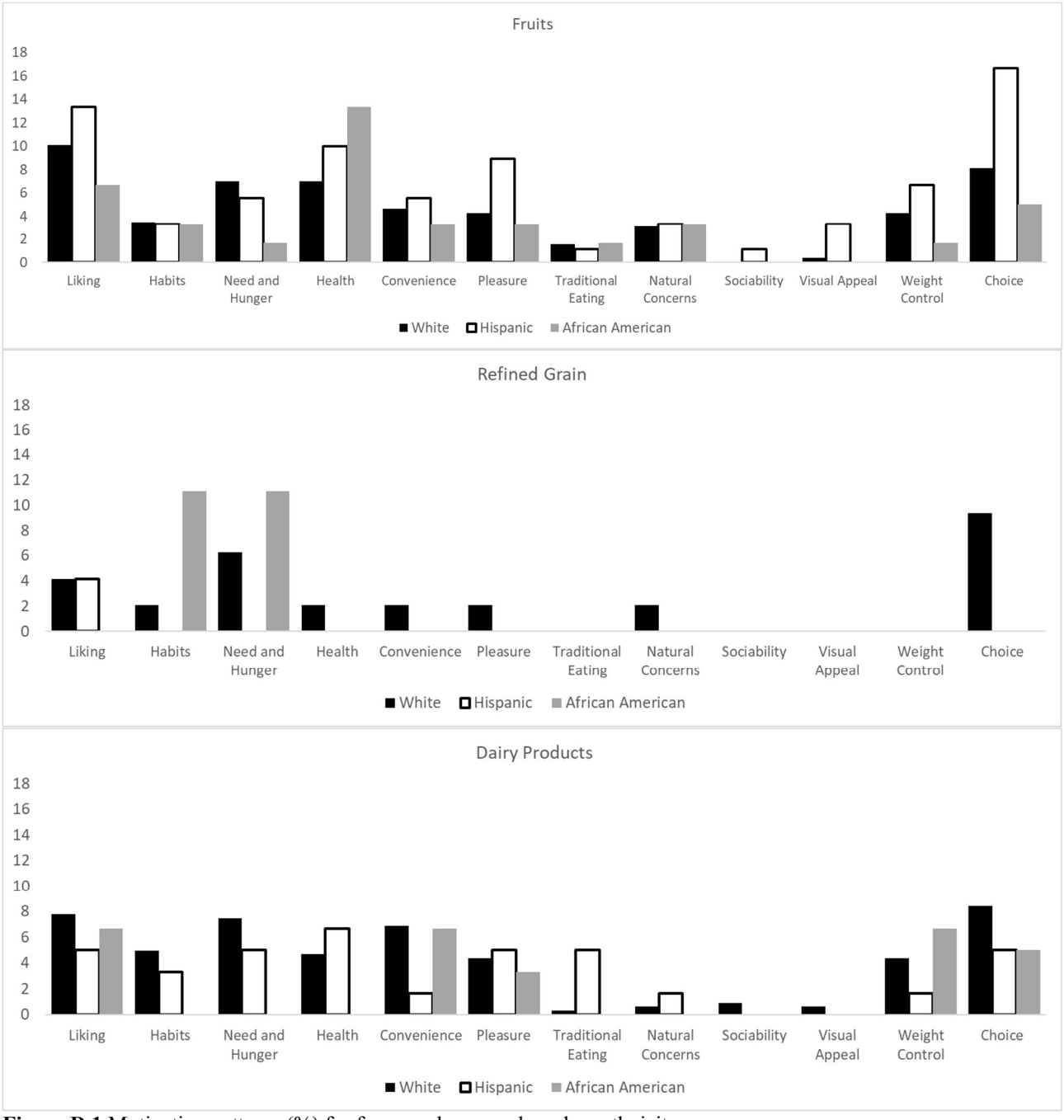

Figure D.1 Motivation patterns (%) for four snack groups based on ethnicity.

Appendix E - Motivation patterns in adults for other snacks based on U.S Region

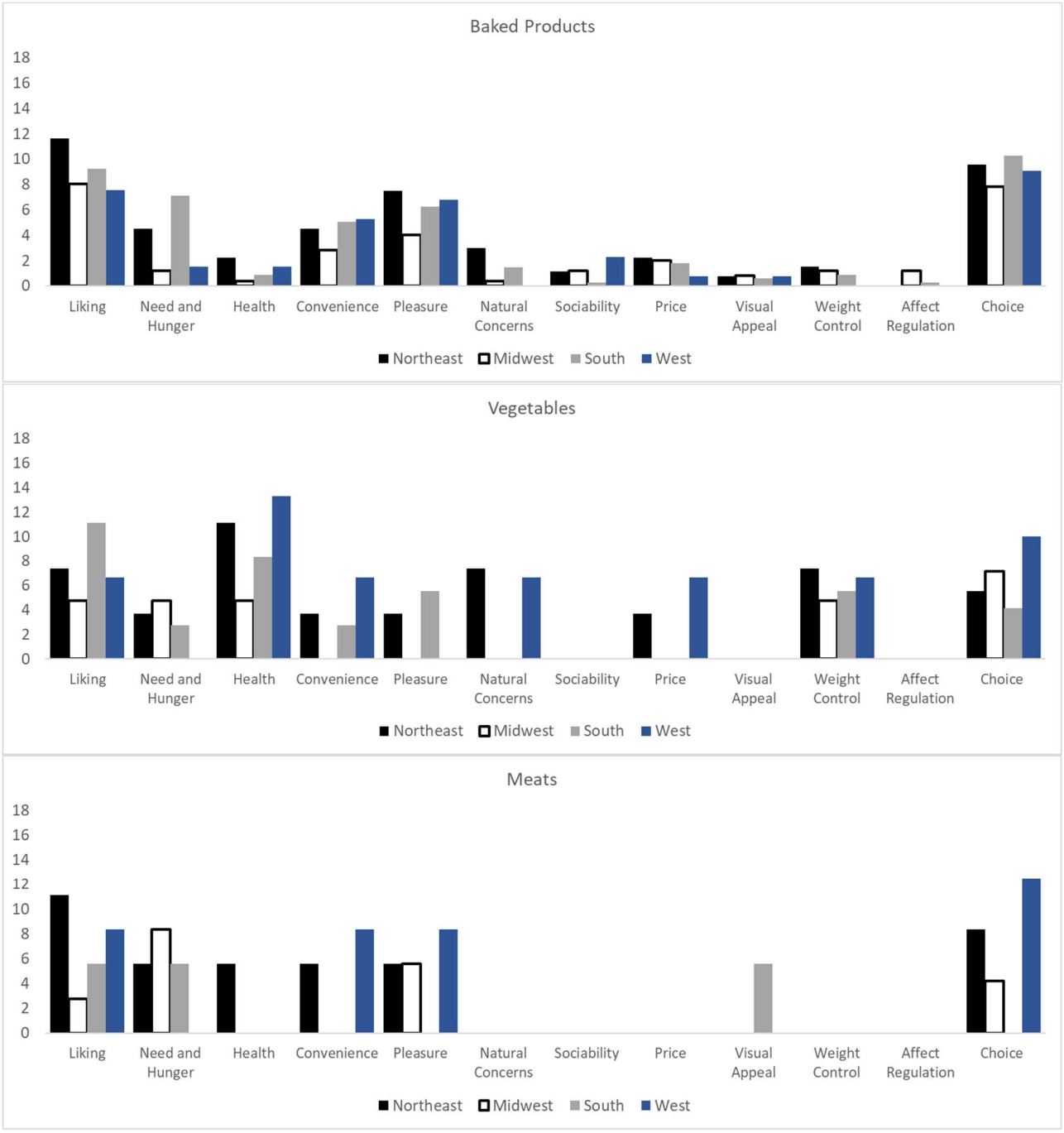

Figure E.1 Motivation patterns (%) for four snack groups based on U.S region.

Appendix F - Motivation patterns in adults for other snacks based on household annual income

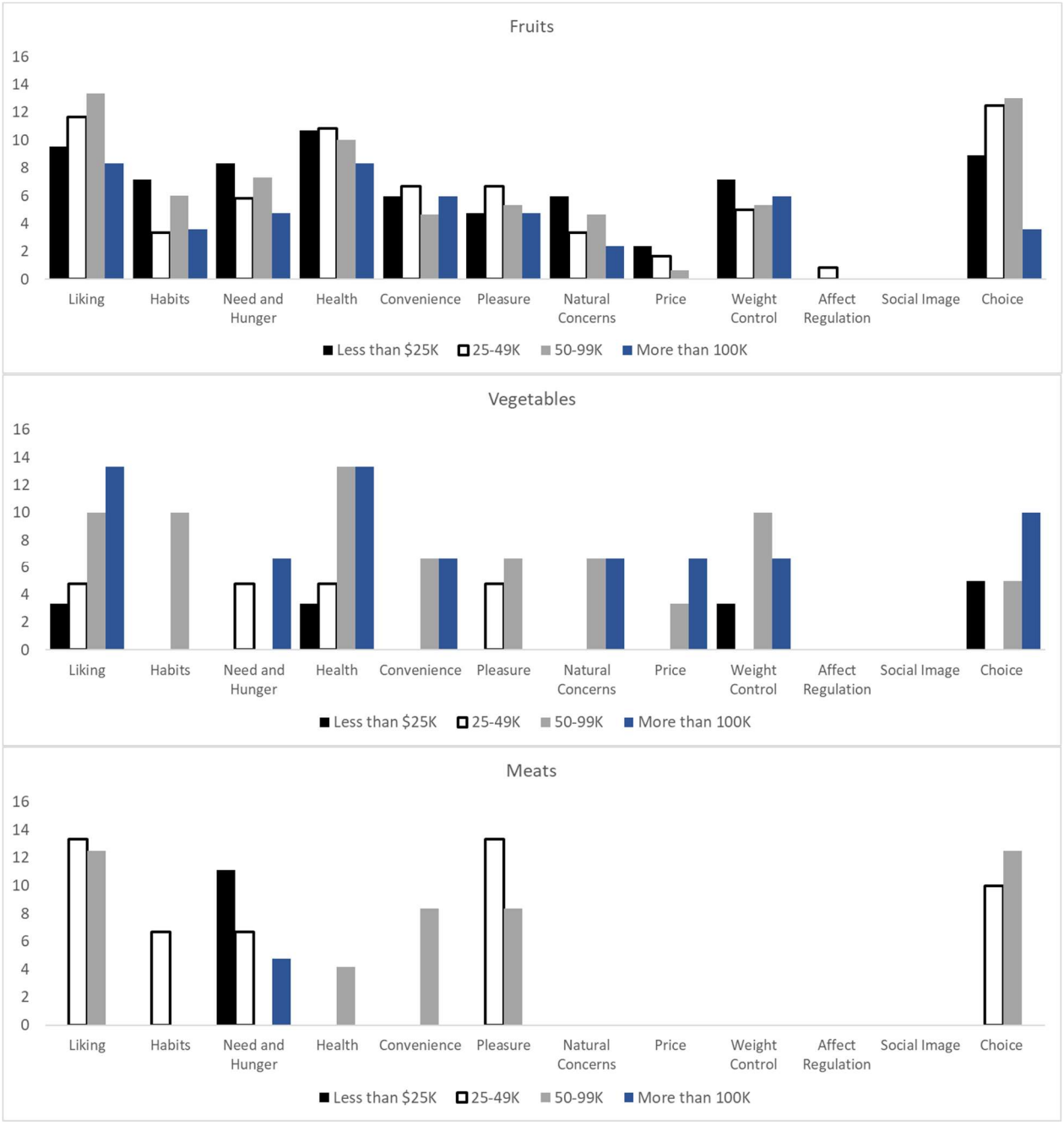

Figure F.1 Motivation patterns (%) for four snack groups based on household annual income.

Appendix G - The Eating Motivation Survey (TEMS)

Liking because it tastes good because I like it because I have an appetite for it	**Pleasure** because I enjoy it in order to indulge myself in order to reward myself	**Weight Control** because it is low in calories because it is low in fat because I watch my weight
Habits because I usually eat it because I am familiar with it because I am accustomed to eating it	**Traditional Eating** because I grew up with it because it belongs to certain situations out of traditions (e.g., family traditions, special occasions)	**Affect Regulation** because I am sad because I feel lonely because I am frustrated
Need and Hunger because I am hungry because it is pleasantly filling because I need energy	**Natural Concerns** because it is natural (e.g., not genetically modified) because it contains no harmful substances because it is organic	**Social Norms** because I am supposed to eat it to avoid disappointing someone who is trying to make me happy because it would be impolite not to eat it
Health because it is healthy to maintain a balanced diet because it keeps me in shape (e.g., energetic, motivated)	**Choice** I want to eat it every day because it is the only choice	**Social Image** because others like it because it is trendy because it makes me look good in front of others
Convenience because it is quick to prepare because it is the most convenient because it is easy to prepare	**Price** because it is inexpensive because it is on sale because I do not want to spend any more money	**Sociability** because it is social so that I can spend time with other people because it makes social gatherings more comfortable
Visual Appeal because it spontaneously appeals to me because the presentation is appealing (e.g., packaging) because I recognize it from advertisements or have seen it on TV		

Figure G.1 16 motivations from The Eating Motivation Survey used in this research.