

ABSTRACT

Title of Thesis: DESIGNING TECHNOLOGY TO INCREASE
ADOPTION OF HEALTHY BEHAVIORS IN
MEN IN THE CONTEXT OF LIGHT FOOD
CONSUMPTION

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Women are more likely than men to engage in healthy eating behaviors. However, men do strongly believe eating healthy, but this does not translate into their eating behaviors. Thus, there is a discrepancy in the health beliefs and behaviors of men, especially in the context of light food consumption. In this study, I aim to understand this discrepancy among young men in depth. I conducted a week-long diary study of the food items consumed by the participants (N = 17) who were all male, followed by semi-structured interviews. Findings indicate the lack of a verified and automated source of nutritional knowledge, misinformation about light food consumption among other themes, and design implications to the current nutrition-tracking mobile applications. This work contributes to the understudied existing literature on men's food behaviors, the challenges faced by them in

adopting healthy eating behaviors in the context of light food consumption, and the role mobile applications play in helping them do so.

DESIGNING TECHNOLOGY TO INCREASE ADOPTION OF HEALTHY
BEHAVIORS IN MEN IN THE CONTEXT OF LIGHT FOOD CONSUMPTION

by

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Foreword

Statement of Co-Authorship

The work in this thesis was done under the supervision of Dr. Eun Kyoung Choe. I am the primary contributor to all aspects of this research.

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Chapter 1: Introduction

With the rapid development of technology, health tracking and monitoring has become popular. Self-monitoring applications and technologies have seen a boom since their inception. Self-monitoring is the procedure by which individuals record the occurrences of their own target behaviors (Nelson & Hayes, 1981). Studies have shown that tailoring messages to user characteristics increases the adoption of the health behavior among the target audience (Orji & Moffatt, 2016). Thus, whether a person is male or female, young or old, well-educated or uninformed determines how a particular message needs to be framed in order to motivate the person to adopt that health behavior. In this research, I propose why and how self-monitoring applications and technologies in the domain of nutrition need to focus on tailoring messages based on user gender so as to motivate men to adopt healthy behaviors, especially in the context of light food consumption.

1.1 Light Food Consumption

Light food consumption is described as the consumption of low-fat, high-fiber foods that promote a healthier lifestyle. The consumption of a large amount of fruit is also considered part of the diet (Wardle et al., 2004; Steptoe & Wardle, 1996). Thus, food items ranging from vegetables (e.g., broccoli, carrots, peas, beets, brussel sprouts), fruits (e.g., bananas, strawberries, apples, pears), legumes (e.g., chickpeas, lentils, kidney beans), whole grains (e.g., oats, quinoa, popcorn, brown rice), and dark chocolate are considered part of light food consumption. Food items such as butter, cheese, oil, red meat (e.g., beef,

lamb, pork), pizza, packaged snack foods (e.g., potato chips, microwave popcorn), ice-cream, cookies, white bread, and fried foods (e.g., french fries, fried chicken) are considered to be detrimental to the diet, and in maintaining a healthy lifestyle. This diet is termed as 'light' food consumption (Wardle et al., 2004) because the volume of food appears to be less and the type of foods selected appear to be less substantial, and hence appeared to be more 'feminine'. The questions related to light food consumption form an integral part of the methodology of this study, and have been used to gauge the difference in the beliefs and behaviors of men in this context.

1.2 Motivation and Research Problem

A report by the Institute of Medicine (Wizemann & Pardue, 2001) states, "...being male or female is an important fundamental variable that should be considered when designing and analyzing basic and clinical research" (p. 7). The report further states, "the understanding of sex differences in health and illness merits serious scientific enquiry in all aspects of biomedical and health-related research" (p. 4). Apart from the physiological differences in men and women which determine their health, behavior and cognitive differences also play a part in how men and women receive their treatment. Many studies of health behaviors have noted that men have higher rates of risky behavior and lower rates of a range of healthy and hygienic practices than women (Dean, 1989; Kandrack et al., 1991; Liang et al., 1999). According to a United Nations world data (2015), women live, on average, 4.5 years longer than men. It also showed that men indulge in smoking and drinking more than women and have unhealthy eating habits as compared to women. This has been attributed to the role of gender in health, where some health behaviors are

considered masculine, whereas others are considered more feminine (Courtenay, 2000). Food choices are an area in which consistent behavioral differences have been observed. Numerous studies have reported that boys and men eat fewer fruits and vegetables, choose fewer high-fiber foods, and have little motivation to avoid high-fat foods (Beer-Borst et al., 2000; Li et al., 2000; Liebman et al., 2001; Patterson et al., 1994). A survey conducted by Wardle et al. (2004) in 23 countries shows that men are 50% less likely than women to eat high-fiber food and avoid high-fat food, and 25% less likely than women to eat fruit at least daily. In the same survey, although women reported significantly stronger beliefs in the importance of each of the aspects of diet than men in almost every country in the sample, the belief scores of men were not lower as such as compared to women, being almost at par. Thus, it is safe to say although men give almost as much importance to eating healthy in the context of light food consumption as women, they are more likely to indulge in unhealthy behaviors than women in the context of light food consumption. In this research, I aim to understand the discrepancy between the beliefs and behaviors of men, the challenges they face in adopting healthy eating habits, and the role current nutrition-tracking mobile applications play in helping them do so.

1.3 Purpose of the Study

Food and nutrition are among a set of commonly self-monitored health behaviors, including sleep, physical activity, and smoking. Although many technological interventions have been developed to help people monitor their dietary intake, most do not take into consideration the gender differences in health behaviors and beliefs to tailor their messages in this domain. As Bayne-Smith (1996) had rightfully said, “‘gender and health’

has become synonymous with ‘women's health’ in the domain of food and nutrition, although women continue to receive worse treatment than men in other domains.” Also, as Courtenay (2000) pointed out, health behaviors such as eating healthy and beliefs associated with them are considered to be more feminine than masculine, owing to the traditional gender roles where women are associated with the kitchen and everything related to it. These gender stereotypes have translated to promote self-monitoring applications and technologies in the domain of food and nutrition according to traditional gender roles. Most of the modern self-monitoring applications and technologies related to nutrition and eating healthy have come to be associated and identified with women, with weight loss being the main objective. The self-monitoring applications rarely go the right way of tailoring messages according to user gender, so that both the genders get motivated to adopt healthy eating habits. Thus, the purpose of this research is to understand the food behaviors in men today and the problems they face in adopting healthy eating behaviors in the context of light food consumption, and to propose design changes in the current mobile applications in the domain of nutrition so as to motivate men to adopt healthy eating behaviors.

1.4 Research Questions

With the increasing adoption of self-monitoring applications and technologies, it becomes essential to deliver messages effectively so that users can take maximum advantage of these applications and technologies. In this research, I aim to propose design implications which will motivate men to adopt healthy behaviors in the context of light food consumption. Thus, the following research questions need to be addressed:

RQ1: What are the food behaviors in men today, and what factors influence these behaviors?

RQ2: What problems do men face in adopting healthy eating behaviors in the context of light food consumption?

RQ3: What is the role of mobile applications in helping men adopt healthy eating behaviors?

1.5 Approach

To answer these research questions, I employed a mixed-methods approach involving a week-long diary study, followed by semi-structured interviews to gain an understanding of the food behaviors and beliefs among men, and their use of a nutrition-tracking application, if any.

A one-week long diary study was conducted with the seventeen participants wherein a short 10-minute survey containing questions about their food choices, meal preparations, and grocery shopping was deployed daily at around 9.30 PM (or, at a time selected by the participant) to gain data about the eating habits of the participants, and to provide contextual relevance in the interview.

Then, a semi-structured in-person interview was conducted with each of the seventeen participants to gain an in-depth understanding of their food behaviors and choices, their challenges in adopting healthy eating habits, and their use of a nutrition-

tracking application, if any. The audio files from the interviews were transcribed and qualitatively analyzed using open coding by two researchers.

The findings indicate the discrepancy between the health beliefs and behaviors in men with regards to eating healthy, the reasons for this discrepancy such as convenience, lack of nutritional knowledge, lack of personal motivation among others, the influence of a female figure on their food choices, the diets adopted by them to help them eat healthy, and their likes and issues with the current mobile nutrition-tracking applications. Thus, design implications and scope of further research were identified to enhance the current nutrition-tracking technology for helping men in adopting healthy eating behaviors.

1.6 Overview

This thesis is structured into the following chapters. Chapter 2 covers some theoretical frameworks relevant to the study. Chapter 3 covers the related work. Chapter 4 describes the recruitment process of the 17 participants, the diary study conducted for a week with each participant exploring their food behaviors and choices, followed by the individual interviews conducted with each participant thereafter in context to the diary study and their use of a nutrition-tracking application, if any. Chapter 5 reflects the overall findings from the study, while Chapter 6 outlines possible future work related to the design of mobile applications for men in the domain of nutrition.

Chapter 2: Theoretical Framework

I was motivated by two theoretical underpinnings in this research: the role of gender in informing the health beliefs and behaviors of individuals, and the subsequent tailoring of health messages with respect to gender. I summarize these theoretical underpinnings, and then proceed to clarify how these can be drawn upon in this research.

2.1 Gender Differences in Health

This section discusses the behavioral differences between women and men, and their receptiveness to adopting various health behaviors. Keller & Lehmann (2008) performed a meta-analysis of studies and sampled approximately 22,500 participants along a variety of health behaviors. They confirmed that women have significantly greater intentions than men towards activities that improve their health. This is because they are (i) more concerned about health and its physical consequences (Beech & Whittaker, 2001), (ii) more likely to engage in systematic health message processing (Meyers-Levy, 1988), and (iii) more concerned about long-term effects (Smith & Stutts, 2003). An International Health Behavior Survey, inspired by the European Health Behavior Survey (Stephoe & Wardle, 1996), conducted by Wardle et al. (2004) in 23 countries found that women are more likely than men to eat high fiber foods, avoid fat, and consume fruits daily. In terms of health beliefs, women ranked significantly higher than men across the countries in the context of avoiding fat and eating high-fiber foods and fruits. These studies therefore show that there are significant gender differences in the context of health and nutrition, especially in the context of nutrition and light food consumption.

2.2 Gender Effects on Health Message Tailoring

Gender effects are found to be prevalent when designing motivational messages in the context of physical activity. Busch et al. (2016) found that male participants ranked competition and comparison as more persuasive, whereas female participants ranked reward and self-monitoring to be more persuasive. Vries et al. (2017) reported that male participants found experiential processes, that is, processes which focus on influencing the experiences related to the physical activity behavior change to be more motivating. With respect to gender, Keller & Lehmann (2008) found that health communications that focus on personal consequences in a negatively emotional manner will increase intentions in a female audience, but a positively emotional appeal is more effective if the target is a male audience. Studies also show that men and women are motivated by different types of messages when trying to adopt a health behavior. Women may prefer an emotional, self-rewarding route, whereas men may prefer an unemotional, social comparison route. Thus, gender and its effects need to be considered when designing messages to promote the adoption of healthy eating habits. Since men have lower health beliefs in regards to eating healthy in the light food consumption than women, and are generally less motivated to adopt healthy eating habits, messages which motivate men to adopt healthy eating habits need to be designed.

2.3 Summary

Gender differences in health and in health message tailoring highlight the importance of understanding the more intricate details by which the two genders differ in the context of health and designing interventions for the same. The theoretical underpinnings mentioned in this section guided me in understanding how men make food choices, and in making recommendations for effectively designing mobile nutrition-tracking applications so that men may take proper advantage of them. These underpinnings also form the basis of the related work, which is discussed in detail in the next chapter.

Chapter 3: Related Work

In this chapter, I provide a review of existing research on the gender differences in the context of nutrition, and how people make food choices and the factors affecting it. I also look into how men make food choices and their health literacy in the context of healthy eating, and how this has been understudied previously. I also outline the different factors affecting how health messages are perceived with respect to gender, and how ineffectively the current self-monitoring applications and technologies in the domain of nutrition leverage these findings.

3.1 Gender Differences in Nutrition

Various studies have shown that women have greater intentions than men towards activities that improve their health and are more likely to engage in systematic health message processing (Keller & Lehmann, 2008; Meyers-Levy, 1988). Wardle et al. (2004) also confirmed this in their survey in 23 countries, finding that women give more importance to and are more likely to engage in healthy eating behaviors than men. Courtenay (2000) pointed out that the reason for this gender difference in behavior is the gender stereotyping of roles. Men are traditionally supposed to indulge in “risky behaviors” such as drinking, smoking, eating anything, whereas women are supposed to practice “safe, feminine behaviors” such as eating healthy, maintaining weight, etc. A survey conducted by Levi et al. (2006) among university students also confirmed this gender stereotype related to food choices. The female subjects in the survey scored higher than male subjects on factors associated with food choices that promote a healthy lifestyle, such as attention

to food label information or healthiness of their choices. Consistent with literature on masculinity and health, male students in this study showed lower levels of involvement and interest in food decisions than women. Thus, there is a gender discrepancy in the beliefs and adoption of healthy behaviors in the context of nutrition.

When tracking nutrition, people are interested in tracking their calorie intake and weight (Krebs & Duncan, 2015). Applications like MyFitnessPal, Fitbit, and Yazio Calorie Counter make use of journaling to help their users keep track of the food and calories they consume in order to maintain their weight. Most of the popular fitness apps tend to be favored by women, with Fitbit users having the highest proportion of women at almost 70% (all activities combined) (SurveyMonkey Intelligence Medium Blog, 2016). The exception is Garmin, with its majority users (52%) being male. One of the reasons for this difference could be that Garmin only allows its users to track physical activity, and not nutrition. Also, a survey conducted by Statista (2017) among US adults showed that 24% of women regularly utilize a fitness app to track their fitness as compared to 15% of men. In the same survey, 22% of men said they would not use a fitness app as compared to 16% of women. This shows that men are less motivated to use an application to track their fitness as compared to women. In the context of nutrition, in the same survey by Statista (2017), 18% of women said that they regularly use an app to track their diet and nutrition as opposed to 10% of men. Also, 15% of women said that they would not use an app to track their diet and nutrition as compared to 23% of men. This shows that a higher percentage of women currently use an application to track their diet and would so in the future. Thus, there is a gender difference in the demographics of the users who make use of fitness applications, particularly in the context of nutrition, with women being the majority of the

users. A more gender-specific intervention needs to be developed so as to motivate men to adopt healthy eating behaviors as well.

3.2 Factors Affecting Food Choices in Men

Obesity is an accelerating global health challenge. According to the data from National Health and Nutrition Examination Survey (NHANES, 2015–2016) conducted by the National Center for Health Statistics in the U.S., approximately 70.2% of the adult population was found to be overweight or obese. Approximately 73.7% of men and 66.9% of women were considered overweight or obese. According to this survey, the total HEI (Healthy Eating Index, 2015) score for Americans is 59 out of 100 (54.30 for adults), which indicates that the average diets of Americans do not conform to dietary recommendations. Thus, it is necessary for Americans, and men in particular, to be aware of their food choices and maintain a lifestyle for healthy eating.

Studies have been conducted exploring the food-choice making process in both men and women. A study conducted by Steptoe et al. (1995) found that women give more importance to factors such as health, mood, natural content, weight control, and ethical concerns, as compared to men. The gender differences were found to be more prominent for health and weight control factors, with women giving more importance to these two factors than men. The health factor included items related to the prevention of chronic diseases (e.g., foods ‘high in fiber and roughage’) and to general nutrition and well-being (e.g., ‘nutritious’). The weight control factor included dietary restraint and a calorie deficit diet (a diet in one loses more calories than one consumes). Another study by Tepper et al. (1997) involving 137 males showed that men who followed restrained eating were more

likely to consume ‘healthy foods.’ Nutritional knowledge and food beliefs played only modest roles in the study. Furthermore, Driskell et al. (2006) looked into the fast-food restaurant eating habits of a group of college students and reported that a significantly higher percentage of men (84%) than women (58%) typically ate fast foods for lunch at least once weekly. More women than men reported choosing small portion sizes and considering healthier options in the menus at the fast food restaurants. Although these studies suggest there are significant gender differences in food behaviors and choices, there is little research exploring the processes by which men make food choices and the factors that influence their decisions.

A study by Mróz et al. (2010) which entailed a meta-analysis of existing literature to understand the food behaviors in men specifically found that men’s health activities, including food choice behaviors, are shaped by the dominant ideals of masculinity, many of which conflict with healthy eating practices. The existing studies, however, provide little evidence on how to improve men’s uptake of healthy behaviors (Robertson et al., 2008). Furthermore, although female partners are acknowledged to be important influences on men’s food practices (Schofield et al., 2000), there is little research in this area (Lyons, 2009). Also, the intricate ways in which gender shapes men’s eating habits are poorly understood (Roos et al., 1998). Thus, little is known about the food behaviors and choices in men, and the factors influencing them.

3.2 Factors Affecting Health Message Tailoring

Traditionally, nutrition tracking has been considered a prevention behavior (Rothman & Salovey, 1997), and hence gain-framed messages (focusing on the benefits of

adopting a health behavior) are preferred over loss-framed (focusing on the loss of not adopting a health behavior) to motivate people to adopt this behavior. In addition, other factors need to be considered while tailoring health messages, such as emotions, social factors, and education levels, which motivate the two genders differently. The following section discusses how these factors tend to influence and are influenced by gender.

3.2.1 Emotions

The study conducted by Keller & Lehmann (2008) showed that women are motivated by emotional (often negative), rewarding messages with a component of social support from peers, whereas men are motivated by positive messages with a component of social comparison. Thus, men get motivated by a sense of competition among their peers, whereas women prefer social support from their peers. Emotional valence also plays a central role in age differences in information processing as older adults relative to younger adults demonstrate a shift in preference from negative to positive information (Carstensen & Mikels, 2005). Also, adults tend to remember positively framed messages more than negatively framed ones (Shamaskin et al., 2010). Fish'n'Steps, an interactive computer game developed by Lin et al. (2006) suggested that encouragement or positive emotions resulted in a long-term behavioral change than negative reinforcements, especially when individuals were not meeting their own expectations. Thus, positive framing more often results in behavioral changes that last longer. Although men may not always get motivated by emotional messages unlike women, positive emotional messages do tend to bring about a behavioral change in them.

3.2.2 Social Factors

People can be motivated to adhere to their goals when external support is provided. A study by Chung et al. (2017) showed that women participants regularly tracked their food intake by journaling it on a social media platform, such as Instagram. The platform provided them with accountability and emotional support from others who were trying to do the same, while at the same time helping them to keep a record of what they ate. On the other hand, a study by Busch et al. (2016) found that participants who identified themselves as male found social competition more appealing and persuasive. Moreover, social comparison is an attribute which motivates men to meet their goals. (Keller & Lehmann, 2008). Thus, different forms of social interaction tend to have a positive effect on the adoption of health behaviors in men and women.

3.2.3 Education Levels

The data from the National Health and Nutrition Examination Survey (NHANES, 2015–2016) suggested that men and women with college degrees had lower obesity prevalence compared with those who had less education. This finding suggests that men and women with higher levels of education are more receptive towards health messages and are more open to adopting healthy eating behaviors. The International Health Behavior Survey conducted by Wardle et al. (2004) in 23 countries concluded that although men's ratings of the importance to health of dietary behaviors were lower than that of women in the context of light food consumption (fiber, fats and fruits), they were not lower as such and were still above 5 (i.e., on a Likert scale from 1 to 10, where 1 was least important and

10 was most important, men's ratings of their beliefs were above 5). Their data showed men believe eating healthy is important to some degree, but not as strongly as women. This could be partly due to their sampling consisting of well-educated men. Thus, education levels could also influence people's beliefs and how they perceive messages. A study by Arcia et al. (2016) showed that participants (85% female) with low health literacy demanded more information and visualization in their infographics. Participants with high health literacy demanded more specificity. Research on the health literacy of men and their subsequent reactions to health messages in the context of eating healthy has not been looked into thoroughly in the literature.

3.3 Self-monitoring Interventions in Nutrition

According to a nation-wide survey by Fox and Duggan (2013), 60% of U.S. adults say they track their weight, diet, or exercise routine. Out of these, 49% of trackers say they keep track of progress "in their heads"; 34% say they track the data on paper, such as in a notebook or journal; and 21% say they use some form of technology to track their health data. Forty-six percent of trackers say that this activity has changed their overall approach to maintaining their health or the health of someone for whom they provide care. Tracking does help in changing behavior or in adopting a new behavior (Nelson & Hayes, 1981). Many self-monitoring interventions have been developed for tracking health, but for the scope of this research, the interventions have been limited to the context of nutrition. I also look at how these interventions have been utilized in consumer technology today to cater to the needs and demands of men in the context of nutrition.

Self-monitoring is the procedure by which individuals record the occurrences of their own target behaviors (Nelson & Hayes, 1981). Self-monitoring applications and technologies are convenient to use and maintain with the advent of mobile technologies, and hence researchers are developing many self-monitoring applications and technologies to help people track their health (Klasnja et al., 2011). This research looks into how self-monitoring applications and technologies have been useful for people in adopting healthy behaviors, and how they can be further tailored to help men in adopting healthy eating behaviors.

Epstein et al., (2016) developed a mobile application, Food4Thought, in which they designed nutrition and non-nutrition ‘crumbs’ to help people adopt healthy behaviors. A nutrition crumb is nutritionally prescriptive (“Eat something high in fiber”), while non-nutrition crumbs are prescriptive without the nutritional content (“Eat something yellow”). Non-nutritional crumbs provide mindfulness and do not make people feel judged about their nutritional choices. The study found that participants were more engaged with non-nutrition crumbs in the social condition, where they had a group of fellow users to discuss each crumb. The study contributed to raising awareness in people about what they were eating and kept them engaged throughout.

Bentley et al. (2013) developed a system called Health Mashups which suggested connections between different activities to users (“You sleep more when you eat less”). The system gave users certain goals which made analysis of user data required in most self-monitoring technologies much simpler and easier. Also, since there were correlations between different activities, the system motivated users to take up other activities in order to aid in their primary activity goal. This system of nudging can be used to motivate men

to adopt healthy eating habits by correlating this behavior with another desired behavior of their choice.

Hwang and Mamykina (2017) developed a nutrition game to help users track their dietary intake and food purchases through the use of an online avatar, which became fat when the users didn't make healthier choices while consuming as well as purchasing food. The two types of framings—two-way Inoculation (negative visuals showing the bad effects of consuming high-calories snacks; positive messages highlighting the benefits of consuming healthy snacks) and Subversive (visuals and texts both negative highlighting the bad effects of consuming high-calorie snacks) had different effects. Inoculation influenced users to eat healthier, but subversive messages increased their awareness of the calorie content of snacks.

The majority of participants in the interventions mentioned are female, and hence there tends to be a gender bias in the way the self-monitoring interventions are marketed, designed, and studied. Even though the bias might not be significant, it strengthens our hypotheses that interventions in the domain of nutrition have not been adequately designed keeping men in mind. Current self-monitoring applications in nutrition such as MyFitnessPal, Fitbit, and Yazio Calorie Counter are mostly used by women. Almost 70% of Fitbit users are women (SurveyMonkey Intelligence Medium Blog, 2016). This research focuses on the reasons for the gender gap in the current interventions and aims to suggest designs that could help in closing this gap in the context of nutrition.

3.4 Summary

The literature review suggests that although more men than women are overweight or obese, they do not take actions as strongly as women do to eat healthy in order to lead a healthier lifestyle. Although men may believe that eating healthy is an important health behavior, they do not necessarily translate this belief into their behavior. The literature is suggestive of more tailored, customized methods to increase adoption of a health behavior, but the current interventions do not seem to have adopted this suggestion, especially for male audience in the domain of food and nutrition, which also adversely affects motivation levels in men who are otherwise less motivated. The gender difference in the adoption of nutrition applications is suggestive of this problem. Thus, a more tailored, gender-specific system needs to be developed in order to motivate men to adopt healthy eating behaviors. I aim to do this by understanding the food behaviors among young men today, the factors affecting their food behaviors, the challenges faced by them in adopting healthy eating behaviors, and the role mobile applications play in helping them do so. To explore these questions, the following chapter describes the research methods I employed.

Chapter 4: Methodology

This chapter describes the procedures employed for participant recruitment and the selection criteria applied; the details of how the diary study and the interviews were conducted; and the qualitative analysis of the data generated in the interviews to answer the research questions.

4.1 Participants

Since the study focuses on motivating men to adopt healthy eating behaviors, the participants selected were male. The study by Levi et al., 2006 shows that there are sufficient gender differences in the health behaviors of university students also, and hence I aimed to recruit male participants (students and employees at the University of Maryland College Park) to understand why the differences exist. The study by Wardle et al. (2004) also shows that although men strongly believe in adopting healthy eating habits, they do not necessarily do so. Thus, the aim was to recruit men with high beliefs in adoption of healthy eating habits, but not strict healthy eating behaviors in the context of light food consumption to find out the underlying reasons for the discrepancy between their beliefs and behaviors. Recruiting participants who live nearby the UMCP campus helped in the logistics of the study.

The inclusion criteria required them to have strong beliefs in adopting healthy eating habits (i.e., International Health Behavior Survey's health belief score of 5.5 or above [Wardle et al., 2004]), and to not have exhibited strict healthy eating practice as per the International Health Behavior Survey (i.e., did not simultaneously have a health

behavior result of Yes for eating high-fiber food, a result of Yes for avoiding fats, and a result of Daily for the frequency of eating fruits [Wardle et al., 2004], which were the criteria for exhibiting strict healthy eating practices in the context of light food consumption). Additionally, they were required to be healthy males who did not have a health condition (such as diabetes) that motivated them to maintain a diet, were fluent in English, and could participate in the study at the University of Maryland, College Park campus.

A Recruitment Text (attached in Appendix A) and a Screening Questionnaire (attached in Appendix B) were circulated among the students, faculty, and staff of the College of Information Studies at the University of Maryland, College Park (UMCP). Forty-eight people filled out the questionnaire, out of which twenty-two participants qualified for the study. Out of the twenty-two participants that were initially screened, seventeen participants consented to moving onto the next step, by agreeing to fill in the diary study and participate in the interview. The participants were mostly students (except for one who worked part-time) with no health condition that required them to maintain a diet. They were living in urban areas where access to healthy and fresh foods is possible. Six were international students. All seventeen participants (average age = 24 years; Min = 19 years; Max = 34 years) believed in eating healthy, the attributes of which varied with each participant. On average, the participants gave a score of 6.47 on how important it is for them to avoid foods containing fat, a score of 7.70 on how important it is for them to eat foods containing fiber, and a score of 7.88 on how important it is for them to eat fruits, on a scale of 1 to 10 where 1 was marked as least important and 10 was marked as very important. Out of these seventeen participants, ten participants answered Yes to

Consciously making an effort to avoid foods containing fat, seven participants answered Yes to Consciously making an effort to eating high fiber foods, and eight participants answered Yes to Eating fruits Daily when asked about their eating behaviors in the screening questionnaire. Details are shown in Table 4.1 and Table 4.2. Eight out of the seventeen participants reported using an application to track their nutrition currently or in the past. Details are shown in Table 4.3.

Participant ID	Age	On a scale from 1 (least important) to 10 (very important), how important is it for you to - Not eat too much fat	On a scale from 1 (least important) to 10 (very important), how important is it for you to - Eat enough fiber	On a scale from 1 (least important) to 10 (very important), how important is it for you to - Eat enough fruit
P1	21	4	10	10
P2	19	7	9	9
P3	21	7	6	9
P4	28	5	7	5
P5	21	8	10	9
P6	21	7	3	7
P7	20	3	7	7
P8	34	10	10	9
P9	25	6	7	4
P10	20	7	6	8
P11	25	6	7	7
P12	26	7	9	9
P13	23	7	7	8
P14	21	6	9	9
P15	25	3	9	8
P16	28	8	7	9
P17	30	9	8	7

Table 4.1: Reported Health Beliefs of Participants

Participant ID	Age	Do you make a conscious effort to avoid food that contain fat?	Do you make a conscious effort to eat foods that are high in fiber?	How often do you eat fruit?
P1	21	Yes	Yes	2-3 times a week
P2	19	Yes	No	2-3 times a week
P3	21	Yes	No	Daily
P4	28	No	No	Daily
P5	21	No	Yes	Daily
P6	21	Yes	No	Once a week
P7	20	No	Yes	2-3 times a week
P8	34	Yes	Yes	2-3 times a week
P9	25	No	Yes	2-3 times a week
P10	20	Yes	No	2-3 times a week
P11	25	No	Yes	Daily
P12	26	No	Yes	Daily
P13	23	Yes	No	2-3 times a week
P14	21	Yes	No	Daily
P15	25	Yes	No	Less than once a week
P16	28	Yes	No	Daily
P17	30	No	No	Daily

Table 4.2: Reported Health Behaviors of Participants

Participant ID	Age	Profession	Program	Nutrition Application Use (either current or at some time in the past)
P1	21	Student	Undergrad	My fitness Pal
P2	19	Student	Undergrad	Health app
P3	21	Student	Undergrad	N/A
P4	28	Student	Masters	N/A
P5	21	Student	Undergrad	MyFitnessPal
P6	21	Student	Undergrad	N/A
P7	20	Student	Undergrad	MyFitnessPal
P8	34	Student	Masters	NA
P9	25	Student	Ph.D.	Fitbit
P10	20	Student	Undergrad	N/A
P11	25	Student	Masters	MyFitnessPal
P12	26	Student	Ph.D.	I don't track
P13	23	Student	Masters	N/A
P14	21	Student	Undergrad	My Fitness Pal
P15	25	Student	Ph.D.	MyFitnessPal
P16	28	Student	Masters	None
P17	30	Student	Masters	no such thing

Table 4.3: Nutrition Application Use by Participants

4.2 Procedure

The study protocol was approved by the Institutional Review Board (IRB) at the University of Maryland, College Park. The study involved the employment of listservs (e.g., UMD HCIL, ischooldiscussion listservs) to roll out a brief informational meail about the study, along with a link to the screening questionnaire on Qualtrics.

The study comprised a 10-minute survey that was administered every day for a week, followed by an in-person semi-structured interview. An initial pilot study was

conducted with two male participants, whose responses helped in refining the daily survey and the interview questions. Based on the responses from the screening questionnaire and their consent received to participate further in the study, seventeen male participants who had strong beliefs in eating healthy but did not exhibit healthy eating behaviors were recruited for the final study. They were asked to participate in a daily survey which involved questions about their food choices, their meal preparations, and their grocery shopping for that day. The week-long diary study was followed by an in-person semi-structured interview wherein the researcher asked the participants questions about their food behaviors and choices, the challenges they encounter while trying to eat healthy, and their use of a nutrition application in tracking their diet (if any). The interviews were audio-recorded, as well as visually captured in photographs. The participants were compensated with \$30 Amazon gift cards for their efforts.

4.2.1 Daily Survey

The daily survey was set up on Qualtrics and deployed to the participants after receiving their consent. A reminder was sent to each participant at approximately 9.30 PM daily, or at a time of their choice, to nudge them to fill in the survey. The reminder reduced the burden of self-reporting on participants to some extent. The daily survey involved questions about the food items consumed by the participants during the day, the types of meal preparations involved, and their grocery shopping. The daily survey helped in gauging the participants' knowledge about what food items or preparations they thought were healthy, as well as provided contextual data for the interview. The following questions were asked:

1. Did you make a conscious effort to avoid foods that contain fat today? (Y/N)
 - 1.1 What food/s did you avoid which contain fat? Name them.
2. Did you make a conscious effort to eat foods that are high in fiber today? (Y/N)
 - 2.1 What food/s did you eat which are high in fiber? Name them.
3. Did you eat any fruit today? (Y/N)
 - 3.1 What fruits did you eat today? Name them.
4. Name (the name that you know it as) the different kinds of food you had for your meals today in the column you think is appropriate. You can mark the meal as missed if you missed eating it today.

Meal	Home Cooked	Restaurant food /Take Out	Packaged (e.g., frozen pizza, cup noodles)	Fresh Items (e.g., fruit, salad)	Others	Missed
Breakfast						
Lunch						
Dinner						
Snacks (throughout the day and night)						

Figure 4.1: Daily Survey

5. Did you shop for groceries today? (Y/N)

Instructions were provided at the beginning of the survey so as to aid participants in entering factually-correct information. The instructions are attached in Appendix C.

4.2.2 Semi-structured Interview

The daily survey was followed by an in-person semi-structured interview to obtain qualitatively rich data about the food behaviors and choices of the participants, the challenges faced by them in adopting healthy eating behaviors, and the role of mobile applications in helping them to do so. The interview included demographic and background questions, followed by questions about their food choices and grocery shopping experiences, the factors affecting the same, the challenges faced by them while deciding to eat healthy, and their use of a food tracking application (if any). A more detailed list of interview questions is attached in Appendix D. Interviews ranged from 33 to 95 minutes, averaging 59 minutes. The interviews with the seventeen participants generated rich data on the eating beliefs and behaviors of men, especially in the context of light food consumption (fat, fiber, fruits). All interviews were audio-recorded. Photographs of the interview session were also taken for record-keeping purposes.

4.3 Analysis

The interviews were transcribed to aid in a thematic analysis (Braun & Clarke, 2006). Two researchers separately reviewed and coded eight transcripts, and then gathered to conduct an affinity analysis of the codes generated by collectively adding, merging, or deleting codes. After reaching an understanding about the codes generated by analyzing

the initial eight transcripts together, the researchers divided the remaining nine transcripts among themselves to individually code and then add the codes generated to the affinity analysis individually. Three high-level themes were identified, which contained 18 sub-themes, which drilled down into further sub-themes. The next chapter discusses the results in detail.

Chapter 5: Findings

This chapter describes the findings from the diary study and the interviews based on a thematic analysis of the data. This chapter is divided into three sections: Section 5.1 aims at answering RQ1, Section 5.2 aims at answering RQ2, and Section 5.3 aims at answering RQ3.

5.1 Diary Study Results

The 10-minute daily survey generated data about the consumption of fiber and fruits, and the avoidance of fat among the participants. It also threw light on the type of meals consumed by the participants, and their grocery shopping frequency. This section shows some of the findings from the daily survey.

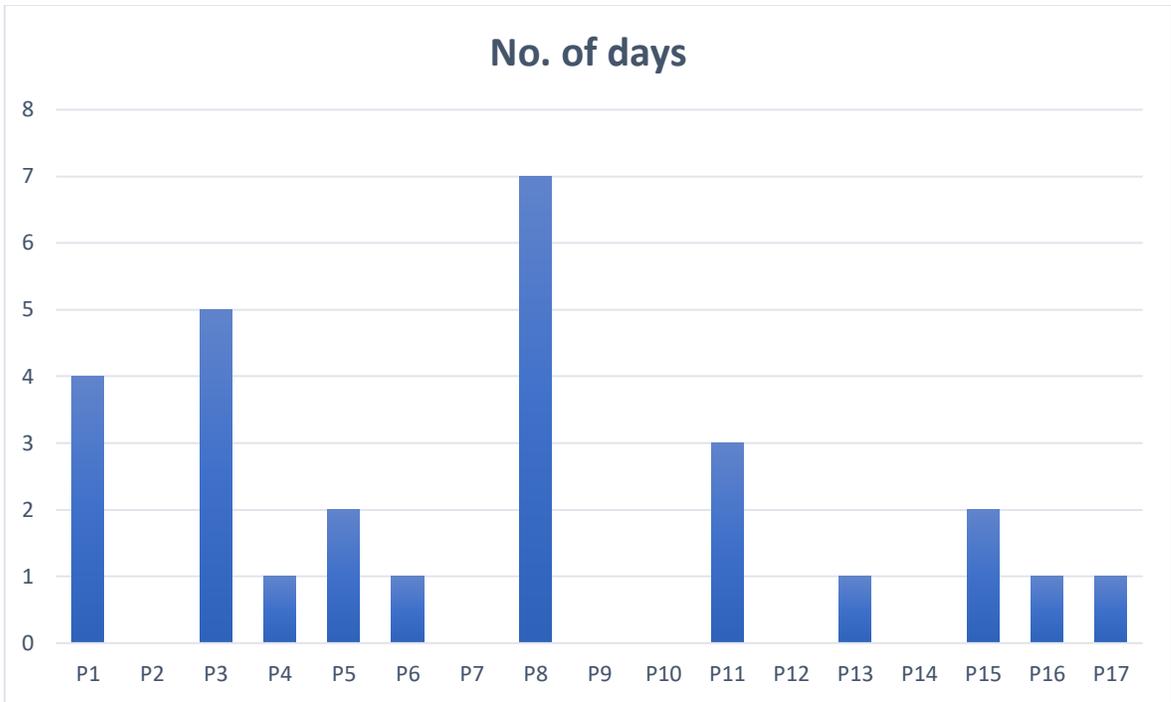


Figure 5.1: Conscious Effort to Avoid Foods Containing Fat

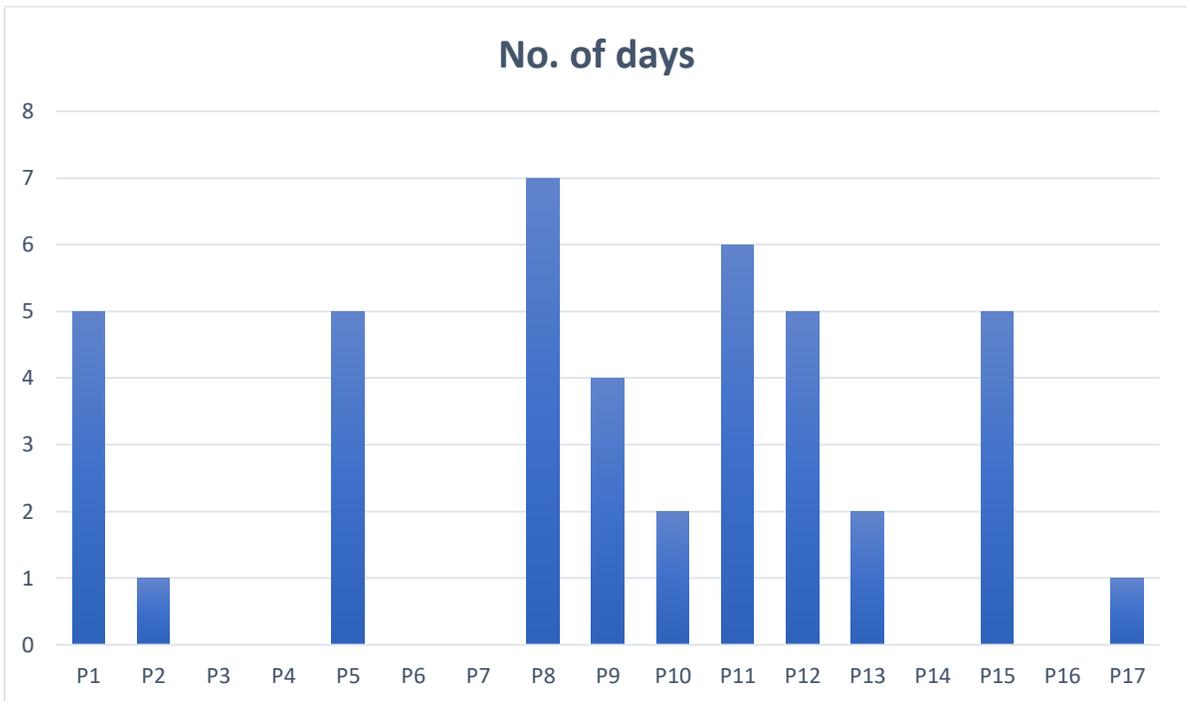


Figure 5.2: Conscious Effort to Eat High Fiber Foods

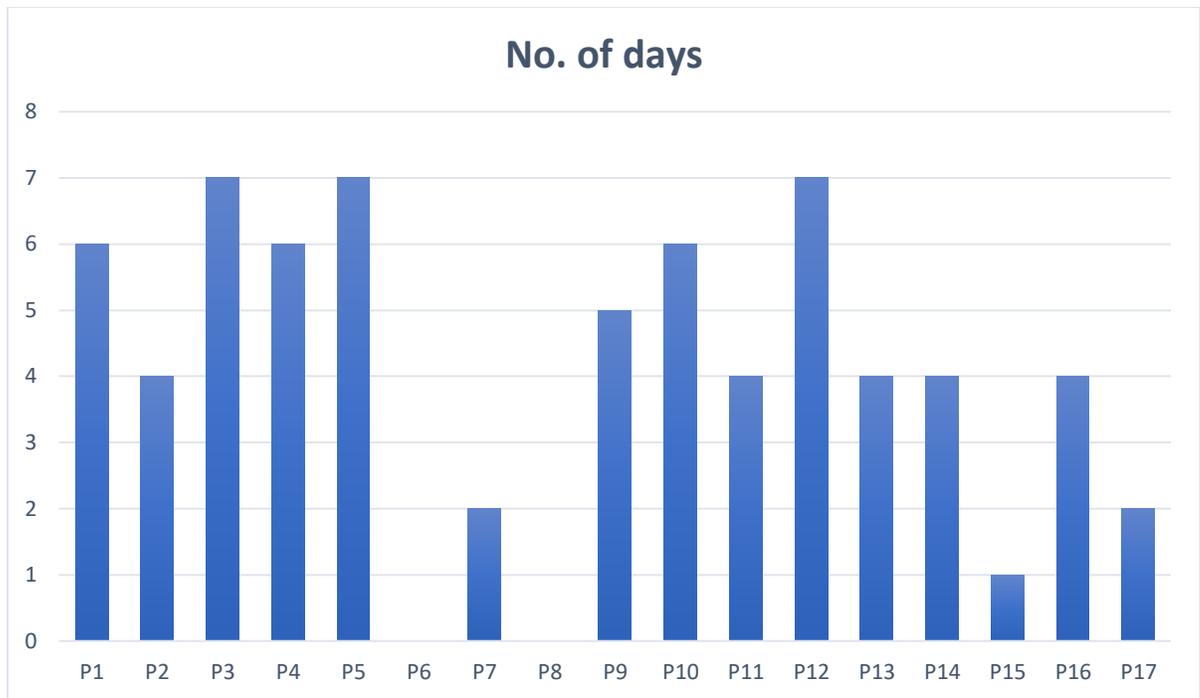


Figure 5.3: Consumption of Fruits

As we can see from the graphs, out of the total 17 participants, 4 participants actively avoided fat for three or more days, 4 participants actively included fiber for three or more days, and 8 participants actively consumed fruits for three or more days. This is indicative of unhealthy food behaviors in men in the context of light food consumption. Additionally, some participants (n = 6) also reported missing at least one meal for three or more days, with breakfast being the majority of the meals missed.

For the meal preparation, 5 participants consumed home-cooked food for two or more meals in a day, whereas 12 consumed restaurant or take-out for two or more meals in a day. Additionally, 12 participants reported consuming more processed food items than fresh items in a day, which is further indicative of unhealthy food behaviors in men.

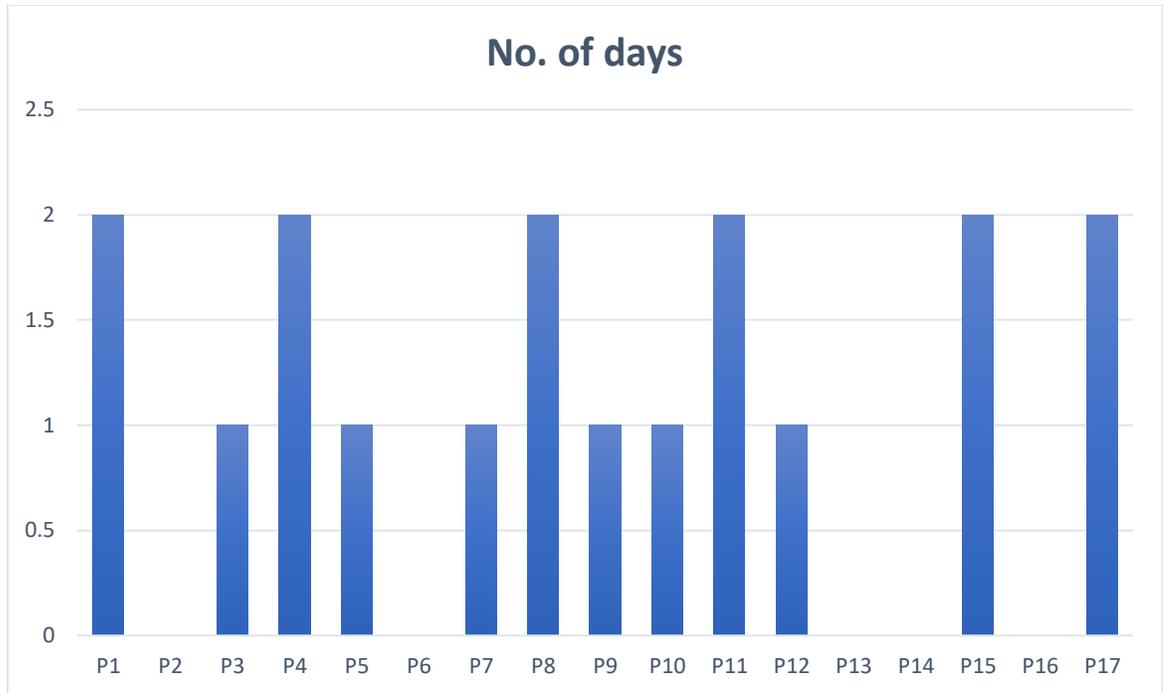


Figure 5.4: Grocery Shopping Frequency

From the graph on grocery shopping frequency, we see that 6 participants shopped for groceries twice in the week, 6 participants shopped for groceries once in the week, and 5 did not shop for groceries at all in the week. The reasons behind these behaviors and the factors affecting them as obtained from analyzing the interviews are discussed in detail in the next section.

5.2 Food Behaviors in Young Men and Factors Influencing Them

In this section, I discuss in detail the findings that shed light on the food behaviors of the participants, especially in the context of light food consumption. I discuss their beliefs regarding eating healthy, as well as their current food behaviors, and the factors influencing these food behaviors. In this section, I aim to answer RQ1.

5.2.1 Beliefs in Eating Healthy

Although all the participants believed in eating healthy, their perceptions of what constituted healthy eating varied, as it was fueled by their personal motivations and sources of knowledge about healthy eating, which are discussed here.

Perceptions of Healthy Eating Behavior

The most common theme was eating some kind of vegetables, fruits, or green and fibrous foods, with all participants deeming these food items as part of healthy eating. As for drinks, many participants (n = 15) believed water to be the healthiest form of drink, with some saying smoothies made from vegetables to be healthy too (n = 2). Many participants (n = 9) also stressed on avoiding synthetic fruit juices and alcohol as they did not contain fiber, but some of them (n = 3) did consider soda drinks and alcohol to be healthy if consumed in limited quantities, or in healthier forms such as diet soda drinks or wine which contain less sugar. According to P1, *“Even with drinks such as soda, there's always the right amount that you can drink and still be okay.”* The theme of portion control also resonated among a few other participants (n = 2) when discussing food items they did not consider healthy (such as fat). For example, P16 stated, *“You can eat smaller portions of things that are I guess not as good for you but you'd like combine them, but it's more portion control to me than anything.”* Other participants (n = 2) also discussed portion control in light of healthy eating wherein they consider having small meals throughout the day to be healthier than eating a few large meals, with P8 saying he *“believes in having small meals.”* The timing of the meals also mattered to some participants (n = 2), such as

P16, who said that there is a whole concept behind eating earlier in the day versus eating late at night and advised not to eat high-fat foods before sleeping because *“you don't burn as many calories when you're sleeping.”*

Another prevalent theme is how food items are prepared (n = 15) which also determines if they are healthy or not. The participants said that eating home-cooked food or fresh items (n = 7), specifically roasted or baked items (n = 2) was considered to be a healthy behavior as they had less fat. For example, when asked what food items he considers healthy, P13 answered: *“Um, yeah, I would say good amount of fresh stuff I would say, roasted items or baked items which have less number of cheese, or less amount of cheese, and definitely not sodas- water most of the time- yeah, I would say that.”*

Many participants deemed healthy eating as avoiding processed and packaged food items (n = 15). For P13, healthy food meant removing *“the bad food out of it and then keep that section as healthy.”* Regarding what food items count as unhealthy and should be avoided, P7 described high-fat foods such as, *“Donuts, pizza, hamburgers, fried food, um, anything with a lot of sugar and saturated fats. So, like, ice cream is super bad for you. Oh, hmm, too much cheese, too much bread, too much pasta, too much- too many carbohydrates probably make you fat.”*

Sources of Knowledge about Healthy Eating

The participants described a variety of sources from which they obtained knowledge about eating healthy, and the food items which should be consumed (or avoided) as part of healthy eating. The three main mentioned were media (n = 13) including videos, websites, and podcasts; professionals, including nutritionists and gym instructors

(n = 3); and acquaintances, including colleagues and relatives (n = 2). These sources tended to influence their beliefs about healthy eating, although there was no way for them to verify their validity. P3 worried, *“There are just a bunch of information out there that leads you to believe that, like, you know, eating too much of this is bad, eating too much of that is gonna like, cause cancer, it’s gonna give you, like, heart disease. And that, like, worries me, uh, personally.”* The sources provided information about specific diets for maintaining a particular physique or body weight, but none provided information about light food consumption as a lifestyle.

Intrinsic Motivation for Eating Healthy

The participants were motivated for three main reasons for eating healthy in the context of light food consumption: staying in shape or losing weight (n = 9), not being lethargic (n = 7), and preventing future or mediating current health conditions (n = 5). Other participants (n = 9) also resorted to eating healthy when they took up a physical activity.

P15 considered himself overweight and wanted *“to go to the healthy side.”* P13 had a case of above-average bad cholesterol levels, as he mentions, *“...especially when I came from India I had a little bit, like my cholesterol was above average, and I was like oh shit this is bad, I’m like 22 how can I have this, so I just googled what potential options can I have to like reduce cholesterol itself- reduce the bad cholesterol and put in good cholesterol.”*

P7 thinks it is important for him to eat healthy because he feels tired if he does not do so, as he says, *“when I eat healthy I feel better, and I get more stuff done in the day.”*

Um, if I eat too badly for too long like over a Christmas break or something, or when I have a birthday, like I feel so tired, sleepy all the time.”

Thus, there are some intrinsic motivations for the participants to maintain light food consumption as a lifestyle and integrate it with other activities, rather than as a stand-alone regimen or a diet.

5.2.2 Food Behaviors and Factors Influencing Them

In this section, I discuss the current eating, cooking and grocery-shopping habits of the participants, the effects of culture, social interactions, and convenience on these habits, and the steps these participants take to eat healthy in their own different ways.

Eating Behaviors of Young Men

Five participants reported currently (or at some point in the past) adhering to some form of a diet, such as intermittent fasting (n = 3), calorie deficit (n = 1), or a protein-rich diet (n = 1). In regard to intermittent fasting, P3 stated, *“I sometimes do intermittent fasting, which is like, where you eat, like, for like, I think six hours out of the day instead of, like, eating three consistent meals. I’ll just have, like, one big meal, or like, two half size meals.”* He further adds that he eats *“Literally just the same stuff. It’s just eating it at different time periods if that makes sense.”* P15, who was trying to lose weight, aimed for a *“calorie deficit with a forty, forty, twenty ratio.”* It forced him to add fruits and eggs and stay away from heavily processed foods. P6 started a protein-rich diet as a result of his training at the gym; he described: *“...it’s more like I just wanted to add more protein to what I eat, so*

I started eating chicken and rice and a lot more oatmeal.” None of the participants reported to actively maintaining a lifestyle that involved light food consumption.

Many participants tended to skip meals (n = 12), particularly breakfast, due to lack of time in the morning when they are commuting to work/school. There was also a difference in the eating behaviors of some of the participants (n = 8) between weekdays vs weekends, with them eating more regular and home-cooked meals during weekends as compared to the weekdays, where they are pressured for time. Skipping breakfast is seen to be consistent during weekends as well as the participants wake up late. A few participants (n = 5) reported mostly consuming home-cooked food majorly, whereas other participants reported consuming restaurant/take-out or packaged items more often. The definition of home-cooked food also varied. For example, P17 stated, *“Or it could be if I'm in a hurry I would just make up very simple sandwiches, just two slices of bread, some ham, cheese and pretty much that's it. Home-cooked. Yeah, because I made that.”*

In terms of drinks, the participants reported having water (n = 5), coffee (n = 7), and alcoholic drinks (n = 7) as the main items.

Cooking Habits of Young Men

Few participants (n = 3) said they cook almost daily; some (n = 5) said they mostly cook on weekends when they are relaxed and have time; some (n = 2) reported cooking one meal daily, such as dinner; while others (n = 4) cook approximately two times a week. Some of the participants also said that they cooked in large batches so as to be able to eat the food for multiple meals. P15 cooks for four one days on one day as he doesn't want to *“end up cooking every day.”* He further adds, *“That saves me time and it saves me effort.”*

When cooking, some (n = 3) of the participants made a conscious effort to lower their carbohydrate intake, while some (n = 2) roasted or oven-baked their food items in an effort to eat healthy. There were mentions of trying to include fibrous foods such as greens (n = 3), and some mentions of trying to avoid fat (n = 5) while cooking.

Grocery-Shopping Habits of Young Men

The participants said they went for grocery shopping every four days (n = 2), once every two-three weeks (n = 3), or on the weekends (n = 5), while the rest (n = 7) shopped for groceries when they felt it was convenient. Some participants avoided shopping for groceries for as long as they could, or made small store runs when they ran out of groceries (n = 4). Grocery shopping frequency dictated their cooking habits as well, as the participants (n = 6) tend to cook more home-cooked food when they go for grocery shopping more often. Familiarity with products (n = 4), cooking recipes (n = 5), price (n = 9), and effort (n = 7) dictated their grocery shopping techniques, wherein the participants preferred products which were familiar, cheaper, frozen and cut or small, and could be used in recipes they were familiar with. In terms of effort, P17's strategy is to purchase things which are *"boneless and peeled"*. He adds, *"If you're buying chicken, you're buying boneless chicken, boneless chicken leg, boneless thigh, boneless chicken breast. If you're buying shrimp, you buy peeled shrimp, frozen shrimp so that you don't have to cook them or peel them from scratch."* This proved to be a hindrance to them maintaining a light food consumption lifestyle as they considered fresh vegetables and low-fat foods to be expensive, difficult to acquire and include in recipes, and not tasty.

Factors Affecting Food Behaviors

The participants reported various factors affecting their food habits. Some participants (n = 14) considered the time and effort it required to procure a healthy meal; some (n = 9) looked at the price, preferring cheaper options to expensive ones; some (n = 7) looked at the quality of food items, and tended to get fresh items in bulk; while others (n = 7) looked at the satisfaction the food provided them. Satisfaction was a subjective factor, which made some participants go for unhealthy foods (n = 5), while others (n = 3) considered home-cooked food to be satisfying. P7 resorted to eating “*something very heavy like pasta, or like a sandwich or something that has, like, some carbohydrates and that'll usually last me throughout the day*”. On the other hand, satisfaction for P15 meant being able to have freshly-cooked food as frozen foods lost their “*flavor, consistency*” and “*from a taste point of view, satisfiability, um, did that satisfy me, um, it does not.*” Since food items which fall under the category of light food consumption were seen to be expensive, time-consuming, and less satisfying, the participants (n = 12) preferred processed foods or take-outs, which were cheaper and took less time in comparison, and gave the participants the satisfaction of a full belly.

The different cultural backgrounds of the participants also influenced their current eating and shopping habits, with many participants (n = 9) opting for food they have had before or have been having since their childhood. Participants (n = 5) also look at access to ingredients known to them to determine what food items they will have. P13 resorted to Indian ingredients known to him because “*being an Indian I have been brought up on having this itself. So, I don't really see myself diverting to another food choice.*” There was also a perception of certain cuisines to be unhealthy among some participants (n = 5). For

example, P17 being an Asian, considered American cuisine to be “*fatty and unhealthy*”. Thus, there is a need for recognition of healthy foods (which form a part of light food consumption) within the group of food items consumed by the participant as part of his previous or cultural experience, so that the chances of the participant incorporating those food items in his eating behaviors increase.

The social influence of friends and family (n = 15) and living arrangements (n = 6) also affected their food choices. With regard to living arrangements, the effect of roommates on the eating habits of the participants was notable. For example, P13 said, “*I cook in a large amount, so all my flat mates can also enjoy them. That’s how we usually...that’s how the thing works in a flat. When we cook, we cook for all of us.*”. The influence of family and friends was immense, with the majority of influence (n = 9) coming from female friends or family. P9’s food choices conformed to that of his girlfriend, as “*I cook with my girlfriend and she is in a particular diet. So that changes my food choice.*” For home-cooked food, P6 ate “*what my mom makes*” as he enjoys it. Thus, the effect of females was considerable, leaning more towards helping the participants adopt healthy eating habits, and more intake of fibrous and low-fat foods (n = 7).

Strategies for Healthy Behaviors

The participants developed their own ways of introducing light food consumption into their everyday lives, some of which are discussed here. The participants (n = 15) tried involving more vegetables, more fibrous foods in their daily food schedule, by either eating a fruit a day, or adding a slice of lettuce or tomato to their sandwich. P7 always added lettuce to sandwiches because he thought he was “*adding a little healthy stuff.*” He further

said, *“I was eating out a lot this week, so I had some vegetables to cut it out like, okay I need to balance it out. Let me eat some fruit, fruit smoothie.”*

Some participants (n = 6) also went for healthier options when eating restaurant, take-out, or packaged food. P15 explained, *“Even in a take-out situation you could still largely avoid, uh, heavily processed foods. And Taco Bell is not a good option when you think about the sodium it has. Um, if you take a Subway, and not add any, um, of those, uh, sauces. No diet sauces, yes strictly prepared. It’s one option.”* P8 similarly stated, *“Even if I get pizza, I’ll put spinach on it. It all adds up. Even if I get a sandwich from outside, I tend to put spinach on it. It all adds up. You tell them, “Don’t put mayo. Put less cheese.” It all adds up. You go to Chipotle, you don’t get sour cream. You get the healthy stuff. It all adds up.”*

Some participants (n = 7) said they eat home-cooked food because they have more control over the ingredients and the preparation of the meal, which allowed them to eat healthy. P12 cooks at home so that he *“can control the food and also the way I cook it.”* His basic strategy is *“try to eat fresh”*, so he grocery shops *“once a week as frequently as possible.”*

Many participants tried avoiding high-fat (n = 9) and high-sugar (n = 8) foods in order to eat healthy. For example, P9 said, *“So, this is one thing, I have tried to cut back on sugar. Then beyond that, I do not eat out a lot and so I try to stay away from a lot of fried food.”* Some participants (n = 4) also maintained their calorie intake to a limit which they considered healthy. For P15, *“according to my body weight, [to] maintain a body weight with the amount of exercise I do, I have to get, like, 2200 calories a day. If I have*

to get a deficit, the deficit would be around 1700 calories. So, I stick to that 2200, 1700 aim, eighteen hundred aim to maintain my body weight.”

Another strategy adopted by some participants (n = 4) was to not miss or skip any meal. P8 stressed the importance of not missing any meals, especially breakfast, by saying that *“The most important change which I did was having breakfast regularly. That switched everything.”* There were other participants who had unique strategies, such as, having fish oil tablets for the intake of ‘good cholesterol’ (P13), taking vitamin supplements (P12), having lemon in hot water in the morning (P8), and having coconut or almond milk instead of regular milk (P17).

Thus, there were many other strategies, apart from including fibrous foods and excluding high-fat foods that the participants adopted in order to eat what they deemed to be healthy, and which could be looked into for promoting light food consumption among young men.

5.3 Challenges in Adopting Healthy Eating Behaviors

In this section, I aim to answer RQ2. The participants cited various hurdles they face in eating healthy food items and sustaining the habit over a period of time. The challenges mentioned include a lack of proper knowledge about healthy eating habits and food items in the context of light food consumption; mis-information about these food items; lack of convenience in adopting the healthy eating behaviors in the context of light food consumption; lack of self-control in avoiding foods that are otherwise deemed as unhealthy but are tasty and satisfying; and the social influence of friends and family which influences their food choices. These are discussed in detail in this section.

5.3.1 Lack of Nutritional Knowledge

Many participants (n = 8) reported having little to no knowledge about the nutritional content of food items, or of trusted sources from which they could find out information regarding what changes needed to be made to their diet as part of light food consumption. Finding a good source of knowledge and then incorporating the changes in their eating habits took a lot of effort, which the participants were not willing to do. This posed as a major barrier to the adoption of healthy eating habits, particularly in the context of light food consumption among the participants, who did not have the time or energy in going the extra mile. P13 said he was definitely aware of the calories but not really aware of the “*nutritional value*” a particular food item provided him. He further added, “*I do know that okay this has proteins, this has that, but then in the mixture of things I don't know what just what, like what item or dish will help me in nutritional content.*” Another participant, P3 said, “*So I'm not as well aware of what has fiber and what doesn't. I just know that some, like, breads have more fiber than others.*”

There is also a theme of misinformation, wherein participants (n = 7) had wrong or misleading information about a food item or about a behavior, which they had adopted thinking it to be the correct one. In regard to adopting and maintaining intermittent fasting, P11 acknowledged, “*It's just that it's morphed into something, some form which I'm doing right now. I don't know if it's still considered intermittent fasting but that is what I think my dietary routine was based on previously.*” P13 talked about how information from a video made him question his food choices, not for the better, “*Freshness is a big thing for me, but then I recently saw this video which says that fresh items and frozen items have the*

same nutrient value itself regardless of whatever happens. So, that kind of like keeps me like two minds whether that makes sense or not.”

Some participants (n = 5) also reported cultural biases which affected their intake of healthy food items in the context of light food consumption. P17 considered American cuisine to be *“unhealthy and fatty”*, while P8 justified his less consumption of fibrous and low-fat food saying that *“Anything Indian requires a lot of effort”*. Some participants also seemed to have pre-conceived notions about healthy food, particularly fibrous and low-fat foods, which may or may not be correct. For many (n = 6), taste and healthy eating did not go together. For P3, *“taste is a reason why I don’t get healthier foods as well. Some, like, vegetables are, like, disgusting. That’s all I got for that.”* P17 also cited this as a reason for not maintaining healthy eating habits in the context of light food consumption, as he did not consider healthy foods to be tasty, *“Then after that I still think of taste because I’m not a very determined person. I cannot do healthy eating habits a lot, even it’s against my instincts.”* Thus, a lack of valid source and continuous source of information poses to be a barrier in the adoption of healthy eating habits in the context of light food consumption among the participants.

5.3.2 Lack of Convenience

Many participants described issues relating to convenience, such as a lack of time (n = 11), the degree of effort required (n = 11), the higher price of eating healthy (n = 7), the greater difficulty of accessing healthier food (n = 4), and the quick expiration of healthy food (n = 3) when asked for their reasons for not being able to regularly consume home-cooked or fresh, fibrous, and low-fat foods. The busy schedules of the participants gave

them little to no time to cook home-cooked food or run grocery-shopping errands frequently, which drove them to eat restaurant or take-out food items. P17 said he did not *“have the luxury to spend a lot of time cooking stuff or eating a meal or something unless it's a special occasion or I'm really free, super free.”* This also caused some of the participants to skip meals, especially breakfast. P7 was *“waking up late a lot.”* So, he *“didn't have time to get breakfast.”*

The effort required to grocery shop or cook home-cooked foods also made it difficult for the participants to adopt these behaviors. P8 said, *“I do like fruit. It's just that I'm lazy and it's too ... I wouldn't call it expensive. It's just I have to go out of my way to a supermarket to get it. It's not easily available.”* Lack of access to or limited availability of a variety of fresh foods was also an issue for some, as P11 said, *“Some vegetables, even if I want to eat them, they are not easily available, it's quite harder to find, maybe come back to India where it's easier to find those vegetables, it's harder to find here.”*

Some participants found price to be an issue, with healthier and fibrous foods being more expensive. P16 said, *“I used to drink a lot of smoothies like veggie smoothies and that kind of thing. But they just they get too expensive.”* A few participants had issues with the quick expiration of fresh foods, saying they do not buy such items because they expire before they can consume them. P3 had the habit of drinking milk occasionally, but these days, he does not *“really get that as much since it expires too easily.”*

Consumption of fibrous or low-fat foods was viewed as a special diet that the participants needed to adhere to, instead of incorporating it into their lifestyle. This negative connotation of a diet brings in more barriers to adoption of healthy eating

behaviors in the context of light food consumption in men, who are otherwise less motivated to eat healthy.

5.3.3 Lack of Self-Control

Many participants (n = 9) reported giving in to their cravings or hunger pangs, thus often opting for an unhealthier, high-fat meal option. P13 confessed to eating *“a good amount of chips”* because he was *“just craving for them.”* P4 also said, *“I guess I don't care much about, when I'm hungry, I just don't care about the content of the food. It's just whatever I see and I like, I guess.”* Another theme of satisfaction emerged, wherein participants (n = 7) reported consuming high-fat food options because of the satisfaction and happiness it provided them. P17 found happiness in eating unhealthy food: *“You want to eat, you want to have fried chicken or fried stuff, you don't really want to eat a whole healthy meal because that makes you sad.”*

Lack of motivation (n = 5) to eat healthy and the social influence (n = 6) of friends and family were cited as reasons for not eating healthy. Participants lacked intrinsic motivation to maintain or adopt a healthy eating behavior as they considered their health to be fine, and not worrisome. P7 figured that *“if I was mostly okay with my diet, I'd be ok, like I'd be generally fine, so I stopped worrying so much about counting all the calories, seeing how much nutrients I had in a day.”* Friends and family of some participants also adversely influenced their food choices, making them eat unhealthier food options. P4 described his reasoning for his unhealthy food choices: *“...other times it was just because my wife wanted something. She wanted pizza that day. Well yeah, on Monday, someone, a family member had some chicken wings and fried rice so I just had that.”*

5.4 Role of Nutrition-tracking Mobile Applications

Out of the seventeen participants recruited, nine participants had experience using a nutrition-tracking application, currently or at some point in the past. Some participants ($n = 5$) used an application to religiously track their diet currently or in the past, while other participants ($n = 4$) tried it for just a few times in the past because it was bundled together with other health tracking applications. Only a few ($n = 2$) continue to track their nutrition using an application. Some participants also talked about using other methods such as Microsoft Excel Sheets ($n = 3$) or taking handwritten notes ($n = 1$) to keep a track of their food intake. In this section, I aim to answer RQ3. This section discusses the reasons cited by the participants for using an application to track their diet, the use cases of these applications, and what they liked and disliked about the applications. The challenges they faced in sustaining the use of a mobile application to track their diet and the functions or features the participants desired in the nutrition-tracking applications are also addressed in this section.

5.4.1 Reasons for Using Nutrition-tracking Applications

The participants ($n = 5$) who used an application to religiously track their nutrition at some point in their lives all made use of an application named MyFitnessPal. Out of the participants ($n = 4$) who experimented using an application to track their diet, two participants used Fitbit's diet tracker, one participant used an application called Wowway, and another participant used Health App. Thus, out of the nine participants who have some experience with nutrition-tracking applications, five participants have used MyFitnessPal,

two have used Fitbit's diet tracker, and the other two have experience with the Wowway and Health App. The reason for most (n = 5) participants choosing MyFitnessPal was its popularity. People, podcasts, articles, videos, websites recommended the use of MyFitnessPal. P11's reason for adopting MyFitnessPal was, *"It was quite popular back then, everybody was doing that, and I got recommended, that particular application from most of the shows or podcasts I was listening to. Most of the people were using that."* The primary reason (n = 5) for them to use an application was to become aware of their food intake and dietary habits. As P16 said, *"Like, I had no idea what I was eating every day. And I wasn't really entirely aware of it. So, I was thinking maybe it could make me more aware of what I was eating. Maybe I can find something that I can change about my diet if I needed to, but I didn't really stick with it long [enough] to do that kind of thing."*

Other participants (n = 4) experimented with an application because it came bundled with other health-tracking applications and devices. For P9, *"It was not exactly effort to track nutrition per se. I bought a Fitbit over a Black Friday sale. It was an offers items, so I started using all the things that it has to offer. So, it had a nutrition tracking thing. So, started logging in for a week on this, and I realized it's too much effort."* Some participants (n = 3) also made use of Excel Spreadsheets to track their food intake, as they found it easier to customize, and was available across devices. P11 found spreadsheets to be much easier because *"you just open it and put in elements"* and *"it could be synced to desktop and all that."*

5.4.2 Use Cases of Applications

The participants (n = 8) who used a nutrition-tracking application at some point in their lives said they mainly used the application to log the food items they were consuming, the time at which they were consuming those items, and the calorie content of these foods. P5 logged in what he ate when he received the alerts which the application sent him *“saying, Oh, you reached the calorie limit today or you reached the fat limit for today.”*

Some participants (n = 5) made use of the applications at the time they were deciding what to eat so they could make informed food choices, in order to avoid foods high in fat or sugar, or to include foods rich in nutrients. P14 would sometimes *“pre-fill the daily diary”* to check *“if I were to eat these foods then would I be getting enough macros and calories, and then if I wasn't, I would substitute one food for something else, or maybe a different brand of that same food.”* When eating out, P15 used the application to make informed choices: *“So, if I'm going to eat a hamburger from McDonalds, it would give me a good amount of value, but I can measure it in that sense, so I have to rely on their pre-computed values. So yeah, I would put in something, check how my daily macros would look, remove it, try it out with other things, so I would end up having a Subway.”*

Thus, the participants used the applications as a decision-making system which would guide them towards making the healthiest food choice out of the available options in front of them.

5.4.3 Participant Likes and Dislikes Regarding the Nutrition-tracking Applications

Participant Likes Regarding Nutrition-tracking Applications

The participants liked that they could set goals (n = 4), see their micro- and macro-nutrient profile apart from their calorie intake (n = 2), could use it across devices (n = 2), and could look up almost all foods when searching (n = 4). Other factors which contributed to their liking of the application was that it was easy to use (n = 4), they could reflect on their data logged over a period of time through reports generated (n = 2) and could receive reminders to log in or stay within a particular goal limit (n = 2). The applications were easy to use as they could scan the barcode of food items and log them in and were integrated with other applications that they came with. P1 found it easier *“when you buy the food that you scan the barcode and that will immediately show you the food and the calories per serving.”* Uniquely, one participant P15 also liked that he could measure food by weight, and then the application would calculate his nutrient intake based on the weight. He said, *“the other is that it has mostly an option for gram by gram tracking. Um, it’s very good, um, because you should measure food by weight not by volume, um, that’s a common tracking mistake.”*

Participant Dislikes Regarding Nutrition-tracking Applications

The participants disliked that the applications had a calorie counter (n = 4) as their main feature, which required manual effort and was often inaccurate. P9 was *“particularly looking for micronutrients. They also had a calorie count, but I was particularly looking for micronutrients. Yeah. That did not help me a lot.”* Some of the participants also found it tedious to determine their serving size and food measurements (N = 3), as it was not standard. P7 said, *“I didn’t measure my food, so I would have to guess. So, I’d be like oh*

that was a cup of rice, more or less. It was like a fist sized piece of chicken, and so I didn't know how much that was."

The participants were also disappointed with the narrow range of home-made foods (n = 3) that the applications recognized, and also that they were missing the food of some restaurants. As P7 noted, *"But my mom has like a lot of recipes she makes. I make a lot of different foods, out of traditional foods so it's kind of hard to, you know, get real statistics on, like, foods that didn't exist on their database or whatever."* Other dislikes included a lack of reminders to log in data (n = 2); required to effort to log in food items (n = 3); presence of ads (n = 2); lack of a mechanism to recommend food items to consume (n = 1) and set personalized goals (n = 2); and failure to consider the price of food items (n = 1).

5.4.4 Challenges in Sustained Use and Desired Functions

Challenges in Food-tracking Over a Long Period of Time

Some participants did not like the discrepancy between the real-world and the application, in terms of the calorific value calculated based on the data pre-programmed in the application (n = 3), the discrepancy between actual ingredients used and the actual method of preparation vs what was pre-programmed in the application (n = 5), and the lack of a standard measure of quantity (n = 4). For example, with respect to calorie tracking, P13 found it ridiculous to guess the calories of food items when eating out *"based on your assumptions of this food."* Also, with respect to actual ingredients used, P15 found that *"There's a difficulty with the app, there's a variation in what you have put in to your actual Subway, and with the one which they have measured."* Quantity measurements were also a challenge, as P9 pointed out, *"One big thing that I have an issue with is getting an idea*

of what is the amount of food I'm having. I'm not exactly sure I'm having what they're claiming to have.”

The participants said that they lacked intrinsic motivation (n = 7) to adhere to a tracking regime involving their food intake. P3 expressed his reluctance in adopting a healthy eating behavior and sticking to this regime: *“I mean, I don't feel the need to. So, like, there's no point. I'd probably lose interest real quick. Because I'm already, I already think my diet is fine. Until somebody else proves me otherwise, I'm gonna keep going with it. I'm stubborn.”* The participants also felt that food tracking required a lot of effort (n = 9), which they were not willing to put up with. P13 cited not being *“diligent of myself- of tracking my food items from breakfast to dinner”* as his reason for not tracking his food intake. The participants also said that because of a lack of routine (n = 3), they would often forget to log in the food items. Also, the participants had a hard time recalling the dishes they had (n = 4), with the dish names being different in the applications, which posed a problem.

Desired Functions and Features in Nutrition Tracking Applications

Some participants wanted to be able to reflect on their past eating behaviors and food items (n = 4), and also wanted the application to assess their diet and provide recommendations (n = 4). P10 desired that the application *“have a summary or statistics of how much fat I've been eating or the fibrous foods I've been eating maybe what I need to improve on in my diet.”*

Some participants also wanted the application to be *“smart”* and automatic (n = 6), wherein the application takes care of the data crunching involving the calorie and nutrition

intake, while also automatically runs in the background so that the participants did not have to try to open the application and use it. The participants did not mind putting in a bit of effort as long as the application did the rest of the tasks for them. P12 exclaimed, *“You have a phone and then you take a picture of the food, you identify what's the major ingredients and then, calculate the calories, maybe some nutrition for you. If it can do that accurately, I don't mind taking a picture of the food each meal, that seems okay. And if they are accurate and don't require too much a conscious effort.”* The participants also wanted the application to remind them to log in the food items, at a time suitable for them.

Some participants desired the applications to solve the problem of quantity measurement (n = 3) and come up with a standard measure. The one big issue P9 had was *“getting an idea of what is the amount of food I'm having. I'm not exactly sure I'm having what they're claiming to have. If a tracker could solve that problem, maybe that would be a first step for me to try.”* The participants also sought greater accuracy in terms of recognizing home-made foods (n = 3). The participants wanted to be able to set personalized goals and set limits for their food intake accordingly (n = 2). One participant also wanted to be able to have a *“cheat day”*, which would not mess up his progress so far. P7 wanted some leniency in his tracking regimen: *“If I want to restart, if I have a bad day, or if you miss a day, it doesn't ruin the data.”* Finally, some participants (n = 3) wanted the application to be able to motivate them to adhere to their food-tracking regimen.

5.5 Summary

The findings confirm that although the participants believe in eating healthy and their beliefs about eating healthy in the context of light food consumption align with those

as mentioned in the literature, there are many reasons (both intrinsic and extrinsic) why they do not adhere to healthy eating behaviors, especially in the context of light food consumption. The findings also show that the participants are reluctant to adopt nutrition-tracking applications to track their diet. A lack of knowledge about the food items and behaviors which promote healthy eating in the context of light food consumption seems to be a common theme between the three research questions, followed by lack of convenience and intrinsic motivation. Another theme that is prevalent is the reliance on female partners or female figures to guide them on the path towards eating healthy in the context of light food consumption. Popularity of habits among their peers also fuel the motivations of the participants to adopt that particular habit, which is indicative of a social component in the food decision-making process. Finally, the cultural differences and the biases associated with them also tend to influence the adoption of healthy eating behaviors in the context of light food consumption.

Chapter 6: Discussion

This study highlights the discrepancy between the beliefs and behaviors of the participants towards adopting healthy eating behaviors in the context of light food consumption, providing insights into the reasons why this discrepancy exists. At the same time, this formative research identifies directions for future work and identifies issues with current mobile nutrition-tracking applications which should be addressed in order to motivate men towards adopting healthy eating behaviors. In this chapter, I discuss the generalizability of the findings, the limitations of the study, and the possible avenues for future work.

6.1 Subset of Target Audience

The study included male participants between the age of 18 – 35 years, mostly students who were educated, healthy, and lived in urban areas having access to healthy food. This elite subset of the target group is at an advantage as compared to the other subsets who do not have access to one or more out of education, good health, and/or healthy food. Thus, the problems identified in the eating habits of this subset population could be expanded to other subsets who do not have the means or the motivation to tackle the problem of healthy eating. The age, however, could be an interesting dimension to explore in the future as studies have shown that older men are more receptive than younger men to changing their health behaviors (Bennett, 2007; Springer & Mouzon, 2011).

6.2 Research Probe: Daily Survey

The diary study in the form of a 10-minute survey administered daily to the participants for seven days was used as a research probe to: (i) make participants aware of their eating behaviors before the interviews, (ii) provide contextual information to the interviews (iii) and elaborate interview results. The data generated from the daily survey that lasted for a week for each participant helped in asking specific questions related to each participant's consumption of certain food items as relevant in the context of light food consumption. The data also helped in confirming the results of the interviews. A challenge was to make the participants adhere to a regimen of filling the daily survey every day for seven weeks, which was resolved to an extent by providing them with daily reminders to fill in the survey for that day.

6.3 Affordances for Adopting Healthy Eating Behaviors

The participants expressed a need for a support system which could regularly motivate them to adopt healthy eating habits in the context of light food consumption. This is supported by previous work on the effect of emotions on perception of health messages, which indicated that men respond to positive health messages (Shamaskin et al., 2010). Most participants said that they did not have adequate knowledge to make informed choices about which food items to consume and what behaviors to adopt in order to eat healthy. They expressed a need for a decision-making system which could inform them of their food choices in terms of nutrient intake, and also recommend them food items or diets they should adhere to in the future so as to maintain a healthy eating lifestyle. An expert opinion in this regard would be helpful, as some participants did take help from professionals such as nutritionists and gym instructors to improve their diets. This is partly supported by

literature which indicated that individuals with high literacy make healthier choices, although it has been understudied in the case of men (Wardle et al, 2004). I expand on previous literature by introducing the need for information targeting healthy eating behaviors required by even well-educated men, as they may not necessarily have the adequate knowledge to make informed decisions in this domain. Moreover, this need for information also highlights the fact that the participants considered light food consumption as a regimen or diet to adhere to instead of as a lifestyle that may require very little effort on their part. Thus, portraying light food consumption as an integrated part of the men's lives, and providing them with the correct strategies and information on adoption of food items related to this lifestyle would be the future goal of this work.

The influence of peers on the use of nutrition-tracking mobile applications was discovered to be an important factor in the adoption of such technology among the participants. Thus, having a social component which allows men to garner support, or even compete (Keller & Lehmann, 2008) as part of their tracking regimen could be helpful in sustaining their behaviors over a long period of time. Previous literature has also suggested the influence of female partners on the food practices of men (Schofield et al., 2000), though there is little research in this area (Lyons, 2009). I expand on previous literature by suggesting that most men tend to conform to the food practices of female figures physically present around them, and thus tend to consume food items as consumed by these female figures. This was observed among nine of the seventeen participants recruited. In seven cases, the females did end make up making healthier choices than the men, although the degree of doing so may vary from person to person. Thus, men do not prefer to take responsibility or be accountable for their food choices, if given an option.

Cultural differences and previous eating habits also influenced the eating behaviors of participants in the context of light food consumption. The participants resorted to eating healthy food items within the culture that they were familiar with previously. The ideas of masculinity also differed between cultures, with some cultures having incorporated more feminine and healthy eating habits than others. Thus, the cultural backgrounds of men also need to be considered when designing nutrition-tracking applications for them in the context of light food consumption.

A lack of convenience was also a highly prevalent as a theme across the research questions in terms of the time, effort, and money required to conform to and maintain healthy eating behaviors, especially in the context of light food consumption. Men resorted to eating healthier food options only when they deemed there was something wrong with their body, or when they took up a physical activity, or if there was a female presence (mothers, partners) around. The concept of intermittent fasting came up as among some participants, who adjusted the diet to better fit their schedules and needs. This led to a false sense of satisfaction and sense of healthy eating. Thus, systems need to be developed so as to make it possible for men to adopt healthy eating behaviors in the context of light food consumption, who are otherwise less motivated to do so.

6.4 Implications for Design of Mobile Nutrition-tracking Applications for Young Men

The effect of female figures (mothers or partners) on the dietary habits of the participants was significant, with participants admitting that they conformed their diets around that followed by these female figures who were present around them physically.

This partially aligns with previous literature which suggests that healthy eating in the context of light food consumption is considered majorly a feminine behavior (Wardle et al., 2004; Courtenay, 2000), and hence men prefer women taking the lead and guiding them in the adoption of healthy eating habits, particularly in the context of light food consumption wherein gender differences are maximum. A design suggestion would be to inculcate role of women as influencers on the eating habits of men and subsequent adoption of healthy behaviors among men in the context of light food consumption. This should be mediated over time as propagation of the idea of healthy eating in the context of light food consumption is majorly a feminine behavior and female-led domain is detrimental to the overall argument of this research that as much men as women need to eat healthy in the context of light food consumption. Some participants also reported using mobile applications for nutrition tracking because of the popularity of the application among their peers. Thus, factoring in social influence of friends, family members, and roommates is a key factor to designing an effective system which will help in the adoption of healthy eating behaviors in men over a long period of time.

The main challenge that the participants faced with sustained use of a nutrition-tracking application was the lack of intrinsic motivation to adhere to a regime. The participants resorted to eating healthy only when they perceived “*something was wrong with them*” in terms of their health or body weight and shape; or when they took up a physical activity and were required to maintain a healthy diet. Previous literature has suggested that men are motivated by positive messages (Shamaskin et al., 2010), but I expand on this framing and suggest that men be first introduced to negative messages about the consequences of not eating healthy as relevant to them personally, followed by

subsequent positive messages which praise efforts in trying to adopt healthy eating behaviors in the context of light food consumption. The negative messages help men to become aware of the effects of not eating healthy and motivate them to adopt healthy eating behaviors; and then the positive messages will keep them motivated to adhere to the lifestyle of eating healthy in the context of light food consumption. The messages could also be administered in the form of nudging, wherein the messages are not too interfering (with respect to the messages being less frequent and timed perfectly at a time when men can reflect on them) with the everyday lives of the men, who are slowly nudged towards adopting healthy eating habits as part of their lifestyle.

The participants also expressed a concern with the nutritional knowledge available to them about food items and the effort required to obtain healthy food items in the context of light consumption, especially when they were grocery-shopping. They were well-educated but unaware of the food items high in fiber and low in fat. Additionally, the participants also wanted to be able to reflect on their previous food intake, and for the nutrition-tracking application to suggest them recommendations about food items high in fiber and low in fat in order to improve their diet. A design suggestion would be to introduce an education system which informs men about the nutritional content of food items in the context of light food consumption and suggests changes to their diet in order to incorporate more high-fiber and low-fat food items. Another suggestion would be to improve the nutrition-tracking application be smart and make decisions related to selecting high-fiber and low-fat food items when men are in the process of making those decisions, especially when they are grocery-shopping.

The ideas of masculinity also differed between cultures. There were a few cultural differences noted, with some of the participants deeming one cuisine healthier or unhealthy as compared to other reasons, and often citing culture as a justification for them resorting to eating or not eating food items as part of light food consumption. The participants also resorted to eating healthy food items as part of light consumption which were relevant to their own culture and previous eating habits. Thus, a design suggestion would be to make recommendations relevant to the men in the context of their culture. Some of the design suggestions may also be applicable for women in general, but these suggestions would definitely motivate men in adopting healthy behaviors in the context of light food consumption.

6.4 Limitations of the Study

There are a few limitations to this study. The first is the selection of participants. Since the participants were young (18-35 years), healthy, well-educated, living in urban areas of the US, the findings of this study may differ with participants from other demographics, something which can be looked into in the future. Six of the participants were international students and did cite cultural differences. However, more international participants will have to be recruited to understand the effect of culture on the food-related perceptions and behaviors of men.

The study is limited in its context, as questions about food beliefs and behaviors are focused only on fat, fibers, and fruits, as significant gender differences were previously observed in regard to these factors (Wardle et al., 2004). Though the participants did talk about limiting their use of other items such as sugar, salt, sodium, carbohydrates, and

protein, a more expansive study could be designed in the future which could cover the other nutrients which make up for healthy eating.

Another limitation could be the time duration of the diary study. Since the diary study lasted for only a week, it could not account for any set patterns or changes observed in the diets of the participants, which could provide more contextually relevant data to answer the research questions. A recommendation would be to conduct a longitudinal study on the food behaviors of men, and then observe for any patterns, factors responsible for and deflections from healthy eating behaviors.

6.5 Future Work

As formative HCI research, this thesis enumerates various avenues for future work. Future work on improving the design of current nutrition-tracking mobile applications to make them more inclusive gender-wise, or even developing a new system based on the findings, and their subsequent evaluation among the participants could pave way for more research in this area. Interesting dimensions to further explore would be age and economic barriers, cultural differences, and influence of female figures on the adoption of eating behaviors in men in the context of light food consumption for the design of these applications or systems. Some of the design suggestions might be helpful in motivating more women to adopt healthy eating habits in the context of light food consumption, as in order for technology to be inclusive, the design of nutrition-tracking applications should be able to motivate both men and women.

Additionally, since this study was conducted over a short period of time, it would be important to conduct a longitudinal study which spans for a greater period of time. This

will help in successfully accounting for patterns observed and design recommendations as a result of sustained adherence to the study.

Appendices

Appendix A. Recruitment Text

Subject line: Invitation to Participate in a Research Study on Exploring Food Choice Behaviors in Men

Hello! I am conducting a study as part of my HCI Master's Thesis Project under the supervision of Dr. Eun Kyoung Choe.

We are looking for healthy men (ages 18 and older) who do not have a health condition that may require you to follow a specific diet (e.g., diabetes). The goal of our research is to understand how men make food choices. This research will help us design better food tracking applications for men to promote a healthy lifestyle.

In this study, we will (1) send you a short daily survey lasting for about 10 mins daily for one week about your food choices (e.g., what you had for breakfast, lunch, and dinner) and grocery shopping, (2) conduct an in-person interview with you about your food choices after the completion of the week-long daily survey, and (3) also ask you questions about your experience using a food tracking application during the interview (if any). The interview will take about 1.5 hours.

To thank you for your participation, we will provide a \$30 gift card upon completion of the study.

To participate in the study, you should meet all of the following criteria:

- You are a male aged 18 or older
- You do not have a health condition (e.g., Diabetes) that requires a specific diet
- You can participate in a study at the University of Maryland College Park campus
- You have a smartphone
- You speak English

If you are interested, please go to this link and fill out a screening questionnaire:

https://umdsurvey.link_to_survey.

If have any questions or want to learn more about the study, please contact Diva Smriti (dsmriti@umd.edu) with your contact information so that we can contact you for further screening.

Appendix B. Screening Questionnaire

Introduction to Study

Research Study on Exploring Food Choice Behaviors in Men

We are looking for healthy men (ages 18 and older) who do not have a health condition that may require you to follow a specific diet (e.g., diabetes). The goal of our research is to understand how men make food choices. This research will help us design better food tracking applications for men to promote a healthy lifestyle.

In this study, we will (1) send you a short daily survey lasting for about 10 mins daily for one week about your food choices (e.g., what you had for breakfast, lunch, and dinner) and grocery shopping, (2) conduct an in-person interview with you about your food choices after the completion of the week-long daily survey, and (3) also ask you questions about your experience using a food tracking application during the interview (if any). The interview will take about 1.5 hours. To thank you for your participation, we will provide a \$30 gift card upon completion of the study.

If interested in participating in the study, please fill out the following questionnaire.

1. Your Name
2. Your Age (in years)
2. Gender (M/F)
3. What is your association with the University of Maryland? (Student, Employee, None)
4. If Student, which program are you currently enrolled in at UMD? (Undergrad, Masters, PhD)?
5. Can you participate in our study at University of Maryland College Park campus?
(Y/N)
6. Are you comfortable with communicating in English? (Y/N)

Before you answer the following questions, here are a few examples to help you

What does the term “fat” mean?

Fat is a type of nutrient, which in controlled amounts helps in providing energy to the body.

Some foods which contain fat are:

Pizzas, white breads, pastries, cookies, cake, fried foods (french fries, fried chicken, etc.), cheese, butter, red meat (beef, lamb, pork, etc.), ice cream, packaged snack foods (potato chips, microwave popcorn, etc.) among a few.

What does the term “fiber” mean?

Fiber is a type of carbohydrate which cannot be digested, but it helps to regulate the body’s use of sugar, and also helps in digestion.

Some foods which contain high fiber are: **vegetables** (broccoli, carrots, beets, brussel sprouts, split peas, etc.), **fruits** (banana, strawberries, apples, pears, raspberries, etc.), **legumes** (lentils, kidney beans, chickpeas, etc.), **whole grains** (oats, quinoa, popcorn, brown rice, etc.), nuts(almonds), dark chocolate among a few.

7. On a scale from 1 (least important) to 10 (very important), how important is it for you to:

- i. Not eat too much fat
- ii. Eat enough fiber
- iii. Eat enough fruit

8. Do you make a conscious effort to avoid food that contain fat? (Y/N)

9. Do you make a conscious effort to eat foods that are high in fiber? (Y/N)

10. How often do you eat fruit?

- i. Daily
- ii. 2-3 times a week
- iii. Once a week
- iv. Less than once a week
- v. Never

11. How often do you eat out (including take-out)?

- i. Daily
- ii. 2-3 times a week
- iii. Once a week
- iv. Less than once a week
- v. Never

12. How often do you eat at home?

- i. Daily
- ii. 2-3 times a week
- iii. Once a week
- iv. Less than once a week
- v. Never

13. Do you have access to kitchen? (Y/N)

14. How often do you cook?

- i. Daily
- ii. 2-3 times a week

- iii. Once a week
- iv. Less than once a week
- v. Never

15. How often do you shop for groceries?

- i. More than once a week
- ii. Once a week
- iii. Once in two weeks
- iv. Once a month
- v. Less than once a month

16. Have you tracked your food (currently or in the past)? (Y/N)

17. If yes, do you currently track your diet? (Y/N)

18. Have you used an application to track your diet (currently or in the past)? (Y/N)

19. If yes, do you currently use an application to track your diet? (Y/N)

20. What is the name of the application you have used to track your diet?

21. Do you have a health condition that motivates you to track your diet? (Y/N)

22. If yes, name the health condition(s):

If you qualify for this study, a researcher will contact you. Please provide your email and phone number that we can use.

24. Please provide your email and phone so that researchers can contact you for the next step.

Appendix C. Daily Survey Instructions

What does the term “fat” mean?

Fat is a type of nutrient, which in controlled amounts helps in providing energy to the body.

Some foods which contain fat are:

Pizzas, white breads, pastries, cookies, cake, fried foods (french fries, fried chicken, etc.), cheese, butter, red meat (beef, lamb, pork, etc.), ice cream, packaged snack foods (potato chips, microwave popcorn, etc.) among a few.

What does the term “fiber” mean?

Fiber is a type of carbohydrate, which cannot be digested, but it helps to regulate the body’s use of sugar, and also helps in digestion.

Some foods which contain high fiber are: **vegetables** (broccoli, carrots, beets, brussel sprouts, split peas, etc.), **fruits** (banana, strawberries, apples, pears, raspberries, etc.), **legumes** (lentils, kidney beans, chickpeas, etc.), **whole grains** (oats, quinoa, popcorn, brown rice, etc.), nuts(almonds), dark chocolate among a few.

Food Diary

You will also be asked to fill out a diary of the food items you had each day and categorize them as you think appropriate. You can also mark a meal as missed.

An example of a diary for a day would look like this:

Meal	Home Cooked	Restaurant food /Take Out	Packaged (e.g., frozen	Fresh Items (e.g.,	Others	Missed

			pizza, cup noodles)	fruit, salad)		
Breakfast						X
Lunch		Rice, falafel		Apple	Soda	
Dinner	Rice, lentils			Salad		
Snacks		Paneer Wrap		Chips, Cereal		

Appendix D. Interview Questions Script

Introduction

Hello, my name is Diva. Thank you for participating in my study. The purpose of this study is to gain an understanding of your food choices and behaviors, and your experience using a food or nutrition-tracking application, if any.

Consent Form

Before we begin, I have two consent forms for you to sign. One is for you to keep for yourself, and the other one is for me. You can go through the consent form, and we can discuss any questions that you may have. You can take as much time as you would like to do so. If at any point you feel that you no longer want to continue with the study, just let me know.

Please sign the consent form.

(After signing) *Here is a copy for you to keep.*

I will now start audio-recording.

Let us begin!

1. Can you talk to me about your background?
 - 1.1 Something about your major?
 - 1.2 Something about your job title (if working)?
 - 1.3 Something about your living environment?
 - 1.4 How much would you say do you cook?
 - 1.5 Do you have access to a kitchen?
2. (Show diary study data) Do you mostly eat: home cooked food/ restaurant food or take-out/ packaged food/ fresh items/ or any other food? What are those items that you eat? Why?
3. What comes to your mind when you hear the phrase healthy eating?
 - 3.1 What food items do you eat as part of eating healthy? Any drinks?
 - 3.2 What food items do not appeal to you as part of healthy eating?
 - 3.3 What food items do you consider healthy but do not like eating?
4. How important is it for you to eat healthy?
 - 4.1 What strategies, if any, do you use to eat healthy?
5. Do your eating habits in the past week reflect your eating habits in general?
 - 5.1 If not, why do you think it deferred from you normal eating behavior?
 - 5.2 If not, what do you. Normal eating habits look like?

- 5.3 Can you walk me through a day in your life in terms of what you eat?
- 5.4 How do your eating habits differ between weekdays and weekends, if at all?
6. Were you on any kind of diet over the week that you filled in the daily survey?
- 6.1 If yes, what was the diet?
- 6.2 If yes, why this diet?
7. What factors do you consider while making food choices (when you are deciding what to eat)?
- 7.1 There are some other factors which you may or may not consider such as: price, taste, time to make/eat, nutritional content, and calorie content. Can you rank them in order of the importance you would give them, and think out loud in the process?
8. Over the past one week (Ask these questions while showing their daily survey data)
- (i) What are some of the foods that are high in fiber that you ate? Why these specific items?
- (ii) What are some of the foods that contain fat that you consumed? Why these specific items?
- (iii) What are the fruits you ate? Why these specific fruits?
- (iv) Were there food items that you had but forgot to log? What are those food items? Why do you consume these items?
- 8.1 Looking at your data from the diary study, how would you assess your diet over that week?
- 8.2 What would you like to change in that week's diet?
9. In the last week, you shopped for groceries x number of times.

9.1 When do you generally shop for groceries?

9.2 Where do you generally shop for groceries?

9.3. On this day that you shopped for groceries, what did you buy?

(i) What kind of veggies? What kind of fruits?

(ii) Any snacks?

(ii) Any drinks?

9.4 What are the factors you consider while making a food choice when you are grocery shopping?

(i) There are some other factors which you may or may not consider such as: price, taste, time to make/eat, nutritional content, and calorie content.

Can you rank them in order of the importance you would give them, and think out loud in the process?

9.5 Can you recall any point in time when you were deciding between which items to purchase? How did you go on about deciding which item to buy?

10. Over the past one week, how did the daily survey affect you, if at all?

10.1 Did it make you aware of anything?

10.2 How did it affect your eating behavior, if at all?

10.3 Can you describe any challenges you encountered while filling in the daily survey?

Now we are going to switch gear a little bit. I will now ask you questions related to your experience with a food or nutrition-tracking application, if any.

11. What applications, if any, do you use for tracking your nutrition?

- 11.1 What are your reasons for choosing these applications?
- 11.2 What tasks do you perform on these applications?
- 11.3 How do you use the application while deciding what to eat?
- 12. Have you used any applications in the past to track your nutrition?
 - 12.1 What are these applications?
 - 12.2 What were your reasons for choosing these applications?
 - 12.3 What tasks did you perform on these applications?
 - 12.4 How did you use the application while deciding what to eat?
- 13. What do/did you like about these applications?
 - Probe: How do they motivate you to track nutrition?
- 14. What do/did you dislike about these applications?
 - Probe: Any improvements that you would like to suggest?
 - 14.1 Are you open to the idea of using another application to track your diet?
- 15. If you do not/have not used any applications currently or in the past, what are your reasons for doing so?
 - 15.1 Are you open to the idea of using an application to track your diet?
 - 15.2 What tasks would you like to perform on this application?

End Note

We have reached the end of the study. Thank you for your time. Is there anything else you want to share or ask?

Here is the \$30 Amazon gift card as a token of our appreciation.

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