SELF-WEIGHING FREQUENCY AMONG U.S. ADULTS AND ITS RELATIONSHIP WITH

HEALTH MEASURES

by

MEGAN ELIZABETH HOUSTON

(Under the Direction of Jamie A. Cooper)

ABSTRACT

Studies show frequent self-weighing is useful for weight management. The objective of this thesis was to determine SWF among U.S. adults. We hypothesized that greater than 50% of U.S. adults would report weighing <1x week, a greater percentage of women would report higher SWF, and greater SWF would be associated with lower Body Mass Index (BMI), higher physical activity (PA) and health behaviors. 533 adults (Mean age: 35.8 ± 12.8, 51% female) completed a questionnaire assessing SWF. Respondents were categorized by SWF: Never (n=129, 24.2%), <1x week (n=187, 35.1%), 1x week (n=127, 23.8%), and >1x week (n=90, 16.9%). This study was the first to report SWF among U.S. adults independent of a weight program. According to our data, 60.0% of U.S. adults weigh <1x week and 25% never weigh. We did not observe differences in BMI or sex between SWF. SWF was associated with healthier dietary choices and higher PA.

INDEX WORDS: SELF-WEIGHING, SELF-WEIGHING FREQUENCY, BMI, WEIGHT

MANAGEMENT, U.S ADULTS, PHYSICAL ACTIVITY, IPAQ, DIET

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MEGAN ELIZABETH HOUSTON

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THE RELATIONSHIP BETWEEN SELF-WEIGHING FREQUENCY AND HEALTH

MEASURES

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MEGAN ELIZABETH HOUSTON

Major Professor:	Jamie A. Cooper
Committee:	Michelle vanDellen
	Jung Sun Lee

Electronic Version Approved:

Suzanne Barbour
Dean of the Graduate School
The University of Georgia
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DEDICATION

I would like to dedicate this work to my grandparents, Mr. and Mrs. Lewis Reeves Jr., for their continuous support and always encouraging me to go one step further.

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CHAPTER 1

INTRODUCTION

Obesity is defined as an abnormal or excessive fat accumulation that presents a concern to health [1]. The cause of the obesity epidemic is likely multi-factorial with contributors such as an increased intake of energy-dense foods, decreased physical activity (PA), and changes within society and the environment that support a more obesogenic lifestyle [1]. In the U.S. alone, approximately 70.7% of adults over 20 years of age are overweight or have obesity in [2]. Obesity is linked to a number of chronic diseases such as diabetes, musculoskeletal disorders, cardiovascular diseases (mainly heart disease and stroke), and certain cancers. Thus, even a reduction of 1% of obesity prevalence could tremendously reduce health care costs and chronic disease risk [2].

Weight management is defined as a method of weight reduction or deterrence of weight gain [3]. Finding a useful weight management tool to prevent gradual weight gain could prevent overweight and obesity tremendously since the average adult only gains about 1 kilogram per year [4]. It is perceived that many overweight and obese patients lack will power, find weight management challenging, have little nutrition awareness, and are unaware of the risks that concur with obesity [4]. Techniques most prevalently used by physicians to encourage weight loss include goals setting, food diaries, and partnering with someone [4]. However, the prevalence of obesity continues to remain high and even grow in some populations groups [4]. In a concept analysis of weight management, critical components to success were behavior modification, self-

monitoring, engagement of the individual, and successful dietary and physical activity adaptations that could be continued as a lifelong practice [3].

Historically, it has been recommended that individuals should weigh themselves no more than once per week. However, more recent literature has shown that more frequent self-weighing is associated with better weight management. This has been demonstrated with weight loss interventions [5-9], weight loss maintenance [3,10,11], and the prevention of age-related weight gain [12-14]. Data has also shown that during a lifestyle intervention, regular self-weighing was not correlated with increased depressive symptoms, disordered eating or body satisfaction, and was associated with improved weight loss and management which is an essential consideration for overall health [15].

To date, however, there have been no studies assessing self-weighing practices among a U.S. adult population. Additionally, research examining the relationship between the self-weighing frequency (SWF) with a number of health outcomes including dietary habits, physical activity level, and body weight status in adult men and women in the U.S. without a weight loss intervention is lacking. Therefore, the current study has two objectives: (1) to determine the frequency of self-weighing among U.S. adults, (2) to examine the relationships between self-weighing frequency with dietary habits, body weight status, physical activity levels, and between men and women. To test these aims, participants completed an online survey assessing SWF, dietary and physical activity characteristics, lifestyle factors, and other health outcomes. All questions were analyzed for the whole study population as well as by sex. Determining self-weighing practices could provide vital evidence on which to base future weight management

recommendations and have a significant impact on weight management, chronic disease risk reduction, and reducing healthcare costs.

The literature review (Chapter 2) provides a synopsis of the current literature surrounding obesity, intervention tools for weight loss and weight loss maintenance, SWF, and potential theories for the mechanism behind SWF. Chapter 3 contains the manuscript, which examines SWF behaviors among U.S. adults as well as the association between SWF and BMI, physical activity levels, dietary habits, and other health behaviors. We hypothesized that less than 50% of U.S. adults would report weighing themselves once a week or more. Further, we hypothesized that a greater percentage of women would report weighing once a week or more compared to men. We also hypothesized that greater self-weighing frequency would be associated with lower BMI, higher levels of PA and health behaviors. Chapter 4 includes a summary and the conclusions of this research study.

CHAPTER 2

LITERATURE REVIEW

Obesity and Weight Management

Obesity Statistics and Definitions

Obesity has become a prevalent issue in the world where it began to surface as a major

health problem in the United States (U.S.) around the late 1980s [2]. Obesity has been defined as a

weight that is excessive for a given height. One common population-wide screening tool for

obesity is measuring body mass index (BMI) [16]. BMI is calculated by the individual's weight in

kilograms divided by their height in meters squared [17]. A BMI less than $18.5 kg/m^2$ is

underweight, a BMI between 18.5 to $24.9 kg/m^2$ is normal weight, 25 to $29.9 kg/m^2$ is

overweight, and greater than $30.0 kg/m^2$ is considered to be obese [16].

Over the past four decades, the U.S. and many other countries have seen a dramatic

increase in the prevalence and degree of overweight and obesity as measured by BMI[13]. The

worldwide prevalence of obesity was 11% for men and 15% for women in 2014 compared with

5% for men and 8% for women in 1980 [18]. Overweight and obesity affects both men and women,

and adult men in the U.S. have a higher prevalence of overweight and obesity (71.3%) compared

to women (65.8%)[5]. According to a recent poll, approximately 60% of overweight people do not

realize that they need to lose weight [19]. Unfortunately, the outlook for the future of this epidemic

does not look promising. Obesity prevalence continues to rise, and it is projected that 42% of

adult Americans will be obese by the year 2050 [20]. This is problematic given that obesity greatly

increases the risk of hypertension, hyperlipidemia, type 2 diabetes, heart disease, stroke, osteoarthritis, and certain cancers [3]. Thus, obesity may not directly cause death, but it does lead to diseases that increase rates of mortality tremendously. This contributes to greater health care costs and reduced quality of life. Health expenditures of people with a BMI over 40 are also estimated to be 81% higher than non-obese individuals [21]. It has been estimated that a 1% reduction from the predicted trend of obesity rates could reduce obesity-related medical expenses by approximately $84.9 billion over the next two decades [2].

Causes of Obesity

Obesity is thought to be multifactorial as it has been linked to genetics, obesogenic environments, and physiological and behavioral factors [2]. Ultimately, though, overweight and obesity arise due to excess energy intake (EI) and/or decreased energy expenditure (EE) resulting in an energy surplus and ultimately fat mass gain [20]. Since weight (fat) gain can occur due to either excess EI or low EE, it is important to examine both sides of the energy balance equation. With regard to EE, exercise or physical activity is an important aspect of maintaining weight. While structured exercise has not decreased over the past years, occupational physical activity has decreased by 30% since the 1960s [2]. Thus, it is crucial to find ways to for U.S. adults to engage in more physical activity in their daily lives.

An examination of the other side of the energy balance equation (EI) reveals that we live in a food-rich environment. As our environment changes to improve health (e.g., reduction in infectious diseases, extension of lifespan), it also has contributed to non-communicable diseases such as obesity [2]. Energy-dense foods that are not rich in nutrients are a staple product in the U.S. These energy-dense foods may cause weight gain if not compensated for by exercise or reduced portion sizes.

Unfortunately, the media is flooded with fad diets and unproven techniques to lose weight which has led to confusion for many people seeking help without the proper resources and raised a barrier to access adequate weight management resources [3]. Therefore, it is vital that adults can find a weight-loss intervention that helps with both weight loss and weight loss maintenance. It has been shown that only 20% of adults who lose 10% or more of their body weight are able to maintain their weight loss [22]. Since weight loss and weight loss maintenance are so challenging, some researchers believe the key to overcoming the obesity epidemic is to take a prevention approach and set up tools to prevent additional weight gain in adults.

Patterns of Weight Gain

Studies have shown that increased EI is associated with increased portion sizes, easy access to food, dining with other people, and longer eating sessions [23]. However, most adults do not gain substantial amounts of weight in short periods of time. Average weight gain among U.S. adults is between 0.4 to 1.0 kg (0.9 and 2.2 lbs) per year [23]. This average yearly weight gain is most prevalent in early and middle adulthood[18]. While this amount may seem small, a consistent gain each year can lead to significant weight gain over time and has been termed "creeping obesity."

In addition to a small annual weight gain, research shows that much of this annual weight gain appears to come from a few critical times throughout the year such as Thanksgiving, Christmas, and even vacations [23,24]. In one study focusing on weight gain during short term vacations (7 to 21 days), a significant increase in body weight was reported (0.32 ± 0.08 kg, $p < 0.05$) during the vacation period and this weight gain persisted post vacation (6 weeks later) [23]. This study also showed that increased PA during vacation did not protect against weight gain indicating that the excess weight was due to excess EI [23]. At the final study visit, only 32% of

participants were trying to lose the weight gained during vacation despite 61% having gained weight over vacation. This may suggest why consistent weight gain (0.4-1.0 kg) each year is not noticed by most individuals; the amount is small and may go unnoticed unless notified in some way. Similarly, several studies have reported significant weight gain during the holiday season with an average gain across all studies of 0.5kg [24-26], which also persists post-holiday. This excess EI and persistent weight gain contradicts the set point theory [21], which would suggest that an energy deficit should follow after these surpluses until an individual had returned to their original body weight [23]. Therefore, small gains in weight, such as 0.32 kg, may not be enough weight to activate the compensation action seen in the set point theory [23].

One study examined the association of weight gain from early to middle adulthood with subsequent risk of major health outcomes in men and women from 2 large cohort studies [18]. From early to middle adulthood, participants gained a mean of 12.6 kg in women and 9.7 kg in men. Those who gained more weight were more likely to be physically inactive, were not smokers, had unhealthy dietary habits, and had a higher prevalence of chronic diseases at the age of 55 years [18]. Weight change in early to middle adulthood was associated with the development of type 2 diabetes, hypertension, cardiovascular disease, cataracts, cholelithiasis, severe osteoarthritis, and mortality [18]. The increased risk for developing diseases occurred when participants gained 5.0 to 9.9 kg [18].

As mentioned above, the highest rate of weight gain appears in young adulthood. The developmental period between the ages of 18-25 years old has been associated with numerous life transitions such as living independently, work, and school [27]. In 2016, more than 40% of 18-25 year old adults met criteria for overweight or obesity, and this was associated with increased unhealthy weight-related behaviors such as decreased physical activity, increased consumption

of fast food and not enough sleep [27,28]. Excessive consumption of energy-dense, nutrient poor food and failing to reach dietary guideline recommendation has proven a key factor to weight gain in adolescence and adulthood [29]. It has been shown that the transition from overweight status to obesity often occurs from 18-29 years of age based off BMI [28]. However, the future for young overweight and obese adults is not the only concern. One study found that among a sample of undergraduate college students, 14% and 49% had hypertension or prehypertension, and increased depressive symptoms compared to normal weight undergraduate students [28].

Based on the fact that the trajectory of weight gain in highest among adults between the ages of 18-25y, young adulthood may be a pivotal time to establish long-term health behaviors to prevent weight gain and unhealthy eating and physical activity habits [30]. Furthermore, adults with higher BMIs gain weight at an increased rate compared to those who have median BMIs, while very little weight gain occurs in those whose baseline BMI is below the median BMI [13]. Age may also play a factor in the degree of weight gain in adults. As age increases, BMR (basal metabolic rate) decreases causing a decreased need of energy; however, dietary habits may not appropriately change to keep the body in energy balance resulting in weight gain. It is important to note, however, that healthy weight individuals in young adulthood appear to be the most at risk for gradual weight gain over a long period of time, indicating that adults of all BMIs are susceptible to short-term or long-term weight gain and appropriate interventions to prevent weight gain are needed.

Weight Loss and Weight Loss Maintenance

A small amount of weight loss can make a significant impact on health. A 5-10% weight loss in individuals with obesity has been associated with a significant improvement in health-related outcomes for many obesity-related comorbidities [31,32]. A current meta-analysis found that

a 5.5 kg decrease in body weight reduced mortality risk by 15% [31,32]. Three long-term studies (Diabetes Prevention Program (DPP), the Diabetes Prevention Study (DBS), and the Da Qing IGT and Diabetes (Da Qing) study) have determined that modest weight loss during short term weight management interventions can decrease the risk for developing T2D by 58% [31-33]. Long-term benefits were preserved as well; risk was reduced 34% 10 years later and 27% 15 years later [33]. Furthermore, a 9 kg reduction in body weight reduced the risk for a range of cancer biomarkers such as E-selectin and IL-6 in the Iowa's Women's Health Study [32]. The core weight loss and weight maintenance strategies that have been identified include consumption of a low-energy, low fat-diet, high levels of physical activity, and consistent self-monitoring of weight [22].

Weight loss maintenance, however, is even more challenging than weight loss in treating obesity. According to the National Weight Control Registry, the two most noteworthy predictors of weight regain are the magnitude of initial weight loss and duration of weight loss [12]. It has been shown that in weight loss interventions, participants who lost 20% or more of their body weight were 2.8 times more likely to regain weight compared to those who lost 10-15% [10]. Further, across several weight loss trials, only 3-6% of weight loss was maintained post-intervention [34]. Thus, weight maintenance tools may be even more important than weight loss programs. The American Heart Association suggests that participants involved in a weight loss intervention maintain contact with a trained interventionist for at least one year after they complete the program to improve weight maintenance [34]. Furthermore, current research suggests that continued support and encouragement from a counselor using behavioral techniques is the most effective and long-term solution to weight loss post-intervention [35].

Many individuals make repeated attempts to lose and maintain weight using a variety of diets and are unsuccessful. Finding effective weight loss behaviors is vital in achieving weight

loss and then maintaining that loss. Behaviors that have been associated with weight loss and maintenance include consuming a low-energy diet, low-fat diet, frequent self-weighing, maintaining high levels of physical activity, and eating breakfast regularly [9]. Additionally, weight loss maintenance studies have also found that self-monitoring, peer and social support, and maintaining contact with fellow weight loss participants can reduce weight gain after a weight loss intervention [36].

Tools for Weight Management and Weight Change

Taking a closer examination of individuals who have lost weight and maintained that weight loss is crucial to understanding how to improve weight loss maintenance [37]. One study focused on weight loss registries and formulated a web-based questionnaire to better understand successful methods of current weight loss maintainers [37]. Participants in the study had lost an average of 26.5% of their initial body weight. When examining other health behaviors, they found that almost 30% did not drink alcohol, ~50% reported regular vigorous exercise 3 times a week, and almost half did leisure time physical activity with others [37]. One-third of participants also reported community exercise and more than half of participants had a sedentary job. 84.2% also reported about 2 hours of screen time on a daily basis. Overall, participants smoked less, drank less alcohol, and were physically active in their leisure time [37].

Physical activity trackers and step goals are other potential tools for weight loss and weight loss maintenance [38]. Guidelines suggest aerobic physical activity 150 minutes of moderate or 75 minutes of vigorous activity a week [38]. These levels do promote cardiovascular benefits but have not been associated with clinically significant weight loss without energy restriction [38]. This amount of exercise is more likely to maintain one's weight, improve cholesterol levels, and promote cardiovascular benefits; however, it has been shown that daily

exercise is associated with clinically significant weight loss when metabolic equivalents (MET) are equal to 600 MET kilocalories per day without an increase in EI [38]. The American College of Sports Medicine currently recommends 225-420 min/week of exercise training for individuals trying to lose weight and 150-250 min/week of exercise for individuals preventing weight gain [38]. To prevent weight gain after clinically significant weight loss, they recommend 200-300 min/week of physical activity [38]. This suggests that physical activity is a tool for weight loss but may have greater effects when paired with energy restriction or another weight maintenance tool rather than physical activity alone. The National Weight Control Registry found that successful weight loss maintainers engaged in physical activity at least one hour each day [39]. According to the Physical Activity Guidelines of America, adults should reach approximately 150-300 minutes a week of moderate-intensity activity, or 75-150 minutes a week of vigorous-intensity aerobic physical activity, or combination of the two for significant health benefits [40]. The guidelines also suggest muscle-strengthening activity of moderate or greater intensity on 2 or more days a week [40].

Dietary self-monitoring that provides feedback has also been associated with clinically significant weight loss [15]. One study found that food logging 3 or more days per week was associated with more weight loss compared to participants whom food logged less [15]. The nutrition content of food has also been found to improve weight loss and maintenance. In a dietary study, men adhering to a healthy eating pattern (unprocessed cereal, fruit, vegetables, egg, olive oil, low-fat dairy) were more likely to be successful in weight loss and maintenance than men who regularly consumed soda, snacks, and alcohol [5]. Using semi-structured interviews, qualitative studies carried out with individuals who had been successful at weight loss and

maintenance underlined the importance of a healthy, balanced eating approach including regular meals, increased levels of activity and social support [22,34].

The environment in which people eat is another factor affecting weight loss and weight loss maintenance. A higher frequency of eating away from home has been associated with higher BMI, weight gain, and poor diet quality while eating at home has been shown to be protective against some of these effects [34]. Slower eating patterns and involvement with food preparation have also been associated with weight loss and maintenance [34]. The availability of social support has been shown to be a key feature in weight loss maintenance with positive reinforcement being particularly important during the first 2-5 years following weight loss [39].

Controlling portion size is yet another tool that may be useful in weight loss and maintenance [41]. Portion controlled meals have consistently shown greater weight loss and maintenance compared to a conventional diet [5,41]. In a weight loss intervention focusing on portion-controlled meals, behavior education, and exercise, there was a clinically significant increase in diet quality HEI-2010 scores (Healthy Eating Index). This translated to greater weight loss and higher physical activity levels. Increased diet quality was associated with greater weight loss at all checkpoints [41]. Encouraging overweight and obese individuals to use smaller plates and bring healthy lunches to work were just two examples of behavior modification that helped with weight loss and maintenance.

Stress is another factor that can play a major role in weight management since stress levels have been positively associated with weight gain [35]. Higher stress is associated with increased EI, especially foods that are energy dense [35]. One study compared the effects of two programs focused on either intuitive eating (IE) or emotional brain training (EBT) to combat stress-induced eating [35]. The EBT program taught participants about tools to decrease stress, and

the IE program focused on mindfulness strategies to improve awareness of hunger and satiety. The EBT program was associated with significant weight loss and changes in stress during the 7-week active intervention [35]. Furthermore, EBT participants continued to lose weight 7-weeks post-intervention. EBT participants also showed decreases in blood pressure, perceived stress levels, and stress-induced eating. No significant changes were found in the IE group in weight or any other measure [35]. This suggests that implementing stress management tools may decrease weight and improve weight management long-term. Intuitive eating may also be a tool for weight maintenance since participants did not gain weight during the 7-week intervention or post-intervention period [35].

In a systematic review, several other behaviors were identified that were associated with weight maintenance after a weight loss intervention. One study found that similar behaviors (a low-fat diet, regular self-weighing, and high physical activity) as previously reported did encourage weight maintenance [10]. Other factors identified included regular meal rhythm, breakfast regularly, social support, self-monitoring, and lower emotional eating [10]. Factors that tended to lead to weight gain among participant included a history of weight cycling, poor coping strategies, dichotomous thinking, and lack of motivation in a variety of areas in their lives [10,22,39]. This evidence suggests that stress, family, depression, and economic status can all influence weight gain due to emotional eating. Creating attainable goals and having successful coping strategies may also decrease stress and encourage weight maintenance, and available emotional support appears to be the key factor in enabling people to cope with high-stress situations without resorting to food [39].

Self-Weighing

A Behavioral Weight Management Tool

One final behavioral tool that may be important for weight loss and weight loss maintenance is frequent or daily self-weighing. Regular self-weighing in a consistent pattern is a way to provide awareness to the effects of certain behaviors or environments that provide desired or undesired changes to the body. It has been shown that weighing at least once a week is effective in increasing weight loss during a lifestyle intervention and weighing at least 5 times a week was associated with greater weight loss [15]. The National Weight Control Registry, a study of adults who lost approximately 70 pounds and maintained their weight, has identified frequent self-weighing as one of the key behaviors associated with the weight loss and maintenance [9]. Among these adults who reported self-weighing, 44% of these participants report weighing daily and 31% report weekly weighing [42]. In another behavioral weight control study, participants who daily or weekly self-weighed had greater weight loss over 2 years than those who weighed less frequently or not at all [43]. Those who reported only monthly self-weighing or less gained weight during the 2-year period [43]. This suggests self-weighing may be a tool to slow weight regain thereby enhancing weight maintenance.

There are numerous other studies that have demonstrated the benefits of frequent self-weighing for weight loss or weight loss maintenance. In a 3-month behavioral lifestyle intervention, self-weighing and its benefits were promoted to participants [27]. Over the three-month period, 42.9% of participants reported weighing weekly compared to 19% at baseline. Those that weighed several times a week or more had greater weight loss than weighing weekly or less, and more frequent self-weighing was associated with clinically significant weight loss [27]. Another study looked at self-weighing data that was collected from wifi-enabled scales in a

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weight loss intervention called EMPOWER [44]. The intervention included group sessions, self-monitoring of dietary intake, and exercise goals. The high/consistent self-weighing group (>6 days per week) lost on average 10.19% ± 5.78% at 6 months and 9.90% ± 8.16% at 12 months compared to the minimal weighing group who lost on average 2.00% ± 4.58% at 6 months and 0.65% ± 3.58% at 12 months [44]. The consistent self-weighing group also met their energy intake goal and dietary self-monitoring regimen significantly more days per week compared to the minimal self-weighing group. This corresponded to greater weight loss compared to the minimal self-weighing group [44].

A qualitative study evaluating the success of weight loss maintenance found that those who regained weight spoke about avoiding the scale. One study examined whether an increase in daily EI on one day led to non-adherence to self-weighing the next day [42]. They reported that most participants did not weigh on Saturdays or Sundays and were least likely to skip self-weighing and dietary monitoring on Mondays. Higher adherence to self-weighing and dietary monitoring were both independently associated with greater weight loss at 12 weeks [42]. An average of 300 kcal daily surplus was associated with 1.33 times increased odds of not adhering to self-weighing the following day. These findings reveal that increased EI on one day is associated with avoidance of self-weighing the next day [42,44]. Gaining a better understanding of how EI on one day can impact behaviors the next day may be important for identifying strategies to prevent weight regain.

Frequency of Self-Weighing Practices for Success

Many studies have highlighted self-weighing in weight loss interventions and maintenance in the presence of additional tools, but it is interesting to understand why self-weighing is a successful strategy in weight loss maintenance is. In a study comparing successful weight loss

individuals to weight-stable individuals, the frequency of weighing among weight loss

individuals averaged between once a week and several times a week while the weight-stable

individuals averaged self-weighing less than once a month[22]. The participants reported that

stepping on the scale was a safety measure and informed them of whether they had properly

managed their week/day or not, which was the trigger for action when weight was increasing [22].

Without the help of the scale, weight loss maintenance individuals felt like were unable to

identify weight regain [22]. Thus, self-weighing frequently gave maintenance individuals the

ability to react and adjust behavior to lose weight back to their goal weight and maintain losses.

Self-weighing once a week or more has been shown in other studies to be more effective for

weight loss and maintenance compared to weighing once a week or less [36,45]. Studies have also

found daily self-weighing as part of a weight loss intervention leads to that those who daily self-

weighed had greater decreases in percent body fat compared to those who never self-weigh [30].

These results suggest that daily self-weighing has a beneficial association with weight and may

decrease the risk for chronic diseases associated with high body fat percentages.

Self-Weighing Frequency as Part of Other Interventions

    Like most weight loss interventions, a recent systematic review did show that self-weighing

alone was less effective in weight management than when it was incorporated into a

multicomponent intervention [46]. Other data suggest that behavior and weight management

interventions are more effective with self-weighing, but self-weighing alone without additional

accountability is not beneficial towards weight loss [45,46]. Thus, it may take multiple behaviors to

maintain weight loss rather than one strategy alone. Self-weighing has been a distinguishing tool

between those who had maintained weight loss from those who had regained weight, combined

with adopting a long-term approach, setting realistic weight goals, having a routine and feelings of organization, avoiding food deprivation, and coping with lapses better when self-weighing [22].

Self-weighing and Potentially Unhealthy Behaviors

The literature on self-weighing during weight loss and weight maintenance interventions have concluded that more frequent self-weighing is associated with greater weight loss and does not report evidence of negative psychological effects [47]. In a systematic review, 8 out of 22 articles addressed psychological outcome during a weight intervention that incorporated self-weighing. They found that self-weighing and self-monitoring of food intake and physical activity overall did not lead to unhealthy behaviors or negative psychological effects [46]. Conversely, other studies have shown that in young adults more frequent self-weighing was associated with more unhealthy weight behaviors, more binge eating and depression, lower self-esteem among women, and body dissatisfaction in men [9,14,22,27,47,48]. However, in another recent study, adolescents who were successful at weight loss and were frequent self-weighers reported more healthy behaviors such as decreasing high-fat foods, decreasing junk food, increased activity, and less screen time [9].

Therefore, in general, existing data support frequent self-weighing for weight management among adults. There is, however, a lack of studies that have tested for disordered eating symptoms over long term follow-up after elective use of self-weighing [47]. In a randomized controlled trial of young adults (n = 167) using the caloric titration method to prevent gain, only two participants discontinued the intervention because self-weighing resulted in an unwanted focus on weight and diet [49]. In 2 large weight gain prevention groups consisting of 628 female participants, only 7% of participants reported self-weighing induced binge episodes [47]. Thus, there may be a smaller part of the population in which frequent self-weighing may not be

protective against weight gain, and this needs to be explored more thoroughly. While a small subset of individuals may be negatively affected by frequent self-weighing, many other studies have found positive associations between body image and frequent self-weighing [50]. In a large adult population cohort, frequent self-weighing was associated with greater health orientation, evaluating oneself as more fit, and self-classified weight [50]. Gender may influence responses to self-weighing though. Women who self-weighed more were more concerned about their body shape in one study while men who self-weighed more frequently showed a greater likelihood toward health and fitness such as being physically fit and being more satisfied with their body image [50]. Therefore, more frequent self-weighing among young adults may be a healthier tool for men compared to women. This could be attributed to women having more concern with body attractiveness causing a preoccupation with being overweight, greater shape concern, and reduced body dissatisfaction [50]. Overall, the most recent evidence has suggested that frequent self-weighing in men and women may be beneficial for weight control, including weight loss, prevention of weight gain, and prevention of weight regain after a weight loss intervention [6]. However, certain subgroups in the population may have a negative response to self-weighing, such as young adult women.

Caloric Titration Method (CTM) of Self-Weighing

The caloric titration method (CTM), focuses on daily self-weighing with individualized visual (graphic) feedback [49]. Upon self-weighing, an automated e-mail that contains a graph of recorded weight over a period of time is sent to the user. The graph also contains a line that indicates the target weight goal that is at or below the user's current weight. The graphical feedback provided by the weight chart is theorized to reinforce behaviors that cause weight to move in the intended direction, allowing participants to make changes in their eating or activity

that works best for them in their daily lives [6]. The rationale for using slow weight loss (1% increments on the CTM method), is that people will try several techniques to reduce their EI or increase EE. All techniques may work in the short-term, but this helps individuals find behaviors that they can change for a prolonged period of time.

In a randomized controlled trial of young adults (18-25 years old), CTM was tested for efficacy against a control group who also had access to a scale but was not provided CTM software. The frequency of self-weighing was significantly different. 95% of CTM participants weighed themselves three or more times a week, and 67% of participants weighed themselves five or more times a week [49]. In the control group, 15% and 9% weighed themselves 3+ times a week or 5+ times a week, respectively [49]. This study found that frequent self-weighing with electronic feedback reduced age-related weight gain among young adults [49]. The intervention prevented weight gain for the entire academic year while the control group gained a significant amount of weight [49].

Isolating the effects of frequent self-weighing for weight loss and maintenance is important in understanding its effects in the field of weight control or management. Frequent self-weighing is a simple and affordable behavioral technique and adding visual feedback, such as CTM, can be very helpful for weight loss and maintenance [6]. One study conducted a 2-year intervention using CTM in adults. The intervention group and control group were given evidence-based strategies for weight loss including small changes that could result in a 100kcal/day energy deficit. The intervention group, however, was also given the tools to incorporate CTM. After 1 year, the control group participants were informed and given the CTM tools and were asked to incorporate into their current weight loss strategies [6]. On average, more than 4 weigh-ins per week were entered into the CTM program among the intervention group,

and a significant difference in weight loss was found between the control group (n=65, 0.5 kg ± 4.4 kg) and the CTM intervention group (n=70, -2.6 ± 5.9 kg) [6]. The control group lost weight during year 2 when provided the CTM method (-1.9 kg ± 5.7 kg) and the average weight change for the intervention group in year 2 was 0.1 ± 4.8 kg. This evidence suggests that the use of frequent self-weighing accompanied with visual feedback (CTM), without a prescribed diet or exercise plan, was effective in producing a small, but sustainable weight loss, specifically in males. The results in women were not significant but showed a trend towards significance [6]. This study also provided evidence that daily self-weighing encouraged weight maintenance [6].

Theories behind Self-Weighing

Social Cognitive Theory

There are multiple theories that could be used to explain the mechanisms by which frequent self-weighing is effective for weight loss, weight loss maintenance, or the prevention of age-related weight gain. One such theory is the social cognitive theory (SCT). SCT states that behavior changes are influenced by 'reciprocal determinism' occurring between personal factors, environmental factors, and attributes of one's behaviors itself [29]. The most central mechanism underlying behavior in SCT is self-efficacy, the belief one has the ability to do a certain action by themselves [51]. Self-efficacy affects motivation, thought, processes, and emotions that may encourage or discourage an action [51]. Self-efficacy determines a person's goals. In frequent self-weighing, one's goal may be to maintain weight or lose weight in a certain time frame. Self-efficacy has also been hypothesized to indirectly change behavior through outcome expectations, goals, and socio-structural barriers and facilitators [52]. It has been suggested that long-term success in weight control may be to adhere to the SCT to encourage physical activity, healthy eating, and changes in mood, feelings of well-being, body image, self-efficacy and esteem, and

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coping abilities [53]. Outcome expectations are the perceived benefits or cost of an action while goals are the intentions of the self-regulatory behaviors [52]. Observational learning is another key component of SCT [51], which is learning through modeling others' behaviors [51]. Thus, self-weighing may be more encouraging if a participant has a partner, is encouraged by someone, or sees that self-weighing is beneficial for others in maintaining or losing weight. Thus, behavior change to weigh more often and increase healthy behaviors and eating habits may be more successful according to the SCT when focusing on integrating theory into an intervention.

Self-regulation

Self-regulation enables people to adjust their behaviors, and good self-control seems to lead to many desirable outcomes such as school and work success, mental health, and healthy relationships [54]. Self-regulation is made up of four components: standards, motivation, monitoring, and willpower[54]. The concept of self-regulation is greatly influenced by the feedback loop theory in which a person performs a test and compares themselves to the standard; if he/she falls short, one will make adjustments and evaluate with a series of test to reach the goal [54]. Willpower is also known as self-regulatory strength and has shown to be depletable. Motivation is the incentive to achieve the goal. When motivations differ, self-regulation is essential to success [54]. Evidence suggests that self-regulation can be guided by a promotion focus or prevention focus [55]. A promotion focus is oriented with pleasurable outcomes or gains while prevention focus is oriented toward avoiding pain or some sort of "loss" [55]. These terms have also been labeled as "approach or avoidance" [55]. Failure within an approach orientation or promotion focus has been shown to lead to sadness or frustration while avoidance or prevention usually leads to fear [55]. This can be applied to weight loss or maintenance where approach would

be to achieve a healthy state (weight management) while avoidance may be to avoid chronic disease, weight gain, or obesity.

The feedback loop is essential in understanding the mechanisms behind self-weighing. It is termed a negative feedback loop because it functions to reduce deviations from a comparable value [56]. The feedback loop starts at a reference point, and if a discrepancy is perceived between the person's present state and the reference value, the person changes their behavior to reduce the discrepancy [56]. The behavior does not counter the inconsistency directly, but the behavior has an influence on the surrounding environment instead [56]. The environmental influence creates a change in the present condition which is then compared once again to the reference value. The overall purpose is to lessen aberrations from the standard reference point [56]. The central function of the feedback system is not to create a behavior. Rather, it preserves the perception of a desired condition [56]. Self-weighing may also work in this way. A set goal weight is the reference point. Self-weighing acts to reduce this discrepancy between one's goal weight and his/her current weight. Self-weighing also causes a person to change their environment, such as increasing activity level or eating healthier meals, to achieve the goal. Recording one's behaviors and then comparing the actual state with the desired states prompts individuals for self-corrective adjustments to achieve one's goal through the feedback loop system [22].

Health Belief Model

Although SCT of self-regulation is the most likely candidate for the success of frequent self-weighing, especially using CTM, the Health Belief Model (HBM) is another model that may have applications for self-weighing frequency. HBM is a hypothetical framework that recognizes perceptions reflecting the extent to which people are willing to adhere to healthier lifestyle behaviors [28]. There are several constructs that make up HBM. Perceived susceptibility, severity,

barriers, benefits, self-efficacy, and internal and external cues are the most crucial parts to HBM [28]. Perceived susceptibility and severity work together to create a degree of perceived threat associated with a disease or condition [28]. Internal and external cues to action act as motivators that may increase one's willingness to change. Behavior change is also influenced by many other factors such as age, gender, and income status [28]. An individual believes the benefit is the outcome that will happen if they change their behavior. It has been shown as weight increases, physiological changes begin to occur within the body that contribute to a number of symptoms that will begin to surface such as decreased energy levels, impaired mobility, and joint pain [3]. Thus, when applying HBM to weight loss, an individual's desire to change is based on their new physical symptoms and body image. The perceived benefits of weight loss and the perceived threat of adverse health outcomes are great factors to promote weight management and self-weighing. Benefits may also come from external sources such as social support or a decrease in medical expenses [28]. Self-efficacy would be reinforced as people began to see improvements in markers of health as well as increased self-esteem [3]. Studies have shown that more intensive interventions achieve the best results [3].

The HBM has been successfully used with college students to study compliance with food safety recommendations, adoption of osteoporosis-preventive behaviors, diabetes self-management, and participation in regular physical activity [28]. A cross-sectional study examined the ability of HBM to predict BMI among a large sample of college students using an online questionnaire reported that students with a lower BMI believed being overweight was detrimental to health and presented a concern to disease later in life [28].

The HBM also provides researchers a framework and opportunity to formulate weight loss interventions based on certain factors. Focus groups were conducted to examine qualitative

factors in order to formulate a weight loss program guided by the HBM [57]. The decision to lose weight was heavily based on the perception of one's current weight. Using the HBM, researchers were able to find several main constructs to focus on in the future: lifestyle management, defining *healthy weight,* addressing ways to overcome barriers and increase self-efficacy, emphasizing the relationship between weight and chronic disease, and emphasizing weight loss and maintenance [57].

General Summary

In conclusion, more frequent self-weighing, such as daily self-weighing has been shown to be a beneficial weight loss and weight loss maintenance tool. It is important to gain a better understanding of whether or not more frequent self-weighing is effective for long-term weight management. Furthermore, there is a lack of data on current self-weighing practices among the general U.S. adult population. This could have a major impact on the way we treat obesity. The results of this thesis are also designed to reveal how self-weighing frequency may be associated with other health practices that are associated with weight loss or healthy body weight, such as reducing stress, increasing physical activity, and improving diet quality. More frequent self-weighing could potentially be a vital tool in decreasing obesity across the U.S.

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CHAPTER 3

SELF-WEIGHING FREQUENCY AMONG U.S. ADULTS AND ITS RELATIONSHIP WITH

HEALTH MEASURES

Abstract

Purpose: To investigate self-weighing frequency (SWF) among adults and whether SWF was associated with health markers. **Methods:** 533 U.S. adults completed a questionnaire on SWF and other health markers. Respondents were categorized into 4 quartiles of SWF: "Never," "<1x a week," "1x a week," or ">1x a week." **Results:** 60.0% of adults weighed <1x week and 25% never weighed. More frequent self-weighing was associated with less sedentary time, more vigorous physical activity (PA) and several healthier practices including reading nutrition labels, eating whole grains, drinking less soda, self-monitoring food, PA and weight change, and choosing lower-calorie options. Conversely, there was no difference in BMI, age, stress, education, sleep, screen time, or chronic diseases between 4 SWF quartiles. **Conclusion:** While SWF was associated with some markers of health including vigorous PA and some healthier dietary habits, SWF was not linked to BMI, stress, sleep, or chronic diseases.

Keywords: Self-weighing, daily self-weighing, obesity, weight management, physical activity

Introduction

Over two-thirds of the adult U.S. population is overweight or obese [14], and 1 in 13 is considered to have extreme obesity [58]. The average U.S. adult gains an average of 0.9 kg per year but this small [23], continual gain every year can lead to substantial weight gain over a more extended period and has been termed "creeping obesity" [23,49]. Factors that have been associated with gradual weight gain include unhealthy eating habits, easy access and low cost for highly palatable and energy-dense foods, physical inactivity, greater screen time and electronic usage, poor sleep habits, holiday or vacation weight gain, and/or limited access to healthy foods or safe places to be active [3,23,29,58].

Finding effective behavioral modification tools to either achieve weight loss or maintain body weight can be challenging given our current obesogenic environment. One method that may contribute to body weight maintenance is frequent self-weighing. Self-monitoring has been proven to be a successful method in a variety of health issues such as healthy eating, physical activity, and alcohol reduction [7]. Historically, recommendations for self-weighing frequency (SWF) were once a week. However, recent studies have shown that more frequent self-weighing, such as daily self-weighing (DSW) may be an effective strategy for weight loss [8,15,30,43], weight loss maintenance [15,9,43], or the prevention of weight gain during susceptible periods such as freshman weight gain in college [30]. In a 2-year weight loss intervention, both DSW and weekly self-weighing was associated with significantly greater weight loss compared to participants who reported weighing monthly or less [43]. Additionally, according to the National Weight Control Registry, 44% of individuals who maintain substantial weight loss for at least 1 year reported performing DSW [30].

Self-weighing is a method of monitoring a result (or number) rather than an action [7]. However, self-weighing may initiate behavior changes in a variety of daily habits such as healthier eating and higher levels of physical activity (PA) to keep one's current weight in line with a desired weight. Furthermore, self-weighing is a low cost, low burden activity which may increase its ability to be implemented wide-spread. Due to its effectiveness, affordability, and simplicity of use, frequent self-weighing could become a standard practice of care for weight management.

To date, no one has examined SWF practices among adults in the general public independent of a weight loss program. Additionally, there is no information about the relationship between SWF and other health practices or outcomes such as body mass index (BMI), PA levels, healthy eating practices, or medical conditions. Knowledge of self-weighing habits among U.S. adults will help inform the development and delivery of recommendations for weight management practices [58]. Therefore, the purpose of this study was to assess self-weighing practices among U.S. adults and to examine the relationship between SWF with BMI, PA, and other health-related measures. We hypothesized that less than 50% of U.S. adults would report weighing themselves once a week or more. Further, we hypothesized that a greater percentage of women would report weighing once a week or more compared to men. Finally, we hypothesized that greater SWF would be associated with lower BMI, higher levels of PA and other positive health behaviors.

Methods

Study Design

This study used a cross-sectional design in which a convenience sample of participants completed an online survey. All participants completed the questionnaire through the online software program, Qualtrics (Qualtrics® Software Company Provo UT and Seattle WA). The study was approved by the Institutional Review Board, and informed consent was obtained prior to data collection for each participant.

Participants

We recruited 533 adult men and women between the ages of 18-75y. Exclusion for the study included anyone outside of the designated age range, anyone without access to the internet, anyone not living in the U.S., or anyone who could not read English. Of those 533 adults, 405 participants were recruited from Mechanical Amazon Turk (Mturk), and 128 participants were recruited by social media, email, and word of mouth. Amazon Mechanical Turk (Mturk) (© 2005-2018, [Amazon Mechanical Turk](#), Inc.. Seattle, WA) is a web service that enables people to survey target populations across the United States. Participant recruitment and all data collection occurred during a 2 month window in late spring to avoid potential seasonal differences in study variables.

Questionnaire

All participants received an electronic invitation to complete the questionnaire through Qualtrics. The questionnaire took approximately twenty minutes to complete and was composed of 7 different sections. The total number of questions varied due to follow up questions if a participant answered 'yes' versus 'no' to certain questions with a range of 110-118 questions. The 7 sections included in the questionnaire were: Section A: General Lifestyle and Health,

Section B: Weight Management, Section C: Health History, Section D: Nutrition and Health

Supplements, Section E: Mobile Health Applications, Section F: Physical Activity, and Section

G: Self-Weighing Recall.

In section A, the questions assessed socio-demographic and general health data such as

age, race, ethnicity, sex, and income. In section B, questions were centered around SWF, weight

loss history, and the use of weight loss programs or supplements to lose weight. The initial

categories for SWF were on a Likert scale and included the following categories: Never, Less

than once a month, Less than once a week, Once a week, Several times a week, Daily, More than

once daily. In Section C, health history questions such as chronic diseases, alcohol and drug use,

medications, and stress levels (e.g. scale from 0-10) were ascertained. Section D focused on

nutrition preferences and eating habits such as eating breakfast, the frequency of meals and

snacking each day, the use of supplements, and soda/snack tendencies. In section E, questions

were centered around the use of online tools and apps to assist in weight loss and PA. Section F

consisted of the International Physical Activity Questionnaire (IPAQ short version)[59], and

Section G consisted of a calendar in which participants were asked to recall their weighing habits

for the past 10 days using a time-line follow-back procedure starting with the day the

questionnaire was completed [60].

The IPAQ uses metabolic equivalents (METs) to represent the energy exerted through

PA. One MET is equal to the amount of oxygen consumed while sitting at rest (3.5 mL O_2 per kg

body weight per minute) [61]. The IPAQ classifies walking as 3.3 METS, moderate PA to be 4

METS, and vigorous PA to be 8 METS [61]. The Total MET calculation was the sum of walking,

moderate, and vigorous METs. The MET score calculation ranges from 1 to 3; 1 represents high

METs, 2 represents medium METs, and 3 represents low METs. Participants are categorized into

the low MET score category if they do not meet moderate or high criteria. Participants are categorized into the moderate MET category if they achieve 3 or more days of vigorous activity of at least 20 minutes per day, OR if they achieve greater than 4 days of moderate activity and/or walking of at least 30 minutes per day, OR if they achieve more than 5 days of any combination of walking, moderate, or vigorous activities that total to a sum of at least 600 MET min/week [61]. To be categorized in the high MET category, participants achieve vigorous activity at least 3 days/week totaling at least 1500 MET min/week, OR they have 7 days of any combination of activity that totals at least 3000 MET min/week. Kilocalories (Kcal MET) were calculated by multiplying total METs by the following formula: weight in kilograms/60 kilograms [61].

Statistical Analysis

JMP version 14.1.0 (SAS, Cary, NC). was used for all statistical analyses. Participants were grouped into quartiles based on their response of the SWF Likert item. The 4 categories included: Never, Less than once a week, Once a week, or Several times a week or more. The rationale for creating 4 categories from the initial 6 categories was to increase the number of participants in smaller categories that might skew the distribution of data (i.e., the number of participants per group). Therefore, "daily" and "more than once daily" were combined into the "several times a week or more" group. Pearson's Chi-Square was used to explore the association between SWF with categorical questions. A one-way ANOVA was used to assess differences between quartiles for the health-related data for continuous and categorical variables. When appropriate, numerical values for scales were calculated when choices had more than 2 possible choices. Thus, we created mean score variables for items assessing frequency and other continuous variables. Mean scores within each quartile were then compared for statistical significance. If significance was found, post hoc analyses were completed using a Tukey's test.

Finally, *p for trend* analysis was used to test the hypothesis of an ordered relationship across

categories of a predictor variable. To examine *p for trend*, the quartiles of SWF were ranked

from least to most frequent and a linear trend was evaluated. Statistical significance was set at *p*

≤ 0.05.

Results

581 participants initially responded to complete the online questionnaire. A total of 533

participants were included in the data analysis. Forty-eight respondents were excluded from

statistical analysis due to incompletion of the questionnaire or failure to answer essential

questions which included current weight, height and SWF. Forty of the 50 states in the U.S. were

represented in this study with Georgia and California having the highest representation (22.6%

and 9.2%, respectively)**.** Respondents were initially categorized into sextiles based on responses

to 1 of the 6 SWF categories: Never (n=129, 24.2%), Less than once a week (<1x week) (n=187,

35.1%), Once a week (1x week) (n=127, 23.8%), Several times a week (n=53, 9.9%), Daily

(n=35, 6.6%), More than once a day (n=2, 0.3%). To maximize statistical power, Several times a

week, Daily, and More than once a day were grouped to form a new category labeled >1x week

(n=90, 16.9%), resulting in 4 quartiles of SWF categories formed for data analysis. The

distribution of SWF for all participants is shown in **Figure 1**. Nearly 60% of adults in this study

reported weighing themselves less than 1x a week while approximately 40% of adults self-weigh

once a week or more.

Participants' demographic and weight characteristics can be found in **Table 1.** There

were approximately equal numbers of men and women in the study (n=263 males, n=270

females). Participants were 35.8 ± 12.8 years old, and 79.0% identified themselves as Caucasian.

There was no difference in the sex or BMI distribution within each self-weighing category

(**Table 1**). There were also no differences across quartiles for sex (**Figure 2**), BMI (**Figure 3**) or BMI category (e.g., Underweight, Normal weight, Overweight, Obese) (**Table 1**). Further, there were no differences in BMI when separated by gender (data not shown). There was a significant difference for race with the 1x week quartile having proportionately higher Black/African American and Other participants compared to all other SWF quartiles ($p < 0.02$). There were no other differences found between races or with ethnicity, education level, employment status, or marital status. Interestingly, however, there was a *p for trend* in income level showing that as SWF increased, total household income also increased ($p < 0.05$).

All other continuous variable and PA data can be found in **Table 2.** 18 women (n = 3 in Never, n = 5 in <1x week, n = 7 in 1x week, and n = 3 in >1x week) and 30 men (n = 7 in Never, n = 9 in <1x week, n = 10 in 1x week, and n = 4 in >1x week) were excluded from the PA analysis following the IPAQ scoring protocol which calls for exclusion of data in each intensity domain when a duration of 3 hours or more is reported [62]. Therefore, to minimize biased answers on PA, anyone who reported more than 3 hours of activity per day in any 1 of the 3 categories (walking, moderate, or vigorous) was excluded for the PA data analysis only. There were no differences between SWF groups for alcohol consumption, sleep hours, stress levels, or the number of meals per day (Meals/Day). For PA as a whole group, participants that Never weigh reported greater weekend sitting minutes compared to participants that weigh themselves >1x a week (367.5 ± 282.4 vs. 270.4 ±196.7 minutes, respectively, $p < 0.05$, respectively). Also, participants who Never weighed had lower levels of vigorous METs compared to <1x week and >1x week ($p < 0.003$), and lower total Kcal METs compared to all other SWF groups ($p < 0.002$). There was also a significant *p for trend* showing less weekend sitting minutes as SWF

increased ($p < 0.05$). There were no significant differences between SWF groups for any other PA data (walking METs, moderate METs, MET score, or total METs) (**Table 2**).

When examined by sex, there were differences across SWF quartiles for some measures in men, but not women. There were no differences between categories of SWF for any PA measure in women (**Table 3**). Similar to the whole group analysis, there were no significant differences between SWF groups for any other continuous variables (age, BMI, alcohol consumption, sleep, stress levels, or the number of meals per day) in either men or women (**Tables 3-4**). Conversely, men who weigh themselves <1x a week had greater week day sitting minutes compared to those that Never weigh (400.7 ± 320.9 vs. 243.6 ± 155.6 minutes, respectively, $p < 0.005$). There were no significant differences between SWF groups for weekend sitting minutes. However, there was a *p for trend* showing a decrease in weekend sitting minutes as SWF increased ($p < 0.01$). Men who reported weighing >1x week had higher levels of vigorous activity compared to men who Never weighed ($1{,}745.3 \pm 1{,}775.7$ vs. 781.8 ± 1321.1 METs, respectively, $p < 0.02$). There was also a *p for trend* with increasing vigorous activity as SWF increased ($p < 0.003$). There were no significant differences between any other PA measures in men including walking METs, total METs, Kcal METs, or MET score (**Table 4**). However, a similar *p for trend* was observed for walking METs ($p < 0.02$) Total METs ($p < 0.01$), and Kcal METs ($p < 0.01$) with higher levels occurring as SWF increased.

Questions related to food and dietary habits can be found in **Table 5.** Participants who weighed themselves >1x week reported proportionately more knowledge of the Dietary Guidelines for Americans ($p < 0.05$), reading nutrition facts on food labels more often ($p < 0.002$), consuming low-calorie or artificial sweeteners ($p < 0.05$) and caffeine ($p < 0.007$), identifying as gluten sensitive more often ($p < 0.05$), and reporting healthy eating as more

important (on a scale from "not important to very important") ($p < 0.001$), more so, than all other SWF categories. There was also a *p for trend* with more nutrition facts reading ($p < 0.01$) and greater importance of healthy eating ($p < 0.001$) as SWF increased. Participants who Never weighed themselves reported proportionately higher consumption of grains vs. >1x week ($p < 0.01$). Whole grain consumption was proportionately greater for those who reported >1x week and <1x week compared to Never ($p < 0.002$), while overall diet soda consumption was greater for those who reported weighing >1x week compared to <1x week or Never ($p < 0.004$). We also observed a *p for trend* with the consumption of diet soda increasing as SWF increased ($p < 0.001$), and for less regular soda consumption as SWF increased ($p < 0.001$). Finally, there were no differences between SWF categories for other health questions including fruit and vegetable intake, nut intake, eating breakfast regularly, dining out, or snacking frequency.

Questions related to overall health by SWF groups can be found in **Table 6.** There were no differences between SWF categories for any questions including bariatric surgery history, current and past smoking and alcohol use, access to health insurance, chronic diseases, the frequency of experiencing high stress, or annual physical exams. For medication use, participants who weighed >1x week had a greater proportion of individuals reporting the use of at least 1 medication compared to <1x week ($p < 0.003$). We also observed a *p for trend* with use of any medications increasing as SWF increased ($p < 0.05$). Questions related to weight history, self-monitoring tools, and screen time can be found in **Table 7.** Participants who weighed 1x week or more had a higher proportion of subjects reporting tracking food consumption ($p < 0.001$), tracking weight change ($p < 0.001$), and rewarding themselves when health goals are met ($p < 0.001$) compared to participants who weighed themselves <1x a week or Never. Participants who weighed themselves >1x week also had a higher proportion of people tracking PA ($p < 0.004$)

compared to all other quartiles of SWF. There were no significant differences between SWF groups for current weight description, weight loss history, or any screen time.

Discussion

Our primary objectives were to report on self-weighing practices among U.S. adults and to determine the associations between SWF and a number of health-related variables. In our study population, nearly 60% of adults reported weighing less than 1 time a week. Additionally, approximately 25% of adults never weigh themselves. Conversely, almost 24% reported weekly weighing, but only 6.6% of our study population reported DSW. We also did not observe differences in SWF between men and women or between different BMI categories, which was contrary to our hypotheses.

According to recent research, adults who weigh several times a week or more not only have significant weight loss but also maintain that weight loss more effectively than adults who weigh less than several times a week [27]. Based on the previously documented success of incorporating frequent self-weighing as a component of a weight loss or maintenance program, we expected to see lower BMI as among higher SWF quartiles. However, in this cross-sectional analysis of free-living adults who were not involved in a weight loss program, there was no relationship between SWF and BMI. This could be due to a number of reasons. First, it is possible that independent of a weight loss program, frequent self-weighing may not have any relationship with body weight. Secondly, we had a fairly homogenous study sample, so bias towards our health survey may not adequately represent the relationship between SWF and body weight. Finally, all data collected in this study was self-reported, which could contribute to some degree of error or bias, and this error/bias may not be uniform across our study sample.

Previous literature has shown that self-reported body weight is under-reported [63-66] whereas height and PA are over-reported [65-68]. Research has also shown that people who are obese are more likely to under-report EI and body weight [65] and over-report PA [69], and the magnitude of under-reporting increases as the degree obesity increases [70]. This error in reporting could be the result of people being unaware of their current body weight [67], which holds true with our study since nearly 25% of our participants claimed to "Never" self-weigh. In a national health survey, 41% of female participants and over 50% of male participants were also considered to be "weight unaware" [67]. Self-report is also prone to serval factors that can cause distortion including false memories, social desirability, and the need to respond in a culturally appropriate manner to look better [65,71,72]. In addition to infrequent weighing, errors in self-reported body weight have also been linked to social desirability [65]. Therefore, it is possible that reporting bias affected our results concerning BMI and that the bias was not uniform across SWF groups.

There is less data available on whether over- or under-reporting of SWF occurs. However, one recent weight loss and maintenance study showed that self-reported and objective weighing frequency had an 80.8% agreement between the two indicating accurate self-reported weighing in that study [73]. In a different 12-week weight management intervention, there was also a 95% agreement regarding frequency of self-weighing and self-report data [74]. In our questionnaire, the final section had participants perform a self-weighing recall from the past 10 days. When comparing this 10-day recall data to the Likert scale of SWF, on average, participants in our Never group reported weighing 0.2 ± 1.2 times, <1x week reported weighing 0.8 ± 1.2 times, 1x week reported weighing 1.5 ± 1.5 times, and >1x week reported weighing 6.6

± 4.0 times during the 10-day recall. Therefore, self-reported SWF quartiles determined by the Likert item in our study showed high accuracy with the 10-day recall of self-weighing.

Although we did not find differences in BMI based on SWF, we did observe some relationships between select PA measures, especially in men. There was an inverse relationship between SWF and sedentary time, and a positive relationship between SWF with vigorous activity in men, while no such relationships were observed in women. While both men and women can be prone to reporting bias, research has shown that women, especially middle-aged women with lower levels of education, experience more weight discrimination at lower levels of excess weight than men which has been linked with poorer body image [75]. Thus, women may be more likely to under-report weight and EI, and over-report PA and height compared to male peers due to social desirability, and this may effect not be uniform across SWF groups, particularly among women [65,75].

Contrary to the lack of differences in BMI, we did observe stronger evidence for other healthy dietary habits among more frequent self-weighers. These included having knowledge about the Dietary Guidelines of America, reading nutrition facts on food labels, considering healthy eating to be more important, tracking food intake, choosing low-calorie beverages and sweeteners, drinking less sugary soda, and eating more whole grains. These results mimic what previous experimental studies have shown in successful weight maintainers who frequently self-weigh [22,34,37,38,41].

Studies have shown that SWF along with healthier lifestyle choices help participants feel more in control of their weight and relieves fear of weight regain [22]. Thus, frequent self-weighing may increase healthier lifestyle choices to maintain body weight. Self-weighing has also been demonstrated to help improve the use of other weight loss intervention strategies (i.e., food-

logging, PA tracking) in a variety of platforms including online, group settings, and face-to-face consultation [27,11,18]. Therefore, a "healthier lifestyle", which includes healthier eating and more PA, may also include more frequent self-monitoring through self-weighing practices.

Although this cross-sectional study makes it impossible to determine cause and effect, we can speculate on the associations between some of the measures of higher PA and better dietary habits with more frequent self-weighing. Following from theories of self-regulation, self-weighing may initiate healthy behaviors. In these theories, behavioral regulation changes in response to a discrepancy between a standard (e.g., an ideal weight) and the current self (e.g., one's current weight) [55,56,76]. Daily or frequent self-weighing supports this feedback loop by offering an objective comparison between the standard and the current self. Knowing that one's current weight is different than one desires (or is not progressively becoming smaller at the desired rate), should lead to increased PA and healthier eating habits. Experimental studies have shown that weekly and daily self-weighing have been associated with weight management success [9,14,22,36], providing support for this theory, though not for a direct test of the feedback loop process.

Contrary to the differences between SWF groups in numerous dietary habits and a few PA measures, we did not find any differences between SWF quartiles for stress, sleep, screen time, the frequency of dining out, or chronic diseases. Some practitioners believe frequent self-weighing can elicit negative psychological responses such as depression, anxiety, and stress [43]. However, in this study, more frequent self-weighing was not associated with higher stress or other unhealthy behaviors. More than 40% of 18-25-year-old overweight and obese adults have reported higher levels of unhealthy weight-related behaviors such as decreased PA, increased consumption of fast food and not enough sleep [27,28]. Our study consisted of a very homogenous

sample with no difference in BMI between SWF quartiles. This may explain the lack of differences in sleeping or stress patterns between SWF groups. We also did not observe differences in week day or weekend screen time. This finding is somewhat surprising because previous research has shown that successful weight loss maintainers report lower screen time than other U.S. adults [9,37]. Again, it is possible that independent of a weight loss program, some health-related behaviors such as screen time are not linked to SWF.

Limitations

There were some limitations to this study. We had a relatively large sample size; however, this was a convenience sample, and most of the participants were of similar age, BMI, race, and education. As mentioned above, data were all self-reported, so additional research is needed on SWF with objective weight and PA measures. Further, dietary and health information is subject to self-reporting bias. We also had a minimal number of subjects in a few of the original SWF categories which resulted in 3 categories being combined into 1. This could mask potential differences between those that weigh several times a week vs. those that weigh daily or more than once a day. This was also a cross-sectional study, so although associations between SWF and other health habits can be assessed, we cannot establish cause and effect, so the study is mainly descriptive.

Conclusion

This study was the first to report on self-weighing practices among U.S. adults independent of a weight loss program. According to our data, less than 60.0% of U.S. adults weigh once a week or more, and nearly 25% report never weighing themselves. Because more than two-thirds of the adult U.S. population is overweight or obese [14], and frequent self-weighing has been shown to aid in weight loss and weight loss maintenance, increasing the prevalence of

SWF may be a critical tool for reversing this statistic. Conversely, based on self-report data, we did not observe any differences in BMI or sex between SWF groups. SWF was, however, associated with less sedentary time, and healthier food or dietary choices such as reading nutrition labels, eating whole grains, drinking less soda, self-monitoring food and weight change, and choosing lower-calorie options. The data on greater PA with higher SWF was strong in men but absent in women. Further research is needed to gain knowledge about SWF and the effects on lifestyle choices and health outcomes in a more diverse population of U.S. adults, and to obtain objective measures of PA and anthropometrics in both men and women.

Table 1 – Basic Demographics and Weight Characteristics

		Never n =129 24.2%	%	<1x week n =187	%	1x week n =127 23.8%	%	>1x week n =90	%	*P for trend*
Age		36.0±13.1		34.2±12.2		36.6±13.0		37.9±13.2		**ns**
Height		1.7±0.2		1.7±0.1		1.7±0.1		1.7±0.2		**ns**
Weight (kg)		76.7±23.7		76.0±18.1		79.8±25.2		75.5±18.8		**ns**
BMI		26.3±9.5		25.8±5.6		27.1±8.5		25.6±5.8		**ns**
Gender	Male	65	29.1%	93	35.4%	65	24.7%	40	15.2%	**ns**
	Female	64	23.7%	93	34.8%	63	23.0%	50	18.5%	**ns**
BMI Categor	Underw	9	7.0%	9	4.8%	14	11.0%	3	3.3%	
	Normal	58	45.0%	86	46.0%	42	33.1%	45	50.0%	
	Overwei	29	22.5%	59	31.6%	39	30.7%	25	27.8%	
	Obese	33	25.6%	33	17.6%	32	25.2%	17	18.9%	
	Score	**2.7**		**2.6**		**2.7**		**2.6**		**ns**
Male	Under	5	76.0%9	4	4.3%	8	12.3%	2	5.0%	
	Normal	25	38.5%	39	42.3%3	21	32.3%	18	45.0%	
	Over	17	26.1%5	35	38.0%	24	36.9%	12	30.0%	
	Obese	18	27.6%9	14	15.2%	12	18.4%	8	20.0%	
	Score	**2.7**		**2.6**		**2.6**		**2.7**		**ns**
Female BMI	Under	4	6.4%	4	4.2%	4	6.4%	0	0	
	Normal	33	53.2%	47	50.0%	22	35.4%	28	56.0%	
	Over	12	19.3%	24	25.5%	16	25.8%	12	24.0%	
	Obese	13	20.9%6	19	20.2%	20	32.2%	10	20.0%	
	Score	**2.6**		**2.6**		**2.8**		**2.6**		**ns**
Race [a]	White	107	83.0%	151	80.8%	86	67.7%	77	85.6%	
	Black	11	8.5%	20	10.7%	21	16.5%	4	4.4%	
	Other	11	8.6%	12	6.4%	19	15.0%	9	10.0%	
Ethnic-ity	Hispani	17	13.2%	24	12.8%	12	9.6%	7	7.8%	
	Non-	112	86.8%	163	87.2%	113	90.4%	83	92.2%	
Income in $1000	0-14.9	11	8.5%	11	69.0%	1	0.8%	4	4.4%	
	15.0-29.9	27	20.9%	33	17.8%	29	11.5%	14	7.9%	
	30.0-44.9	27	20.9%	31	16.8%	18	7.1%	16	9.0%	
	45.0-59.9	18	14.0%	35	18.9%	29	11.5%	13	7.3%	
	60.0-74.9	16	12.4%	25	13.5%	16	6.4%	12	6.8%	
	75.0-89.9	7	5.4%	19	10.3%	12	4.8%	13	7.3%	
	$90.0+	21	16.3%	25	13.5%	17	6.8%	16	9.0%	
	No	2	1.6%	6	3.2%	4	1.6%	2	1.1%	
	Score^	**3.9**		**4.2**		**4.2**		**4.4**		**<0.05**
Educat-ion	High	23	17.8%	0	0.0%	0	0.0%	0	0.0%	
	Tech.	10	7.8%	44	24.0%	29	23.0%	14	16.1%	
	2-year	16	12.4%	12	6.6%	6	4.8%	10	11.5%	
	4-year	55	42.6%	20	10.9%	26	20.6%	11	12.6%	

	Grad.	25	19.4%	107	58.5%	65	51.6%	52	59.7%	
	Score	**3.2**		**3.1**		**3.0**		**3.3**		**ns**
Emplo.	Full	86	66.7%	135	72.2%	86	67.7%	68	75.6%	
Status	Part	12	9.3%	20	10.7%	23	18.1%	10	11.1%	
	Other	31	24.1%	32	17.1%	18	14.1%	12	13.2%	
	Score	**1.6**		**1.4**		**1.5**		**1.4**		**ns**
Marital	Married	50	38.8%	71	38.0%	63	49.6%	40	44.4%	
Status	Not	79	61.2%	116	62.0%	64	50.4%	50	55.6%	

Where applicable, data are presented as Means ± SD. BMI - body mass index; Quartiles/Categories represent self-weighing frequencies. Percentages for variables are calculated within each quartile. Scores for categorical variables were calculated by ranking answer selections numerically (mean frequency). Average scores were then calculated within each quartile and assessed for significance with a one-way ANOVA (or Chi-Square for yes/maybe/no questions) and then for the *p for trend analysis*; [a] indicates 1x week had proportionately more African American/Black and Other participants compared to all SWF categories ($p < 0.02$); ^ indicates that as income increases, SWF increases (*p for trend, $p < 0.05$*).

Table 2 – Physical activity and Other Continuous Variable Data

	Never n=129 24.2%	<1x week n=187 35.1%	1x week n=127 23.8%	>1x week n=90 16.9%	*P for trend*
Alcohol (drinks/day)	2.4±3.2	2.6±3.0	3.1±4.4	2.8±4.3	ns
Sleep (h/night)	7.2±1.2	7.0±1.2	6.9±1.3	7.0±1.2	ns
Stress Level (0-10 scale)	4.0±2.6	3.9±2.6	3.7±2.5	4.4±2.3	ns
Meals/Day	3.9±1.9	3.6±1.6	3.8±1.9	3.7±1.7	ns
Week Day Sit Min	446.2±341.7	477.4±1,087.4	339.2±293.7	352.9±222.2	ns
Weekend Sit Min^	367.5±282.4[a]	320.9±257.4	297.0±313.1	270.4±196.7	< 0.05
Vigorous MET	684.4±979.6[b]	1,211.0±1,427.4	1,104.8±1,453.4	1,312.0±1,512.4	ns
Moderate MET	406.6±660.8	649.3±941.0	627.8±914.2	521.0±798.1	ns
Walking MET	585.5±804.6	710.4±847.7	649.7±772.7	813.9±875.5	ns
Total MET	1,589.5±1,646.6	2,496.7±2,261.8	2,287.3±2,468.7	2,661.6±2,399.7	ns
Kcal MET	1,926.0±2,167.9[c]	3,140.8±3,018.3	3,193.6±4,033.1	3,413.0±3,278.9	ns
MET Score	1.8±0.9	1.6±0.8	1.7±0.9	1.6±0.8	ns

Data are presented as Means ± SD. BMI – Body Mass Index; Meals/Day – meals per day; MET – metabolic equivalents measured by the International Physical Activity Questionnaire (units = 1 kcal/kg/hour); MET Score – 1 is high – 2 is medium – 3 is low; Averages were calculated within each quartile and then assessed for significance one-way ANOVA and the *p for trend analysis*; [a] indicates higher weekend sitting minutes in Never versus >1x week ($p < 0.05$); [b] indicates lower Vigorous MET in Never compared to <1x week and >1x week ($p < 0.003$); [c] indicates lower Kcal MET in Never compared to all other SWF groups ($p < 0.002$); ^ indicates that as weekend sitting minutes decrease SWF increases (*p for trend, $p < 0.05$*).

Table 3 – Physical activity and Other Continuous Variable Data for Women

	Never n= 64 23.7%	<1x week n= 93 34.8%	1x week n= 62 23.0%	>1x week n= 49 18.5%	*P for trend*
Age (y)	38.0±14.7	35.1±13.7	38.2±13.3	37.6±13.8	ns
Height (meters)	1.6±0.1	1.7±0.1	1.6±0.1	1.6±0.1	ns
Weight (kg)	67.5±18.3	70.8±17.3	77.4±25.8	68.8±14.7	ns
BMI (kg/m²)	25.4±6.8	26.0±6.1	28.6±9.4	25.7±5.2	ns
Alcohol (drinks/d)	1.8±2.2	2.1±2.2	1.6±1.8	1.9±3.4	ns
Sleep (h/night)	7.0±0.9	6.9±1.1	6.8±1.1	7.0±1.1	ns
Stress Level (0-10 scale)	4.0±2.5	4.5±2.5	4.1±2.4	4.5±2.3	ns
Meals/Day	4.1±1.7	3.7±1.7	3.9±1.7	3.5±1.9	ns
Week Day Sitting Min	411.4±254.2	372.4±279.9	307.3±215.0	350.2±225.7	ns
Weekend Sitting Min	339.2±30.1	283.1±24.9	278.5±30.9	275.7±34.1	ns
Vigorous MET	611.0±843.8	967.4±1273.1	747.9±1,002.7	998.6±1,187.3	ns
Moderate MET	288.2±95.4	591.4±79.9	442.6±100.4	603.9±109.8	ns
Walking MET	716.3±931.6	796.5±1,325.9	624.0±789.7	775.9±835.9	ns
Total MET	1,615.5±1,540.7	2,355.2±2,320.9	1,814.5±1,849.5	2,378.4±2,221.4	ns
Kcal MET	1,673.4±1,557.3	2,740.0±3,037.3	2,258.1±2,234.7	2,708.7±2,651.8	ns
MET Score	1.9±0.9	1.7±0.8	1.8±0.9	1.7±0.9	ns

Data are presented as Means ± SD. BMI – Body Mass Index; Meals/Day – meals per day; MET – metabolic equivalents measured by the International Physical Activity Questionnaire (units = 1 kcal/kg/hour); MET Score – 1 is high – 2 is medium – 3 is low; Averages were calculated within each quartile and then assessed for significance one-way ANOVA and the *p for trend analysis*; For MET data, 18 participants' data was removed as being a physiological outliers (n = 3 in Never, n = 5 in <1x week, n = 7 in 1x week, and n = 3 in >1x week).

Table 4 – Physical activity and Other Continuous Variable Data for Men

	Never n= 65 29.1%	<1x week n= 94 35.4%	1x week n= 65 24.7%	>1x week n= 42 15.2%	P for trend
Age (y)	34.1±11.0	33.3±10.4	35.1±12.5	38.5±12.6	ns
Height (meters)	1.8±0.2	1.8±0.1	1.8±0.2	1.8±0.3	ns
Weight (kg)	85.8±25.0	81.2±17.6	82.1±24.6	82.9±20.3	ns
BMI (kg/m^2)	27.1±11.6	25.5±5.0	25.7±7.3	25.5±6.5	ns
Alcohol (drinks/day)	2.9±3.8	3.1±3.6	4.3±5.3	3.5±4.6	ns
Sleep (h/night)	7.3±1.4	7.1±1.3	6.9±1.5	7.0±1.3	ns
Stress Level (0-10 scale)	4.0±2.6	3.2±2.4	3.2±2.6	3.4±1.8	ns
Meals/Day	3.6±2.2	3.5±1.6	4.3±5.3	3.7±1.9	ns
Week Day Sitting Min	243.6±155.6	400.7±320.9[a]	366.2±350.3	310.1±208.1	ns
Weekend Sitting Min^	394.9±296.6	358.2±264.3	280.7±262.9	280.6±209.0	<0.01
Vigorous MET^	781.8±1,321.1	1,335.4±1,407.4	1,362.8±1,730.7	1,745.3±1,775.7[b]	<0.003
Moderate MET	611.9±1,490.5	662.8±921.2	733.45±1,073.5	457.4±712.8	ns
Walking MET^	687.3±763.2	736.3±873.3	687.3±763.2	844.7±914.9	<0.02
Total MET^	1,940.2±2,784.3	2,734.5±2,345.9	2,783.5±2,912.9	3,076.4±2,628.9	<0.01
Kcal MET^	2,794.6±4,189.1	3,762.0±3,501.2	4,126.1±5,075.6	4,298.5±3,760.1	<0.01
MET Score	2.0±0.9	1.6±0.8	1.7±0.9	1.5±0.7	ns

Data are presented as Means ± SD. BMI – Body Mass Index; Meals/Day – eating sessions per day; MET – metabolic equivalents measured by the International Physical Activity Questionnaire (units = 1 kcal/kg/hour); MET Score – 1 is high – 2 is medium – 3 is low; Averages were calculated within each quartile and assessed for significance using a one-way ANOVA and the *p for trend analysis*; [a] indicates higher week day sitting minutes in <1x week versus Never ($p < 0.005$); [b] indicates higher vigorous MET in >1x week versus Never ($p < 0.02$). ^ indicates that as SWF increases, weekend sitting minutes decrease (*p for trend* < 0.01), and several other measures of physical activity increase (vigorous MET (*p for trend* < 0.003), walking MET (*p for trend* < 0.02), total MET (*p for trend* < 0.01), and kcal MET (*p for trend* < 0.01). For MET data, 30 participants' data was removed as being a physiological outliers (n = 7 in Never, n = 9 in <1xweek, n = 10 in 1x week, and n = 4 in >1x week).

Table 5 – Nutrition and Dietary Habits

		Never n=129 24.2%	%	<1x week n=187 35.1%	%	1x week n=127 23.8%	%	>1x week n=90 16.9%	%	*P for trend*
Nutrition consult	Yes	11	8.5%	16	8.7%	14	11.1%	11	12.4%	
	No	118	91.5%	169	91.4%	112	88.9%	78	87.6%	
Know DGA [a]	Yes	52	40.3%	75	40.5%	50	39.7%	50	56.2%	
	No	77	59.7%	110	59.5%	76	60.3%	39	43.8%	
Used DGA?	Yes	20	38.5%	31	41.3%	25	51.0%	28	56.0%	
	No	32	61.5%	44	58.7%	24	49.0%	22	44.0%	
Do you eat breakfast regularly?	Yes	85	65.9%	122	66.0%	93	74.4%	54	60.7%	
	No	44	34.1%	63	34.0%	32	25.6%	35	39.3%	
Do you eat grains?	Yes	122	94.6%	169	91.4%	107	85.6%	73	82.0%	
	No	7	5.4%	16	8.7%	18	14.4%	16	18.0%	
Preferred Grain[c]	Whole	47	38.5%	93	55.0%	47	44.3%	47	64.4%	
	Equal mix	37	30.3%	41	24.3%	34	32.1%	14	19.2%	
	Refined	38	31.2%	35	20.7%	25	23.6%	12	16.4%	
Do you eat nuts?	Yes	102	79.1%	142	76.8%	106	84.8%	72	80.9%	
	No	27	20.9%	43	23.2%	19	15.2%	17	19.1%	
Sensitivity or allergy to gluten? [a]	Yes	6	4.7%	10	5.5%	7	5.6%	12	13.5%	
	No	123	95.3%	173	94.5%	118	94.4%	77	86.5%	
Do you use low calorie sweeteners?[a]	Yes	19	15.0%	24	13.2%	19	16.0%	25	28.7%	
	Maybe	18	6.3%	11	6.0%	8	6.7%	8	9.2%	
	No	100	78.7%	147	80.8%	92	77.3%	54	62.1%	
Do you consume	Yes	95	74.2%	136	74.3%	82	66.7%	81	91.0%	
	No	33	25.8%	47	25.7%	41	33.3%	8	9.0%	
How often do you drink regular soda?	Never	54	42.5%	81	44.5%	48	39.7%	46	52.3%	
	<1x month	18	14.2%	32	17.6%	21	17.4%	15	17.1%	
	<1x week	13	10.2%	14	7.7%	14	11.6%	10	11.4%	
	>1x week	22	17.3%	38	20.9%	20	16.6%	9	10.3%	
	1x day or more	20	15.7%	17	9.4%	18	14.9%	8	9.1%	
	Score	**2.5**		**2.3**		**2.5**		**2.1**		**<0.001**
How often do you drink diet soda? [d]	Never	91	71.7%	126	69.2%	82	67.8%	50	57.5%	
	<1x month	17	13.4%	22	12.1%	8	6.6%	5	5.8%	
	<1x week	8	6.3%	7	3.9%	5	4.1%	7	8.1%	
	>1x week	6	4.8%	14	7.7%	12	10.0%	16	18.4%	
	1x day or more	5	4.0%	13	7.3%	14	11.6%	9	10.5%	
	Score	**1.6**		**1.7**		**1.9**		**2.2**		**<0.001**
How often do you eat vegetables?	1x week or less	19	14.8%	30	16.2%	17	13.6%	11	12.4%	
	Several x week	46	35.7%	50	27.0%	37	29.6%	21	23.6%	
	1x day	26	20.2%	45	24.3%	39	31.2%	22	24.7%	
	2x day	25	19.4%	48	26.0%	21	16.8%	27	30.3%	
	3x> day	13	10.1%	12	6.5%	11	8.8%	8	9.0%	
	Score	**2.7**		**2.8**		**2.8**		**3.0**		**ns**
How often do you eat fruit?	1x week or less	34	26.5%	46	24.9%	39	31.2%	24	27.0%	
	Several x week	45	34.9%	53	28.7%	41	32.8%	23	25.8%	
	1x day	32	24.8%	46	24.9%	21	16.8%	20	22.5%	
	2x day	13	10.1%	30	16.2%	18	14.4%	16	18.0%	
	3x> day	5	3.9%	10	5.4%	6	4.8%	6	6.7%	
	Score	**2.3**		**2.5**		**2.3**		**2.5**		**ns**
Do you eat out?	Never	5	4.1%	10	5.5%	8	6.7%	2	2.3%	
	<1x month	19	15.5%	47	25.8%	27	22.5%	24	27.6%	
	<1x week	35	28.5%	44	24.2%	25	20.8%	17	19.5%	
	1x week	30	24.4%	47	25.8%	37	30.8%	28	32.2%	

Question	Answer	n	%	n	%	n	%	n	%	p
	Several x week	34	27.7%	34	18.7%	23	19.1%	17	18.4%	
	Score	**3.6**		**3.3**		**3.3**		**3.4**		**ns**
Do you snack?	Yes, between	20	15.8%	17	9.3%	18	14.9%	14	15.9%	
	Yes, only	34	26.8%	38	20.9%	43	35.5%	25	28.4%	
	Yes (3-6x/	31	24.4%	44	24.2%	16	13.2%	15	17.1%	
	Yes (1-	18	14.2%	39	21.4%	18	14.9%	13	14.8%	
	No	24	21.5%	44	24.2%	26	21.5%	21	23.9%	
	Score	**2.9**		**3.3**		**2.9**		**3.0**		**ns**
Do you read the Nutrition Facts on grocery items? [a]	Almost always	28	21.7%	53	28.7%	22	17.6%	40	44.9%	
	Usually	42	32.6%	59	31.9%	46	36.8%	23	25.8%	
	Sometimes	38	29.5%	45	24.3%	46	36.8%	19	21.4%	
	Rarely	21	16.3%	28	15.1%	11	8.8%	7	7.9%	
	Score	**2.4**		**2.3**		**2.3**		**1.9**		**<0.01**
How important is healthy eating? [a]	Unimportant	6	4.7%	4	2.2%	1	0.8%	1	1.1%	
	Somewhat	43	33.3%	51	27.6%	28	22.6%	13	14.6%	
	Important	47	36.4%	75	40.5%	56	45.2%	27	30.3%	
	Very Important	33	25.6%	55	29.7%	39	31.5%	48	53.9%	
	Score^	**2.8**		**3.0**		**3.1**		**3.4**		**<0.001**

DGA – Dietary Guidelines of America; How often do you eat out? - includes restaurants, fast food chains, grocery store made to order food or salad bar; Scores for categorical variables were calculated by ranking answer selections numerically (mean frequency). Average scores were then calculated within each quartile and assessed for significance with a one-way ANOVA (or Chi Square for yes/maybe/no questions) and then for the *p for trend analysis*; [a] indicates a significant difference in >1x week compared to all other SWF groups ($p < 0.05$ for proportionately more 'yes' for DGA; $p < 0.001$ for higher importance for healthy eating; $p < 0.002$ for reading nutrition facts more often; $p < 0.007$ for proportionately more 'yes' for caffeine consumption; $p < 0.05$ for proportionately greater use of low calorie sweeteners; $p < 0.05$ for proportionately higher gluten sensitivity); [b] indicates 'yes' for proportionately more grain intake in Never compared to >1x week ($p < 0.01$); [c] indicates proportionately more whole grain and mixed grain consumption in >1x week and <1x week compared to Never ($p < 0.002$); [d] indicates greater diet soda consumption in >1x week compared to <1x week and Never ($p < 0.004$); ^ indicates that as SWF increases, importance of healthy eating increases (*p for trend*, $p < 0.001$), frequency of reading nutrition facts increases (*p for trend*, $p < 0.01$), and diet soda consumption increases (*p for trend*, $p < 0.001$) and regular soda consumption decreases (*p for trend*, $p < 0.001$).

Table 6 – Health Indicators

		Never n =129	%	<1x week n =187	%	1x week n =127 23.8%	%	>1x week n =90	%	P for trend
Medications [a]	Diabetes	3	10.0%	7	18.4%	4	11.4%	4	8.2%	
	Hypothyroidis	4	13.3%	7	18.4%	5	14.3%	6	12.2%	
	Hypertension	7	23.3%	8	21.1%	6	17.1%	10	20.4%	
	Statins	4	13.3%	5	13.2%	5	14.3%	10	20.4%	
	Anti-	12	40.0%	11	29.0%	15	42.9%	19	38.8%	
	Any	24	18.6%	23	12.3%	26	20.5%	28	31.1%	
	Score^	**0.2**		**0.1**		**0.2**		**0.3**		**0.05**
Currently	Yes	19	14.7%	28	15.1%	15	11.8%	11	12.2%	
Smoke?	No	110	85.3%	157	84.9%	112	88.2%	79	87.8%	
History of	Yes	36	27.9%	53	28.5%	31	24.6%	29	32.2%	
Smoking	No	93	72.1%	133	71.5%	95	75.4%	61	67.8%	
Currently	Yes	64	49.6%	93	50.0%	50	39.4%	41	45.6%	
	No	65	50.4%	93	50.0%	77	60.6%	49	54.4%	
How often do	Never	8	13.1%	17	18.3%	10	20.0%	6	14.6%	
You drink?	<1x week	20	32.8%	28	30.1%	14	28.0%	7	17.1%	
	1x week	11	18.0%	22	23.7%	19	38.0%	8	19.5%	
	>1x week	19	31.2%	21	22.6%	5	10.0%	16	39.0%	
	Daily	6	9.8%	5	5.4%	2	4.0%	4	9.8%	
	Score	**2.9**		**2.7**		**2.5**		**3.1**		**ns**
Health	Yes	104	80.6%	158	85.0%	106	84.1%	80	88.9%	
Insurance?	No	25	19.4%	28	15.0%	20	15.9%	10	11.1%	
Visit	Yes	78	60.5%	117	62.9%	81	63.8%	60	66.6%	
Annually?	No	51	39.5%	69	37.1%	46	36.2%	30	33.3%	
Experience	Never	14	10.9%	20	10.8%	15	11.8%	6	6.8%	
Stress Level	Occasionally	72	55.8%	106	57.0%	81	63.8%	50	55.6%	
	Frequently	38	29.5%	47	25.3%	27	21.3%	29	32.2%	
	Constantly	5	3.9%	13	7.0%	4	3.2%	5	5.6%	
	Score	**2.3**		**2.3**		**2.2**		**2.4**		**ns**
Chronic	CVD and Risk	17	11.5%	25	12.1%	15	10.9%	11	10.2%	
	Mental	40	27.0%	55	26.7%	50	36.2%	34	31.5%	
	Chronic Pain	9	6.1%	19	9.2%	12	8.7%	12	11.1%	
	Hepatitis	34	23.0%	20	9.7%	29	21.0%	21	19.4%	
	Other	48	32.4%	65	31.6%	32	23.2%	28	25.9%	
	Any	73	56.6%	90	48.1%	65	51.2%	54	60%	
	Score	**1.2**		**1.1**		**1.1**		**1.2**		**ns**

CVD – cardiovascular disease; "CVD and Risk" – refers to atherosclerosis, coronary artery disease, coronary heart disease, type 2 diabetes, pre-diabetes, heart attack, heart failure, high triglycerides, high cholesterol, stroke, and high blood pressure; "Currently Drink" and "How often do you drink" – refers to alcohol consumption; "Mental Disability" – refers to anxiety, Alzheimer's, autism spectrum disorders, depression, eating disorder, schizophrenia, other psychotic disorders; "Chronic Pain" – refers to arthritis, chronic obstructive pulmonary disease, Chron's Disease or irritable bowel syndrome, lower back pain, osteoporosis, polycystic ovarian syndrome; "Other" – refers to asthma, celiac disease, chronic kidney disease, urinary incontinence, cancer, HIV/AIDS; Percentages for variables are calculated within each quartile; Percentage for "Any Disease/Risk" is calculated based on the number of people within each quartile that reported at least 1 chronic disease or risk; Score for Chronic Diseases represents "All Disease/Risk"; Percentage for "Any Medications" is calculated based on the number of people within each quartile that reported using at least 1 medication; Score for Medications represents "Any Medications"; Scores for categorical variables were calculated by ranking answer selections numerically (mean frequency). Average scores were then calculated within each quartile and assessed for significance with a one-way ANOVA (or Chi-Square for yes/maybe/no questions) and then for the *p for trend analysis*; [a] indicates proportionally greater use of Any Medication in >1x week compared to <1x week ($p < 0.003$).); ^ indicates that as SWF increases, "Any Medication" use increases.

Table 7 – Weight History, Self-Monitoring, and Screen Time

		Never n=129 24.2%	%	<1x week n =187 35.1%	%	1x week n =127 23.8%	%	>1x week n =90 16.9%	%	*P for trend*
Describe your current weight	Underweight	11	8.5%	10	5.4%	6	4.8%	2	2.3%	
	Normal	60	46.5%	103	55.4%	56	44.5%	42	23.5%	
	Overweight	58	45.0%	73	39.3%	64	50.8%	45	25.2%	
	Score	**2.4**		**2.4**		**2.5**		**2.5**		**ns**
Have you lost weight?	Yes	105	81.4%	143	76.5%	108	85.0%	81	90.0%	
	No	24	18.6%	44	23.5%	19	15.0%	9	10.0%	
Weight loss program?	Yes	18	14.0%	30	16.0%	28	22.1%	26	28.9%	
	No	107	83.0%	148	79.1%	93	73.2%	59	65.6%	
Reward when health goal met? [a]	Yes	22	15.9%	27	14.8%	39	32.2%	24	27.6%	
	No	55	43.7%	98	53.9%	59	48.8%	53	60.9%	
	No Health	51	40.5%	57	31.3%	23	19.0%	10	11.5%	
Do you track Food? [a]	Yes	11	8.7%	18	9.9%	26	21.5%	26	30.0%	
	No	116	91.3%	164	90.1%	95	64.6%	61	54.0%	
Do you track your activity?	Yes	30	23.6%	43	23.6%	34	28.1%	41	47.0%	
	No	97	76.4%	139	76.4%	87	71.9%	46	36.2%	
Do you track your weight?	Yes	6	4.7%	16	8.8%	24	19.8%	29	33.3%	
	No	121	95.3%	165	91.2%	97	80.2%	58	60.7%	
Week day TV time	None	8	6.3%	10	5.5%	5	4.2%	5	5.8%	
	< 1 hr	18	14.2%	36	19.9%	25	21.2%	19	21.8%	
	1-2 hr	49	38.6%	66	36.5%	40	33.9%	29	33.3%	
	2-3 hr	26	20.5%	39	21.6%	28	23.7%	20	23.0%	
	3-4 hr	10	7.9%	16	8.8%	9	7.6%	9	10.3%	
	>4 hr	16	12.6%	14	7.7%	11	9.3%	5	5.8%	
	Score	**3.5**		**3.3**		**3.4**		**3.3**		**ns**
Weekend TV time	None	7	5.5%	8	4.4%	2	1.7%	5	5.8%	
	< 1 hr	18	14.2%	20	11.1%	32	26.9%	10	11.5%	
	1-2 hr	38	29.9%	56	30.9%	38	31.9%	27	31.0%	
	2-3 hr	24	18.9%	46	25.4%	20	16.8%	24	27.6%	
	3-4 hr	18	14.2%	27	14.9%	7	5.9%	14	16.1%	
	>4 hr	22	17.3%	24	13.3%	20	16.8%	7	8.1%	
	Score	**3.7**		**3.7**		**3.6**		**3.6**		**ns**
Week day social media time	None	4	3.2%	5	2.8%	3	2.5%	2	2.3%	
	< 1 hr	29	22.8%	44	24.3%	33	27.7%	16	18.4%	
	1-2 hr	34	26.8%	54	29.8%	30	25.2%	34	39.4%	
	2-3 hr	24	18.9%	28	15.5%	23	19.3%	16	18.4%	
	3-4 hr	9	7.1%	13	7.2%	12	10.1%	5	5.8%	
	>4 hr	27	21.3%	37	20.4%	8	15.1%	14	16.1%	
	Score	**3.6**		**3.6**		**3.5**		**3.6**		**ns**
Weekend social media time	None	6	4.7%	5	2.8%	2	1.7%	2	2.3%	
	< 1 hr	27	21.3%	46	25.4%	32	26.9%	19	21.8%	
	1-2 hr	37	29.1%	53	29.3%	38	31.9%	30	34.5%	
	2-3 hr	16	12.6%	31	17.1%	20	16.8%	17	19.5%	
	3-4 hr	14	11.0%	13	7.2%	7	5.9%	6	6.9%	
	>4 hr	27	21.3%	33	18.2%	20	16.8%	13	14.9%	
	Score	**3.6**		**3.6**		**3.5**		**3.5**		**ns**

"Have you lost weight" – refers to weight loss within the past year; "Weight loss program?" – refers to past participation in a weight loss program (i.e., Nutrisystem, Weight Watchers, Atkins diet); "Reward when health goal met?" refers to whether the individual rewards themselves in some way when your health goals are met; Week day and weekend TV included videos on DVD, Blue Ray, Netflix, Hulu, and Amazon Prime; Week day and weekend social media/screen time included computer, video games, email, Facebook, Instagram, and Twitter; Scores for categorical variables were calculated by ranking answer selections

numerically. Percentages for variables are calculated within each quartile. Average scores were then calculated within each quartile and assessed for significance with a one-way ANOVA (or Chi-Square for yes/maybe/no questions) and then for the *p for trend analysis*; [a] indicates proportionately more 'yes' in >1x week and 1x week compared to <1x week or Never ($p < 0.001$ for rewarding when health goals are met; $p < 0.001$ for food tracking; $p < 0.001$ for tracking weight, respectively); [b] indicates proportionately more 'yes' in >1x week for physical activity tracking compared to all other SWF groups ($p < 0.004$).

Table 8 – U.S. Representation

State	Never n =129 24.2% Freq.	%	<1x week n =187 35.1% Freq.	%	1x week n =127 23.8% Freq.	%	>1x week n =90 16.9% Freq.	%	Total	%
Alabama	2	1.7	0	0	1	.9	2	2.4	5	1.0
Alaska	0	0	0	0	0	0	0	0	0	0
Arkansas	0	0	0	0	1	.9	2	2.4	3	.6
California	13	10.7	11	6.5	10	8.5	11	12.9	45	9.2
Colorado	1	.8	2	1.2	0	0	0	0	3	.6
Conn.	1	.8	1	.6	0	0	0	0	2	.4
Delaware	0	0	0	0	0	0	0	0	0	0
Florida	10	8.3	14	8.3	6	5.1	3	3.5	33	6.7
Georgia	31	25.6	37	22.0	26	22.2	17	20	111	22.6
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	0	0	0	0
Illinois	2	1.7	2	1.2	2	1.7	5	5.88	11	2.2
Indiana	3	2.5	3	1.8	2	1.7	1	1.2	9	1.8
Iowa	0	0	0	0	0	0	0	0	0	0
Kansas	3	2.5	0	0	2	1.7	0	0	5	1.0
Kentucky	1	1.7	2	1.2	2	1.7	0	0	5	1.0
Louisiana	0	0	2	1.2	3	2.6	0	0	5	1.0
Maine	0	0	0	0	0	0	0	0	0	0
Maryland	0	0	2	1.2	3	2.6	2	2.4	7	1.4
Massachus.	5	4.1	2	1.2	3	2.6	2	2.4	12	2.4
Michigan	3	2.5	12	7.1	4	3.4	2	2.4	21	4.3
Minnesota	1	.8	0	0	1	.9	3	3.5	5	1.0
Mississippi	0	0	1	.6	1	.9	0	0	2	.2
Missouri	0	0	2	1.2	2	1.7	1	1.2	5	1.0
Montana	0	0	0	0	0	0	1	1.2	1	.2
Nebraska	0	0	1	.6	1	.9	0	0	2	.4
Nevada	1	.8	0	0	0	0	1	1.2	2	.4
New Ham.	0	0	1	.6	0	0	0	0	1	.2
New Jers.	1	.8	3	1.8	3	2.6	1	1.2	8	1.6
New Mex.	0	0	1	.6	0	0	0	0	1	.2
New York	9	7.4	10	6.0	12	10.2	4	4.7	35	7.1
N. Carol.	2	1.7	8	4.8	4	3.4	3	3.5	17	3.5
North Dak.	0	0	1	.6	0	0	0	0	1	.2
Ohio	4	3.3	7	4.2	3	2.6	2	2.4	16	3.3
Oklahoma	2	1.7	0	0	2	1.7	2	2.4	6	1.2
Oregon	2	1.7	3	1.8	0	0	0	0	5	1.0
Penn.	3	2.5	8	4.8	2	1.7	3	3.5	16	3.3
Rhode Is.	0	0	0	0	1	.9	0	0	1	.2
South Car	1	.8	1	.6	2	1.7	3	3.5	7	1.4
South Dak.	0	0	0	0	0	0	0	0	0	0
Tenness	5	4.1	1	.6	4	3.4	1	1.2	11	2.2
Texas	6	5.0	10	6.0	5	4.3	6	7.1	27	5.5
Utah	1	.8	0	0	0	0	0	0	1	.2
Vermont	0	0	0	0	0	0	0	0	0	0
Virginia	2	1.7	6	3.6	2	1.7	4	4.7	14	2.9
Washington	2	1.7	8	4.8	3	2.6	2	2.4	15	3.1
West Virgi.	0	0	0	0	0	0	0	0	0	0
Wisconsin	2	1.7	3	1.8	0	0	1	.2	6	1.2
Wyoming	0	0	0	0	0	0	0	0	0	0
Arizona	2	1.7	3	1.8	4	3.4	0	0	9	1.8

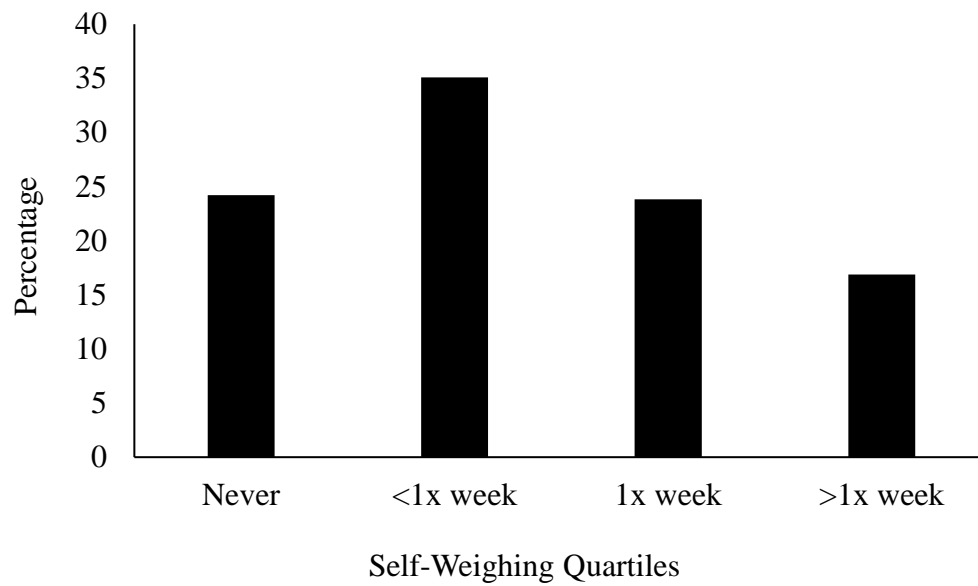**Figure 1.** Self-weighing frequency split into 4 quartiles: Never, Less than 1 time a week (<1x week), 1 time a week (1x week), and Several times a week or more (>1x week) (which includes 3 previous categories of Several times a week, Daily, and More than once daily).
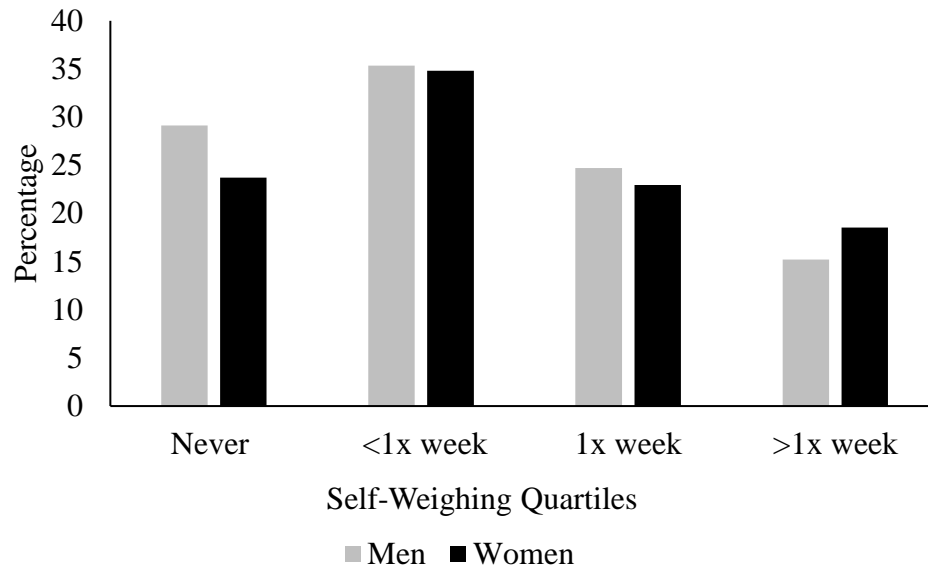
Figure 2. Self-weighing frequency split into 4 quartiles by sex: Never, Less than 1 time a week (<1x week), 1 time a week (1x week), Several times a week or more (>1x week). There was no significant difference in SWF between men or women.
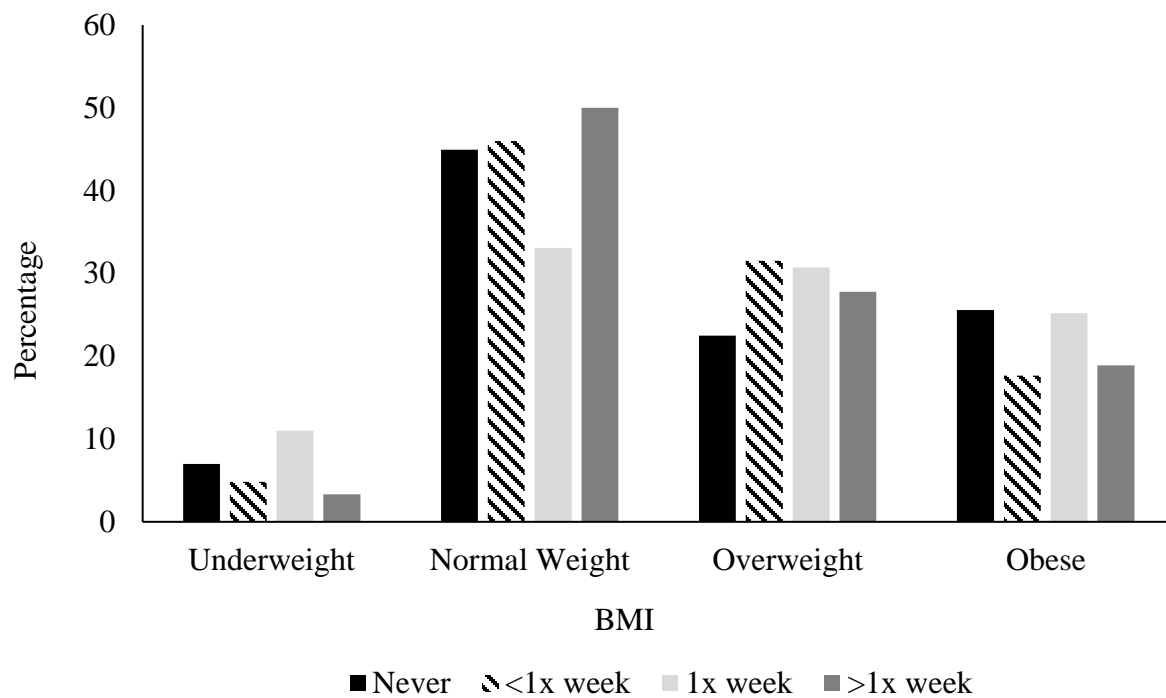
Figure 3: Self-weighing frequency split into 4 quartiles by BMI: Never, Less than 1 time a week (<1x week), 1 time a week (1x week), Several times a week or more (>1x week). There was no significant differences in SWF between BMI categories. BMI – body mass index (kg/m^2).

CHAPTER 4

SUMMARY AND CONCLUSIONS

While there is a growing body of research on the efficacy of SWF as a component of a behavioral weight loss program, there is no previous research assessing self-weighing practices among U.S. adults independent of a weight loss program. There were three primary objectives of this thesis. We wanted to determine self-weighing frequency (SWF) among a sample of U.S. adults, determine if there were differences between men and women by SWF, and we also wanted to examine the relationship between SWF and a number of health-related measures such as BMI, PA, dietary habits, chronic diseases, and other health-related measures. Previous research has shown that SWF is associated with weight loss [49], weight loss maintenance [6], and the prevention of weight gain [27]. Previous research has also shown SWF to be an effective tool when used in conjunction with other weight loss self-monitoring tools such as food diaries and PA tracking [37]. However, prior to this study, there was no literature available on current SWF practices among the U.S. Our study is the first to assess SWF in a general population independent of a weight loss/maintenance program and examine its association with other health outcomes.

The results presented in chapter 3 revealed that almost 60% of adults reported weighing less than one time a week and of those, approximately 25% never weigh themselves. Interestingly, there were no differences for SWF between men and women or by BMI category. Previous research has revealed that self-weighing several times a week or more is associated with significant weight loss and long term weight maintenance [27], yet the majority of U.S. adults

in this study reported weighing less frequently. Surprisingly, SWF in our study was not associated with a number of outcomes including BMI, stress, hours of sleep, screen time, weight loss history, alcohol and smoking use, snacking habits, age, educational level, screen time, chronic disease, or by sex. However, as SWF increased, there was an increase in income level, less sitting time, more physical activity, and some healthier eating indicators. Participants in this study who weighed SWF >1x week reported more vigorous physical activity compared to those who performed self-weighing less. In males, SWF >1x week or more also had higher levels of vigorous activity compared to participants who never weigh. As SWF increased, vigorous activity, walking activity, and total activity increased and weekend sitting minutes decreased across groups in men. These differences were not found in PA for women. This was a self-report questionnaire, and previous literature has shown that adults are likely to over- or under-report answers concerning their weight, height, and physical activity, which can create reporting bias and may have led to the lack of significant differences between SWF groups [63,64,67]. Participants who weighed more frequently reported more healthy dietary habits such as reading nutrition labels, opting for low-calorie beverages and sweeteners, and choosing whole/mixed grains over refined grains, more so, than SWF groups that reported weighing less often. Finally, higher SWF participants also reported practicing greater overall medication use and other self-monitoring techniques such as tracking food and weight change, more so, than SWF groups who reported weighing less often.

One of the main possibilities for the lack of significant differences among SWF may be attributed to a very homogenous sample and an insufficient number of participants reporting daily self-weighing reducing the original six groups to four, which may have hidden or masked significant differences in those who daily self-weigh. We also had several challenges with

reaching participants across the U.S. leading to a majority of participants coming from the southeast, particularly Georgia. This, in combination with the convenience sample, may have prevented us from detecting significant differences. Furthermore, this was all self-reported data, and research has shown that people innately over-report height and underreport weight [64]. Future studies should consider a more controlled approach in a laboratory setting to collect objective health data. Also, future studies should look towards more susbstantial health examinations surveys such as NHANES to formulate optimal choices/options for related questions to improve data collection and analysis.

Altogether, the study was to first examine the SWF among U.S. adults independent of a weight management program and its association to a number of health-related factors. The results of this study indicate that SWF is relatively low among U.S. adults and may not be used to its full potential to assist in weight management in the general population. However, given the sample size of this study and the self-report bias potential, future studies are warranted to elucidate SWF practices in US adults and its relationship to a number of health-related outcomes.

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APPENDIX

A

CONSORT Flow Diagram
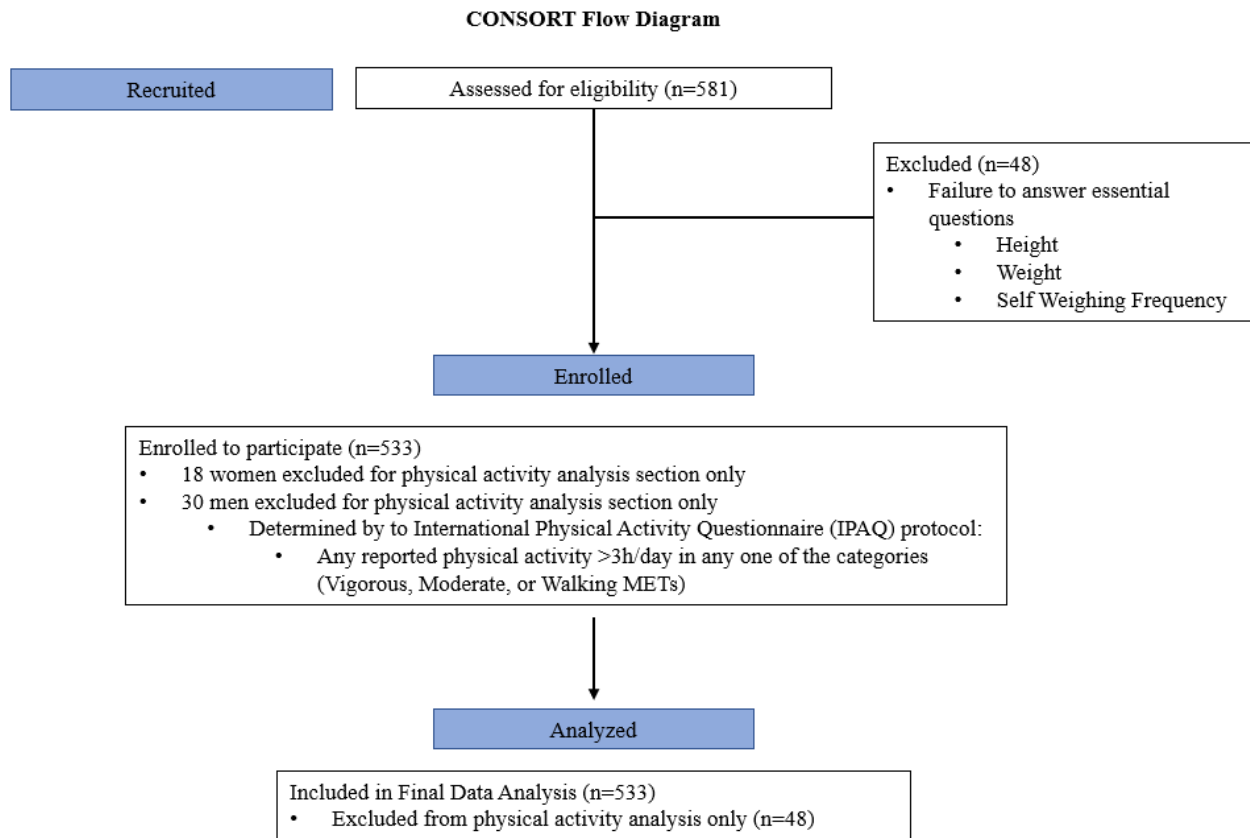
B

QUESTIONNAIRE

An Assessment of Health Practices and Behavior in Adults

Q1 What is your age?

_____

Q4 What is your sex?

○ Male (1)

○ Female (2)

Q5 What is your race?

○ White (1)

○ Black or African American (2)

○ American Indian or Alaska Native (3)

○ Asian (4)

○ Native Hawaiian or Pacific Islander (5)

○ Other (6)

Q6 Is your ethnicity Hispanic or Latino?

○ Yes (1)

○ No (2)

Q2 Are you currently married?

○ Yes (1)

○ No (2)

Q3 If you are not married, please specify:

○ Never Married (1)

○ Living with partner (2)

○ Divorced (3)

○ Widowed (4)

○ Separated (5)

○ Other (6)

Q7 How many years of education have you COMPLETED?

☐ Elementary (grades 1-8) (1)

☐ High school (grades 9-12) (2)

☐ Vocational/Technical school (3)

☐ 2-year college degree (4)

☐ 4-year college degree (5)

☐ Graduate school (e.g. master's or PhD) (6)

☐ Professional school (e.g. law school, medical school) (7)

Q9 What was your major/area of study for your highest degree obtained?

_____

Q8 What is your current employment status?

○ Full time - (35 or more hours a week) (1)

○ Part time - (less than 35 hours a week) (2)

○ Unemployed full time college student (10)

○ Laid off or unemployed, but looking for work (3)

○ Laid off or unemployed, but not looking for work (4)

○ Retired, not working at all (5)

○ Retired, working part time (6)

○ Disabled (7)

○ Full time homemaker (8)

○ Other, please specify (9) _____

Q10 What is your primary occupation? If you are retired and not working, what WAS your
primary occupation?

_____

Q11 Do you have any children?

○ Yes (1)

○ No (2)

Q12 How many children do you have?

○ 1 (1)

○ 2 (2)

○ 3 (3)

○ 4 (4)

○ 5 (5)

○ 6 (6)

○ 7 (7)

○ 8 (8)

○ 9 or more (9)

Q13 Are you pregnant?

○ Yes (1)

○ No (2)

Q14 Are you nursing?

○ Yes (1)

○ No (2)

Q15 How many people live in your household including yourself?

☐   Adults (over 18): (1) _____

☐   Children (under 18): (2)

_____

Q16 What is your total gross household income before taxes?

○ $0-14,999 (1)

○ $15,000-29,999 (2)

○ $30,000-44,999 (3)

○ $45,000-59,999 (4)

○ $60,000-74,999 (5)

○ $75,000-89,999 (6)

○ $90,000-and above (7)

○ I choose not to answer (8)

Q17 What is your height? (In feet and inches)

	0 1 2 3 4 5 6 7 8 9 10 11 12
Feet ()	
Inches ()	

Q18 To the best of your knowledge, what is your weight? (In pounds)

_____

Q19 When was the last time you weighed yourself?

○ Today (1)

○ This week (2)

○ This month (3)

○ 1-3 months ago (4)

○ 1-3 months ago (5)

○ 4-6 months (6)

○ 6 months or more ago (7)

Q20 How do you describe your current weight?

○ Underweight (1)

○ About the right weight (6)

○ Overweight (7)

Q21 If you could choose any weight, what would your "ideal" body weight be? (In pounds)

_____

Q22 Have you been able to maintain your current weight within the past 6 months?

○ Yes (1)

○ No (2)

Q23 If no, has your weight increased or decreased?

○ Increased (1)

○ Decreased (2)

Q24 Have you lost weight before?

○ Yes (1)

○ No (2)

Q25 If yes, when have you lost weight before?

○ In the last week (1)

○ Within the last month (2)

○ Within the last three months (3)

○ Within the last 6 months (4)

○ Within the last year (5)

○ More than one year ago (6)

Q26 Was your weight loss intentional?

○ Yes (1)

○ No (2)

Q27 How much weight did you lose? (In pounds)

_____

Q28 Have you ever participated in a weight loss program?

○ Yes (1)

○ Maybe (2)

○ No (3)

Q29 When may have participated?

○ currently involved (1)

○ In the last 6 months (2)

○ Between 6 and 12 months ago (3)

○ 1-2 years ago (4)

○ More than 2 years ago (5)

Q30 In the past, have you participated in any of the following weight loss programs? (Please select all that apply)

☐ Nutrisystem (1)

☐ WeightWatchers (2)

☐ MayoClinic diet (3)

☐ Southbeach diet (4)

☐ Jenny Craig diet (5)

☐ DASH diet (6)

☐ Atkins diet (7)

☐ Intermittent fasting or Alternate Day fasting (8)

☐ Paleo diet (9)

☐ Whole 30 (10)

☐ Ketogenic diet (11)

☐ Step One diet (American Heart Association diet) (12)

☐ Other: Please specify (13)

_____

Q31 Out of the following weight loss tools, which do you find the most useful? (Select all that apply)

☐ Tracking food/calories (1)

☐ Physical activity (2)

☐ Self-weighing (3)

☐ Dieting (4)

☐ Eating organic (5)

☐ Diet pills or medications (6)

☐ Protein supplements (7)

☐ Eating no fat (8)

☐ Visual feed-back and tips from an app (9)

☐ Never tried any of these methods (10)

Q32 Do you own a scale? (To weigh yourself)

○ Yes (1)

○ No (2)

Q150 Do you have access to a scale? (ex: gym, work place, etc.)

○ Yes (1)

○ No (2)

Q33 During the past month, how often did you weigh yourself?

○ Never (1)

○ Less than once a week (3)

○ Once a week (4)

○ Several times a week (5)

○ Daily (6)

○ More than once a day (7)

Q34 During the past 6 months, how often have you been weighing yourself?

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ Several times a week (5)

○ Daily (6)

○ More than once a day (7)

Q35 How often do you think it is best (or should be recommended) for individuals to weigh themselves?

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ several times a week (5)

○ Daily (6)

○ More than once a day (7)

Q36 Do you monitor your weight?

○ Yes (1)

○ No (2)

Q37 Do you keep a log or journal of your weight?

○ Yes (1)

○ No (2)

Q38 How much control do you think you have over your weight?

○ A great deal (1)

○ Some control (2)

○ Very little control (3)

○ None at all (4)

Q39 Medications

Please indicate if you take the following medicine or drugs (mark all that apply), and list all other medications or drugs you presently take. Please include over-the-counter medicines as well as prescription medications

	Name and Dosage and Frequency		
	Name (1)	Dosage (2)	Frequency taken (3)

Hypothyroidism drugs (e.g. Synthroid) (1)			
Statins (e.g. Lipitor, Crestor, Mevacor, Vytorin) (2)			
Anti-inflammatory drugs (e.g. aspirin, ibuprofen) (3)			
Diabetes drugs (e.g. Insulin, Lantus, Januvia, Invokana) (4)			
Hypertension drugs (e.g. Thiazide, Vasotec, Doivan, Norvasc, metoprolol) (diuretics, ACE inhibitors, ARBs, calcium channel blockers, beta blockers) (5)			
Other Medication (6)			

Other Medication (7)			
Other Medication (8)			

Q40 How much sleep do you typically get each night?

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Hours ()	
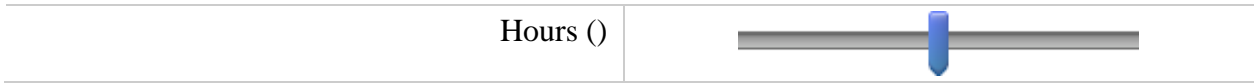
Q41 Have you been diagnosed with any of the following? Please select all that apply.

☐ Anxiety (22)

☐ Alzheimer's disease OR Dementia (26)

☐ Asthma (1)

☐ Arthritis (osteoarthritis or rheumatoid) (6)

☐ Atherosclerosis (18)

☐ Autism Spectrum Disorders (ASD) (2)

☐ Cancer - Please Specify: (9)

☐ Celiac disease (28)

☐ Chronic bronchitis, COPD (3)

☐ Chron's disease OR Irritable Bowel disease (34)

☐ Chronic kidney disease (10)

☐ Coronary artery disease (16)

☐ Coronary heart disease (17)

☐ Depression (23)

☐ Eating disorder (24)

☐ Type 1 Diabetes (8)

☐ Type 2 Diabetes (30)

☐ Pre-diabetes (high blood sugar) (31)

☐ Heart attack (4)

☐ Heart failure (11)

☐ High triglycerides (32)

☐ Hepatitis (Chronic Viral   A, B and C) (12)

☐ HIV/AIDS (13)

☐ High cholesterol (hyperlipidemia) (14)

☐ High blood pressure (hypertension) (15)

☐ Lower back pain (7)

☐ Osteoporosis (19)

☐ Polycystic Ovarian Syndrome (PCOS) (33)

☐ Sleep apnea (25)

☐ Stroke (5)

☐ Schizophrenia or other psychotic disorders (20)

☐ Urinary incontinence, problems controlling the bladder (21)

☐   Other - Please Specify: (27)

_____

Q42 Have you had bariatric surgery?

○ Yes (1)

○ No (2)

Q137 What type of bariatric surgery did you have?

○ Roux-en-Y gastric bypass (1)

○ Laparoscopic adjustable gastric banding (4)

○ Sleeve gastrectomy (5)

○ Duodenal switch with biliopancreatic diversion (6)

○ Other, please specify (3) _____

Q43 When did you have bariatric surgery? (mm/year)

_____

Q44 Do you have health insurance?

○ Yes (1)

○ No (2)

Q45 Do you visit a physician for an annual check-up/physical?

○ Yes (1)

○ No (2)

Q46 How often would you rate your stress level as high?

○ Never (1)

○ Occasionally (2)

○ Frequently (3)

○ Constantly (4)

Q47 On a scale from 1 to 10, 1 being none, and 10 being the highest, what is your current stress level?

	0 1 2 3 4 5 6 7 8 9 10
Stress Level ()	▬▬▬▬▮▬▬▬▬

Q48 What are the effects you feel from stress? Please select all that apply.

☐ Anxiety (1)

☐ Depression (2)

☐ Mood swings (3)

☐ Other - Please Specify: (7)

_____

☐ Insomnia (4)

☐ Over-eating (5)

☐ Under-eating (6)

Q49 Do you currently smoke?

○ Yes (1)

○ No (2)

Q50 Do you have a history of smoking?

○ Yes (1)

○ No (2)

Q51 Do you currently drink alcohol?

○ Yes (1)

○ No (2)

Q52 How often do you drink alcohol?

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ Several times a week (5)

○ Daily (6)

○ More than once a day (7)

Q53 How many drinks do you have when you drink alcohol? One standard drink is equal to one 12 ounce beer, five ounces of wine, or 1.5 ounces of distilled spirits.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

1 ()

Q54 Is there ANYTHING else you feel we should know about you or your current/past health?

○ Yes (1)

○ No (2)

Q55 Please explain any additional information about your current/past health

_____

Q56 Have you gone to a registered dietitian or nutritionist for a nutrition consult?

○ Yes (1)

○ No (2)

Q57 Did your nutrition consult help you learn more about nutrition?

○ Yes (1)

○ No (2)

Q58 Do you know about the Dietary Guidelines of America?

○ Yes (1)

○ No (2)

Q59 Have you used the Dietary Guidelines of America?

○ Yes (1)

○ No (2)

Q60 How important is healthy eating to YOU?

○ Unimportant (1)

○ Somewhat Important (2)

○ Important (3)

○ Very Important (4)

Q61 Do you read the Nutrition Facts labels on grocery items?

○ Almost always (1)

○ Usually (2)

○ Sometimes (3)

○ Rarely (4)

○ Never (5)

Q62 Where do you get your information about nutrition, dieting, or weight management? Select all that apply.

☐ Schools (1)

☐ Peers/friends (2)

☐ Health personnel (3)

☐ Parents/guardian (4)

☐ Radio/tv/magazines/books (5)

☐ Internet (6)

☐ Other Please Specify: (8)

_____

☐ I do not get or try to find nutrition information (9)

Q63 Do you take any of the following? Please mark all that apply.

☐   Multivitamin (1)

☐   BCAA supplements (2)

☐   Calcium supplement (3)

☐   Collagen supplement (4)

☐   CoQ10 supplement (5)

☐   Creatine supplement (6)

☐   Curcumin supplement (7)

☐   Detox tea (8)

☐   Energy drink (9)

☐   Fiber supplement (10)

☐   Glutamine supplement (11)

☐   Magnesium supplement (12)

☐   Meal replacement shake (13)

☐   pre or post workout shake/supplement (14)

☐   Prenatal vitamins (15)

☐   Probiotic supplement (16)

☐ Sleep aid supplement (17)

☐ B vitamin supplement (18)

☐ Iron supplement (19)

☐ Testosterone supplement (20)

☐ Turmeric supplement (21)

☐ Vitamin C supplement (22)

☐ Biotin supplement (23)

☐ Vitamin D supplement (24)

☐ Zinc supplement (25)

☐ Protein powder supplement (For example: Whey, Casein, Egg, Hemp (26)

☐ Other vitamins and minerals - Please specify: (27)

_____

☐ Fish oil supplement (28)

☐ Medicinal/herbal - Please specify (29)

_____

☐ Other - Please specify (30)

_____

Q64 Are you lactose intolerant?

○ Yes (1)

○ No (2)

Q65 Do you have a sensitivity or allergy to gluten?

○ Yes (1)

○ No (2)

Q66 Do you avoid any of the following food groups? Please select all that apply.

- [ ] Dairy (1)

- [ ] Red meat (2)

- [ ] Grains (3)

- [ ] Fruits (4)

- [ ] Vegetables (5)

- [ ] Fat (6)

- [ ] Added sugars (7)

- [ ] Carbohydrates (8)

Q67 Is breakfast a part of your NORMAL morning routine?

- ○ Yes (1)

- ○ No (2)

Q68 How often do you eat vegetables?

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ Several times a week (5)

○ Once a day (6)

○ Twice a day (7)

○ Three or more times a day (8)

Q69 How often do you eat fruit?

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ Several times a week (5)

○ Once a day (6)

○ Twice a day (7)

○ Three or more times a day (8)

Q70 Do you eat grains?

○ Yes (1)

○ No (2)

Q71

When you eat grains, which do you eat more of?

○ Whole grains (Examples of whole grains: brown rice, whole wheat bread, whole wheat pasta) (1)

○ Refined grains (Examples of refined grains: sourdough bread, white bread, white rice, multigrain bread) (2)

○ Equal mix (3)

Q144 Do you eat nuts?

○ Yes (4)

○ No (5)

Q148 Please use this graphic to answer the following question

Q138 If you eat PECANS, please select the type and frequency (please select all that apply)

	Frequency
Handful, one ounce (1/4 cup or 19 halves) (1)	▼ Never (1 ... Three or more times a day (8)
Pecan nut butter (11)	▼ Never (1 ... Three or more times a day (8)
small snack bag, 1-2.5 ounces (12)	▼ Never (1 ... Three or more times a day (8)
Baked good, ex: banana bread or scone (13)	▼ Never (1 ... Three or more times a day (8)
Small Can (4)	▼ Never (1 ... Three or more times a day (8)
Other, Please Specify (5)	▼ Never (1 ... Three or more times a day (8)

Q147 Please use this graphic to answer the following question

Q139 If you eat ALMONDS, please select the type and frequency (please select all that apply)

	Frequency
Handful, one ounce (24 almonds) (1)	▼ Never (1 ... Three or more times a day (8)
Almond nut butter (11)	▼ Never (1 ... Three or more times a day (8)
Small snack bag, 1-2.5 ounces (12)	▼ Never (1 ... Three or more times a day (8)
Baked good, ex: banana bread or scone (13)	▼ Never (1 ... Three or more times a day (8)
Small Can (14)	▼ Never (1 ... Three or more times a day (8)
Other, Please Specify (15)	▼ Never (1 ... Three or more times a day (8)

Q149 Please use this graphic to answer the following question

Q140 If you eat WALNUTS, please select the type and frequency (please select all that apply)

	Frequency

Handful, one ounce (1/4 cup or 14 halves) (1)	▼ Never (1 ... Three or more times a day (8)
Walnut nut butter (11)	▼ Never (1 ... Three or more times a day (8)
Small snack bag, 1-2.5 ounces (12)	▼ Never (1 ... Three or more times a day (8)
Baked good, ex: banana bread or scone (13)	▼ Never (1 ... Three or more times a day (8)
Small Can (14)	▼ Never (1 ... Three or more times a day (8)
Other, Please Specify (15)	▼ Never (1 ... Three or more times a day (8)

Q142 Please check all of the following sources of nuts you consume at least once a week

☐ Pistachios (4)

☐ Cashews (5)

☐ Peanuts (6)

☐ Macadamia nuts (8)

☐ Brazil nuts (9)
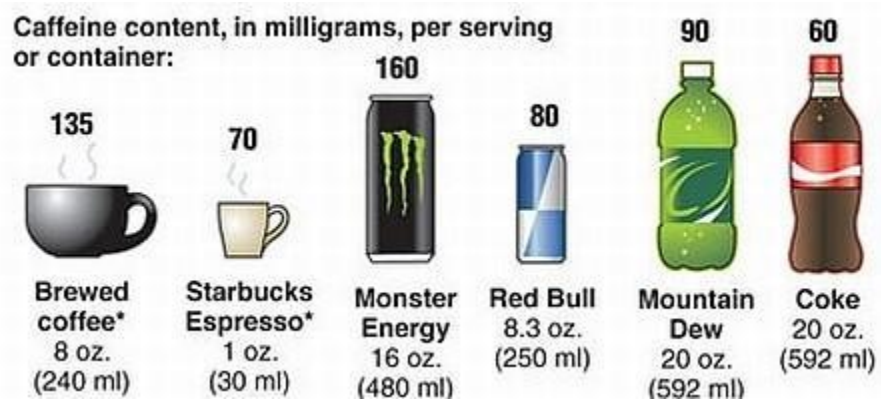
☐ Other: please specify (7)

_____

Q72 Do you consume caffeine?

○ Yes (1)

○ No (2)

Q73

Please take a moment and look at this graphic to get a visual of the drinks you may consume and the amount of fluid in the container. Feel free to go back to this graphic to answer the next question.

Caffeine content, in milligrams, per serving or container:

135	70	160	80	90	60
Brewed coffee* 8 oz. (240 ml)	Starbucks Espresso* 1 oz. (30 ml)	Monster Energy 16 oz. (480 ml)	Red Bull 8.3 oz. (250 ml)	Mountain Dew 20 oz. (592 ml)	Coke 20 oz. (592 ml)

Q124 Please check all of the following sources you receive caffeine from in a normal day and how much.

	Please Write Brand (Starbucks, Monster, Diet Coke, etc.	Please Indicate Serving Size (Example: Please write - one 12 oz can, 1 cup, 16 oz bottle, three 20 oz bottles, etc.)
	Name of Brand (1)	

Coffee (1)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)
Espresso (2)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)
Black or Green Tea (3)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)
Iced Tea (4)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)
Cola, Soda, Pop (5)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)
Energy drink (6)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)
Chocolate (7)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)

Supplements (8)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)
Other: Please Specify (9)		▼ Less than one cup (1 ... normal size chocolate candy bar (10)

Q74 How often do you drink soda? (For example: Coke, Pepsi - DO NOT INCLUDE DIET

SODA)

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ Several time a week (5)

○ Once a day (6)

○ Twice a day (7)

○ Three or more times a day (8)

Q75 How often do you drink DIET soda?

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ Several times a week (5)

○ Once a day (6)

○ Twice a day (7)

○ Three or more times a day (8)

Q76 How many times do you eat each day? (Include both snacks and meals)

	0	2	3	5	6	8	9	11	12	14	15
Please include all meals of any type ()											

Q77 Do you USUALLY snack between meals?

○ Yes, between every meal every day (1)

○ Yes, but only between some meals every day (2)

○ Yes, but only between some meals 3-6 days a week (3)

○ Yes, but only between some meals 1-2 times a week (4)

○ No, I rarely snack between meals (5)

Q78 What snacks do you regularly eat? Please select all that apply.

☐ Cake, cookie, or other dessert (1)

☐ Chips, popcorn, pretzels, crackers (2)

☐ Fruit (3)

☐ Nuts, seeds (4)

☐ Vegetables (5)

☐ Chocolate (6)

☐ Yogurt/cheese (7)

☐ Other - Please specify: (8)

_____

Q79 How often do you eat out? (For example: restaurants, fast food chains, grocery store made to order food or salad bar)

○ Never (1)

○ Less than once a month (2)

○ Less than once a week (3)

○ Once a week (4)

○ Several times a week (5)

○ Once a day (6)

○ More than once a day (7)

Q80 Do you use any low or no calorie sweeteners?

○ Yes (1)

○ Maybe (2)

○ No (3)

Q81 Which low or no calorie sweeteners do you use? Please select all that apply.

☐ Aspartame (Equal, NutraSweet, NatraTaste, Blue) - Diet coke, Crystal Light (1)

☐ Sucralose (Splenda) - Chikfila Lemonade, light yogurt (2)

☐ Acesulfame K (ACE K, Sunette, Equal Spoonful, Sweet One, Sweet'n Safe) - Crystal Light, light yogurt (3)

☐ Saccharin (Sweet 'N Low, Sweet Twin) (4)

☐ Stevia (5)

☐ Truvia (6)

☐ Xylitol, Sorbitol (7)

☐ I don't know (8)

Q82 Do you use an app to track your food intake?

○ Yes (1)

○ No (2)

Q83 What app do you use to track your food? Please check all that apply.

○ MyFitnessPal (1)

○ Lose It (2)

○ SparkPeople (3)

○ Cronometer (4)

○ Calorie Counter (5)

○ My Diet Coach (6)

○ Other: Please Specify (7) _____

Q84 Do you use an app to track your activity or steps?

○ Yes (1)

○ No (2)

Q85 Which app do you use to track your activity?

○ MyFitnessPal (1)

○ Fitbit (2)

○ RunKeeper (3)

○ Endomondo (4)

○ C25K (5)

○ Nike Training Club (6)

○ Other, Please Specify (7) _____

Q86 Do you use an app to track your weight?

○ Yes (1)

○ No (2)

Q87 What app do you use to track your weight?

○ Lose It! (1)

○ SparkPeople (2)

○ MyFitnessPal (3)

○ Fitbit (4)

○ Weight Watchers (5)

○ Fat Secret (6)

○ Cronometer (7)

○ Other, please specify (8) _____

Q88 Does the app provide feed or weight loss goals/tips?

○ Yes (1)

○ No (2)

Q89 What kind of goals and tips does the app provide?

_____

_____

_____

_____

_____

Q90 Do you reward yourself when health goals are met?

○ Yes (1)

○ No (2)

○ I do not have any health goals (3)

Q91 How do you reward yourself? Please select all that apply.

☐ Food (1)

☐ Shopping - clothes, shoes (2)

☐ Social time with friends (3)

☐ Alcohol (4)

☐ Other - Please Specify: (5)
_____

Q92 On an average week day, how much time do you spend watching TV? (including videos on DVD, Blue Ray, Netflix, Hulu, Amazon Prime. etc.)

○ None (1)

○ Less than 1 hour (2)

○ 1-2 hours (3)

○ 2-3 hours (4)

○ 3-4 hours (5)

○ 4 or more hours (6)

Q93 On an average weekend day(Saturday or Sunday), how much time do you spend watching TV? (including videos on DVD, Blue Ray, Netflix, Hulu, Amazon Prime. etc.)

○ None (1)

○ Less than one hour (2)

○ 1-2 hours (3)

○ 2-3 hours (4)

○ 3-4 hours (5)

○ 4 or more hours (6)

Q94 On an average week day, how much time do you spend on social media/screen time during?

(Examples: computer, video games, email, Facebook, Instagram, Twitter, etc.)

○ None (1)

○ Less than one hour (2)

○ 1-2 hours (3)

○ 2-3 hours (4)

○ 3-4 hours (5)

○ 4 or more hours (6)

Q95 On an average weekend day (Saturday or Sunday), how much time do you spend on social media/screen time? (Examples: computer, video games, email, Facebook, Instagram, Twitter, etc.)

○ None (1)

○ Less than one hour (2)

○ 1-2 hours (3)

○ 2-3 hours (4)

○ 3-4 hours (5)

○ 4 or more hours (6)

Q129 Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a

time.   During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

○ 1 (1)

○ 2 (2)

○ 3 (3)

○ 4 (4)

○ 5 (5)

○ 6 (6)

○ 7 (7)

○ No vigorous physical activities (8)

Q130 How much time did you usually spend doing **vigorous** physical activities on one of those days?

☐ Hours per day (1) _____

☐ Minutes per day (2) _____

☐ Don't know/Not sure (3)

Q131 Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

○ 1 (1)

○ 2 (2)

○ 3 (3)

○ 4 (4)

○ 5 (5)

○ 6 (6)

○ 7 (7)

○ No moderate physical activities (8)

Q132 How much time did you usually spend doing **moderate** physical activities on one of those days?

☐   Hours per day (1) _____

☐   Minutes per day (2) _____

☐   Don't know/Not sure (3)

Q133 Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.   During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

○ 1 (1)

○ 2 (2)

○ 3 (3)

○ 4 (4)

○ 5 (5)

○ 6 (6)

○ 7 (7)

○ No walking (8)

Q134 How much time did you usually spend **walking** on one of those days?

☐   Hours per day (1) _____

☐   Minutes per day (2) _____

☐   Don't know/Not sure (3)

Q135   Think about the time you spent **sitting** on weekdays during the **last 7 days**. Include time

spent at work, at home, while doing course work and during leisure time. This may include time

spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch

television.   During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

☐   Hours per day (1) _____

☐   Minutes per day (2) _____

☐   Don't know/Not sure (3)

Q136 Think about the time you spent sitting on **weekend** days (Saturday or Sunday) during

the last 7 days. Include time spent at work, at home, while doing course work and during leisure

time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying

down to watch television. During the last 7 days, how much time did you spend sitting on

a weekend day?

☐   Hours per day (1) _____

☐   Minutes per day (2) _____

☐   Don't know/Not sure (3)

Q145 Please use this calendar and identify today's date. Please use this date to answer the

following question.

2018

January	February	March	April
M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
1 2 3 4 5 6 7	1 2 3 4	1 2 3 4	1
8 9 10 11 12 13 14	5 6 7 8 9 10 11	5 6 7 8 9 10 11	2 3 4 5 6 7 8
15 16 17 18 19 20 21	12 13 14 15 16 17 18	12 13 14 15 16 17 18	9 10 11 12 13 14 15
22 23 24 25 26 27 28	19 20 21 22 23 24 25	19 20 21 22 23 24 25	16 17 18 19 20 21 22
29 30 31	26 27 28	26 27 28 29 30 31	23/30 24 25 26 27 28 29

May	June	July	August
M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
1 2 3 4 5 6	1 2 3	1	1 2 3 4 5
7 8 9 10 11 12 13	4 5 6 7 8 9 10	2 3 4 5 6 7 8	6 7 8 9 10 11 12
14 15 16 17 18 19 20	11 12 13 14 15 16 17	9 10 11 12 13 14 15	13 14 15 16 17 18 19
21 22 23 24 25 26 27	18 19 20 21 22 23 24	16 17 18 19 20 21 22	20 21 22 23 24 25 26
28 29 30 31	25 26 27 28 29 30	23/30 24/31 25 26 27 28 29	27 28 29 30 31

September	October	November	December
M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
1 2	1 2 3 4 5 6 7	1 2 3 4	1 2
3 4 5 6 7 8 9	8 9 10 11 12 13 14	5 6 7 8 9 10 11	3 4 5 6 7 8 9
10 11 12 13 14 15 16	15 16 17 18 19 20 21	12 13 14 15 16 17 18	10 11 12 13 14 15 16
17 18 19 20 21 22 23	22 23 24 25 26 27 28	19 20 21 22 23 24 25	17 18 19 20 21 22 23
24 25 26 27 28 29 30	29 30 31	26 27 28 29 30	24/31 25 26 27 28 29 30

130

Q125 Please fill this questions about self-weighing frequency to the best of your abilities.

	Did you Weigh yourself?		How many times that day, did you weigh yourself?
	Yes (1)	No (2)	Please indicate the number of times you weighed (1)

Did you weigh yourself today? (11)	○	○	
Yesterday (1 day ago) (1)	○	○	
2 days ago (the day before yesterday) (2)	○	○	
3 days ago (3)	○	○	
4 days ago (4)	○	○	
5 days ago (5)	○	○	
6 days ago (6)	○	○	

7 days ago (one week ago) (7)	○	○	
8 days ago (8)	○	○	
9 days (9)	○	○	
10 days ago (10)	○	○	